JOURNAL OF BALTIC SCIENCE EDUCATION

ISSN 1648-3898 /Print/
ISSN 2538-7138 /Online/

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THE INFLUENCE OF EXTRACURRICULAR ACTIVITIES ON THE INTEREST OF CZECH AND FINNISH STUDENTS IN BIOLOGY

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Abstract. *Extracurricular learning plays a key role in shaping students' interest in (not only) biology. The research examined which extracurricular areas related to biology can make biology more attractive for the participating Finnish and Czech students. A 5-point Likert scale questionnaire was administered to 178 Finnish and 195 Czech 9th-grade lower-secondary school students. Cronbach's alpha, Varimax rotation and Mann–Whitney U-test were performed. Factor analysis identified 7 areas: Family trips, My career, Biology lessons, Healthy lifestyle, Institutions, Nature-related hobbies, and Information sources. For Czech, hobbies related to nature and family trips are significant contributors to fostering interest in biology, and an informal educational environment is crucial for cultivating a lasting relationship with biology. For Finns, biology classes and career orientation have a more significant influence on students, demonstrating the effectiveness of formal educational strategies in increasing students' interest in biology. Increasing interest in biology among the students observed in both sociocultural environments is significantly influenced by family involvement and the use of information sources. Further research should explore how specific ECA can support the connection between family and school environments and their impact on students' interest and engagement in biology lessons.*

Keywords: *extracurricular activities, interest in biology, lower secondary school students, questionnaire*

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Introduction

The general view of school education is that students acquire their knowledge, and consequently interest in it, through diverse educational activities organized by a teacher within the classroom. Interest is considered a key prerequisite for academic success (Dewey, 1913; Thorndike, 1935) and an important internal factor that influences learning (Ryan & Deci, 2000). Hidi and Renninger (2006) further developed this concept by defining situational interest (external: emerging suddenly in response to environmental stimuli) and individual interest (internal and stable: developing gradually and becoming a long-lasting preference for a topic, also described as a lasting predisposition to re-engage with specific content), both of which are closely linked to student attitudes. Although students' attitudes towards their interests tend to be relatively stable, they can be altered as a result of exposure to extracurricular activities (hereafter referred to as ECA) (Hidi & Renninger, 2006).

A student's interest and attitude towards biology are directly related to their engagement in education (Kang et al, 2019). From the literature of the last two decades, it is evident that biology is among the most favored natural science subjects for students (e.g. Kubiatko & Vlčková, 2011; Kubiatko, 2012; Lavonen et al., 2008; Lavonen & Juuti, 2016; Prokop et al., 2007a; Prokop et al., 2007b; Rowland et al., 2019; Uitto, 2014). However, this interest significantly varies between genders, with girls generally showing stronger inclinations towards biology than boys, who prefer mathematics, physics, and chemistry (Acarli & Acarli, 2020; Baram-Tsabari et al., 2010; Fančovičová & Kubiatko, 2015; Juuti et al., 2004; Uitto, 2014; Trumper et al., 2006). Given the curricular demands for an interdisciplinary approach to education, it is advisable to utilize biological topics that transcend the boundaries of biology to attract students' attention to other natural science subjects and make them appealing regardless of gender.

In addition to gender, a key role in shaping students' interest in biology is also played by extracurricular learning (Braund & Reiss, 2012; Uitto et al., 2006; Uitto et al., 2008), informal education (Campbell & Walberg, 2010), and the nature of ECA. Given these aspects, it is desirable for educators to integrate educational elements that combine formal education with informal extracurricular experiences into their teaching practices. Educators would

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

thus create a more dynamic and varied learning environment; one that resonates with diverse student interests. According to Lawhorne (2008), ECA and out-of-school learning (Uitto et al., 2004) have benefits that extend beyond the experiences provided by school education. These activities aid students in their personal, social, and intellectual development, and can even assist them in achieving their future academic and career goals (Uitto, 2014).

Given that the last two decades have seen a decline in students' interest in natural sciences (Basl, 2011; Janoušková et al., 2014; Vedder-Weiss & Fortus, 2012), it remains relevant and to explore and consider students' extracurricular interests in the context of the school curriculum. From literature (see, for example, Campbell & Walberg, 2010; Debarliev et al., 2022; Denault & Guay, 2017; Martinéz et al., 2016, etc.), it is clear that successful interactions which support students' learning, connect students with each other, and also strengthen the relationship between students and teachers, occur when informal learning elements and extracurricular interests of students are implemented into school education.

The topic of informal education is thus gaining importance not only in the Czech Republic but also in neighboring European Union countries. Informal education enables young people to acquire competencies needed for employment and society; it develops competencies as listed in the school curriculum, but focuses on the development of soft skills (Kohoutová, 2013).

Informal learning and, concurrently, out-of-school education can occur in everyday situations such as interacting with friends and classmates, watching television, reading books or magazines, engaging in various hobbies within interest activities, and in out-of-school organizations (Lawhorn, 2008; Skar et al., 2016). Additionally, visits to institutions such as museums, zoos or botanical gardens also play a role (Braund & Reiss, 2004; Uitto et al., 2006 et al.; Uitto & Kärnä, 2014).

The role of the family and parental influence is indispensable as well (Duarte et al, 2017). This influence can be either direct or indirect, for instance, the extent to which parents encourage their children to engage in activities aimed to strengthen (future) interest in natural science subjects, or how much parents encourage their children to spend time outdoors exploring their surroundings (Campbell & Walberg, 2010; Rantala & Puhakka, 2020). In today's world, the daily lives of students are also influenced by the use of mobile applications and IT technologies. Integrating these into the curriculum can support student learning and meaningfully connect their free time with school assignments (Teplá & Klímová, 2015; Teplá et al., 2021; Rotbain et al., 2008; Yli-Panula & Matikainen, 2014; Wong & Rosindell (2022).

Within the school environment, certain aspects of informal learning occur/begin to take place, for example, during activity-oriented learning (Niemi et al., 2015), especially in group-cooperative learning (Rajsiglová, 2018), student-centered approaches (Kang & Keinonen, 2018), project-based learning (Rajsiglová & Škarková, 2019; Hanney & Savin-Baden, 2013), inquiry-based education, and also during trips or school excursions.

Out-of-school education, therefore, refers to the teaching of students outside the school environment, outside the school campus, led by someone other than a teacher. Informal education, meanwhile, is understood as the time students spend outside standard school attendance, i.e., time within clubs or leisure activities.

Research Aims and Research Questions

The main aim of the presented research was to contribute to the international discussion on the declining interest of students in natural sciences, and to explore ways to make natural sciences more attractive to students. A comparative international study was chosen for several reasons: 1) Since two authors independently had the opportunity to spend a semester in Finland under the Erasmus program, gaining insight into the local school education, the research was conducted in parallel among Czech and Finnish students. 2) Finns regularly rank highly in international surveys (TIMSS and PISA), and thus, the Finnish educational system is considered as one of the potential models (not only) for the Czech Republic. Comparing two socio-culturally different environments thus seemed optimal. 3) The context mentioned above complements the fact that since the late 20th century, Czech education has been accompanied by a curricular reform in the form of the Framework Educational Programs (FEP). FEP require teachers to develop students in key competencies, incorporate cross-sectional themes (see below), and lastly, consider interdisciplinary relationships (FEP EE 2017). These are successfully implemented in schools; however, in international assessments, Czech students rank lower than expected with regard to the reform efforts. 4) Currently, preschool, primary, and secondary education in the Czech Republic is undergoing reform in the form of an FEP revision, which will have an impact not only on the lives of teachers and students but on society as a whole. The main goal of the FEP revision is to provide kindergartens, primary and secondary schools with a clear framework of what children should learn at school, and how education should prepare them for life in today's

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

changing world. Creating such a fundamental document includes obtaining feedback from parents, teachers, and professionals (Melichar, 2024).

Given that no Czech study has examined how extracurricular areas can influence students' interest in biology or other natural science subjects, or that previous research has focused on analyses of individual countries, this research extends the scope by comparing two different educational systems, thus filling a gap in the field of educational research. The comparative analysis of Czech and Finnish 9th-grade students provides a unique perspective to examine the influence of national educational contexts on biology education. This comparative dimension enables a richer understanding of how various pedagogical, cultural, and systemic factors contribute to shaping students' interest (not only) in biology.

In line with the above, the research focused on triggers of interest in biology through ECA among 9th-grade students in lower secondary schools in Finland and the Czech Republic and posed the following research questions: 1. Which extracurricular areas can help foster interest in natural sciences among Czech and Finnish students? 2. To what extent do the identified extracurricular areas contribute to the interest of Czech students in natural sciences compared to Finnish students? 3. How do the identified extracurricular areas that influence students' interest in natural sciences correlate – how do the resulting correlations differ between Czech and Finnish students?

Biology in Basic Education in Czech and Finnish Educational System

In both the Czech Republic and Finland, basic education lasts 9 years (FNBE, 2016; FEP EE, 2017). In the Czech Republic, during the first stage of basic education, the subject 'the world around us' is taught from the 1st to 3rd grade. In the 4th and 5th grades, 'the world around us' is divided into two separate subjects – natural science and social studies. At the second stage, from the 6th to 9th grade, natural science is divided into four separate subjects – physics, chemistry, geography, and biology, within the area called Man and Nature. Besides the area of Man and Nature, a separate area called Man and Health is defined, with subjects such as Health Education and Physical Education.

Biology as a separate subject is taught from the 6th to 9th grade in Czech elementary schools (FEP EE, 2017). In Finland, from the 1st to 6th grade, environmental studies are taught, summarizing knowledge from the fields of biology, geography, physics, chemistry, and health education. From the 7th to 9th grade, the aforementioned subjects are taught separately. Biology as a separate subject is taught in Finnish elementary schools from the 7th to 9th grade (FNBE, 2016).

An important component of both Czech and Finnish education includes key competences—transversal in the case of Finland. In Czech basic education, these involve the competencies for learning, problem-solving, communicative competencies, social and personal competencies, civic competency, work competency, and, newly, digital competency (FEP EE, 2021). Finnish basic education considers competencies such as thinking and learning to learn; cultural competence, interaction, and self-expression; taking care of oneself and managing daily life; multiliteracy; ICT competence; working life competence and entrepreneurship; participation, involvement, and building a sustainable future (FNBE, 2016). The content of Czech and Finnish competencies largely overlaps, as their aim is to develop knowledge, skills, and values necessary for a successful life within society and future employment (FNBE, 2016; FEP EE, 2017).

A mandatory part of Czech basic education also consists of cross-curricular themes, which are a set of current and significant topics about the world in which we live today. Including these themes in the teaching of various subjects primarily develops the values and attitudes of students. These include personal and social education, education for democratic citizenship, education for thinking in European and global contexts, multicultural education, environmental education, and media education (FEP EE, 2017). In the Finnish curriculum, the nearest equivalent is multidisciplinary learning modules; content-wise, they are closest to cross-curricular competencies (transversal competencies) and the fundamental values of the educational process of basic education in Finland (underlying values of basic education).

Both curricula state that the teaching of natural sciences, or biology specifically, should lead students to understand how to apply the learned material to practical life (FNBE, 2016; FEP EE, 2017). The Finnish curriculum emphasizes the involvement of students in decision-making and debates within the local community, collaboration of students with the public, for example, in multidisciplinary modules (FNBE, 2016), and as with Czechs, on engaging students in activities related to environmental protection (FNBE, 2016; FEP EE, 2017). Furthermore, an aim is for students to develop a positive attitude towards nature and environmental protection, as both Czech and Finnish curricula stress the importance of students preferring a sustainable lifestyle, behaving respectfully

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

towards nature, appreciating the value of biodiversity and ecological balance, and being aware of the impact of human behavior on the environment (Brias-Guinart et. al, 2023; FNBE, 2016; FEP EE, 2017; Reunamo & Suomela, 2013; Uitto et al., 2011; Wang et al., 2019).

Research Methodology

General Background

Ninth graders of Czech and Finnish primary schools took part in the research. A questionnaire was picked as the research tool. The questionnaire survey was conducted in Oulu in Finland and in the Czech Republic in Prague. Through research, we monitored and compared the Finnish and Czech students' relationship to biology through ECA. The questionnaire was thematically focused on the students' interest in biology through ECA. The data were collected in the 2018/2019 school year, before the outbreak of the Covid-19 pandemic, so the results were not affected by the pandemic. Students were informed about the pedagogical research, and the research questionnaires were filled in anonymously.

Sample Selection

For the research, 12 schools from Oulu and its surroundings, and 12 faculty schools in Prague were approached; these were randomly selected schools from those that cooperate with the partner universities (the Faculty of Education at the University of Oulu, and the Faculty of Science at Charles University) which participate in the training of future teachers (not only) in biology. Of the schools contacted, 20 agreed to participate in the research, including 9 Finnish and 11 Czech.

A total of 373 9th-grade lower secondary school students, 178 Finnish students (91 girls, 87 boys), and 195 Czech students (96 girls, 99 boys) took part in the quantitative research. The data were collected from a total of 20 consenting primary and lower secondary schools in Oulu, Finland (9 primary and lower secondary schools), and Prague, Czech Republic (11 primary and lower secondary schools).

Instruments and Procedures

To ascertain which factors could trigger or strengthen interest in biology among the observed students, the survey focused on the triggers of interest, the possible role of family, school, and other institutions, and on the students' activities and actions outside school. To further specify the above for the needs of school practice and to consider pedagogical implications, questions were also posed about biology topics in the research, as shown below.

A 5-point Likert-type questionnaire was chosen to collect data. The questionnaire items were adopted and adapted from the studies that inspired our research (Juuti et al., 2010; Uitto et al., 2006; Uitto et al., 2008). The students indicated their age and gender in the questionnaire and then answered 29 questionnaire items. The first 8 items, see Table 1, dealt with (a) what might make biology interesting and useful to students (warm-up questions that introduce students to the subject) - see Table 1, items 1-3; and (b) which thematic parts of biology students have mastered or think they can master – see Table 1, items 4-8. An additional 21 items were employed to explore which ECA could enhance students' interest in science/biology – refer to Table 2 / first column.

During the research, a 5-point Likert scale was employed, allowing students to express their level of agreement with presented statements, ranging from "strongly agree" (1) to "strongly disagree" (5). For statistical analysis, the scale values were reversed. This 5-point scale was selected as it is the most easily understood format for lower secondary school students (Fabiola et al., 2012; Kubiatko, 2016). Simultaneously, an odd number of items was chosen to allow students to give a neutral response. The presence of a neutral point means that the results are not distorted by forcing students to give answers that lean towards one side of the scale or the other, if they do not have a strong opinion on the statement (Kubiatko, 2016; Subedi, 2016).

In 2018, the comprehensibility of the questionnaire was tested in a preliminary survey in the Czech Republic with lower secondary school students in 9th grade ($n = 7$). The preliminary survey was based on personal interviews with each respondent. Each interview lasted on average 48 minutes. The purpose of these interviews was to ensure that the students had understood the questions in the questionnaire; they therefore served as feedback for the authors. The questionnaire was then modified, mainly by reformulating certain questions to be more specific and replacing specialized terms with more general terms. The questionnaire was then translated from Czech into Finnish.

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

The validation process of the questionnaire was conducted by a panel of 3 experts in didactics of biology. The reliability of the questionnaire was assessed using the Cronbach's alpha coefficient. The obtained Cronbach's alpha value (α = .904) indicated high reliability for the questionnaire. The first 8 questions of the questionnaire were analyzed using an ordinal scale

Data Analysis

The questionnaire section, which consists of the following 21 items, was subjected to a factor analysis with Varimax rotation. The appropriateness of the application of the factor analysis was checked by calculating the Kaiser-Meyer-Olkin coefficient (KMO = .85). The result showed that it is possible to use factor analysis when analyzing the data. After the factor analysis, the items were divided into 7 factors, see Tables 1 and 2. 1 item was excluded from further analysis because it did not reach the threshold value of .3. Since the analyzed questionnaire items were merged in groups of 2-4 and further evaluated as such, they were assessed on an ordinal scale (Subedi, 2016; Chytrý & Kroufek, 2017).

The data from the Czech and Finnish students were subsequently analyzed using Mann and Whitney's non-parametric *U*-test. The strength of the statistical effect was determined by calculating *r* ($r = z/\sqrt{N}$).

In the final data analysis, correlations between the identified factors were analyzed, see Table 2. The correlations were established using Spearman's rho (ρ), since the items were evaluated either individually or aggregated across multiple items. Statistical analyses were conducted at a significance level of α = .05. The aforementioned statistical tests were performed using R version 3.6.2 and the Stats package.

Research Results

The obtained Cronbach's alpha value (α = .904) indicated high reliability for the questionnaire. The first 8 questions of the questionnaire were analyzed using an ordinal scale. The results for the first eight items of the questionnaire indicated that, on average, Czech students performed worse than Finnish students across all items (Table 1). The largest significant differences between Czech and Finnish students were measured for the items "I understand the effects of human behavior on ecological problems" (*r* = .362) and "I learn about environmental studies" (*r* = .318). Smaller effects but still significant differences between Czech and Finnish students were found for the items "I learn about living nature" (*r* = .233) and "I learn about health and healthy lifestyle" (*r* = .222) (Table 1). From the results, it can be concluded that Finnish pupils are better able to apply the ecology curriculum to everyday life and are more familiar with ecological issues.

Table 1
Comparison Between Czech and Finnish Students in the First 8 Initial Items

Questionnaire items	Mean of Czech students	Mean of Finnish students	Mann-Whitney *U*	*p*-value	Effect size *r*
Biology is my favourite subject (1)●	2.67	2.95	14538	.005*	.091
I understand the effect of human behavior on environmental problems (2)	3.16	3.63	13408	< .001*	.362
I use biological knowledge on a daily basis (3)	2.68	3.36	11076	< .001*	.155
I learn about living nature (4)	3.50	3.79	14777	.009*	.233
I learn about inanimate nature (5)	3.33	3.50	16241	.265	.117
I learn about the human body (6)	3.86	4.08	15485	.057	.0876
I learn about health and healthy lifestyle (7)	3.47	3.81	14554	.006*	.222
I learn about environmental studies (8)	3.14	3.48	14437	.003*	.318

** $p < .05$; ● numbers in parentheses indicate the order of statements from the first eight-item part of the questionnaire*

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

In the following analysis, the first research question (RQ1) was answered. To search for latent factors, Factor Analysis Extraction was employed, using the Principal Axis Factoring method and a Varimax-rotated factor matrix. The suitability of the factor analysis application was verified by calculating the Kaiser-Meyer-Olkin measure (KMO = .848), including an examination of values in the anti-image matrix (anti-image correlation), and also through Bartlett's Test of Sphericity (approx. Chi-square = 2903.352, $df = 210$; $p < .001$). The result showed that it is possible to use factor analysis when analysing the data.

From the results of the factor analysis, (see Table 2), 7 factors emerged, which were subsequently interpreted as ECA that contribute to Czech and Finnish students' interest in biology - F1: Family Trips; F2: My Career; F3: Biology Lessons; F4: Healthy Lifestyle; F5: Institutions; F6: Nature-related Hobbies; F7: Information Sources.

Table 2
Factor Analysis Results

My interest in biology was contributed by...	F1	F2	F3	F4	F5	F6	F7
(5) Trips or holidays in nature with the family.	.67						
(7) that I spent time alone in nature.	.58						
(6) trips to nature with friends.	.56						
(1) Parents or relatives who have been talking about it since I was a child.	.32						
(18) the fact that one day I would like to become a doctor or a veterinarian.		.82					
(17) the fact that I will apply my knowledge of biology in my future job.		.74					
(19) the fact that one day I would like to become a scientist or teacher.		.58					
(21) that I am comfortable with the way biology lessons are conducted.			.90				
(20) that I like the way the teacher explains the subject matter.			.78				
(16) the fact that I play sports				.79			
(15) my interest in a healthy lifestyle				.59			
(2) visits to the zoo					.73		
(4) visits to museums					.70		
(3) visits to the botanical garden					.57		
(12) caring for a pet						.62	
(13) visiting a riding school or a farm						.57	
(11) gardening						.44	
(10) searching for interesting facts about science on the Internet							.70
(8) reading books or articles about nature							.68
(9) watching videos, movies or documentaries about nature							.62
excluded items							
(14) attending the science club	.13	.16	.08	-.06	.08	.29	.18

Rotation Method: Varimax with Kaiser Normalization.
Numbers in brackets indicate the order of statements from the second, 21-item, part of the questionnaire

For each factor, the reliability was calculated using Cronbach's α, see Table 3. Two factors (F6 and F7) had values only marginally below 7, so the items are internally consistent. One item (14) was excluded from further analysis because it did not reach the threshold value of .3.

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Table 3
Reliability of New Factors

Factors	*N* of items	Cronbach's *α*
F1: Family Trips	4	.77
F2: My Career	3	.79
F3: Biology Lessons	2	.88
F4: Healthy Lifestyle	2	.71
F5: Institutions	3	.78
F6: Nature-related Hobbies	3	.64
F7: Information Sources	3	.62

The results of the factor analysis revealed 7 factors, which were named according to the questions that were evaluated. In a further analysis, the individual factors were calculated and compared between Finnish and Czech students.

The second research question (RQ2) of the research was then addressed. 3 of the 7 identified factors (F1 - Family Trips, F5 - Institutions, F6 - Nature-related Hobbies) contributed more to the Czech students' interest in science than the Finnish students' interest. Conversely, 4 factors (F2 - My Career, F3 - Biology Lessons, F4 - Healthy Lifestyle, F7 - Information Sources) contribute more to the interest of Finnish students in science than to the interest of the Czech students. The Mann-Whitney U-test, as detailed in Table 4, was employed to determine the statistical significance of the differences between the responses of Czech and Finnish students. Significant differences were identified for F2 - My Career ($U = 109417$; $p < .05$), F3 - Biology Lessons ($U = 41929$; $p < .05$), F5 - Institutions ($U = 177464$; $p < .05$), and F6 - Nature-related Hobbies ($U = 189186$; $p < .05$). The extent of these statistically significant differences was also investigated. The largest effect size was observed for F3 - Biology Lessons ($r = .40$), followed by F2 - My Career ($r = .30$). The other effect sizes demonstrated a small to negligible effect, as shown in Table 4.

Table 4
Comparison of Factors (F1 - F7) Between Czech and Finnish Students

Factor name	Mean of Czech students	Mean of Finnish students	Mann-Whitney *U*	*p-value*	*r*
F1: Family Trips	2.81	2.70	287939	.175	.04
F2: My Career	1.72	2.39	109417	< .001*	.30[A/B]
F3: Biology Lessons	2.61	3.58	41929	< .001*	.40[B]
F4: Healthy Lifestyle	3.26	3.33	68623	.781	.01
F5: Institutions	2.72	2.38	177464	< .001*	.14[A]
F6: Nature-related Hobbies	2.85	2.29	189186	< .001*	.21[A]
F7: Information Sources	2.76	2.81	151309	.384	.03

* $p < 0.05$; [A]small effect (.1 to .3), [B]medium effect (.3 to .5)

Institutions (F5) and Nature-related Hobbies (F6) contributed significantly more to Czech students' interest in science than to Finnish students' interest in science. Conversely, the factors My Career (F2) and Biology Lessons (F3) had a significantly stronger influence on Finnish students' interest in science. No statistically significant difference was found for the other factors.

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Correlations between ECA

The 3rd research question of the research (RQ3) was then answered. All (extra)school activities (the extracted domains from the previous factor analysis) were correlated with each other by calculating the Spearman rank correlation coefficient ρ. The correlation analysis was carried out separately for the group of Czech students and the group of Finnish students.

For the group of Czech students, the factor F1 - Family Trips was identified as having the strongest relative correlation with the other factors. The most significant correlation, and the strongest observed in the survey for Czech students, was between F1 - Family Trips and F7 - Information Sources ($\rho = .41$; $p < .01$). A medium to low dependence was noted between F1 - Family Trips and F6 - Nature-related Hobbies ($\rho = .37$; $p < .01$), F5 - Institutions ($\rho = .34$; $p < .01$), and F4 - Healthy Lifestyle ($\rho = .30$; $p < .01$). Conversely, the weakest correlation for Czech students was detected between F3 – Biology Lessons and F2 - My Career ($\rho = .05$; $p < .01$), as detailed in Table 5.

Table 5
Czech Students: Correlation of Factors F1 - F7 (Spearman's ρ).

Factor name	F1: Family Trips	F2: My Career	F3: Biology Lessons	F4: Healthy Lifestyle	F5: Institutions	F6: Nature-related Hobbies	F7: Information Sources
F1: Family Trips	1						
F2: My Career	.2**	1					
F3: Biology Lessons	.14**	.05**	1				
F4: Healthy Lifestyle	.3**	.1	.18**	1			
F5: Institutions	.34**	.21**	.16**	.15**	1		
F6: Nature-related Hobbies	.37**	.21**	.23**	.24**	.23**	1	
F7: Information sources	.41**	.23**	.18**	.23**	.27**	.25**	1

*ρ < .05, **ρ < .01

The correlation between F1 - Family Trips and F7 - Information Sources was also found to be strongest among Finnish students ($\rho = .42$; $p < .01$). Data collected from Finnish respondents indicated that the factor F3 - Biology Lessons correlated most strongly with the other factors. Specifically, medium to low correlations were observed between F3 - Biology Lessons and F4 - Healthy Lifestyle ($\rho = .38$; $p < .01$), F7 - Information Sources ($\rho = .38$; $p < .01$), F1 - Family Trips ($\rho = .35$; $p < .01$), and F6 - Nature-related Hobbies ($\rho = .32$; $p < .01$).

In addition, factor F6 - Nature-related Hobbies correlated relatively more strongly with a larger number of factors; some of these correlations have already been mentioned, and for others, see Table 6.

Based on the Finnish results, the weakest correlations were found for factor F5 - Institution, specifically between F5 - Institutions and F3 - Biology Lessons ($\rho = .11$; $p < .01$) and between F5 - Institutions and F6 - Nature-related Hobbies ($\rho = .11$; $p < .01$).

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Table 6
Finnish Students: Correlation of Factors F1 - F7 (Spearman's ρ)

Factor name	F1: Family Trips	F2: My Career	F3: Biology Lessons	F4: Healthy Lifestyle	F5: Institutions	F6: Nature-related Hobbies	F7: Information Sources
F1: Family Trips	1						
F2: My Career	.21**	1					
F3: Biology Lessons	.35**	.21**	1				
F4: Healthy Lifestyle	.26**	.28**	.38**	1			
F5: Institutions	.24**	.2**	.11*	.17**	1		
F6: Nature-related Hobbies	.32**	.19**	.32**	.31**	.11*	1	
F7: Information sources	.42**	.15**	.38**	.22**	.19**	.32**	1

*p < .05, **p < .01

Discussion

Literature suggests that students' interest and their attitudes towards biology are significant determinants of how much they engage in education and how successful they are in other fields of natural science education. Moreover, numerous studies indicate that ECA, (e.g., Lawhorn, 2008; Skar et al., 2016) out-of-school education, (e.g., Braund & Reiss, 2012; Uitto et al., 2006) and elements of informal education (Debarliev et al., 2022; Denault & Guay, 2017; Martinéz et al., 2016, etc.) formatively affect a student's personality and learning experiences.

In order to target increased interest in science subjects, ideally through biology, as it is the most favored science subject among students, areas of extracurricular influence that could enhance interest in biology among the studied Czech and Finnish students were explored through a questionnaire survey. Factor analysis identified 7 areas: Family trips, My career, Biology lessons, Healthy lifestyle, Institutions, Nature-related hobbies, and Information sources. These contribute to the students' interest in biology. The research revealed several key findings that highlight the dynamics of these factors among 9th-grade students in the Czech Republic and Finland. They are as follows: ECA, especially those related to nature and the outdoors, play a crucial role in shaping students' interest in biology. In the Czech context, hobbies related to nature and family trips appear as significant contributors to fostering interest in biology, indicating that an informal educational environment is essential for cultivating a lasting relationship with the subject. Conversely, in Finland, biology classes and career orientation have a more significant impact on students, demonstrating the effectiveness of formal educational strategies in increasing students' interest in biology. These findings suggest that students' interest in biology is influenced by a complex interplay of factors including gender, the nature of ECA, and the educational context.

Finnish students' interest in biology being significantly boosted by biology classes corresponds with earlier research findings. Previous research revealed that science classes in Finland tend to be traditional. Juuti et al. (2010) report that classes often involve front of class teaching, reading from textbooks, and solving basic problems. However, Uitto and Kärnä (2014) found that students favor front of class teaching, and that methods where the teacher leads the lesson, explains, and discusses complex problems with students lead to a higher preference for natural science subjects (though not necessarily to better results). Yli-Panula and Matikainen (2014) identified school as the primary source of information about nature for Finnish students, followed by media and then family. The current research also found that school was identified by Finnish students as the most significant source of interest in biology, with media following, and then a healthy lifestyle. Yli-Panula and Matikainen (2014) further state that less beneficial sources of information about biology were students' hobbies. This is in agreement with the findings of this research, as it shows that hobbies related to nature contributed least to the interest of Finnish students in biology.

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

In contrast, Czech students do not favor biology lessons. The research showed that Czech students' interest in biology was more likely increased by ECA rather than by teaching hours. This aligns with the findings by Kubiatko and Vlčková (2011) and Vlčková et al. (2019), who discovered that Czech students derive their interest in biology more from outside of school. This resonates with the research intent of this study and the literature cited in the introduction. The importance of connecting curriculum content with students' everyday lives has been long emphasized by many studies, including those aforementioned authors, as well as other Czech studies (e.g., Blažek & Příhodová, 2016; Rajsiglová & Poneszová, 2020) and also Finnish studies (e.g., Kang & Keinonen, 2018; Kang et al., 2019; Loukomies et al., 2013; Niemi et al., 2015; Uitto & Kärnä, 2014).

The presented research also revealed that family influence (see F1), along with the use of information sources (see F7), plays a significant role in increasing students' interest in biology in both of the studied socio-cultural environments. Schools could thus develop programs or events that would encourage family members' participation in science-related activities, thereby strengthening the connection between home, students' ECA, and school life in the context of natural science education. Additionally, parents could also actively participate in curricular changes. This is currently happening in the Czech Republic, as the draft document for the FEP EE (elementary education) revision should be the result of collaboration not only with practicing teachers but also with numerous professional subject associations and organizations from the nonprofit sector, that have long been striving for transformation in Czech education, whether it concerns involving parents, addressing barriers in education, the mental health of students, issues such as school climate, or classroom atmosphere amongst many others. From October 2023, an initiative "Changing Curricula" is also underway, involving subject associations, foundations, and associations such as the Union of Parents Society for All (SOFA), and the Permanent Conference of Associations in Education (SKAV). Together with the National Institute of Education (NIE), they are trying to communicate to the public the essential topics that accompany the curriculum revision.

Furthermore, in the context of the currently ongoing revision of the FEP in the Czech Republic, where emphasis is also placed on so-called digital competency, it is essential to offer students a learning environment rich in information sources. As for the use of information sources, they can help attract students' attention to various educational topics during everyday teaching. Rotbain et al. (2008) described the use of computer animations in the teaching of molecular biology at high school, Teplá et al. (2021) recommend using mobile apps to increase interest in teaching, which are current and attractive to students. How to explore the entire tree of life even on a relatively old mobile device is presented by Wong and Rosindell (2022), and inspiration for teaching biochemistry using Adobe Flash animations is described by Teplá and Klímová r (2015), who report subsequently increased student interest. The authors illustrate that teachers have the opportunity to support students in the meaningful use of mobile apps even in their free time.

This suggests the need for further research to explore how planned activities in nature can support the connection between family and school, the impact of specific types of ECA, such as science clubs, research projects, or STEM competitions on students' interest levels and engagement, which could provide more detailed recommendations for educational practice. Moreover, the difference in the impact of ECA between Finnish and Czech students leads to the need for further research in relation to the analysis of the teaching hours of Finnish and Czech teachers. Key questions that may illuminate why differences are observed between students of the nationalities studied might include how teachers in these countries work with textbooks, how these textbooks are specifically designed for the needs of students and their teachers, what the structure of educational materials is, or explanations of why discussions between teachers and students are appreciated by Finnish students so much more than Czech students, etc. Alongside a quantitatively oriented study, there are also opportunities for qualitatively oriented research that could illuminate the gaps.

From the above, it follows that some extracurricular areas may be more attractive to students than others; however, the real attractiveness should go hand in hand with the current demands of the times, reflecting the mandatory curricular documents. Students should be reinforcing competencies required by the curricula through activities that match their interests or abilities. This can be aided, among other things, by informal educational elements from the realm of extracurricular areas.

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Research Limits

This research is not without limitations, and its results should be interpreted with caution. Firstly, the survey was conducted locally - in Prague for the Czech Republic and in Oulu for Finland, thus, the results cannot be considered representative of the entire country. One way to address this limitation would be to extend the research to include additional regions within the surveyed areas. Secondly, although the curriculum documents of the countries studied share common aspects, it would be essential to inquire directly with teachers about their classroom practices and the extent to which they incorporate elements of non-formal education and extracurricular areas to enhance biology education. This particular point suggests the potential for comparative research, which could refine the survey's findings.

Conclusions and Implications

Understanding how students develop an interest in biology and what role this interest plays in the context of biology could help teachers and researchers increase students' motivation and perseverance, not only in biology but also in other science subjects.

The research examined the impact of ECA on the interest of Czech and Finnish lower-secondary school students in biology. It was conducted a quantitative survey using a 5-point Likert scale questionnaire among 373 students in Finland and the Czech Republic. The results identified seven key areas contributing to interest in biology: family trips, career aspirations, biology lessons, healthy lifestyle, institutional influence, nature-related hobbies, and information sources. It was found that in the Czech context, nature-related hobbies and family trips significantly influence interest in biology, while in Finland, biology lessons and career orientation play a crucial role, demonstrating the effectiveness of formal educational strategies.

Furthermore, the results highlight the importance of family involvement and the use of information sources in both studied socio-cultural environments. The research also emphasizes the importance of linking educational strategies with students' interests and cultural backgrounds to foster more engaging and inclusive biological education. Further research should explore how specific ECA can support the connection between family and school environments and their impact on students' interest and engagement in biology lessons.

Acknowledgements

This work was supported by the project of the Ministry of Education, Youth and Sports: Institutional Support for Long-term Development of Research Organizations - Cooperatio HUM/" General Education and Pedagogy " - Charles University, Faculty of Education (2023) and by funding project Progres Q17.

The authors thank Mgr. Jan Filip for consultations on the statistical processing of the results and help with the translation of the questionnaire Mgr. Jan Dlask and Lasse Suominen, M.A.

The authors would also like to thank the reviewers for their insightful comments, which led to revisions that improved the quality of the manuscript.

Declaration of Interest

The authors declare no competing interest.

References

Acarli, D. S., & Acarli, H. A. (2020). Examination of students' attitudes towards biology and biology course in terms of gender, grade level and pet-keeping. *Problems of Education in the 21st Century*, *78*(3), 328–341. https://doi.org/10.33225/pec/20.78.328

Baram-Tsabari, A., Sethi, R. J., Bry, L., & Yarden, A. (2010). Identifying students' interests in biology using a decade of self-generated questions. *Eurasia Journal of Mathematics, Science and Technology Education*, *6*(1), 63–75. https://doi.org/10.12973/ejmste/75228

Basl, J. (2011). Effect of school on interest in natural sciences: A comparison of the Czech Republic, Germany, Finland, and Norway based on PISA 2006. *International Journal of Science Education*, *33*(1), 145–157. https://doi.org/10.1080/09500693.2010.518641

Blažek, R., & Příhodová, S. (2016). *Mezinárodní šetření PISA* 2015. Česká školní inspekce. [PISA 2015 international survey. Czech School Inspectorate].

Braund, M., & Reiss, M. (2012). *Learning science outside the classroom*. Routledge.

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Brias-Guinart, A., Aivelo, T., Högmander, M., Heriniaina, R., & Cabeza, M. (2023). A better place for whom? Practitioners' perspectives on the purpose of environmental education in Finland and Madagascar. *The Journal of Environmental Education*, *54*(3), 163–180. https://doi.org/10.1080/00958964.2023.2178371

Campbell, J. R., & Walberg, H. J. (2010). Olympiad studies: Competitions provide alternatives to developing talents that serve national interests. *Roeper Review*, *33*(1), 8–17. https://doi.org/10.1080/02783193.2011.530202

Chytrý, V., & Kroufek, R. (2017). Možnosti využití Likertovy škály–základní principy aplikace v pedagogickém výzkumu a demonstrace na příkladu zjišťování vztahu člověka k přírodě [Possibilities of using the Likert's scale–basic principles of application in pedagogical research and demonstration on the example of human relationship to nature]. *Scientia in Educatione*, *8*(1). https://doi:10.14712/18047106.591

Debarliev, S., Janeska-Iliev, A., Stripeikis, O., & Zupan, B. (2022). What can education bring to entrepreneurship? Formal versus non-formal education. *Journal of Small Business Management*, *60*(1), 219–252. https://doi.org/10.1080/00472778.2019.1700691

Denault, A. S., & Guay, F. (2017). Motivation towards extracurricular activities and motivation at school: A test of the generalization effect hypothesis. *Journal of Adolescence*, *54*, 94–103. https://doi.org/10.1016/j.adolescence.2016.11.013

Dewey, J. (1913). *Interest and effort in education*. Franklin Classics Trade Press.

Duarte, R., Escario, J. J., & Sanagustín, M. V. (2017). The influence of the family, the school, and the group on the environmental attitudes of European students. *Environmental Education Research*, *23*(1), 23–42. https://doi.org/10.1080/13504622.2015.1074660

Fabiola, G. B., Iwin, L., Jennifer, L. M., & Zaira, V. V. (2012). The effect of the number of answer choices on the psychometric properties of stress measurement in an instrument applied to children. *Evaluar*, *12*, 43–59.

Fančovičová, J., & Kubiatko, M. (2015). Záujem žiakov nižšieho sekundárneho vzdelávania o biologické vedy [Lower secondary school pupils' interest in biological sciences]. *Scientia in Educatione*, *6*(1), 2–13. https://doi.org/10.14712/18047106.151

FEP EE (2017). *Framework of Education Programme for Elementary Education*. MŠMT ČR. http://www.vuppraha.rvp.cz/wp-content/uploads/2009/12/RVP_ZV_EN_final.pdf

FEP EE (2021). *Framework of Education Programme for Elementary Education*. MŠMT ČR. http://www.vuppraha.rvp.cz/wp-content/uploads/2009/12/RVP_ZV_EN_final.pdf

FNBE (2016). *Finnish National Board of Education 2016: National core curriculum for basic education*. Finnish national board of education. 508 s.

Hanney, R., & Savin-Baden, M. (2013). The problem of projects: understanding the theoretical underpinnings of project-led PBL. *London Review of Education*, *11*(1). http://dx.doi.org/10.1080/14748460.2012.761816

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist*, *41*(2), 111–127. https://doi.org/10.1207/s15326985ep4102_4

Janoušková, S., Hubáčková, L., Pumpr, V., & Maršák, J. (2014). Přírodovědná gramotnost v preprimárním a raném období primárního vzdělávání jako prostředek zvýšení zájmu o studium přírodovědných a technických oborů [Science literacy in the pre-primary and early stages of primary education as a tool for increasing an interest in science and technical studies]. *Scientia in Educatione*, *5*(1), 36–49. https://doi.org/10.14712/18047106.67

Juuti, K., Lavonen, J., Uitto, A., Byman, R., & Meisalo, V. (2004). Boys' and girls' interests in physics in different contexts: A Finnish survey. *Current Research on Mathematics and Science Education*, 55–79.

Juuti, K., Lavonen, J., Uitto, A., Byman, R., & Meisalo, V. (2010). Science teaching methods preferred by grade 9 students in Finland. *International Journal of Science and Mathematics Education*, *8*, 611–632. https://doi.org/10.1007/s10763-009-9177-8

Kang, J., & Keinonen, T. (2018). The effect of student-centered approaches on students' interest and achievement in science: Relevant topic-based, open and guided inquiry-based, and discussion-based approaches. *Research in Science Education*, *48*, 865–885. https://doi.org/10.1007/s11165-016-9590-2

Kang, J., Keinonen, T., & Salonen, A. (2019). Role of interest and self-concept in predicting science aspirations: Gender study. *Research in Science Education*, *1*–23. https://doi.org/10.1007/s11165-019-09905-w

Kohoutová, V. (2013–06–28). *Neformální vzdělávání - co to je a proč je uznávat* [Non-formal education - what it is and why to recognise it]. https://www.msmt.cz/mladez/neformalni-vzdelavani-co-to-je-a-proc-je-uznavat

Kubiatko, M., & Vlčková, J. (2011). Návrh výzkumného nástroje na zkoumání postojů žáků 2. stupně ZŠ k přírodopisu. [The proposal of the measurement tool on the investigation of lower secondary school pupils' attitudes toward biology]. *Scientia in Educatione*, *2*(1), 49–67. https://doi.org/10.14712/18047106.15

Kubiatko, M. (2012). The investigation of Czech lower secondary school pupils toward science subjects. *Journal of Educational and Social Research*, *2*(8), 11–17. https://doi.org/10.5901/jesr.2012.v2n8p11

Kubiatko, M. (2016). Bol Likert ordinalista alebo intervalista? Chyby pri tvorbe a vyhodnocovaní Likertových škál [Was Likert ordinalist or intervalist? The mistakes by the creation and evaluation of Likert scales]. *Pedagogika.sk*, (3), 177–190.

Lavonen, J., Gedrovics, J., Byman, R., Meisalo, V., Juuti, K., & Uitto, A. (2008). Students' motivational orientations and career choice in science and technology: a comparative investigation in Finland and Latvia. *Journal of Baltic Science Education*, *7*(2). http://oaji.net/articles/2014/987-1404719696.pdf

Lavonen, J., & Juuti, K. (2016). Science at Finnish compulsory school. In: Niemi, H., Toom, A. & Kallioniemi, A. (Eds), *Miracle of Education* (pp. 125–144*)*. SensePublishers. http://dx.doi.org/10.1007/978-94-6300-776-4_9

Lawhorn, B. (2008). Extracurricular activities. *Occupational Outlook Quarterly*, *9*(1), 16–21.

Loukomies, A., Pnevmatikos, D., Lavonen, J., Spyrtou, A., Byman, R., Kariotoglou, P., & Juuti, K. (2013). Promoting students' interest and motivation towards science learning: The role of personal needs and motivation orientations. *Research in Science Education*, *43*, 2517–2539. https://doi.org/10.1007/s11165-013-9370-1

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Martinez, A., Coker, C., McMahon, S. D., Cohen, J., & Thapa, A. (2016). Involvement in extracurricular activities: Identifying differences in perceptions of school climate. *The Educational and Developmental Psychologist*, *33*(1), 70–84. https://doi.org/10.1017/edp.2016.7

Melichar, R. (2024-04-02). *NPI spouští veřejnou konzultaci k revizi RVP.* [NIE is launching a public consultation on the revision of the FEP.] https://www.msmt.cz/ministerstvo/novinar/npi-cr-spousti-verejnou-konzultaci-k-revizi-rvp-zapojit-se?highlightWords=revize+rvp

Niemi, R., Kumpulainen, K., & Lipponen, L. (2015). Pupils as active participants: Diamond ranking as a tool to investigate pupils' experiences of classroom practices. *European Educational Research Journal*, *14*(2), 138–150. https://doi.org/10.1177/1474904115571797

Prokop, P., Prokop, M., & Tunnicliffe, S. D. (2007). Is biology boring? Student attitudes toward biology. *Journal of Biological Education*, *42*(1), 36–39. https://doi.org/10.1080/00219266.2007.9656105

Prokop, P., Tuncer, G., & Chudá, J. (2007). Slovakian students' attitudes toward biology. *Eurasia Journal of Mathematics, Science and Technology Education*, *3*(4), 287–295. https://doi.org/10.12973/ejmste/75409

Rajsiglová, J. (2018). Project based learning and other methods and forms used by Prague teachers supervising pedagogical training in science lessons. In *M. Rusek, K. Vojíř (Eds.), Project-based Education in Science Education XV.,* (pp. 144–151). Charles University, Faculty of Education.

Rajsiglová, I., & Poneszová, V. (2020). Popularity of biology and selected topics from the perspective of Czech and Finnish students. In *M. Rusek, M. Tóthová & K. Vojíř (Eds.), Project-based Education and other Activating Strategies in Science Education XVIII.,* (pp. 186–193). Charles University, Faculty of Education.

Rajsiglová, J., & Škarková, B. (2019). Project based learning, its realization and influence on pupil's learning. https://conference.pixel-online.net/NPSE/files/npse/ed0008/FP/5552-EST3758-FP-NPSE8.pdf

Rantala, O., & Puhakka, R. (2020). Engaging with nature: Nature affords well-being for families and young people in Finland. *Children's Geographies*, *18*(4), 490–503. https://doi.org/10.1080/14733285.2019.1685076

Reunamo, J., & Suomela, L. (2013). Education for sustainable development in early childhood education in Finland. *Journal of Teacher Education for Sustainability*, *15*(2), 91–102. https://doi.org/10.2478/jtes-2013-0014

Rotbain, Y., Marbach-Ad, G., & Stavy, R. (2008). Using a computer animation to teach high school molecular biology. *Journal of Science Education and Technology*, *17*, 49–58. http://dx.doi.org/10.1007/s10956-007-9080-4

Rowland, A. A., Knekta, E., Eddy, S., & Corwin, L. A. (2019). Defining and measuring students' interest in biology: An analysis of the biology education literature. *CBE—Life Sciences Education*, *18*(3), article 34. https://doi.org/10.1187/cbe.19-02-0037

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68. https://psycnet.apa.org/doi/10.1037/0003-066X.55.1.68

Skar, M., Gundersen, V., & O'Brien, L. (2016). How to engage children with nature: Why not just let them play?. *Children's Geographies*, *14*(5), 527–540. https://doi.org/10.1080/14733285.2015.1136734

Subedi, B. P. (2016). Using Likert type data in social science research: Confusion, issues and challenges. *International Journal of Contemporary Applied Sciences*, *3*(2), 36–49.

Teplá, M., & Klímová, H. (2015). Using Adobe Flash Animations of electron transport chain to teach and learn biochemistry. *Biochemistry and Molecular Biology Education*, *43*(4), 294–299.

Teplá, M., Distler, P., & Šmejkal, P. (2021). Přehled a využití mobilních aplikací ve výuce chemie [Overview and use of mobile apps in chemistry education]. *Chemické listy*, *115*(12), 679–684.

Thorndike, E. L. (1935). *Adult interests.* Macmillan.

Trumper, R. (2006). Factors affecting junior high school students' interest in biology. *Science Education International*, *17*(1), 31–48.

Uitto, A., Juuti, K., Lavonen, J., & Meisalo, V. (2006). Students' interest in biology and their out-of-school experiences. *Journal of Biological Education*, *40*(3), 124–129. https://doi.org/10.1080/00219266.2006.9656029

Uitto, A., Juuti, K., Lavonen, J., & Meisalo, V. (2008). The importance of pupils' interests and out-of-school experiences in planning biology lessons. *Science Education Review*, *7*(1), 23–27. https://www.learntechlib.org/p/158919/

Uitto, A., Juuti, K., Lavonen, J., Byman, R., & Meisalo, V. (2011). Secondary school students' interests, attitudes and values concerning school science related to environmental issues in Finland. *Environmental Education Research*, *17*(2), 167–186. https://doi.org/10.1080/13504622.2010.522703

Uitto, A. (2014). Interest, attitudes and self-efficacy beliefs explaining upper-secondary school students´ orientation towards biology-related careers. *International Journal of Science and Mathematics Education*, *12*, 1425–1444. https://doi.org/10.1007/s10763-014-9516-2

Uitto, A., & Kärnä, P. (2014). Teaching methods enhancing grade nine students' performance and attitudes towards biology. *Education Research for Evidence-based Teaching and Coherence in Learning. Part*, *2*. http://hdl.handle.net/10138/230997

Vedder-Weiss, D., & Fortus, D. (2012). Adolescents' declining motivation to learn science: A follow-up study. *Journal of Research in Science Teaching*, *49*(9), 1057–1095. https://doi.org/10.1002/tea.21049

Vlckova, J., Kubiatko, M., & Usak, M. (2019). The perception of biology by Czech lower secondary school students. *Eurasia Journal of Mathematics, Science and Technology Education*, *15*(5), em1714. https://doi.org/10.29333/ejmste/105277

Wang, Y., Lavonen, J., & Tirri, K. (2019). An assessment of how scientific literacy-related aims are actualised in the National Primary Science curricula in China and Finland. *International Journal of Science Education*, *41*(11), 1435-1456. https://doi.org/10.1080/09500693.2019.1612120

Wong, Y., & Rosindell, J. (2022). Dynamic visualisation of million-tip trees: The OneZoom project. *Methods in Ecology and Evolution*, *13*(2), 303–313. https://doi.org/10.1111/2041-210X.13766

https://doi.org/10.33225/jbse/24.23.536

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Yli-Panula, E., & Matikainen, E. (2014). Students and student teachers' ability to name animals in ecosystems: A perspective of animal knowledge and biodiversity. *Journal of Baltic Science Education*, *13*(4), 559–572. http://dx.doi.org/10.33225/jbse/14.13.559

Received: *March 25, 2024* Revised: *May 11, 2024* Accepted: *June 08, 2024*

Cite as: Rajsiglová, I., Poneszová, V., & Teplá, M. (2024). The influence of extracurricular activities on the interest of Czech and Finnish students in biology. *Journal of Baltic Science Education*, *23*(3), 536–549. https://doi.org/10.33225/jbse/24.23.536

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