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School students' perceptions of trees and wooden objects in their immediate home environment: Possible implications for school environments

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Abstract

We present a county-wide statistically representative survey with 430 Hungarian school students demonstrating that students who have trees in the parental home environment show more positive attitude towards trees and wood than their peers who do not have any. We aimed at finding out about the current attitudes of the upcoming generation with regard to the use of wood and wood materials, and also about the question as to whether they would consciously use wood materials in the future. Results show that school students who have trees in their parental home environment show significantly higher scores on the cognitive, affective, and conative domains of attitude towards trees and wood compared to those who do not have trees in their parental home environment. The present study contributes to outdoor environmental education research in that we provide quantitative evidence for the positive effect of the immediate environment of children on the attitude towards wood and trees. The findings suggest the imperative need for further novel educational interventions in school gardens related to trees and wooden objects.

Keywords Wood · Extracurricular programs · School gardens · Family gardens · Attitude

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Introduction

Two research objectives

The primary objective of our research is to examine whether the presence of trees in the immediate parental home environment of children increases their positive attitude towards trees and wood, thereby demonstrating the regulatory role of childhood experience and knowledge gained in the immediate parental home environment. We focus on the immediate parental home environment, given the partial prevalence of school gardens in Hungary and their non-traditional role in environmental education within the region. Additionally, this choice is predicated on the rationale that children's immediate environments, to which they are exposed on a daily basis, play a crucial role in their environmental learning and development (e.g., Blair, 2009; Christian et al., 2023).

Our second objective is to examine environmental attitude, as it affects behaviour (e.g., Bradley et al., 1999). Specifically, we explore how the presence of trees at home impacts three distinguished components of attitude, with attitude being a potent behavioural antecedent of environmental awareness (Pooley & O'Connor, 2000). These three components of attitude are as follows: (1) The *cognitive* component of attitude, referring to beliefs, knowledge, awareness, and consciousness, was explored via questions related to family, school, and extracurricular activities; (2) The *affective* component of attitude, which encompassed emotions and feelings; and (3) the *conative* component of attitude, which refers to behavioural antecedents such as future decisions, intentions, and willingness. OEE (Outdoor Environmental Education) research has not yet examined these three components of attitude in connection with trees and the use of wood.

Hypotheses

We posit three distinct hypotheses. The first hypothesis suggests that students who have trees in their parental home environment will exhibit higher scores in the cognitive domain of attitude compared to those without such an environment. The second hypothesis proposes that students with trees in their parental home environment are likely to score higher in the affective domain of attitude than their counterparts without trees. The third hypothesis anticipates that the presence of trees in students' parental home environments is associated with higher scores in the conative domain of attitude, as opposed to students who do not have trees in their parental home environment. Each of these hypotheses aims to explore the correlation between exposure to trees in early home environments and the development of various aspects of attitudinal disposition.

This study assesses the level of awareness among the youth regarding the ecological importance of wood, trees, and forestry and aims to ascertain the depth of their concern for sustainable forest management and the utilization of resources derived from trees. A critical aspect of this research is to clarify the perceptions of young

people towards these natural resources, a task that gains urgency due to the existing ambiguities and ongoing media debates surrounding practices such as wood-felling and logging. By doing so, this study endeavors to propose novel educational interventions related to wood, to be implemented in school gardens.

Environmental education regarding wood-related components and school gardens.

Through outdoor learning, the outdoors serve as a learning context, as noted by Adkins and Simmons (2002). Environmental education, evolving since the 1990s (see Ardoin & Bowers, 2020), gained further emphasis with a 2022 European Commission directive promoting extracurricular activities, often involving outdoor learning, to apply environmental knowledge practically. Hungarian experiences, cited by Kövecsesné (2009) and Leskó (2018), confirm the positive impact of such activities on students' environmental attitudes. Additionally, events like Hungary's Earth Day, Birds and Trees Day, and the International Day of Forests enhance environmental education's effectiveness.

The premise of our study is that the insights and experiences gained in the parental home environment can be transferred to the scenario of school gardens. In the early twentieth century, the "Outdoor Education" bulletin of the School Garden Association of America conveyed important aspects of the school garden movement in that country (Quay & Seaman, 2013). It highlighted the value of hands-on, nature-based learning, aligning with progressive education theories that favoured experiential learning and real-world curriculum integration. This publication was instrumental in advocating for what we now call outdoor learning as essential to comprehensive student development. Much later, in 2016, a notable initiative in the area of school gardens in Hungary is the EFOP-3.4.3–16-2016–00016 subproject of the Széchenyi István University Faculty of Apáczai Csere János, which aims to integrate school garden education with heritage preservation, primarily focusing on agricultural folklore (Maradéknélkül, n.d.) but not on the wood-related topics under investigation in the present study.

The benefits and efficacy of school gardens

School gardens have been shown to effectively shape attitudes (Bogner, 1998; Bogner & Wiseman, 2004; Dettmann-Easler and Pease, 1999; Emmons, 1997; Ferreira, 2012; Johnson & Manoli, 2008; Kruse & Card, 2004; Mullenbach et al., 2018; Sellmann & Bogner, 2013; Zelezny, 1999). However, short-term and less frequently organized programs like forest schools in Hungary do not seem to have lasting impacts on attitudes and values (Sellmann & Bogner, 2013). These forest schools, defined broadly as educational formats in natural settings (Kováts-Németh & Földes-Leskó, 2019), are crucial for fostering environmental awareness, as noted by Lohri and Schwyter (2002). In Hungary, these forest schools may not always be in forest areas, and their curricula may cover more than just forest themes (Hortobágyi, 1991). This suggests that other initiatives may offer a way to achieve more regular daily exposure to living nature in Hungarian schools, beyond taking the forest school approach. Included amongst these is school gardens. Hungarian school

gardens, often near or within schools (Marton, 2019), are scarce but offer educational and interactive benefits (Berezowitz et al., 2015).

For instance, horticultural therapy benefits for older populations are noted (Reis et al., 2023). Furthermore, school gardens positively impact health and welfare (Amiri et al., 2021; Blair, 2009; Chang et al., 2016; Ohly et al., 2016). Australian case studies show gardening's role in developing core competencies (Christian et al., 2023), with Christensen and Wistoft (2019) reporting improved student performance and attention. These studies also investigate students' attitudes towards trees and wooden objects, linking them to environmental policy impacts (Blair, 2009; García-González & Schenetti, 2022; Ohly et al., 2016). Previous findings in Hungary indicate that Hungarian school gardens also enhance skills and competencies (Hortobágyi, 1991; Schróth, 2015; Szászné, 2004; Varga, 2006, 2009). However, the limited effectiveness of current OEE in Hungary is also addressed (e.g., Fűzné, 2002; Havas & Varga, 1998; Havas et al., 2002; Hegymeginé, 2003; Konyha, 2011), advocating for enhanced approaches, including adaptable garden formats like indoor hydroponics and container gardens for urban areas.

School gardens offer educational benefits that overcome some of the limitations of other forms of outdoor environmental education that must occur during specific time periods and in locations distant from the school. These limitations influence the longer term impacts such forms of outdoor environmental education may have on environmental attitude, action, and behavior changes. Key challenges include that many programs, such as some forest schools, may lack the continuous engagement needed for profound learning and behavioral change (Rickinson et al., 2004). Secondly, such programs are often inaccessible in urban or lower socioeconomic areas (Coyle, 2010). Third, these programs frequently occur in settings removed from daily life, like isolated nature reserves, hindering the applicability of learned concepts (Krasny & Tidball, 2009). Fourth, some programs overly emphasize adventure or recreation over educational aspects of environmental conservation (Priest, 1986). Fifth, these programs often lack effective methods to meaningfully measure attitude, knowledge, and behavior changes (Stevenson et al., 2014). Our research specifically addresses the evaluation challenge highlighted by Stevenson et al., (2014) by presenting findings from a statistically representative quantitative questionnaire study. We are aware that further reviews of program deficiencies, including those of school gardens, have been conducted by Ham and Sewing, (1988) and Hudson, (2001).

The incorporation of wood and trees into the curriculum of school gardens and the involvement in family gardens provide a connection to broader environmental policies and the global effort to combat climate change. Through active participation in gardening, individuals not only learn about the ecological benefits of trees, such as carbon sequestration and habitat provision but also about the sustainable use of wood as a resource. This education encourages the adoption of environmentally friendly practices and attitudes, highlighting the critical role that trees play in maintaining ecological balance and supporting human well-being.

A family garden is comparable to a school garden not only in terms of its physical similarity but also in terms of "exhibition time" or "exposure time", i.e., time spent there. Therefore, school and family gardens are instrumental in

Table 1 Gender of Respondents in the Survey

	Frequency (%)
Male	230 (53.5%)
Female	200 (46.5%)
Total	430 (100%)

Table 2 Types of Schools Surveyed

	Frequency (%)
Primary school	230 (53.5%)
Four-year secondary grammar school	20 (4.7%)
Six-year secondary grammar school	15 (3.5%)
Eight-year secondary grammar school	42 (9.8%)
Vocational high school	123 (28.6%)
Total	430 (100%)

Table 3 Location of Schools Participating in the Survey

	Frequency (%)
Village	59 (13.7%)
Town (town: 10–25 thousand inhabitants, e.g., Csorna, Kapuvár)	104 (24.2%)
City (city: over 25 thousand inhabitants, e.g., Sopron, Győr)	267 (62.1%)
Total	430 (100.0%)

Table 4 Types of Settlement of the Participants where they Grew Up until the Age of 12

	Frequency (%)
Village	148 (34.4%)
Town (town: 10–25 thousand inhabitants, e.g., Csorna, Kapuvár)	86 (20.0%)
City (city: over 25 thousand inhabitants, e.g., Sopron, Győr)	196 (45.6%)
Total	430 (100%)

providing experiential learning opportunities related to wood and trees, bridging the gap between theoretical knowledge and practical application. The "exhibition time" spent in these gardens is invaluable for instilling a lasting appreciation and respect for trees and the broader environment, ultimately contributing to more sustainable behaviors and attitudes towards natural resource management (Tables 1, 2, 3, 4 and 5).

Table 5 Questions Belonging to the Three Components of Attitude towards Wood and Trees

Cognitive attitude	Affective attitude	Conative attitude
Do you watch nature films and documentaries about wood/trees?	How sad are you usually when you see a dead or diseased tree?	Later, as an adult, do you plan to plant a tree in your own garden?
Do you have wooden tools in your family? (e.g., furniture, utensils, or ornaments)	How sad would you be if one of your wooden tools were to be destroyed?	How would you replace a destroyed device or object?
Do you have any wooden objects that have been in your family for a long time? (e.g., grandparents' furniture, old objects)	How pleasant does it make you feel to look at that old wooden object?	What would you do with a ruined wooden tool or object?
Have you seen an old farmhouse that has been renovated, is now habitable, or is used for something? (e.g., for an exhibition or museum)	How important do you think it is to know where and how people lived in the past?	Would you like to see this wooden object as an adult in your own home?
Is a house made entirely of wood environmentally friendly?	How beautiful do you find a house made entirely of wood?	Would you choose new wooden furniture for your own home as an adult?
		Have you ever lived in a house made entirely of wood? (temporarily, e.g., at camp, on holiday)
		Would you build a house made entirely of wood for yourself?

Materials and Methods

We conducted a county-wide questionnaire survey in Győr-Moson-Sopron County in Hungary, to obtain data on the environmental attitudes of young people in the age groups of the 7th year of primary school and the 11th year of secondary school. The survey was carried out in April, May, and June of 2021. The questions of the survey had been piloted on ten children, with adjustments made before finalising the questionnaire. The questions and the length of the questionnaire were tailored to the level of the age groups under investigation. Informed consent from both the parents and the schools were collected. The questionnaires were administered online using Google Docs during normal classes with no time limit for filling in the questionnaires, although filling in the questionnaire took most participants approximately 30 min. Neither the teachers nor the participants were aware of the hypotheses of the study. All relevant ethical guidelines were observed in accordance with the Declaration of Helsinki (World Medical Association, 2013). Both the schools and the parents of the children provided written consent (see Consent section).

The questionnaire contained 49 questions mainly comprised of categorical variables and a few ordinal variables (see Tables 6 and 7). After the sociodemographic variables, questions followed related to the respondents' habits in school and family, traditions, feelings, and willingness to use wood in the future. The questions were not randomised or pseudo-randomised across respondents because we did not expect any order or other effects usually associated with other types of questionnaire-studies. Such effects could be, for example, fatigue (e.g., items towards the end of the questionnaire might be answered inattentively), or the tendency of some questions affecting response behaviour with questions appearing later in the questionnaire. Participants taking part in either the pilot study (testing questions) or in the real study did not report any inconsistencies in the questionnaire in debriefings. We opted for the 5-point Likert-scale to let respondents select a neutral value, but also because this scale is consistent with the Hungarian grading system (higher values indicate agreement or high likelihood).

Our questionnaire was completed by 230 male and 200 female participants (for a distribution of gender, see Table 1). The youngest respondent was 10 years old and the oldest was 20 years old (mean age = 14.56 years, SD = 2.18 years). Given the total number of 430 participants and that the relevant demographic variables were counter-balanced (such as age, gender, school type, and size of settlement), the county-wide questionnaire survey is statistically representative to Győr-Moson-Sopron County.

The relevant variables that were submitted to stratification weighting were gender, age, school type, and size of settlement. This sampling method ensured a representative cross-section of the country's population, accurately mirroring its unique demographic and characteristic features. Hence, our sample is a proportional reflection of the specific characteristics in the target population of the county. Based on data from the Central Statistical Office in Hungary, in Győr-Moson-Sopron County there were 33,996 pupils at primary schools and 7,507

Table 6 A Summary of Results from the Factor Variables in the Survey

The factor variables in the questionnaire			
Gender	Boy – 230	Girl – 200	
Type of school participant	Elementary – 230	Secondary grammar school – 77	Vocational high school – 123
Current living environment of participant	City – 267	Town – 104	Village – 59
Environment participant was raised in until the age of 12	City – 196	Town – 86	Village – 148
If there is someone in the family who works with wood as a professional	No – 321	Yes – 109	
Whether participant would like to deal with wood as a professional later in his/her life	I don't know – 116	No – 250	Yes – 64
Whether family heat with wood in the household	I don't know – 60	With coal – 10	With district heating – 46
	With gas – 164	With other heating resource – 20	With wood – 130
Whether participant watches movies or documentaries related to wood	No – 271	Yes, alone – 83	Yes, with my parents – 76
Whether family of participant have trees in their garden	No – 65	Yes – 365	
When there is a family event, such as the birth of a child or a wedding, do they plant a tree?	I don't know – 41	No – 327	Yes – 62
Whether participant plans to plant a tree in adulthood	I don't know – 77	No – 27	Yes – 326
If there is a wooden tool or piece of furniture in the family	I don't know – 14	None – 14	Yes, a few years – 145
	Yes, a lot – 257		
How participant would replace a destroyed or ruined wooden object or tool	I would replace it with other materials – 85	I would replace it with wood – 307	I wouldn't replace it – 38
What participant would do with a broken wooden tool	I would burn it – 116	I would throw it out – 65	I would try to recycle it – 249
If there is a wooden tool in the family of the participant	No – 244	Yes – 186	
If there is an old wooden object in the family inherited	I don't know – 160	No – 67	Yes – 189
If participant would choose a wooden piece of furniture later as an adult	I don't know – 83	No – 8	Yes – 339
If participant has ever seen an old farmhouse from wood which one can still live in, or which can be restored	No – 85	Yes – 345	
If participant has ever lived in a wooden farmhouse	No – 152	Yes – 278	

Table 6 (continued)

The factor variables in the questionnaire			
Gender	Boy – 230	Girl – 200	
If participant finds that a wooden farmhouse is environmentally friendly	I don't know – 169	No – 115	Yes – 146
If participant would build a wooden farmhouse	I don't know – 114	No – 162	Yes – 154
If participant has ever taken part in a school programme or school camp related to wood	No – 244	Yes – 186	
If participant has taken part in such as programme, would they do it again?	I don't know – 208	No – 76	Yes – 146
If participant has ever taken part in a programme where some old wood-related profession was shown	No – 186	Yes – 244	
If participant would like to attend a wood-related workshop at school	I don't know – 137	No – 183	Yes – 110
If participant has ever taken part in a school activity where wood was involved or burnt	No – 96	Yes – 334	
If participant has ever attended a campfire programme	No – 239	Yes – 191	
If participant has ever seen a TV programme which thematised wood or traditions related wood	No – 153	Yes – 277	
In the current location of participant, is there an old wooden tradition currently?	No – 239	Yes – 191	
If participant plans to celebrate wood-related traditions in adulthood	I don't know – 186	No – 155	Yes – 89
Deforesting effect: participant had to answer if he/she thinks that their use of wood is affected by the knowledge/fact that trees are cut	I don't know – 126	No – 142	Yes – 162

Table 7 Descriptive Statistics of the Ordinal Variables

The ordinal variables in the questionnaire	N	Mean (SD)	Median
How sad would you feel if you saw a sick or dead tree?	430	2.98 (1.2)	3
How sad would you feel if a wooden tool broke?	430	3.27 (1.25)	3
How delighted do you feel if you see an old wooden object?	416	3.26 (1.29)	3
How important it is where people lived before?	430	3.38 (1.17)	3
How beautiful do find a wooden farmhouse?	430	3.9 (1.11)	4
How likely would you participate in a wood-related programme?	314	3.25 (1.43)	3
Have you ever been to a programme where old wood crafts were shown to you?	330	3.35 (1.36)	3
How sad would you feel if you missed a programme with campfire?	394	3.59 (1.33)	4
How sad would you feel if a wood-related tradition got lost?	430	2.78 (1.37)	3
How important do you think that we should use much wood nowadays too?	430	3.48 (1.1)	3

at secondary schools enrolled in the year of 2014 (Központi Statisztikai Hivatal [Central Statistical Office], 2015, p. 12). Since the sample size calculation does not change much for populations larger than 20,000 (Daniel, 1999), we used the data from 2014. With a target population size of around 41,500 students, a margin of error of 5%, and a confidence interval (CI) of 95%, 381 participants were needed for the study to be statistically representative, relying on the formula for the calculation of representativeness (e.g., Daniel, 1999). With the actual number of 430 respondents, the margin of error decreased to 4.7% (95% CI). This percentage of the margin of error indicates that there is a 95% probability that the target population in this county would pick the observed value on any item (question) with a 95% probability, with the value in the target population lying within the interval of $\pm$ 4.7%. Our aim was not to extrapolate mathematically to the target population, rather we strove for representativeness. We arrived at the actual number of 430 respondents because we included a safety margin of 10–15% (i.e., data loss due to withdrawals, for example).

Given that the curriculum taught is uniform across all counties in Hungary, we do not expect any significant differences in the curriculum-related outcomes (questions) of our research relative to other counties in Hungary. Therefore, the findings of our survey can, we argue, be generalised to the target population under investigation in Hungary. However, one potential uncontrolled confounding variable is the socioeconomic status of the participants which might affect the outcomes in different counties. Namely, there exist disparities in the average socioeconomic status of children across the counties of Hungary. Additionally, the present research indicates the possibility of minor variations among children within the same county under study. However, we believe that with a cohort of 430 participants the possible effect of this confounder is not significant.

Results

In order to examine the aforementioned three components of attitude, we grouped together thematically related items belonging to these components before conducting the statistical analyses (see Table 5). The cognitive component of attitude, referring to awareness and consciousness, was explored via the questions related to family, school, and extracurricular activities. We grouped together five items belonging to the cognitive component of attitude, five items belonging to the affective component, and seven items under the conative component (see Table 5). Items belonging to the affective component, encompassing emotions, were measured on a 5-point Likert-scale, whereby the value of 5 represents strong agreement in our survey. The conative component reflects future decisions, willingness, and a hypothesized future disposition (see Table 5). The question of whether there are trees in the students' parental environment served as the independent variable because we examined the impact of having trees in the family on students' attitudes towards wood and trees.

Upon recruitment, we made sure that we achieved a similar proportion of primary and secondary school students as in the county (see Table 2).

We included settlements of different size from the county in the sample proportionally. Three types of settlements were distinguished: village, town, and city (see Table 3).

We also explored the location of their upbringing to get an idea of how many of the students were brought up until the age of 12 in the countryside close to nature (see Table 4).

The question "Do you have trees in your garden at home?", our independent variable, was answered by all participants. 365 (84.9%) participants' families have trees in their garden, while 65 (15.1%) participants' families do not have trees in their garden. Data presented remains unaffected by the presence or absence of siblings in the participants' families, as the focus of the study is on the presence of trees in the participants' garden at their parental home and its potential influence on their attitudes. We examined whether the respondents who have trees in their parental home environment showed higher scores on all three components of attitude.

Table 5 summarises the three components of attitude. Hypotheses were formulated for each component of attitude separately (for the hypotheses see the Introduction section as well as Tables 8, 9, and 10 along with the results). Accordingly, the three components of attitude were tested separately (three scores being calculated per participant), with each value being between 0 and 1. The average of the items per participant was taken. Table 5 shows the operationalisation of the three components of attitude. The questions listed in the table were grouped together when computing an overall score per respondent.

Data were analyzed using SPSS 27 (IBM Corp., 2020). Descriptive statistics are presented for factor and ordinal variables separately, see Tables 6 and 7, respectively. There were a few qualitative variables which were left out from the present paper. Such an item was, for example, "If you plant a tree when there

Table 8 The First Hypothesis, Variables, and Result

Hypothesis 1	Variables	Result
Students with trees in their parental home environment have higher scores on the cognitive domain of attitude compared to those without trees in their parental home environment	**Dependent variable:** composite score of the cognitive component of attitude **Independent variable:** family owns trees ("There are trees in your garden at home")	"Yes"-responses: Mean = 0.62 SD = 0.198 "No"-responses: Mean = 0.52 SD = 0.199 U: 8359.500 Z: -3.833 $p < 0.001$ (Bonferroni-corrected p-value = $p < 0.001$)

Note: SD designates standard deviation of the mean. "Yes" and "no" refer to the responses to the item "There are trees in your garden at home"

Table 9 The Second Hypothesis, Variables, and Result

Hypothesis 2	Variables	Result
Students with trees in their parental home environment have higher scores on the affective domain of attitude compared to those without trees in their parental home environment	**Dependent variable:** composite score of the affective component of attitude **Independent variable:** family owns trees ("There are trees in your garden at home")	"Yes"-responses: Mean = 0.34 SD = 0.083 "No"-responses: Mean = 0.31 SD = 0.098 U: 9525.000 Z: -2.5380 $p = 0.011$ (Bonferroni-corrected p-value = 0.033)

Note: "Yes" and "no" refer to the responses to the item "There are trees in your garden at home"

Table 10 The Third Hypothesis, Variables, and Result

Hypothesis 3	Variable	Result
Students with trees in their parental home environment have higher scores on the conative domain of attitude compared to those without trees in their parental home environment	**Dependent variable:** composite score of the conative component of attitude **Independent variable:** family owns trees ("There are trees in your garden at home")	"Yes"-responses: Mean = 0.73, SD = 0.224 "No"-responses: Mean = 0.56, SD = 0.289 U: 7793,500 Z: -4.434, $p < 0.001$ (Bonferroni-corrected p-value = $p < 0.001$)

is a family event, please, name the type of the tree." For the factor variables in Table 6, the number of responses is reported per level of the variable. For the ordinal variables in Table 7, measured on a 5-point Likert-scale, the valid number of responses (represented by "n"), standard deviation (SD) from the mean, and median are reported.

To ensure a high level of data quality, we performed a plausibility check. An implausible questionnaire sample would be, for example, one that contains much missing data, or a questionnaire completed by a respondent without serious interest, a sign of which could be, for instance, the same response pattern across the questions. Implausible values (e.g., age of 26) were removed, with less than 3% of data loss due to implausibility. No respondent was discarded from the analysis. Therefore, the data from all 430 participants entered the analyses. The levels of all factor variables in Table 6 were converted into numbers, with affirmative responses coded as 1, and negative responses as 0. The idea of this conversion to numeric values was to be able to quantify these factor variables, so that these can be entered in the statistical analyses.

The data did not show a normal distribution based on visual inspection of histograms and statistical tests of normality (Kolmogorov–Smirnov test and Shapiro–Wilk test, $p < 0.001$). The lack of normal distribution is unsurprising given that most of the variables were factors with a few ordinal variables. Due to the non-parametric distribution of the data, the measurement levels of the variables (nominal and ordinal), and the occasionally unequal number of cases across comparisons, Mann–Whitney U tests were applied. Results can be seen in Tables 8, 9, and 10 for the three hypotheses, respectively. Mann–Whitney U tests compare medians between two groups. However, we report means, as means can render subtle differences unlike medians. The p-value for all statistical tests is the standard limit of 5%. Bonferroni-adjustment was performed to reduce the likelihood of false positives. Both uncorrected and Bonferroni-corrected p-values are reported (see Tables 8, 9, and 10).

From the raw data, we first calculated means based on the coding scheme already detailed. Answers of "I don't know" were not included in the statistical analyses, as they were neither close to "yes" or "no". Likewise, "Yes, with my parents" and "Yes, alone" (as well as "yes, many" and "yes, some") were converted to "yes" responses because they are affirmative responses with qualitative specifications. These answers were coded as 1 ("yes").

The scores on the Likert-scale variables in Table 7 were divided by 10 so that the scores per person be located between 0 and 1. This division was essential because of the dichotomous variables, which were also converted into 0 and 1. Tables 8, 9, and 10 detail the hypotheses of the study, the types of the variables in the analyses, and the results from the Mann–Whitney U tests. Affirmative and negative responses were defined as two groups (i.e., two levels of the independent variable). Table 6 represents a summary of the results from all the factors variables in the study. Numbers represent the number of valid responses per level of the factor.

In Table 7 we report the outcomes for the ordinal variables. The valid number of responses are represented by "N". SD designates standard deviation of the mean. All

ordinal variables had an observed minimum of 1 and an observed maximum of 5 as values.

We are now reporting the results for the three components of attitude. Before analysing the results of the survey, we had not known how many participants would have trees in the parental home environment: 65 participants gave a negative response, while 365 participants gave an affirmative response. Importantly, the Mann–Whitney U tests are robust in case of such imbalances. We are reporting the results from in Table 8.

A highly significant difference between the two groups was revealed (see Table 8), with higher scores in the cognitive domain of attitude for children with trees in their parental home environment (i.e., "yes" responses; *mean* = 0.62) relative to those without trees in their parental home environment (i.e., "no" responses; *mean* = 0.52). We are now reporting on the results on the affective domain of attitude (see Table 9).

The difference between the two groups was statistically significant (see Table 9), with higher scores in the affective domain of attitude for children with trees in their parental home environment (i.e., "yes" responses; *mean* = 0.34) relative to children without trees in their parental home environment (i.e., "no" responses; *mean* = 0.31).

Third, we hypothesized that children with trees in their parental home environment would have higher scores of the conative domain of attitudes compared to children without trees in their parental home environment (Table 10). "Yes" and "no" refer to the responses to the item "There are trees in your garden at home" (Table 10).

In the conative domain of attitude, significantly higher scores were obtained for children with trees in their parental home environment (i.e., "yes" responses; *mean* = 0.73) relative to those without trees in their parental home environment (i.e., "yes" responses; *mean* = 0.56).

Discussion

Our findings reflect a general appreciation of and engagement with wood and forestry, evidenced by the presence of trees in homes and the preference for wooden objects. However, there is also a lack of professional interest in wood and varied levels of engagement and awareness regarding its sustainability and professional involvement and deforestation impacts. Additionally, addressing the divided perceptions on deforestation could be a key area for EE, aiming to unify understanding and response to these issues.

First, the participation in wood-related school programs and other related activities indicates that students are receptive to hands-on, nature-based learning inherent in school gardens. These related activities include forest schools, which may also be organized during summer holidays, and forestry-related forest schools, where foresters play a crucial role in EE. Additionally, school camps situated in woodlands, multi-day guided summer camps designed for participants to learn about nature, and specific days dedicated to environmental protection (and nature protection) contribute to this initiative. Furthermore, tree-planting events enhance both cognitive and

affective attitudes towards environmental stewardship, as the care of the planted trees foster a long-term commitment to nature conservation and an increased pro-environmentalism (e.g., Rosa & Collado, 2019). Unfortunately, a significant majority of our participants (250) did not express interest in pursuing careers related to wood or forestry. This implies a potential disconnection or lack of appeal of these professions among the youth demographic.

Second, the limited interest in pursuing a profession related to wood reflects a gap in connecting practical environmental education with career aspirations, suggesting that school gardens should play a crucial role in showcasing the potential career paths in environmental and forestry-related fields (such as environmental scientist, forestry technician, conservation scientist, wildlife biologist, environmental consultant, urban planner, environmental educator, natural resource manager, climate change analyst, environmental lawyer, sustainability coordinator, park ranger, ecologist or environmental engineer).

Third, while participants show awareness of wood-related traditions and the ecological importance of trees, there is a division in views on deforestation. This indicates that school gardens should teach about sustainability and ecological responsibility. Fourth, only a small fraction of families reported planting trees during significant life events, indicating a limited cultural or personal practice of tree planting, which might affect reforestation efforts or environmental consciousness in these communities. Hence, school gardens can act as an extension of this home-based environmental learning, reinforcing positive attitudes and practices.

Fifth, the interest in attending wood-related workshops at school and the preference for wooden furniture indicate a general inclination towards practical, hands-on learning experiences, which school gardens can and should effectively provide. In summary, these findings imply that school gardens should engage students in practical learning, connecting environmental knowledge to potential careers, and reinforce cultural and familial values related to nature and sustainability.

Let us discuss out three hypotheses related to the three components of attitude. First, we hypothesized that students with trees in their parental home environment would score higher on the cognitive domain of attitude compared to students without trees in their parental home environment. This hypothesis has been confirmed and this finding underscores the imperative for the establishment of more school gardens (especially in Hungary), given the beneficial effects of school gardens (e.g., Amiri et al., 2021; Blair, 2009; Chang et al., 2016). This necessity is predicated on the rationale that children encounter school gardens with a frequency akin to their exposure to the natural elements in their parental home environment, thereby suggesting a parallel in the influence exerted by these two settings on children's developmental outcomes.

Second, we hypothesized that children with trees in their parental home environment would show higher scores on the affective domain of attitudes compared to children without trees in their parental home environment The difference between the two groups was statistically significant, with higher scores in the affective domain of attitude for children with trees in their parental home environment relative to children without trees in their parental home environment. This suggests that children who have exposure to trees in their parental home environment have a more

positive affective attitude, which have implications for their engagement with and appreciation of school gardens. Namely, it implies that integrating wooden objects into school gardens would enhance children's overall emotional attitudes and experiences in those spaces. This finding is in accord with Waliczek and Zajicek, (1999) who showed that students participating in school garden activities gained more positive attitudes about environmental issues, with their environmental attitudes being significantly more positive after participating in the school garden program.

Third, we hypothesized that children with trees in their parental home environment would have higher scores of the conative domain of attitudes compared to children without trees in their parental home environment. In the conative domain of attitude, significantly higher scores were obtained for children with trees in their parental home environment relative to those without trees in their parental home environment. The implication of this finding for school gardens is that exposure to trees in a child's home environment positively influences their future behavioral intentions and inclinations, which underscores the potential of school gardens as not only educational spaces but also as catalysts for fostering a lifelong commitment to environmental stewardship among the younger generation. Specifically, according to our result school gardens would lay a foundation for the development of a heightened sense of environmental awareness and lead to more active participation in eco-friendly practices and initiatives within and beyond school gardens, for example, later as adults.

The mean score of 2.98 for sadness at seeing a sick or dead tree indicates a very low emotional connection to sick or dead trees, suggesting that school gardens should strengthen students' concern for the natural environment. Responsibility lies also significantly in how these school gardens are utilized by educators and garden managers. This involves integrating targeted educational activities and discussions that specifically address the health of trees and plants, the ecological impact of diseased or dead flora, and the broader implications for environmental health. Moreover, school gardens should include planned, personal and group reflective activities that directly engage students with the life cycles of trees and plants, including the natural processes of sickness and death. Such activities could involve monitoring plant health, diagnosing plant diseases, understanding the ecological role of decay, and discussing how these factors influence biodiversity and the ecosystem. Art projects or storytelling sessions could be introduced so that students can express their feelings about the cycles of life and death they observe in the school garden. School gardens should be part of a larger EE curriculum that develops students' awareness, empathy, and responsibility towards all aspects of the natural environment. Lastly, by involving students in decisions related to the health and maintenance of the garden, including the care for sick and dying plants, they can develop a more profound connection and sense of responsibility towards the environment.

Likewise, the mean score of 3.27 for sadness over a broken wooden tool reflects a moderate level of emotional attachment to wooden objects. Hence, school gardens should involve wooden tools, which can help deepen students' appreciation and care for these items. The mean score of 3.26 for delight in seeing old wooden objects points to a moderate appreciation of the aesthetic and historical value of wood. School gardens should therefore integrate educational components about the cultural

significance of wood in society such as botany and ecology, hands-on woodworking projects, art projects, lessons on sustainable forestry practices, involving local artisans, carpenters, foresters and cultural historians in educational programs or exploring stories, myths, and legends about trees and wood in different cultures. Similarly, a mean score of 3.38 on the importance of historical residence suggests a moderate interest in historical and cultural contexts, an aspect that should be incorporated into the curriculum of school gardens, particularly in studying the history of land use and local ecological practices.

The score of 3.9 for finding wooden farmhouses beautiful indicates an adequate aesthetic appreciation for wooden architecture, which can be leveraged in school gardens by incorporating elements of traditional wooden structures or teaching about sustainable building practices. The likelihood of participating in wood-related programs (mean score of 3.25) shows a moderate interest in such activities, underscoring the importance of incorporating wood-related educational programs in school gardens. The mean score of 3.35 for attending programs showcasing old wood crafts indicates that school gardens should include workshops on traditional woodworking skills. A mean score of 3.59 for sadness at missing a campfire program reflects the emotional importance of such activities. Therefore, school gardens should incorporate campfire-like activities to engage students both emotionally and culturally. The mean score of 2.78 for sadness if a wood-related tradition got lost indicates a very low concern for preserving these traditions, highlighting an opportunity for school gardens to play a role in educating about wood-related cultural heritage. The mean score of 3.48 on the importance of using wood today shows a moderate recognition of the relevance of wood in contemporary times, indicating that school gardens should emphasize the sustainable use and the ecological importance of wood.

In summary, these findings suggest that there is a moderate to low emotional and cultural connection to wood and trees among the participants, along with a moderate appreciation for traditional practices and sustainable use. School gardens should therefore capitalize on these sentiments by providing hands-on experiences, education on sustainable practices, and cultural appreciation related to wood.

Taken together, the combined assumption that "Children who have trees in their parental home environment would have higher scores on the cognitive, affective, and conative domains of attitude compared to students who do not have trees in their parental home environment" has been supported. However, one of the unexpected findings of our study is that despite the fact that the majority, 84.9% of the participants, possess trees in their parental home environment, very few of them are willing to pass this tradition: for example, (i) only 64 of them would deal with wood as a professional later in their life, (ii) only 38 would replace the wooden destroyed, broken or ruined wooden object or tool, and (iii) only 89 would plan to celebrate wood-related traditions in adulthood.

Tree planting held a longstanding tradition within Hungarian culture, particularly during significant family events. Regrettably, this tradition is indeed experiencing a decline in popularity, as witnessed by the survey responses that only 62 individuals expressed their intent to uphold this custom. Notably, in Hungary, the preservation and transmission of traditional customs are integral components of environmental education, as elucidated in the work of Kováts-Németh, (2010).

The substitution of wooden artifacts with wood material yielded noteworthy outcomes, with 307 individuals expressing their intent to opt for wood once again, while 85 respondents indicated a preference for alternative materials. This outcome significantly reinforces the favorable environmental impact associated with the utilization of wood. Notably, the incorporation of wooden objects serves to ameliorate the deleterious effects of climate change. Therefore, this result supports the proposition that the inclusion of wooden objects should be integrated into school gardens.

Furthermore, the survey results unveiled that 189 individuals have chosen to bequeath wooden items, whereas 67 respondents have decided against perpetuating this practice. Intriguingly, 160 individuals remained undecided on this matter. Hence, it is crucial to emphasize the significance of prolonged utilization of wood materials in school gardens, as they serve as a reservoir for sequestering carbon throughout the lifespan of the wooden item. This carbon storage property is inherent to wood materials, and its utilization in various tools further contributes to the mitigation of climate change, aligning with the principles articulated in the National Climate Change Strategy of 2018 and the findings of Rumpf, (2011).

Our findings highlight that school gardens could effectively address the observed gap between environmental education and career aspirations in forestry-related fields. Furthermore, mixed opinions on deforestation emphasize the need for education on sustainability and ecological responsibility, areas where school gardens could make a significant impact. The influence of familial and cultural backgrounds on nature attitudes points to the role of school gardens in reinforcing these values. The preference for practical, experiential learning, as evidenced by the interest in wood-related workshops and wooden furniture, underscores the suitability of school gardens for engaging, hands-on environmental education.

Overall, school gardens are well-suited to foster positive attitudes towards nature, practical learning, career exploration, and cultural appreciation of environmental sustainability. These findings suggest that school gardens could leverage these emotional and cultural sentiments to trees and wood to provide immersive experiences and education in sustainable practices and cultural traditions related to wood and the environment.

Collectively, our findings indicate a critical necessity for the incorporation of wood-related cultural traditions and wooden objects within school gardens, rather than merely focusing on the establishment and maintenance of these gardens in a general sense, given that 36% of participants in the survey did not plan to celebrate wood-related traditions in adulthood.

Our findings, indicating that 43% of the surveyed students exhibited a lack of willingness to participate in wood-related workshops at school, underscore the necessity of the following intervention: workshops should be introduced in school gardens where students can learn basic woodworking skills using wood from the garden or recycled materials. This hands-on experience can teach valuable skills and foster a deeper appreciation for wood as a resource.

Second, lessons about the cultural and historical significance of trees and wood should also be incorporated, given our results showing a very low willingness to pass wood-related traditions. Such lessons can include studies of traditional woodworking crafts, folklore, and the role of trees in different cultures. Third, our research

uncovered a positive influence within the conative domain of attitude, in accord with García-González and Schenetti, (2022), for example, who suggest that the constant contact with nature encourages ecological awareness and sustainable behavior.

Consequently, it is imperative to educate students about sustainable forestry practices and the responsible utilization of wooden resources within the ambit of school gardens. This educational endeavour should encompass dialogues pertaining to conservation strategies, reforestation efforts, and the ecological ramifications of deforestation. In addition, wood and tree parts such as leaves and branches in art projects could be utilized. This can encourage creativity and a personal connection with natural materials, in line with our results showing a beneficial effect in the affective domain. By focusing on these areas, school gardens can become rich educational resources that not only beautify the space or foster health-related benefits but also provide invaluable experiential learning opportunities for students, specifically in relation to wood and trees.

Conclusion

The aim of our study was to show whether the presence of trees in the immediate environment of children increases their positive attitude towards trees and wood and that the presence of trees in the immediate environment would induce emotions and actions later in life. Our hypothesis that the presence of trees in the parental home environment has a positive effect on all three components of the attitude towards trees and wood has been confirmed, in line with, for example, García-González and Schenetti, (2022) who recommend constant contact with nature, which encourages ecological awareness and sustainable behavior. Thus, we have shown the regulatory role of childhood experiences and knowledge gained in the parental home environment (e.g., Ádám et al., 2007; Ardoin et al., 2013; Bogner & Wiseman, 1999; Bradley et al., 1999; Kiszely & Szalay, 2021; Konyha, 2011; Molnár, 2009).

It is important to note that, after the parental home environment, children receive most of their knowledge in educational institutions, with the acquired knowledge being taken home to the parental house (e.g., Vaughan et al., 2003). Hence, the insights from our research can be transferred to school gardens. These are crucial in maintaining wood-related cultural-national heritage.

Although the majority of respondents possessed wooden objects in their parental home environment, they did not show willingness to keep these traditions alive in their future home. This result is in line with previous findings that OEE in their present form have no or not ample effect on environmental attitudes, actions, or changes in behavior to the extent necessary (e.g., Christensen & Wistoft, 2019; Fűzné, 2002; Havas & Varga, 1998; Havas et al., 2002; Hegymeginé, 2003; Konyha, 2011).

Specifically, we could identify three areas within the dimension of conative attitude which indicates that there is a lack of willingness to inherit wooden culture to the extent desired: (i) dealing with wood as a professional later in life, (ii) replace destroyed, broken or ruined wooden objects or tools, and (iii) celebrate wood-related traditions in adulthood.

The present findings are novel in that they examine three components of attitude separately in connection with the use of wood, hitherto underexplored in OEE research. Our findings indicate the strong regulatory role of family, but at the same time also the shortcomings of school gardens in their present form. Specifically, the affective component of attitude should be strengthened by making students active participants in wood-related programmes consistent with Marton, (2019). More wood-related programmes are needed, especially those that can be realized in school gardens. Families should be involved in wood-related programmes organized by schools in line with Marton, (2019), as the role of family is essential in the preservation of wood-related culture but also in building and facilitating social ties. Our topic is relevant also because the carbon sequestered by the use of wood contributes to the protection of the atmosphere, making wood an environmentally friendly and renewable energy source (Fatáj-Online, 2020; National Climate Change Strategy, 2018; Rumpf, 2011), in line with the recommendation of the European Commission, (2022) about the use of wood. Suggestion for the application of our raw data can be submitted to further statistical analyses or for the generation of novel insights within the OEE context are elucidated, for example, in Fekete and Kendöl, (2022), given the large sample size and the statistical representativeness inherent in the study.

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Data availability The raw data that support the findings of this study are openly available in the Figshare repository at https://figshare.com/articles/dataset/Survey_data_of_children_s_attitudes_towards_trees_and_the_use_of_wood/20055500. Researchers must give us credit in the form of a citation, should they use or refer to the research object uploaded. Owner of the dataset is Jutka Nmar-Kendöl.

Declarations

Conflict of Interest The authors have no competing interests to declare.

Ethics Approval The study did not need to be preregistered.

Consent Informed consent by the parents, the schools and the teachers had been collected. Data handling was in line with the most recent version of the relevant EU-law.

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