STUDENT WILLINGNESS TO PARTICIPATE IN ENVIRONMENTAL PROJECT-BASED LEARNING

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Abstract: Project-based learning (PBL) plays a crucial role in environmental education, as it allows students to engage actively with sustainability challenges. The aim of this study is to evaluate the attitudes of students at a selected upper secondary school towards participation in project-based learning focused on environmental topics. The quantitative research was conducted in one selected secondary school in South Bohemia. A total of 168 students participated in the survey. Overall, the results indicate a generally positive attitude among the surveyed students towards environmental topics in education, as well as towards PBL focused on environmental issues. However, hypothesis testing showed that students' willingness to participate in such targeted PBL was not significantly influenced by selected socio-demographic variables or by the level of environmental knowledge acquired through formal education.

Keywords: environmental topics, project-based learning, secondary school, students

1 Introduction

When defining project-based learning (PBL), it is necessary to take into account the dynamic nature of the concept itself. This diversity of definitional features, coupled with the lack of a universally accepted model, can greatly complicate the definition of this teaching method (Du & Han, 2016). PBL can be defined as learning that focuses on deeper learning in context and develops key skills. Its core characteristics are interdisciplinary, rigorous, and student-centred. Students apply knowledge and skills through engaging experience (O'Brien & Defined Learning, 2024).

The empirical results confirm that PBL develops students' autonomy in learning, defining the basic questions, planning the project, monitoring and evaluating the progress of the project and finally verifying the results (Novalia et al., 2025). There is also a significant improvement in collaboration, problem solving, and critical thinking. There are also significant correlations between PBL and educational outcomes, ranging from moderate to significant (Rehman et al., 2024). Another advantage is the possibility to carry out cross-curricular projects (de Reviere et al., 2024; Alsmadi et al., 2024). The aim is to encourage interdisciplinary learning. It can also be concluded from the results that the students who approached believe that the project has more added value (de Reviere et al., 2024). There are also areas that need more attention in projects, such as managing project timelines, improving workflow strategies and integrating domain-specific knowledge (Alsmadi et al., 2024). According to Larmer et al. (2015), project-based learning is particularly time-consuming. It requires thorough preparation in order to achieve the desired quality. PBL also enhances students' ability to apply project management principles in practice. Both soft and technical skills are integrated (Marnewick, 2023). Another positive aspect of PBL may also be its focus on increasing students' self-confidence, discipline, responsibility and self-control (Novalia et al., 2025).

At the elementary school level, it was also found that PBL in the personalized project-based learning variant. In general, the approach improved student achievement and reduced the achievement gap between students (Lin et al., 2025). In the case of PBL in an elementary school in the context of developing websites, there was an increase in student creativity (Marini et al., 2025). In the context of upper secondary education, project-based learning has been shown to enhance students' problem-solving skills, including their ability to approach ethical issues, such as those related to AI, and to develop overall competence in problem-solving (Kong et al., 2024).

Environmental topics can be taught within PBL, for example, in the form of integrating life cycle thinking and circular economy into the curriculum. As a result, students will gain knowledge and skills about the sourcing of materials, the links between products and business models, and the impact on the environment (Reich & Vermeyen, 2025). Further connections between environmental issues, the circular economy, and PBL have been identified in the context of metal recycling within industrial design. Preliminary findings suggest that this approach can serve as a strong motivational factor for students (Schoch et al., 2025).

The circular economy is a key economic concept that supports the achievement of a carbon-neutral European Union (European Commission, 2015; European Commission, 2019). Educational institutions likewise play a critical role in this transition, particularly through their influence on students, parents, and the wider community (European Commission, 2019). A global perspective on the role of schools and the fundamental requirements for climate action in education (UNESCO, 2016) highlights the importance of engaging in school governance, curriculum, infrastructure, and community involvement. In this context, project-based learning emerges as a suitable pedagogical approach to support these objectives.

2 Methods

The aim of this study is to evaluate the attitudes of students at a selected upper secondary school towards participation in project-based learning focused on environmental topics.

The participants in the study are high school students from an upper secondary school (equivalent to a gymnasium in the Czech Republic) in a city located in the South Bohemian Region. After data filtering, a total of 168 questionnaires were used. Data collection took place across seven classes. Three classes belong to the first year, one class to the second year, one class to the third year, and the remaining two classes to the fourth year. The questionnaire was completed by all present students, resulting in a nearly 100% response rate. Data collection took place at the end of 2024. The questionnaire consisted of several interrelated sections. It included the following areas of questions: identification questions, formal environmental education, sources of environmental knowledge, and project-based learning, along with other organisational forms.

The following null hypotheses were set for statistical analysis:

- $H1_0$: *Female students do not show greater willingness to participate in internships at environmental centres or outdoor schools.*
- $H2_0$: *Students from rural areas do not show greater willingness to participate in internships at environmental centres or outdoor schools.*
- $H3_0$: *Completing a school subject focused on environmental topics does not affect the willingness to participate in internships at environmental centres or outdoor schools.*
- $H4_0$: *There is no significant correlation between the amount of environmental knowledge acquired at school and the willingness to participate in internships at environmental centres or outdoor schools.*

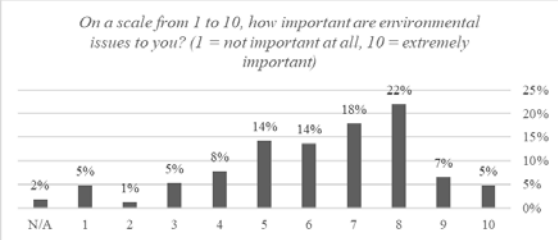
The gender distribution of the sample is as follows: 58% women, 36% men. A total of 6% of the students interviewed did not indicate their gender. Whether students live in a rural or urban area was also an important variable. A total of 64% of the respondents live in urban areas. On the other hand, 35% of the students reported living in a rural area. Only 1% of the respondents did not indicate their place of residence. A last significant variable, which is then also subject to correlation analysis, is whether students have encountered environmental

issues, climate change, or other related topics during their studies. A total of 79% of them have encountered this form of learning. On the contrary, 20% of them stated that they had never encountered such a form during their studies. Only 1% of the respondents did not give an answer.

3 Results

The first primary variable observed was the degree of importance students placed on learning about environmental topics. They were asked to indicate the level of importance on a scale of 1-10 (1 = not important at all, 10 = extremely important). Figure 1 shows that students give relatively higher importance to this teaching. In particular, they indicate values between 5-8, with 8 having the highest frequency, i.e. 22%.

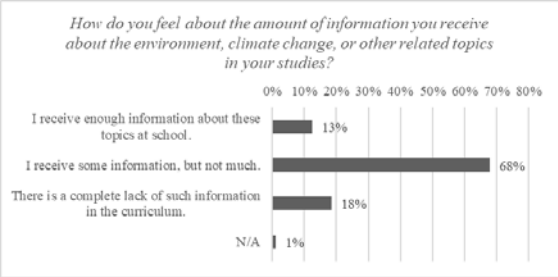
Figure 1: The importance of teaching environmental issues in schools



Source: Own research, n = 168

Another important variable to be monitored is how students themselves perceive the amount of information about the environment, climate change and other related topics. From Figure 2, it can be seen that most students, 68%, report that they get some information but not much.

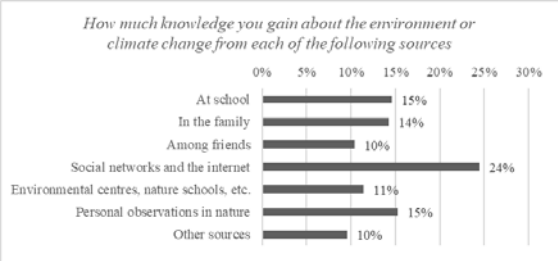
Figure 2: Do students receive sufficient information about the environment, climate change, and other related topics?



Source: Own research, n = 168

To clarify where students get their information about environmental knowledge, an additional question was asked that directly measured the amount of this information across different sources. Figure 3 shows that students obtain most of this knowledge from social networking sites and the internet, at 24%. This is followed by an identical 14% from their own observations outdoors and knowledge gained through formal education, i.e. at school.

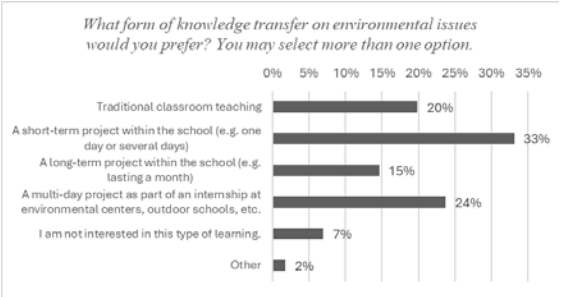
Figure 3: Sources of environmental knowledge according to students



Source: Own research, n = 168

Regarding formal education in schools, students were asked to indicate which form of instruction they considered most suitable for the transfer of environmental knowledge. Traditional classroom teaching was selected by only 20% of respondents. The most frequently chosen option was short-term project-based learning within the school (lasting one or several days), reported by 33% of students. Multi-day projects implemented as part of internships at environmental centres, outdoor schools, and similar settings were selected by 24% of respondents.

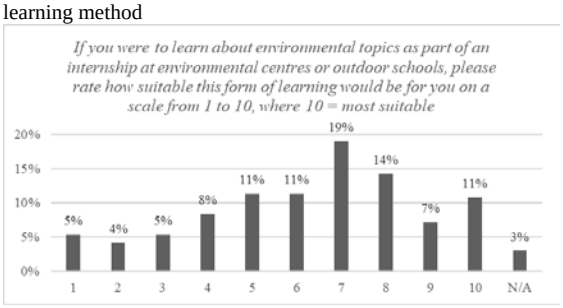
Figure 4: Preferred form of knowledge transfer on environmental issues



Source: Own research, n = 168

In the following question, students were asked to rate, on a scale from 1 to 10, how suitable they considered learning about environmental topics as part of an internship at environmental centres or outdoor schools, with 10 indicating the highest level of suitability. Students rate this form of teaching quite highly, with the most frequent values being 7 (19%) and 8 (14%).

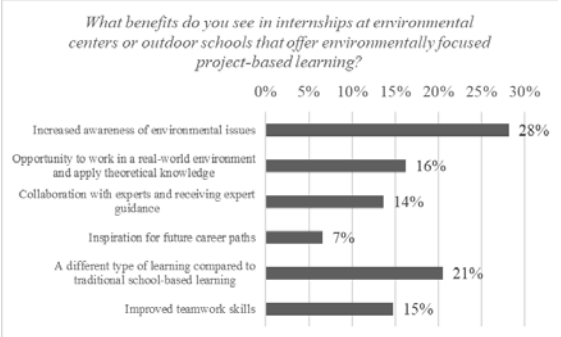
Figure 5: Student ratings of environmental internships as a learning method



Source: Own research, n = 168

The final variable examined was the perceived benefits of participating in the aforementioned form of instruction, as perceived by the students. The most frequently cited benefit was increased awareness of environmental issues, selected by 28% of respondents. This was followed by the opportunity to experience a different type of learning compared to traditional classroom-based education (21%).

Figure 6: Perceived benefits of internships at environmental centres or outdoor schools offering environmentally focused PBL



Source: Own research, n = 168

The original 10-point scale used to assess the perceived suitability of learning about environmental topics through internships at environmental centres or outdoor schools was recoded into three categories for the purposes of analysis. High interest included responses of 10, 9, and 8; medium interest included responses of 7, 6, 5, and 4; and low interest included responses of 3, 2, and 1.

There was no statistically significant relationship between willingness to participate in internships at environmental centres or outdoor schools and gender ($\chi2 = 6.773$; df = 6; p = 0.342). Although Table 1 shows that women show slightly more interest, we do not reject the null hypothesis 1 (*Female students do not show greater willingness to participate in internships at environmental centres or outdoor schools*).

Table 1: Testing of null hypothesis 1 (crosstabs)

Willingness to participate in internships at environmental centres or outdoor schools	Adjusted residual		
	Gender		
	Man	*I do not want to specify*	*Woman*
High interest	-1.8	1.0	1.3
Medium interest	0.6	-0.3	-0.5
Low interest	1.8	-0.6	-1.5

Source: Own research

We also do not reject the second null hypothesis tested (*Students from rural areas do not show greater willingness to participate in internships at environmental centres or outdoor schools*), as no statistically significant relationship was found between willingness to participate in internships at environmental centres or outdoor schools and place of residence ($\chi2 = 5.797$; df = 6; p = 0.446).

Table 2: Testing of null hypothesis 2 (crosstabs)

Willingness to participate in internships at environmental centres or outdoor schools	Adjusted residual	
	Do you live in the city or in the countryside?	
	In the countryside	*In the city*
High interest	-0.6	0.4
Medium interest	1.6	-1.3
Low interest	-1.2	0.9

Source: Own research

As in the previous cases, we also do not reject the third null hypothesis tested (*Completing a school subject focused on environmental topics does not affect the willingness to participate in internships at environmental centres or outdoor schools*), as there was no statistically significant relationship between willingness to participate in internships at environmental centres or outdoor schools and whether students encountered environmental education during their studies (3.744; df = 6; p = 0.711).

Table 3: Testing of null hypothesis 3 (crosstabs)

Willingness to participate in internships at environmental centres or outdoor schools	Adjusted residual	
	Encountered environmental education during studies	
	Yes	*No*
High interest	0.9	-0.8
Medium interest	-0.6	0.4
Low interest	-1.0	1.0

Source: Own research

The last null hypothesis (*There is no significant correlation between the amount of environmental knowledge acquired at school and the willingness to participate in internships at environmental centres or outdoor schools*) was tested using Pearson correlation. Based on the output of the correlation analysis, there was no statistically significant relationship between the variables (r = 0.147; p = 0.062) at the 0.05 significance level. We do not reject the null hypothesis.

To provide context for the last hypothesis tested, the other three most represented sources where students acquire environmental knowledge were also tested, along with the variable of interest - willingness to participate in internships at environmental centres or outdoor schools. Positive correlations were found in all three sources: in the family (r = 0.392; p = 0.000), social networks and the internet (r = 0.234; p = 0.003), and personal observations in nature (r = 0.212; p = 0.007).

4 Conclusions

The aim of this study was to evaluate the attitudes of students at a selected upper secondary school towards participation in project-based learning focused on environmental topics. Overall, the students surveyed perceive the teaching of environmental topics as important. Although they do receive some form of environmental education within the formal curriculum, it is perceived as insufficient. This suggests that the implementation of environmental content in formal education remains limited, indicating space for improvement in light of the EU's educational objectives (European Commission, 2019). The results also suggest that formal education is not the primary source of students' environmental knowledge.

Regarding PBL, the students interviewed would prefer short-term and multi-day forms of this instruction and overall give this form of instruction above average importance. However, the hypotheses tested showed that this willingness to participate in such thematic project-based learning is not influenced by gender, place of residence, or whether they have previously taken such a school-based course. Similarly, there is no correlation between the amount of environmental knowledge from formal schooling and willingness to participate in environmentally focused PBL. These findings can serve to complement existing empirical studies focused on environmental aspects of PBL (e.g. Reich & Vermeyen, 2025; Schoch et al., 2025).

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