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ORIGINAL PAPER

How do educational boards in urban and suburban forests attract the attention of forest users and influence them in the process of understanding nature?

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ABSTRACT

Forming the right ecological attitudes in people towards the surrounding nature is one of the more difficult challenges posed for social informal and formal education. The process of educating the public should take place at every stage of knowledge acquisition and numerous studies have shown that education in natural areas brings much better results when compared to traditional indoor classes. The purpose of the study was to determine how educational boards, which are believed to support informal environmental education activities, located on an educational path in the forest attract the attention of forest users and engage them in the process of understanding nature. The study used the method of non-intrusive observation of forest users and their interaction with 10 educational boards along a path. A total of 881 people were observed. A one-way ANOVA test was used to analyze the data, in addition, differences in the ARR index of individual boards were tested using Scheffe's *post-hoc* test. The results of the study indicate that educational boards with the least amount of text are the most frequently read by forest users. Interactive educational boards achieve the highest retention rate for people's attention as they engage many more senses in the process of informal environmental education. The results presented in the paper clearly indicate the need to change the design of educational infrastructure elements in order to educate more effectively.

KEY WORDS

educational board, educational path, education in nature, forest, informal education

Introduction

Today, one of the biggest natural, and at the same time social, problems is the progressive biodiversity crisis, posing a huge threat to both people and the natural world. The fight against biodiversity loss must be based´ on improving knowledge, education, and skills, including close cooperation within the framework of education for sustainable development (European Commission, 2020).

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Education for sustainable development is aimed at integrating natural, social, and economic knowledge as well as diversifying the goals and content of education, taking into account local tasks and needs, seen against the background of global problems (Shidiq and Permanasari, 2020; Xu and Luo, 2020). Part of the education understood in this way is environmental education defined as pro-environmental education and upbringing, which includes both the transmission of knowledge about the natural environment, the phenomena occurring within it, and the problems associated with its degradation as well as the formation of a pro-environmental system of values (ecological ethics, aesthetic sensitivity, *etc.*) and triggering conservation activities (Grzywacz, 2000; Moskell *et al.*, 2011; Kudryavtsev *et al.*, 2012; Acosta Castellanos and Queiruga-Dios, 2022; Korcz and Janeczko, 2022a). The new EU Forest Strategy 2030 also emphasizes the need to develop skills and empower citizens for a sustainable forest-based bioeconomy (European Commission, 2021). The document includes a provision that as part of the Education for Climate Coalition, the Commission will further promote collaboration and outreach among pupils, students, teachers, and stakeholders on the role of forests, including the benefits of outdoor learning, which has also been repeatedly highlighted in numerous scientific studies (Higgins, 2002; Knight, 2013; Waite *et al.*, 2016; Korcz *et al.*, 2021).

Imparting knowledge outside the path of the formal education system, outside school, in contact with nature – in the forest, expands the horizons of knowledge not only of children and adolescents but also of adults, awakening their interest in the surrounding world, makes often difficult to digest terms and processes easier and more understandable (Jordet, 2010; Skaugen and Fiskum, 2015). Effective education influences a proper understanding of the processes and laws that have always governed nature, thereby increasing the acceptance of human actions to protect it (Torquati *et al.*, 2013; Onopriienko *et al.*, 2021). Research by Donaldson and Donaldson (1958) indicates that outdoor education is much more effective when compared to traditional indoor classes, while Tiplady and Menter (2021) indicate unequivocally that education in open natural spaces has undeniable cognitive and behavioral benefits.

Annerstedt van den Bosch and Depledge (2015) suggested that, as with many social behaviors, pro-environmental behaviors can be induced by external stimuli, particularly by experiencing the natural environment. Sabet (2018) points out that among trends in environmental education, outdoor activities are becoming more common. It also appears that one innovation in informal education may be the increasingly popular forest bathing (Mathias *et al.*, 2020; Korcz *et al.*, 2021), which has so far generally been associated only with psychological benefits, improving people's well-being (Guan *et al.*, 2017). In Poland, one of the more popular forms of informal education aimed at both individual and group audiences is walking on educational trails (Raport, 2021). As of 2021, more than 822 such facilities have been designated in forests administered by PGL LP (State Forests National Forest Holding) alone (more than 80% of Poland's forests), and numerous educational paths are also found in every national park and even within forests administered by municipalities (Janeczko, 2010). As indicated in the report on educational activities of the State Forests (Raport, 2021), the most frequently visited area by forest users is forest educational paths, also called didactic or cognitive paths. These are routes, generally no more than 3 km in length, leading through forest areas, with several, sometimes more than a dozen, thematic stops dedicated to nature as well as forest management and conservation. To date, the few studies on the evaluation of the performance of educational paths have focused on issues such as the optimization of the graphic design of educational boards (interpretative signs, educational boards) (Korcz and Janeczko, 2022a, b), the level of text comprehensibility (Janeczko *et al.*, 2021; Korcz *et al.*, 2022) as well as public preferences for educational infrastructure (Korcz and Janeczko, 2022a), or the ergonomic assessment of infrastructure accompanying educational trails (Ballantyne *et al.*, 2011; Okuniewski, 2011; Olenderek, 2015; Snopek, 2015). Educational boards only appear to be a trivial, insignificant topic on the surface; however, due to the prevalence and power of their message, they definitely require more attention. Nevertheless, not much is known about whether this form of transfer of knowledge regarding nature actually reaches its intended audience. Who are the most frequent recipients of the educational content presented on the boards, which boards attract the attention of forest users for longer periods of time, how much time, on average, does it take to get acquainted with the content of educational boards, *etc.*? Hence, the purpose of our research is to assess the involvement of forest users in the process of informal education conducted through educational boards. The study poses the following research hypotheses:

1. Traditional educational boards located on educational paths have a low power to attract and retain the attention of forest users.
2. Interactive educational boards have more power to retain and attract attention than a traditional board, perceived only through the sense of sight.

Material and Methods

STUDY SITE. The subject of the study is educational boards located on an educational path in a forest, which is a place of daily recreation and leisure for residents of cities such as Lublin (about 340,000 residents) and Świdnik (about 40,000 residents) (Fig. 1). The route is designed for pedestrian users and people on bicycles. The path is a loop, with an improved dirt surface that is easily accessible to pedestrians, cyclists, people with physical disabilities, and families with young children. The path is equipped with 11 educational boards, including two interactive boards) (Fig. 2). The topics of the educational boards are 63% related to forest management issues (issues such as stand conversion, protection against animals, Christmas tree plantation, *etc.*) and 37% to the flora and fauna found in the forest. The route forms a loop of about 2 km.

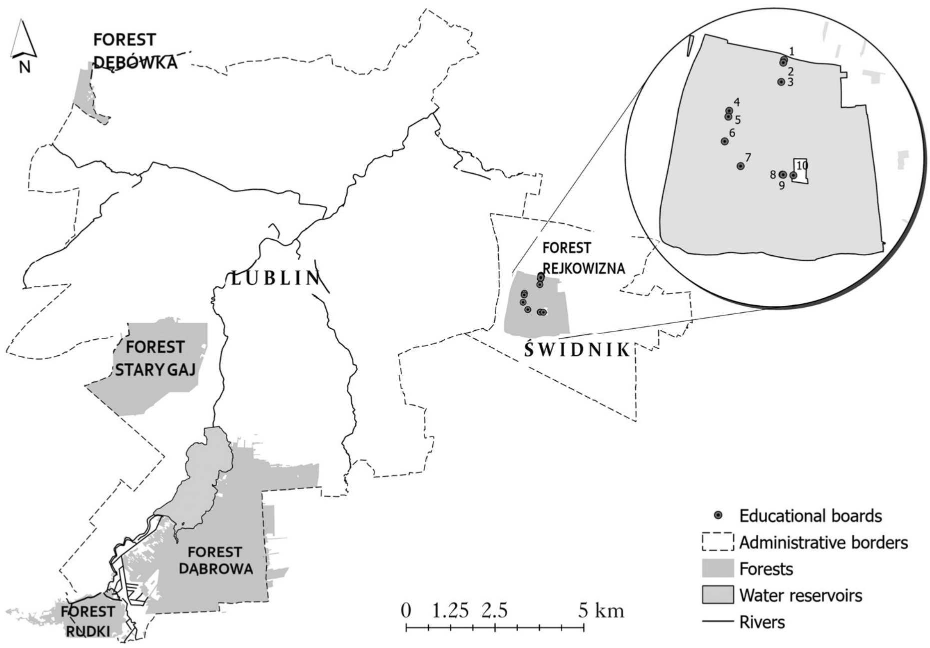

Fig. 1.
Map with the location of forests around Świdnik and Lublin

Fig. 2.
Traditional boards on the educational path

The time taken to walk the route is about 1.5 hours, cycling – about 30 minutes. The trail runs through a deciduous forest (EEA, 2006), where the dominant tree species are oak *Quercus robur* L., birch *Betula pendula* Roth, or pine *Pinus sylvestris* L. The age of the stands along the route averages 100 years.

Research Procedure. The first stage of the fieldwork was to determine the technical condition of the educational boards. A four-point scale proposed by Woźnicka (2006) was used to evaluate the educational boards, where:

1 point – very good technical quality of the device, with no signs of loss, scratches, *etc.*,

2 points – good technical quality, visible dings, burns, or scratches on the equipment, but not affecting its use value,

3 points – poor technical quality, devices with clearly visible defects that can cause injury to a person (sharp ends, protruding nails, instability of the device) or affect the comfort of use significantly (holes in the board), or a device not fully able to perform its functions (lack of shingles in the roofing),

4 points – poor technical quality, devices with very large defects that make it impossible to perform the functions of the device in question. A thorough photographic documentation of the educational boards was made.

Educational boards are divided into two categories: interactive boards, which engage the sense of sight and touch, and traditional boards, which are perceived by sight alone. The types of boards are shown in Figures 2-3.

The next step was to determine the level of attracting and retaining attention for individual boards. The study used a non-intrusive (indirect) observation method (Carter, 2001) whereby, from August 1 to August 31, 2021, during every weekend of the month (a total of 8 days, giving 80 hours of observation of forest users' interaction with educational boards), the authors observed visitors' physical interaction with educational boards (consistency guaranteed). Each board was observed for an hour, at 15-minute intervals (time to move to the next educational board). Given that educational board No. 11 was located behind the route, which formed a loop, it was omitted from the study. A total of 10 educational boards were analyzed.

In order to determine the rate of attention capture and retention by each educational board, the indicator proposed by Švajda and Činčera (2017) was determined. The attention capture rate is the percentage of visitors who stopped at the educational board compared to the total number of people using the route.

Attention retention rate is the average percentage of time (in seconds) that visitors spent reading the panel compared to the total time required to fully understand the panel (Švajda and

Fig. 3.
Interactive boards on the educational path

Činčera, 2017). The average time of retaining attention by route users was measured with a stopwatch phone app, using a Samsung Galaxy M21 phone for this experiment. Based on the photographic documentation of the educational boards, their content was subjected to linguistic analysis through the use of the Promovolt application. The usefulness of this application in research is confirmed in studies by Korniichuk and Siminski (2017) and Janeczko *et al.* (2021). Using Promovolt, the number of sentences and words in the text was determined. For the purposes of the study, it was assumed that an adult reads an average of 200 words per minute (the norm adapted to the Polish language) (Krop, 2002). The study took into account both the main text of the board as well as titles, subheadings, captions, and footnotes under pictures of figures. In the case of interactive boards (Fig. 3), all words from each element of the board were taken into account.

Statistical analysis. A one-way ANOVA test was used to analyze the data, which compares between-group variance to within-group variance. In addition, differences in the ARR (attention retention rate) index of individual boards were tested using Scheffe's *post-hoc* test, which was used because of samples with different sample sizes. Calculations were performed at a confidence level of 0.95, and the maximum error was set at 0.05. Statistica 13.1 PL ver. 13.3 PL (TIBCO Software Inc, 2017) was used for statistical calculations.

Results

General information about educational boards. All educational boards were in very good overall condition and in good technical condition. Interactive educational boards received 4 points each (very good technical condition – 20% of all boards), while half the traditional educational boards received 4 points each (very good technical condition) and 30% of boards received 3 points each (good technical condition). Analysis using the Promovolt program showed that the largest number of words are on the interactive boards, while the least are on board 2 (traditional board) (Table 1).

A total of 881 people passed by the boards, of which half (50.40%) stopped at the boards. The highest percentage of people stopped at board No. 8 (62.50%), No. 9 (59.00%), and No. 7 (55.17%). The smallest percentage of people stopped at board No. 10 (40.74%), No. 1 (43.68%), and No. 3 (44.83%) (Table 2).

Results of the attention-gaining index. The average stopping time at the educational boards was similar for both men and women. Forest users spent the most time at board number 2.

Table 1.
Time needed to read educational content by adults

Board number	Traditional boards		Interactive boards	
	total number of words	time [s] required to completely read the content of the educational board	total number of words	time [s] required to completely read the content of the educational board
1	163	48.9	–	–
2	106	31.8	–	–
3	165	49.5	–	–
4	268	80.4	–	–
5	150	45.0	–	–
6	145	43.5	–	–
7	302	90.6	–	–
8	–	–	487	487
9	–	–	496	496
10	170	51.0	–	–

Table 2.
Number and percentage of people stopping by educational boards

Board number	Number of people who		% people stopping at the board
	passed the board	stopped at the board	
1	87	38	43.68
2	94	45	47.87
3	87	39	44.83
4	74	38	51.35
5	89	44	49.44
6	86	40	46.51
7	87	48	55.17
8	96	60	62.50
9	100	59	59.00
10	81	33	40.74
Total	881	444	50.40

At p=0.654, no significant differences were shown by gender. Respondents spent significantly less time at the educational boards than it takes to read the content on the boards (Table 3).

Results of the attention retention index. Analysis of the attention retention rate by applying the ANOVA statistical test showed statistically significant differences in each table (Table 4).

The p-value for the boards is 0.000079, meaning that there are differences in attention retention by board. The model explains 38.48% of the variation in attention retention rate due to the type of educational board (Table 4).

Based on the data presented in Figure 4, it can be seen that the attention retention rate (ARR) for board #2 is significantly different from the others. This is due to the fact that this board contains the least amount of words and route users needed the least amount of time to read/read all the text on the board. This is also confirmed by Scheffe's *post-hoc* test.

Scheffe's *post-hoc* test indicates that, indeed, the highest index of the strength of attention retention (ARR) falls on Board No. 2. There are significant differences in attention retention between Board No. 2 and Board No. 1, 4, 7, 9, and 10 (Table 5).

The third stage of the study measured deviations from the norm, that is, deviations between the time respondents read the boards and the total time required to fully understand the board.

The *p*-value for the boards is 0.000079, indicating significant differences in the reading time of each board (Table 6). The model explains 77.16% of the variation in reading time. Educational boards are the differentiating factor (Fig. 5).

The attention retention rate for boards 8 and 9 is significantly different from the others. This is due to the fact that these are interactive boards, which require forest users to engage

Table 3.
Average time to attract attention by educational boards by gender (N=881, p=0.654)

Board nr	Number of respondents		Average reading time [s]		Average deviation from the norm [s]		Average rate ARR [%]	
	F	M	F	M	F	M	F	M
1	52	35	19.71	11.03	–29.19	–37.87	40.31	22.55
2	58	36	17.47	23.71	–24.09	–30.00	74.55	54.94
3	53	34	16.79	23.62	–33.05	–24.30	33.92	47.71
4	44	30	31.57	17.50	–18.05	–32.45	39.26	21.77
5	51	38	17.78	24.89	–30.96	–23.90	39.52	55.32
6	53	33	17.15	19.09	–29.70	–31.26	43.90	39.43
7	53	34	27.72	28.82	–25.90	–23.76	30.59	31.81
8	51	45	54.82	55.14	2.43	–2.72	37.74	37.52
9	55	45	50.42	46.69	–9.30	–4.42	34.04	31.53
10	38	43	20.39	17.21	–29.64	–31.69	32.22	27.19

Table 4.
ANOVA test for attention retention rate (ARR)

Source	Sum of squares	df	Mean square	F-value	p-value	Eta-squared
Constant	134.0091	1	134.0091	456.4873	0.000000*	0.343873
Board	10.2340	9	1.1371	3.8734	0.000079*	0.38484
Error	25.6959	71	0.2936	–	–	–

* statistically significant difference (p>0,05)

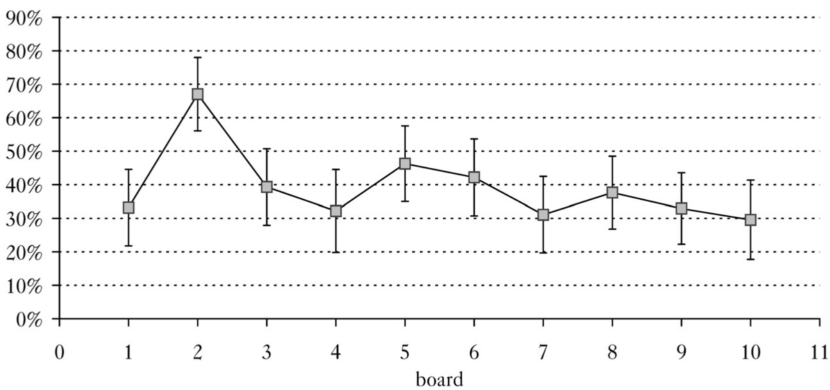

Fig. 4.
Interaction plot for attention retention rate (ARR) at individual educational boards, F(9.871)=3.873, p=0.0008, confidence interval 0.95

Table 5.
Scheffe's *post-hoc* test for attention holding unit (ARR) index, Error: intergroup MS=0.29357, df=871.00, $p<0.05$

Board M=	1 0.332	2 0.670	3 0.393	4 0.322	5 0.463	6 0.422	7 0.311	8+ 0.376	9+ 0.329	10 0.295
1		0.041*	1.000	1.000	0.979	0.999	1.000	1.000	1.000	1.000
2			0.225	0.048*	0.666	0.398	0.019*	0.125	0.024*	0.014*
3				1.000	1.000	1.000	0.999	1.000	1.000	0.998
4					0.974	0.998	1.000	1.000	1.000	1.000
5						1.000	0.943	0.999	0.969	0.908
6							0.994	1.000	0.998	0.986
7								1.000	1.000	1.000
8									1.000	0.999
9										1.000
10										

+interactive boards
*statistically significant difference ($p>0,05$)

Table 6.
ANOVA test for reading time deviation between boards

Source	Sum of squares	df	Mean square	F-value	*p*-value	Eta-squared
Constant	477931.39	1	477931.39	344.05	0.000000*	0.28316
Board	101168.75	9	11240.97	8.09	0.000079*	0.77164
Error	1209.81	71	1389.12			

* statistically significant difference ($p>0,05$)

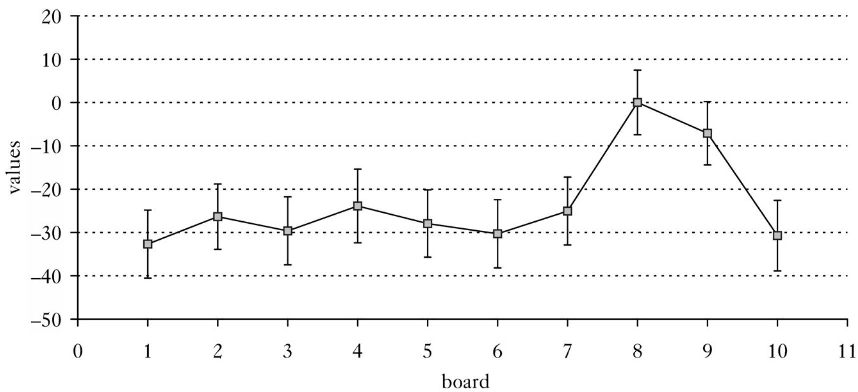

Fig. 5.
Interaction plot for reading time deviation between boards F(9.871)=8.0922, $p<0.0001$, confidence interval 0.95.

their senses more. This is also confirmed by Scheffe's *post-hoc* test, the results of which are shown in Table 7.

Scheffe's *post-hoc* test also indicates that, significantly, the smallest deviations from the reading time norm fall on boards 8 and 9. There are significant deviations from the reading time norm between board 8 and all other boards except board 9, and there are deviations from the reading time norm between board 9 and boards 1, 6, and 10.

Table 7.

Scheffe's test; probabilities for *post-hoc* tests; Error: intergroup MS=1389.1, df=871.00

Board M=	1 –32.68	2 –26.35	3 –29.63	4 –23.89	5 –23.89	6 –30.30	7 –25.06	8⁺ 0.01	9⁺ –7.10	10 –30.73
1		0.998	1.000	0.987	1.000	1.000	0.994	0.000*	0.010*	1.000
2			1.000	1.000	1.000	1.000	1.000	0.005*	0.168	1.000
3				1.000	1.000	1.000	1.000	0.001*	0.050	1.000
4					1.000	0.999	1.000	0.047*	0.474	0.998
5						1.000	1.000	0.002*	0.101	1.000
6							1.000	0.001*	0.038	1.000
7								0.015*	0.291	0.999
8									0.994	0.001*
9										0.037*
10										

⁺interactive boards
*statistically significant difference (p>0,05)

Discussion

In recent years, education in nature (referred to as outdoor or outdoor education) has become the object of scholarly cognitive discourse among many academic disciplines and education practitioners. As Blanco (2002) points out, environmental education in natural areas can be an essential tool in promoting changes in attitudes among people that will lead to an improvement in their quality of life, and at the same time teach them to respect nature. According to Parczewska (2017), adults generally treat nature as a background to what they do. This aspect was also emphasized by Louv (2005, 2011) in his books, pointing out that the nature deficit syndrome among children is generated by the fact that their parents spend too little time in natural open spaces.

Coverage of urban and suburban forests between European cities can vary from less than 1% to more than 75% (Pauleit *et al.*, 2005), but no matter whether urban or suburban forests are extensive or less so, they always carry important values for society related to ecosystem services (Refrowska-Chodak, 2019). Undoubtedly, the recreational and educational potential in Poland's forests is highly valued by society as indicated by numerous studies from different regions of the country (Bartczak *et al.*, 2008; Dudek, 2016; Gołos, 2018; Janeczko *et al.*, 2019). The large number of observed forest users during our survey also confirms this fact (Table 2).

For many users of educational trails, educational infrastructure is a superfluous element (Korcz and Janeczko, 2022a), which is probably why so few forest users paid attention to educational boards during trail activities (Table 2). The attention-getting index clearly indicates that trail users do not spend much time carefully reading the information on educational boards. Similar results were shown in a study by Švajda and Činčera (2017). An important indicator in relation to route design is the fact that board 2, which had the least amount of text, retained the largest number of forest users. Therefore, it is very important to follow the principle of 'less is more' in the design of educational materials. In the given example, it can be seen that the small amount of words was an important indicator of why users of the route became acquainted with the content on the board.

In the context of more effective environmental education in open spaces, the key to retaining attention, and at the same time more effective environmental education of route users, is the interactivity of the routes, as confirmed by our research (Fig. 4, Table 3, 4). By using more senses (touch, sight, hearing), target audiences are more likely to correctly interpret the content on the boards. Our results also confirm the research of Ayres and Melear (1998), indicating that when students interact with an educational interactive element, there is an increase in the knowledge of class recipients compared to a traditional board. In an era of increasing globalization, the so-called sensory learning model (VARK) (Mirza and Khurshid, 2020) has been identified, which plays a very large role in communication and interpretation, as it defines the need to use all the senses to achieve the full success of knowing and learning the world. The VARK model indicates that people assimilate knowledge in four ways: visually (V – Visual), aurally (A – Auditory), written (R – Read/write), and kinesthetically (K – Kinesthetic) (Burmark, 2002; Leite *et al.*, 2010), which is why it is so important to design educational materials in a simple way, but with the possibility to use different senses.

In a smaller study, there are several limitations that may affect the shape of the final results, *e.g.*, by conducting non-intrusive observation, route users were not asked whether this was their first activity at a particular location, or whether they frequent the route regularly. The presence of a lot of random sensory stimuli, which can cause distraction because nature is not static, as well as the graphic design itself or the color scheme, can also affect the retention and attention-getting power of the boards (Ballantyne and Hughes, 2003). Another limitation may be the subject matter of the boards themselves, as everyone has a variety of interests and passions, hence not everyone will stop at the boards in question. Another factor is that most of the research on the use of educational boards in informal learning activities is on state or traditional boards. The results shown herein, give clues to encourage taking a better look at the issue of the use of interactive elements of educational development, including those with more playful elements in them (Soewardi and Perdana, 2019), tourism, or recreation in naturalized areas.

Conclusions

Environmental education in open, natural spaces is becoming a growing trend in more broadly defined education for sustainable development, tourism, or recreation. The spectrum of the use of natural areas, including forest areas, for informal education, is really wide. Nonetheless, due to the popularity of the use of educational boards, whose main claim is to support informal environmental education activities, changes are needed in the design of such educational infrastructure elements. There must be far less text on educational boards, which will not discourage forest users from passive education. In addition, boards should be introduced on educational paths, which will voluntarily force greater interaction of trail users by using not only the sense of sight but also the sense of touch or hearing.

Authors' contributions

Investigation – N.K., conceptualization – N.K., A.K., E.J., data curation – N.K., A.K., A.M.K., E. J., methodology – N.K., A.K., A.M.K., E.J., analysis – A.M.K, writing-original design – N.K., A.K., A.M.K, E.J., visualization – N.K, investigation – N.K. A.K., writing-review and editing – N.K., A.M.K.

Conflicts of interest

The authors declare the absence of potential conflicts of interest.

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STRESZCZENIE

W jaki sposób tablice edukacyjne w lasach przyciągają uwagę użytkowników lasów i angażują ich w proces rozumienia przyrody?

Kształtowanie właściwych postaw ekologicznych wobec otaczającej przyrody jest jednym z trudniejszych wyzwań stawianych przed społeczną edukacją nieformalną i formalną. Proces edukacji społeczeństwa powinien odbywać się na każdym etapie zdobywania wiedzy, a liczne badania wykazały, że edukacja na obszarach przyrodniczych przynosi znacznie lepsze efekty w porównaniu z tradycyjnymi zajęciami w pomieszczeniach zamkniętych. Celem badania było określenie, w jaki sposób zlokalizowane na ścieżce edukacyjnej w lesie tablice, które w założeniu mają wspierać nieformalne działania z zakresu edukacji ekologicznej, przyciągają uwagę użytkowników lasu i angażują ich w proces poznawania przyrody. Miejscem badań była ścieżka edukacyjna Las Rejkowizna, zlokalizowana na obrzeżach Świdnika i Lublina (Regionalna Dyrekcja Lasów Państwowych w Lublinie) (ryc. 1). W badaniu wykorzystano metodę nienachalnej obserwacji użytkowników lasu i ich interakcji z 10 tablicami edukacyjnymi (tradycyjnymi i interaktywnymi) (ryc. 2 i 3). Badania prowadzono od 1 do 31 sierpnia 2021 r. W każdy weekend (łącznie 8 dni, co daje 80 godzin obserwacji interakcji użytkowników lasu z tablicami edukacyjnymi) autorzy obserwowali fizyczną interakcję odwiedzających z tablicami edukacyjnymi (spójność gwarantowana). Każda tablica była obserwowana przez godzinę, w odstępach 15-minutowych (czas na przejście do kolejnej tablicy edukacyjnej). Łącznie obserwacją objęto 881 osób, z czego połowa (50,40%) zatrzymała się przy tablicach (tab. 1). Największy odsetek osób zatrzymał się przy tablicach nr 8 (62,50%), nr 9 (59,00%) i nr 7 (55,17%). Najmniejszy odsetek osób zatrzymał się przy tablicach nr 10 (40,74%), nr 1 (43,68%) i nr 3 (44,83%) (tab. 2). Wyniki badania wskazują na brak istotnych statystycznie różnic ze względu na płeć odnośnie do czasu czytania tablic edukacyjnych. Takie różnice występują w przypadku rodzaju tablicy i ilości tekstu na niej (tab. 3). Tablice edukacyjne z najmniejszą ilością tekstu są najczęściej czytane przez użytkowników lasu i mają wyższy wskaźnik utrzymywania uwagi niż tablice z dłuższym tekstem. Opracowany model wyjaśnia w 38,48% zmienność wskaźnika trzymania uwagi ze względu na rodzaj tablicy edukacyjnej (tab. 4; ryc. 4). Wskaźnik utrzymywania uwagi dla tablicy nr 2 różni się istotnie od wskaźnika dla pozostałych tablic. Warto zauważyć, że respondenci czytają tablice krócej, niż wymaga tego czas, aby przeczytać ze zrozumieniem wszystkie informacje. Model wyjaśnia w 77,16% zmienność czasu czytania ze względu na długość tekstu na

tablicy edukacyjnej. Interaktywne tablice edukacyjne osiągają najwyższy wskaźnik utrzymania uwagi, ponieważ angażują znacznie więcej zmysłów w proces nieformalnej edukacji ekologicznej (tab. 5; ryc. 5). Taka forma przedstawiania informacji jest ciekawsza dla respondentów niż zwykły tekst. Wskaźnik utrzymywania uwagi dla tablic nr 8 i 9 różni się istotnie od wskaźnika dla pozostałych tablic (tab. 6, 7). Wynika to z faktu, że są to tablice interaktywne, które skuteczniej przyciągają uwagę respondentów. Wyniki przedstawione w artykule wyraźnie wskazują na potrzebę zmian w projektowaniu elementów infrastruktury edukacyjnej w celu skuteczniejszej edukacji. Na tablicach edukacyjnych musi być znacznie mniej tekstu, aby nie zniechęcić użytkowników lasu do jego czytania. Ponadto na ścieżkach edukacyjnych należy wprowadzić więcej tablic, które wywołają większą interakcję użytkowników szlaków, wykorzystując nie tylko zmysł wzroku, ale także dotyku czy słuchu.