Papers

jATES

Journal of Applied

Technical and Educational Sciences

Preface

The growing concern over environmental challenges is mirrored in the fact that this thematic issue of jATES 2020/3, is the second thematic issue of the journal this year publishing articles on environmental education. It a great pleasure to me to launch the issue which provides an insight into the thriving world of environmental educational research. The increase of the activity of educational researchers in the field of environmental education gives us the hope, that future generation will be appropriately prepared for the challenges they will face regarding the sustainability of our civilization. This issue presents altogether nine articles three article on general issues of environmental education, three studies on subject-related issues and three thematic studies on the theme of education concerning light pollution.

The first article of the issue by Christiana Glettler and Franz Rauch from Austria deals the with a fundamental aspect for any attempt of environmental education namely with nature-human connectedness. The article convincingly proves that spending time outdoors in nature not just healthy and relaxing but could positively contribute towards a more sustainable future by developing several competences, which are considered vital for sustainability education.

In the second article Viktória Gősi Kövecses and her colleagues gives an overview of the environmental attitudes of the freshmen of a University. Their results are hopeful not just because the overall environmental attitudes of the students are positive but especially because teacher students are aware of the fact that to address environmental attitudes and habits of their pupils will be a significant part of their jobs and are ready to take on this challenge.

Anna Krakker presents a longitudinal study about the effect of using an environmental education package among primary school children in the third article of the issue. The study demonstrates that the long term effectiveness of environmental education methods could be evaluated and so the evidence based development of the environmental education practice is an available opportunity for every stakeholders involved in the development of environmental education.

The first subject related article of the issue is Sándor Csonka's article on the relationship of Physical Education and the outdoor activities of students with special attention tot he possibility of free exploration in nature. The lesson from the analysed data is that although free exploration in nature is effective way to build connection with nature and have a positive effect on student health also, its occurrence in curricula and everyday pedagogical practice is diminishing therefore every effort to provide children with opportunities for free exploration in nature has a particular importance

Éva Karl and György Molnár describe the accentuated role and possibilities of the digital culture subject in the process of education for sustainability and it provides concrete tasks by age groups along with detailed methodological guidance in the fifth article of the issue. The article provides an excellent example of how a could be a balance between the technical development and the goals of environmental education is achievable in the everyday practice of a school.

The last article among the subject related studies is the Erika Homoki's article on the Comparative analysis of the methods of teaching geography in different types of schools- The results highlighted the importance of teachers' personality regarding the effectiveness of teaching as not the type of the school, but the personality of the teacher was found as the most determining in knowledge transfer and student activity during geography classes.

The closing three articles of the current issue form a thematic block on the theme of educational opportunities about light pollution.

Mika János and his colleagues' article presents a questionnaire survey conducted about public awareness on light pollution in four villages. The results points out that public awawereness has a very complex background, and therefore any environmental protection initiatives like Dark Sky Parks needs a well planed public awareness strategy in order to have a effect on people's awareness. The second article on the theme of light pollution by Éva Fodor gives an overview on possible ways of introducing light pollution through nature trails as a part of the efforts aiming at to raise public awareness on the issue. Finally Anna Apró's article presents an analysis of curricula, and notes that the topic of light pollution is poorly represented in educational regulative documents, and therefore do not support effectively the introduction of the topic into the public education system.

30 of September, 2020

Attila Varga, editor of this issue

Nature Learning –

early childhood nature experience and

sustainability education

Christiana Glettler [a], Franz Rauch[b]

[a]KPH Graz, Lange Gasse 2, 8010 Graz, Austria, christiana.glettler@kphgraz.at

[b]University of Klagenfurt, Sterneckerstraße 15, 9010 Klagenfurt, Austria, franz.rauch@aau.at

Abstract

Recent studies confirm that children profit greatly from being in contact with nature. A large body of research focuses on children's psychological development in this respect. While the social and physical aspects are also well researched, less studies focus on the relationship between early childhood nature experience and sustainability education. In this paper, the central research question is concerned with this nexus, asking how children, who spend a lot of time outdoors, a) perceive nature, b) in what ways they act towards protecting nature and c) which competences they show in relation to sustainable development. In order to answer these research questions, two case studies were conducted in an Austrian Kindergarten and a primary school. The findings show that the children in both institutions have a diverse image of nature, a close relationship with nature, are invested in protecting their environment and show several competences, which are considered vital for sustainability education. Thus, the findings indicate, that increasing the amount of time children spend outdoors could positively contribute towards a more sustainable future.

1. Introduction

Ever since the publication of Richard Louv's Book *Last child in the woods* (Louv, 2008), international awareness surrounding the importance of nature for children's development has risen. While not all authors (Dickinson, 2013, Clarke & Mcphie, 2014, Mcphie & Clarke, 2015), agree with Louv's theory of nature-deficit-disorder, studies around the globe have addressed

the relationship between children and nature from various viewpoints in recent years. While the psychological, social and physical aspects are well researched, less studies focus on the relationship between childhood nature experience and sustainability education. However, those studies indicate that nature experience and outdoor learning can be valuable tools in order to reach the goals of sustainability education (Elliott, 2017, Lude, 2001, Stoltenberg, 2009). This study aims at exploring this notion, through investigating how children, who spend a lot of time outdoors view nature, if they show pro-environmental behaviour and which competences related to sustainability education they display.

2. Theoretical Background

2.1. Images of Nature

The images of nature are strongly influenced by its depiction in literature or films, as nature has always been a prominent feature in literature, from poetry to prose, fairy-tales and philosophical texts. Especially children's literature often depicts nature as something wild, slightly mysterious and full of adventure (compare Astrid Lindgren's Ronia, the Robbers Daughter or Six Bullerby Children or J.R.R. Tolkien's' The Lord of the Rings). While reading stories such as those provides children with ideas of the relationship between humans and nature, they don't paint a full picture and children often have a very idealized image of nature as recent studies show. This might explain why many children view nature as something pristine, almost independent of human influence, also often excluding human beings from being part of nature altogether (Brämer, 2006, Brämer, Knoll & Schild, 2016, Stoltenberg, 2009). While these findings indeed suggest a necessity to re-connect children with nature and to allow them to see themselves as part of nature, Clark and Mcphie (2014, 2015, Mcphie & Clarke, 2015) go even beyond this idea. In their essays, they suggest a necessary shift in thinking, away from the re-connection discourse in order to make room to address other important issues of environmental and sustainability education. It is vital for children to understand the interdependencies between human activity and our environment. Only in understanding this, can they realize how our choices and actions shape the world. Stoltenberg (2011b) thus suggests integrating different perspectives on nature:

- Nature affects us through beauty, colours, forms and stimulating changes
- Nature is our living environment
- Nature provides us with resources for all our products and for everything we do, and that these are not unlimited

- Nature is providing basic functions for human life, without which we could not survive, such as regulating the water supply or the air quality
- Nature is functioning on a sensitive balance, which follows for its own laws, which we have to understand and handle, such as the rhythms of nature, or interdependencies in ecosystems.
- Humans are part of nature (p. 35).

2.2. The Children-Nature-Sustainability-Nexus

Despite different approaches to the topic and different philosophical standpoints, there is a global consensus, that being in nature is profitable for children in various ways. Firstly, children profit in their social skills (Dyment, 2005, Dyment & Bell, 2008,O'Brien & Murray, 2005, Palmberg & Kuru, 2000, Stoltenberg, 2009) and develop a more diverse, active and creative play behaviour (Chawla, 2002, Fjørtoft, 2004). O'Brien (2005) also found, that children actually prefer playing outdoors to playing indoors. Secondly, children profit in their psychological and cognitive development (Gebhard, 2013). In this respect, studies show a positive influence concerning children's motivation, independence, self-discipline and self-esteem, creativity and linguistic abilities (Raith & Lude, 2014). Thirdly, being outdoors improves children's physical abilities such as climbing, running, and balancing, which in turn is beneficial for children's general health (Bolay & Reichle 2011, Gebhard 2013, Miklitz 2005, Raith & Lude, 2014).

While the evidence for these aspects seems to be relatively clear, the matter becomes more difficult for the development of environmental awareness and pro-environmental behaviour. Many studies focus on children's environmental knowledge, but more knowledge does not necessarily correlate with more pro-environmental behaviour or even a positive attitude towards the environment (Raith & Lude, 2014). However, several factors seem to be important for children to develop a positive attitude towards nature and pro-environmental behaviour – being in direct contact with nature as early as possible (Aguirre-Bielschowsky, Freeman & Vass, 2012, Meske, 2011, Palmberg & Kuru, 2000), having social and physical experiences outdoors with family and peers (Meske, 2011), growing up with pro-environmental family values, knowledge about nature and spatial proximity to it (Cheng & Monroe, 2012).

Jung (2012) created a model of factors, which influence young people's relationship with nature, based on a survey among his students. As the model shows (compare figure 1), several factors such as early childhood experiences, family values, and the peer group's interest are

influential for a personal emotional relationship. Education and societal norms are a more unstable ingredient.
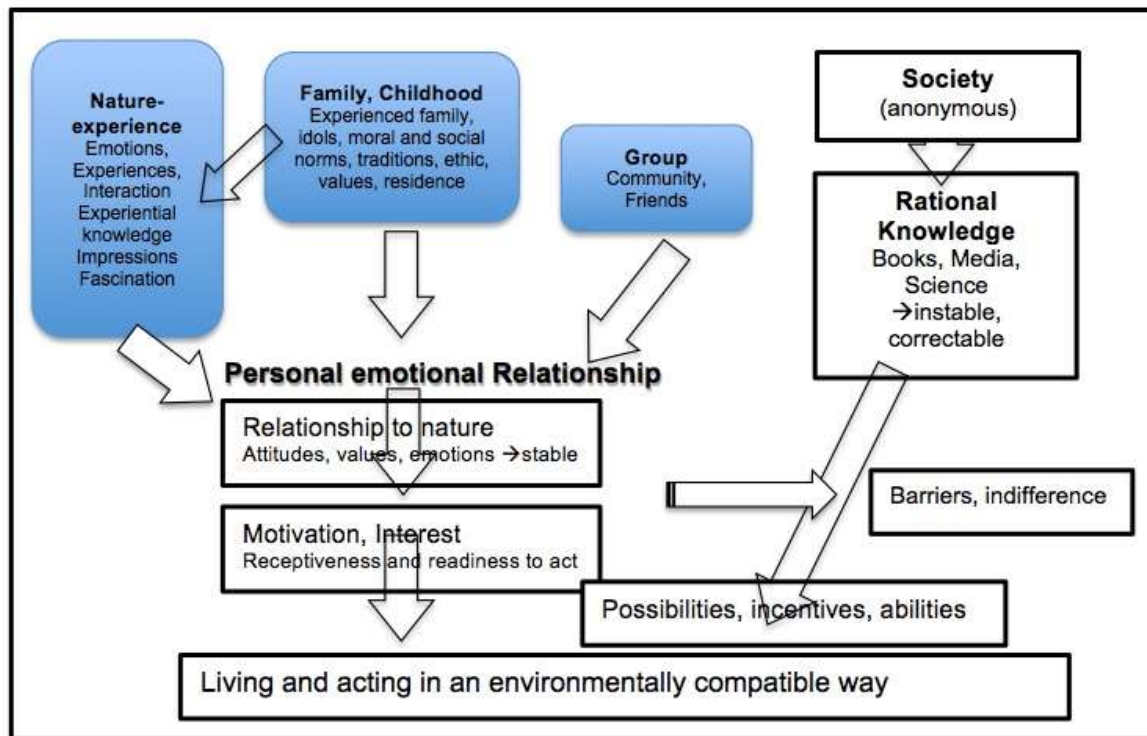
Fig. 1: The influences of different factors on nature-related values and pro-environmental action (slightly adapted and translated from Jung, 2012, p. 131)

2.3. Education for sustainable development

Education has been seen as an important aspect in the discussion surrounding sustainable development since the publication of Agenda 21 (UN, 1992). This importance has been further underscored through the Decade for Education for Sustainable Development (DESD), 2005 – 2014. The current Agenda 2030 with the 17 Sustainable Development Goals (SDGs) again stresses the importance of Education (UN General Assembly, 2015, UNESCO, 2017). The Austrian Uni-NEtZ project brings together academics from 16 Austrian universities as well as external partners. The overall aim of the project is to develop strategies to realise the UN Sustainable Development Goals (SDGs) in Austria. The group responsible for SDG 4 emphasize in their current position paper (Uni-NetZ SDG 4, 2019) the importance of education in order to reach the SDGs. The authors stress the responsibility of research and education in order to, "find solutions, which contribute to an all-encompassing transformation toward a sustainable future which is worth living" (Uni-Netz SDG 4, 2019, p.1). In an era, which is

characterized by a climate crisis, the shortening of resources and global inequalities, it is pertinent to empower people not only to change their thinking but also to drastically change their actions. Consequently, education should, "impart knowledge and competences in order to enable learners to develop strategies and lifestyles which lead to the realization of a solidary and just relationship with our fellow humans, society and the environment" (Uni-NetZ SDG 4, 2019, p.1). The authors state that subject- and action competences as well as a reflected politically-ethic attitude aligned with human rights are vital in order to be able to anticipate and evaluate the effects of one's own decisions and actions in a global, lasting dimension, with the goal of adapting lifestyles accordingly. Additionally, the importance of cooperation and networks for the implementation of Education for Sustainable Development (ESD) is stressed (Rauch & Pfaffenwimmer, 2020).

The discussion around competences, learners should acquire takes an important position in ESD. These competences are supposed to enable learners to actively take part in shaping the world towards a more sustainable future (Rauch & Steiner, 2013). De Haan and Plesse (2008) describe the following competence areas in their adapted version of shaping competence (De Haan & Harenberg, 1999) for primary school students:

- Thinking in a forward-looking manner
- Gathering knowledge in a spirit of openness
- Acting in an interdisciplinary manner
- Communicating and cooperating
- Planning and acting
- Being just and showing solidarity
- Being motivated and being able to motivate others
- Reflecting upon one's own lifestyle and principles

Furthermore, Rauschmayer and Oman (2012) emphasize the ability to be empathic as central in order to put oneself in someone else's shoes, as well as being able to relate to values and associated inconsistencies.

3. Methodology and research procedure

The data for this paper was collected as part of a larger research project (Glettler, 2018). The central research questions were concerned with the children-nature-sustainability-nexus, asking:

1. How do children, who spend a lot of time outdoors, perceive nature?

2. In what ways do they act towards protecting nature?

3. Which competences do they show in relation to sustainable development?

In order to answer these research questions, the case study methodology was selected, as it was necessary to 'capture the circumstances and conditions of an everyday situation' (Yin, 2014, p. 52). The project can be characterized as a relativist, interpretative case study of two common cases, grounded in social constructivism (Glettler, 2018). The cases were selected based on pre-determined attributes:

-   Educational institution for children between five and eight years old

-   Outdoor Learning elements included in the timetable on a daily basis

-   Mission statement stating the importance of outdoor learning

-   Terms such as ESD environmental education or eco-literacy mentioned in the curriculum / mission statement

-   Located in Austria

The selected cases were a forest kindergarten, close to a major Austrian city and a rural, private primary school.

Case 1:

The Forest Kindergarten, which was selected, was founded in 2013 and was the first Styrian childcare institution without a regular building. The children spent their mornings from 8:30 am to 1:30 pm outdoors in a woodland area surrounding a tipi, forming the centre of the institution. The focus of the data collection was on the 5-6-year olds. 15 children, the three main educators, and the children's parents were involved in the study.

Case 2:

The primary school has a strong focus on outdoor learning and environmental education projects. The children can spend at least one hour everyday outside in the large school grounds. Additionally, regular outings with a forest educator are part of the programme. Data was collected in Primaria 1 (Years 1 & 2). 14 children aged six - eight, their class teacher, the headmistress, a forest educator, and the children's parents were involved.

In both cases, interviews were led with the children, based on Weltzien's (2009) dialogue-supported interviews with children under consideration of their peer-relationships. Accordingly, the children were mostly interviewed in pairs and on one occasion in a group of

three. Three children opted to be interviewed on their own. The interviews lasted between five and thirty minutes. The interviews with the educators were conducted individually. They were semi-structured interviews following an interview guide (Hancock & Algozzine, 2011) and lasted between 50 and 60 minutes. Further data sources for both cases were parent questionnaires (Glettler, 2018), observation protocols from participant observation (Cohen et al., 2007), conducted by the first author as well as media articles about the two institutions. The different data sources were converged to achieve data triangulation (Yin, 2014).

The quantitative data from the parents' questionnaires were analysed using descriptive statistics (Cohen et al., 2007) to present the data in terms of summary frequencies. The qualitative data, including the qualitative data from the questionnaires were analysed using qualitative content analysis based on Charmaz' (2006) grounded theory approach. This approach allows for the themes of the data to emerge throughout the analysis process and consists of three or more different coding approaches, leading to a comprehensive coding system. Following Charmaz' (2006) guidelines for coding, the material was first approached using line-by-line coding. In this step, a small part of the data (two interviews in this case) are read thoroughly and all elements, that are relevant for the analysis, are coded. The resulting, large number of initial codes were then compared to further data material synthesizing the data more and more. This second analysis step – focused coding (Charmaz, 2006) – led to a preliminary coding system. In the third step – axial coding (Charmaz, 2006) – the codes from the preliminary system were summarised into larger categories. This step "specifies the properties and dimensions of a category, and reassembles the data you have fractured during initial coding to give coherence to the emerging analysis" (Charmaz, 2006, p.60). The full coding system conists of 12 categories including several subcategories (Glettler, 2018). For this publication six of these categories are relevant. They are shown in table 1.

Table 1. Data analysis themes and code definitions

Code Category	Category Key	Definition
Self-Competence	C2	Passages that describe or hint at children's personal competence
Social Competence	C3	Passages that describe or hint at children's social competence

Subject Competence	C4	Passages that describe or hint at children's subject competence
Awareness of environmental protection	C9	Passages that describe or hint at children's tendencies toward pro-environmental behaviour
Emotions towards nature	C10	Passages that describe or hint at how children feel towards nature
Roles of nature	C11	Passages that describe or hint at different functions of nature

4. Findings

The findings, presented in this chapter follow the order of the outlined research questions, starting with how children perceive nature, continuing with their actions towards protecting the environment and closing with a description of their displayed competences.

4.1. Children's perception of nature

Categories 10 (*Emotions towards nature*) and 11 (*Roles of nature*) describe how the children perceive their natural environment, how they feel about it and which functions they ascribe it. The data here shows slight differences between the two cases. While at the kindergarten it is clear that all children love being outdoors and are extremely interested in plants animals and their surroundings in general, the situation is less clear at the case of the school. Here, one of the educators explains, that for some of the children it takes a while to get used to being outdoors so much and to learn to love it, as some of them are afraid to get dirty or show disgust towards bugs or slugs. However, this usually changes over time and the children learn to appreciate the outdoor time.

Nevertheless, the data indicate that the children in both institutions feel very strongly about their natural environment, react emotionally in situations when they experience something that they perceive as harmful to nature and also lobby for pro-environmental behaviour around their parents. The children even acted protectively towards plants while being in the middle of a soccer game, always making sure that nobody stepped in the flowerbeds when running to retrieve a lost ball. Furthermore, they also develop a strong relationship to the vegetables they

plant in their gardens, as one of the educators explains: 'I notice how good it does the children and how proud they are of their harvest. And how strongly they suddenly feel about the fact that snails are infesting their salad. Something they probably would not care about at all if it happened to their mums.' This perception is supported by the data from the participant observation. Some of the children proudly presented their vegetable beds and could explain in detail which vegetables they had planted. The educators agreed that while children might forget facts they learn, they keep an emotional connection and a positive attitude towards nature.

While the children often start out to see nature merely as a playground, their attitude mostly changes over time, when they develop a deeper connection and start to take on responsibility for protecting it. The following extract from an interview with one of the children at the kindergarten (they were asked to describe their perfect kindergarten) shows their deep appreciation of nature:

> A meadow, or well, a meadow at the front. And a whole lot of wild strawberries are there. And a huge tree, which would for example be as thick as the whole area here [gestures around the area, where we are sitting; approximately five metres in diameter]. That would be like that. That all those trees would grow together. And also, like, that there would be a treehouse. And a tent. That would be it.

During the interviews and the observation time several roles became apparent, that the children attribute to nature. While nature as a playground is an obvious function, the children also saw nature as a source for food, an area of relaxation, a place to make new experiences and learn new things and a source of inspiration for games and activities (Glettler, 2018).

4.2. Children's awareness and actions towards protecting nature

The data from both institutions indicate, that the children have an awareness of environmental issues, which is profound for their respective age groups. The category *awareness of environmental protection* (C9) includes several passages describing the children's attitude about nature and the environment as well as actions towards protecting the environment. One of the parents describes how being outdoors at school shapes the children's awareness the following way:

> Through the focus on outdoor learning, the children develop into critical little characters, who question every plastic wrapping during shopping trips, make sure that lights are not turned on too long and also question thoroughly where food is coming from and how it is produced.

This view is confirmed by parents and educators from both cases, sometimes adding that the children are generally more aware of natural resources and care greatly about recycling and

waste management. Educators from the kindergarten case especially emphasize how sensitive the children are to waste lying around in their forest as well as also in the afternoon, when they are outdoors with their parents.

In the kindergarten case another aspect was salient – the children's relationship to water. As there is no running water directly in the area where they mostly spend the morning, children have to collect water from a nearby well. Thus, water becomes very valuable to the children and they take great care not to waste any while pumping it or carrying it back to the others.

However, one of the educators explains, the children still need guidance from educators to understand difficult relationships as they have a tendency to anthropomorphize animals and thus sometimes do more harm than good. For example, they think that insects like to be cuddled and patted like a cat or dog, harming them in their enthusiasm.

4.3. Children's competences in relation to sustainable development

In both cases the data on the children's competences are very rich and show that the children display abilities in different areas. The children displayed competences in the areas of subject competence, self-competence and social competence, as defined in the Curriculum for Austrian Kindergartens (*Bildungsrahmenplan*) (Ämter der Landesregierungen der österreichischen Bundesländer, Magistrat der Stadt Wien & Bundesministerium für Unterricht, Kunst und Kultur, 2009), in both cases.

4.3.1 Subject competence

The codes for this competence area are the same in both cases – *being able to identify connections / interrelationships* and *knowledge about biology / ecology*. The children in both cases show a profound knowledge about plants, animals and nature in general. This becomes more apparent in the case of the Kindergarten, as it is less expected for children of this age group. Additionally, educators in both institutions attest, that the children are well able to identify connections and interrelationships.

4.3.2 Self-competence

When comparing the codes from both cases, it becomes apparent, that the similarities are by far greater than the differences. There is only one additional code for the kindergarten data (*developing self-confidence / trust in one's abilities*).

One of the most salient aspects of the data, was the children's great independence and self-reliance. They do not generally depend on being told what to do by the educators but find their own activities. This holds true for the kindergarten throughout the day, while at the school some children sometimes need ideas for activities when they are outside in the schoolyard after school. In relation to this aspect, the second code is also important. The children are very curious about their natural environment and show a great fascination and also perseverance, when exploring their surroundings. Here too, a slight difference can be seen between the cases as with the children at school sometimes disgust from a spider or a bug might hinder an exploration or they might want to go back indoors when it is raining, while at the forest kindergarten, the children do not seem to be affected by these issues at all.

The children are very articulate and creative in both institutions, which can be frequently observed during periods of free outdoor play. This is also the time, when the children show their ability to develop strategies in order to build something or to motivate others to join in their games. They can work very well together and find solutions for their problems mostly without help from the adults. In general, the data also show, that the children can concentrate very well on their tasks, and even in the kindergarten case listen attentively to a story for almost 30 minutes. However, at school, the educators note, that some children have a harder time concentrating when they are outdoors, getting easily distracted by the many different stimuli.

The fact that the code *developing self-confidence / trust in one's abilities* only appears in the findings on the kindergarten case might be slightly misleading. It does not mean that the children at school are not self-confident or do not trust in their abilities but rather, that here, the educators might not be aware of the fact that this is special. In contrast, the educators in the forest kindergarten are probably more aware of the children becoming more self-confident over time.

4.3.3   Social competence

In this competence area differences between the cases are apparent from the codes. While taking over responsibility is present in both cases, this code has an additional connotation with the school case. Here, the ability to work independently is often mentioned by the educators, an ability which is probably less looked for at the kindergarten and thus not apparent in the interviews. Similarly, the code *being able to collaborate with others* only appears for the school case. While the children at the forest kindergarten collaborate with each other regularly during

their games and building activities, this might not be in the educators' focus as a desirable competence.

However, here, the educators focussed more on the motivational aspect, mentioning the children's ability to motivate others to join in their games. This is more important at the kindergarten, as there are less activities prescribed by the educators. Additionally, *being able to communicate with each other* only appears for the data of the kindergarten. This does not imply, that the children do not talk to each other at school, but rather, that the educators do not focus on it at school, taking it for granted.

As far as the other codes are concerned, the findings are more similar for the two cases. In both institutions, the children are able to change perspective and to show empathy, they learn how to deal with conflicts, thus getting along well with the other children.

5. Discussion

The findings show that the children in both institutions have a diverse image of nature, a close relationship with nature and are invested in protecting their environment. The first aspect – the positive image and close relationship – concur with the findings of other studies (Aguirre-Bielschowsky, Freeman & Vass, 2012, Meske, 2011, Palmberg & Kuru, 2000) stating, that direct nature experience is vital for a positive image of and relationship with nature. The fact, that the children are not only aware of environmental issues, but also act in order to protect the environment is especially interesting as Raith and Lude's (2014) review of 174 international studies implies, that it is very difficult to influence environmental action. However, the situation at both institutions seems well suited to foster children's inclination towards pro-environmental action. When comparing it with Jung's (2012) model, many aspects are covered – the children have positive nature experiences, come from families who care for the environment and they spend time outside with their friends. All these factors increase interest in the environment and motivate to protect it.

The findings further showed, that the children have many competences which are relevant for sustainable development. In the following section the findings on the children's competences will be discussed making comparisons to the Model of de Haan & Plesse (2008).

5.1. Children's displayed competences in the light of ESD

The children's abilities in the areas of creativity and imagination are rated very high by parents and educators in both cases. This is an important aspect in ESD, as creativity is fundamental to find new, not-yet-tested approaches to problems and challenges of the world we live in and is considered important in de Haan and Plesse's (2008) sub-competence *thinking in a forward-looking manner*. The second sub-competence *acting in an interdisciplinary manner* calls for experiential- and inquiry-based learning approaches, which depend on children's fascination with the world around them (de Haan & Plesse, 2008). This aspect was prominent in both cases, as the children showed curiosity and were busy investigating their surroundings in order to understand their world. This aspect is also considered vital by Stoltenberg (2011a), as curiosity and an urge to explore one's surroundings is a prerequisite for learning about sustainability issues.

Similarly important for *acting in an interdisciplinary manner,* is the children' self-confidence, respectively their trust in their own abilities. Furthermore, the children's ability to understand interdependencies and their broad knowledge of nature topics seem important for this sub-competence. This aspect is also considered as important by Stoltenberg (2011b), as this kind of knowledge supports the children in gaining further insights into central life questions.

Moving on to the children's communication skills, they are considered vital as a basis in order to solve conflicts, gather knowledge, and generally to work successfully in teams. In this respect also the finding, that the children generally get along with each other very well in both cases is important. These two areas correspond with de Haan and Plesse's sub-competence *communicating and cooperating*. Similarly, Stoltenberg (2011a, b) describes that philosophizing with children on sustainability related topics is a meaningful method in ESD, demanding well developed communication skills. Furthermore, children need to be articulate in order to participate in democratic decision-making processes (Stoltenberg, 2011a).

One aspect that is linked to the sub-competence *planning and acting* is taking over responsibility, which is a very important aspect in both institutions as the children are involved in many activities and are trusted to do their part. This is seen as fundamental by many authors (de Haan, 2010, de Haan & Harenberg, 1999, Stoltenberg, 2009). Stoltenberg (2011b) claims sustainable development depends on people, who have the courage to intervene, who are

motivated to do something in terms of sustainable development, and who have made the experience, that this is meaningful and possible (p.33).

Another important aspect is the ability to develop strategies, which is well developed in the children of both cases. This aspect is generally considered vital in the ESD discussion (de Haan, 2010, Stoltenberg, 2008, 2011a, b). When viewing children as 'pioneers of change' (Henze, 2016, p. 35) it becomes especially clear that being able to develop strategies is vital in order to promote a change towards a more sustainable lifestyle.

For the next sub-competence – *being just and showing solidarity* -, de Haan and Plesse (2008) stress the importance of the ability to be empathic and compassionate. They continue explaining that for children to develop this competence, it is important to practise changing perspectives. Both of these abilities are very prominent in both cases, as the children learn these skills through role-play but also through the careful guidance of their educators. This ability is also important for the sub-competences *thinking in a forward-looking manner* and *gathering knowledge in a spirit of openness*. Rauschmayer and Oman (2012) also emphasize the importance of being empathic for reaching the goals of sustainable development.

Finally, it can be said that as far as the sub-competence *being motivated and being able to motivate others* is concerned, the children in both cases show a high degree of motivation to protect the environment and also regularly display their ability to motivate others.

6. Conclusion and Recommendations

The findings indicate, that increasing the amount of time children spend outdoors could positively contribute towards a more sustainable future. However, the presented case studies can only be seen as a starting point for exploring the overlap between outdoor learning and ESD. Further research into this area is necessitated to expand on the findings obtained and to offer more profound and perhaps contrasting insights into the research field. Additional studies of other cases would provide a deeper insight into the factors facilitating the effects of being outdoors shown in this study. In this respect, an interesting question would be what impact the parents' attitudes have and how children of different backgrounds develop in settings, similar to those of the case study institutions. Furthermore, the influence of the children's experience realm including cultural background and their family history are of great interest. In this respect,

especially migration and cultural diversity in present day societies seem worthwhile aspects of future research endeavours.

In addition, longitudinal studies would be indicated in order to see how children who spend their early childhood in an institution offering outdoor learning elements develop throughout their further education and beyond. However, despite the necessity of further research, the findings suggest that children generally profit greatly from being outdoors in various aspects of their development. Thus, implementing elements of nature experience, such as regular forest days or a more natural design of the (school-) grounds in elementary and primary education seems indicated.

In conclusion, ESD or transformative education (Bittner & Pyhel, 2016, Singer-Brodowski, 2016) are vital concepts in the current state of the planet. While new terms and definitions emerge with every new policy document, there is still a need for research on how to actually educate children and young people but also adults in order to raise their awareness of current issues and support the goals of sustainability leading to a sustainable life.

References

Aguirre-Bielschowsky, I., Freeman, C. & Vass, E. (2012). Influences on children's environmental cognition: A comparative analysis of New Zealand and Mexico. Environmental Education Research, 18(1), 91–115. doi:10.1080/13504622.2011.582093

Ämter der Landesregierungen der österreichischen Bundesländer, Magistrat der Stadt Wien & Bundesministerium für Unterricht, Kunst und Kultur. (2009). Bundesländerübergreifender BildungsRahmenPlan für elementare Bildungseinrichtungen in Österreich.

Bittner, A. & Pyhel, T. (2016). Die Bedeutung von gesellschaftlicher Transformation, sozio-ökologischer Resilienz und Engagement für Nachhaltigkeitslernen. In A. Bittner, T. Pyhel & V. Bischoff (Eds.), *Nachhaltigkeit erfahren – Engagement als Schlüssel einer Bildung für nachhaltige Entwicklung. DBU-Umweltkommunikation, Band 8* (pp. 7–20). München: Oekom.

Bolay, E. & Reichle, B. (2011). Waldpädagogik, Teil 1: Theorie (2.). Hohengehren: Schneider Verlag.

Brämer, R. (2006). Natur obskur – Wie Jugendliche heute Natur erfahren. München: Oekom.

Brämer, R., Koll, H. & Schild, H.-J. (2016). 7. Jugendreport Natur – Erste Ergebnisse.

Charmaz, K. (2006). Constructing grounded theory: A practical guide through qualitative

analysis. London: Sage.

Chawla, L. (2002). Spots of time: Manifold ways of being in nature in childhood. In
P. H. Kahn & S. R. Kellert (Eds.), Children and nature: Psychological, sociocultural
And evolutionary investigations (pp. 199–225). Massachusetts: Massachusetts
Institute of Technology.

Cheng, J.C.-H. & Monroe, M.C. (2012). Connection to nature: Children's affective attitude
toward nature. Environment and Behavior, 44(1), 31-49. Doi:10.1177 /
0013916510385082

Clarke, D. A. G. & Mcphie, J. (2014). Becoming animate in education: Immanent
materiality and outdoor learning for sustainability. Journal of Adventure Education
and Outdoor Learning, 14(3), 198–216. doi:10.1080/14729679.2014.919866

Clarke, D. A. G. & Mcphie, J. (2015). From places to paths: Learning for sustainability,
teacher education and a philosophy of becoming. Environmental Education Research,
22(7), 1002–1024. doi:10.1080/13504622.2015.1057554

Cohen, L., Manion, L. & Morrison, K. (2007). Research methods in education (6th ed.).
London: Routledge.

de Haan, G. (2010). The development of ESD – related competencies in supportive
institutional frameworks. International Review of Education, 56, 315–328. doi:10.
1007/s11159-010-9157-9

de Haan, G. & Harenberg, D. (1999). *Bildung für eine nachhaltige Entwicklung. Gutachten zum
Programm. Booklet no. 72*. Bund-Länder Kommission für Bildungsplanung
und Forschungsförderung.

de Haan, G. & Plesse, M. (2008). Grundschule verändern durch Bildung für Nachhaltige
Entwicklung (BNE). [Changing primary school through education for sustainable
development (ESD).] Retrieved from http://www.transfer-21.de/daten/texte/
grundschule_veraendern.pdf%20on%20the%2028/11/2016

Dickinson, E. (2013). The misdiagnosis: Rethinking "nature-deficit disorder". Environmental
Communication, 7(3), 315–335. doi:10.1080/17524032.2013.802704

Dyment, J. E. (2005). Gaining ground: The power and potential of school ground greening in
the Toronto district school board. Retrieved from https://www.
evergreen.ca/downloads/pdfs/Gaining-Ground.pdf

Dyment, J. E. & Bell, A. C. (2008). 'Our garden is colour blind, inclusive and warm':
Reflections on green school grounds and social inclusion. International Journal of
Inclusive Education, 12(2), 169–183. doi:10.1080/13603110600855671

Elliott, S. (2017). An Australian perspective: Seeking sustainability in early childhood outdoor play spaces. In T. Waller, E. Ärlemalm-Hagsér, E. B. Hansen Sandseter, L. Lee-Hammond, K. Lekis & S. Wyver (Eds.), *The Sage handbook of outdoor play and learning* (pp. 295–316). London: Sage.

Fjørtoft, I. (2004). Landscape as playscape: The effects of natural environments on children's play and motor development. Children, Youth and Environments, 14(2), 21–44.

Glettler, C. (2018). *Teaching Nature: two case studies of five- to eight-year-old children engaged in outdoor learning activities* (Dissertation, Karl-Franzens-Universität Graz).

Gebhard, U. (2013). Kind und Natur. Die Bedeutung der Natur für die psychische Entwicklung (4th ed.). Wiesbaden: Springer.

Hancock, D. & Algozzine, B. (2011). Doing case study research (2nd ed.). New York: Teachers College Press.

Henze, C. (2016). Nachhaltige Entwicklung, Transformation und Resilienz – Zur Relevanz von Partizipation und Bildung für eine nachhaltige Entwicklung. In A. Bittner, T. Pyhel & V. Bischoff (Eds.), Nachhaltigkeit erfahren – Engagement als Schlüssel einer Bildung für nachhaltige Entwicklung. DBU-Umweltkommunikation, Band 8 (pp. 21–40). München: Oekom.

Jung, N. (2012). Natur und Entstehung von Werten. [Nature and the development of values.] In N. Jung, H. Molitor & A. Schilling (Eds.), *Auf dem Weg zu gutem Leben – Die Bedeutung der Natur für seelische Gesundheit und Werteentwicklung. Eberswald Beiträge zu Bildung und Nachhaltigkeit* (Vol. 2, pp. 113–135). Opladen: Budrich UniPress.

Louv, R. (2008). Last child in the woods – saving our children from nature-deficit disorder (2nd ed.). Chapel Hill, NC: Algonquin Books of Chapel Hill.

Lude, A. (2001). *Naturerfahrung & Naturschutzbewusstsein*. Innsbruck, Wien, München: Studien-Verlag.

Meske, M. (2011). "Natur ist für mich die Welt'". Lebensweltlich geprägte Naturbilder von Kindern. Wiesbaden: VS Verlag für Sozialwissenschaften.

Mcphie, J. & Clarke, D. A. G. (2015). A walk in the park: Considering practice for outdoor environmental education through an immanent take on the material turn. The Journal of Environmental Education, 46(4), 230–250. doi:10.1080/00958964.2015.1069250

Miklitz, I. (2005). Der Waldkindergarten – Dimensionen eines pädagogischen Ansatzes (3rd ed.). Weinheim und Basel: Beltz.

O'Brien, L. (2005). Trees and their impact on the emotional well-being of local residents

on two inner London social housing estates. Report to Peabody Trust, Trees for Cities and Forestry Commission. Forest Research.

O'Brien, L. & Murray, R. (2005). 'Such enthusiasm – a joy to see' an evaluation of forest school in England. Retrieved from https://www.forestry.gov.uk/pdf/ ForestSchoolEnglandReport.pdf/$FILE/ForestSchoolEnglandReport.pdf

Palmberg, I. E. & Kuru, J. (2000). Outdoor activities as a basis for environmental responsibility. The Journal of Environmental Education, 31(4), 32–36. doi:10.1080/ 00958960009598649

Raith, A. & Lude, A. (2014). Startkapital Natur. München: Oekom.

Rauch, F. & Pfaffenwimmer, G. (2020). The Austrian ECOLOG-Schools Programme Networking for Environmental and Sustainability Education. In A. Gough, J. Chi Kin Lee & E. Po Keung Tsang (Eds.) (2020), *Green Schools Globally: Stories of Impact for Sustainable Development*. Dortrecht: Springer. (Forthcoming).

Rauch, F. & Steiner, R. (2013). Competences for Education for Sustainable Development in Teacher Education. CEPS-Journal (Centre for Educational Policy Studies Journal), 3(1), 9-24.

Rauschmayer, F., & Oman, I. (2012). Transition to Sustainability: Not Only Big, But Deep. Reaction to M. Bilharz, K. Schmitt. 2011. Going Big with Big Matters. The Key Points Approach to Sustainable Consumption. GAIA 20/4: 232-235. GAIA, 21(4)

Singer-Brodowski, M. (2016). Transformative Bildung durch transformatives Lernen. Zur Notwendigkeit der erziehungswissenschaftlichen Fundierung einer neuen Idee. In: ZEP 1/2016, p. 13-17.

Stoltenberg, U. (2008). Bildungspläne im Elementarbereich. Ein Beitrag zur Bildung für nachhaltige Entwicklung? Eine Untersuchung im Rahmen der UN-Dekade "Bildung für nachhaltige Entwicklung". Retrieved from http://www.unesco. de/fileadmin/medien/Dokumente/Bibliothek/Bildungspl_C3_A4ne_20im_20Elementa rbereich.pdf

Stoltenberg, U. (2009). Mensch und Wald – Theorie und Praxis einer Bildung für eine nachhaltige Entwicklung am Beispiel des Themenfelds Wald. München: Oekom.

Stoltenberg, U. (2011a). Bildung für eine nachhaltige Entwicklung für Kita-Kinder. In U. Stoltenberg & R. Thielebein-Pohl (Eds.), KITA21 – Die Zukunftsgestalter – Mit Bildung für eine nachhaltige Entwicklung Gegenwart und Zukunft gestalten (pp. 57– 70). München: Oekom.

Stoltenberg, U. (2011b). Bildung für eine nachhaltige Entwicklung für pädagogische Fachkräfte in Kitas. In U. Stoltenberg & R. Thielebein-Pohl (Eds.), KITA21 – Die Zukunftsgestalter – Mit Bildung für eine nachhaltige Entwicklung Gegenwart und Zukunft gestalten (pp. 27–56). München: Oekom.

UN. (1992). Agenda 21. Retrieved from http://www.un.org/depts/german/conf/
agenda21/agenda_21.pdf

UN General Assembly. (2015). Transforming our world: The 2030 agenda for sustainable
development. Retrieved from http://www.un.org/ga/search/view_doc.asp?
symbol=A/RES/70/1&Lang=E

UNESCO (2017) Education for sustainable development goals: Learning objectives. Paris:
UNESCO.

UniNEtZ SDG 4 Positionspapier (2019). https://www.uninetz.at/reflexionen/reflexionen/sdg-
4-positionenpapier (accessed on 18 July 2020), own translation.

Weltzien, D. (2009). Dialoggestützte Interviews mit Kindern im Kindergarten- und
Grundschulalter unter Berücksichtigung ihrer Peerbeziehungen. Methode und
empirische Ergebnisse. In K. Fröhlich-Gildhoff, I. Nentwig-Gesemann & R. Haderlein
(Eds.), Forschung in der Frühpädagogik. Materialien zur Frühp.dagogik Band 2 (pp. 69–
100). Freiburg: FEL.

Yin, R. K. (2014). Case study research – design and methods (5th ed.). London: Sage.

About Authors

Christiana GLETTLER received her M. Sc. from Karl-Franzens-University Graz in 2006 and a PhD from Karl-Franzens-University Graz in 2018. She is a lecturer and researcher at KPH Graz in the elementary and primary teacher education programmes. Her areas of teaching and research include outdoor education, environmental and sustainability education and didactics of primary school science teaching.

Franz Rauch received his M. Sc. from Karl-Franzens-University Graz in 1985, a PhD from Karl-Franzens-Unviersity Graz in 1990 and holds a Habilitation in Education with a focus on Environmental Education. He is currently a Professor at the University of Klagenfurt in Austria and has been a research fellow at the University of Northumbria in Newcastle upon Tyne, England and a Fulbright Scholar at the University of Missouri - St. Louis, USA. He has been involved in research and development projects internationally and nationally for many years. He is one of the editors of Educational Action Research Journal and serves on editorial boards of other Journals (like The Journal of Environmental Education and ARISE – Action Research in Science Education). His areas of research, teaching and publication are environmental education and education for sustainable development, networks in education, school development, science education, continuing education for teachers and action research.

**Journal of Applied
Technical and Educational Sciences
jATES**

http://jates.org

Investigation of the attitudes of first-year-students towards sustainability and environmental awareness at Széchenyi István University

Viktória Gősi Kövecses PhD, Bálint Lampert, Tiborné Petz, Lajosné Csenger PhD

*Széchenyi István University Apáczai Csere János Faculty, Liszt Ferenc Street 42. Győr 9022, Hungary,
gosi.viktoria@sze.hu*
*Széchenyi István University Apáczai Csere János Faculty, Liszt Ferenc Street 42. Győr 9022, Hungary,
lampert.balint@sze.hu*
*Széchenyi István University Apáczai Csere János Faculty, Liszt Ferenc Street 42. Győr 9022, Hungary,
csenger.lajosne@sze.hu*
*Széchenyi István University Apáczai Csere János Faculty, Liszt Ferenc Street 42. Győr 9022, Hungary,
petztiborne@gmail.com*

Abstract

At the Apáczai Csere János Faculty, we have been teaching environmental and sustainability education in teacher training for over 20 years. Trainee teacher are prepared for their future profession - including environmental education - by considering the concept of sustainability. In our previous studies, we analysed the environmental attitudes of children before and after forest school programs. Our current research focuses on the older generation. We prepared a questionnaire for first-year students arriving at the Széchenyi István University in September. It was filled in electronically by 553 students of the nine faculties of the university. Our aim was to study the environmental awareness of the first-year-university-students. In addition we aimed to survey their environmental attitudes, to map their knowledge, behaviour and emotions related to sustainability and environmental issues. Our further goal is to increase the effectiveness of sustainability education in our higher education practice, considering the results of the study and our resources.

Keywords: environmental attitudes, education for sustainability, sustainable development goals

1. Introduction

Global problems and the humans' unsustainable lifestyle have become a central issue in recent decades. At the same time it is inevitable to focus on the competencies that can contribute to find any solution for this situation (Kollarics, 2019).

Sustainable Development Goals identify key areas that need to be given a place and support at all levels of education. These include systems thinking, which is the ability to recognize and understand relationships, analyze complex systems, and manage uncertainty (Könczey, 2017).

The second area is forecasting, which is the understanding and evaluation of multiple future outcomes (possible, probable, and desirable); the ability to create one's own vision and to apply the precautionary principle; estimating the consequences of actions; managing risks and coping with change.

Normative competence is the ability to understand and give back the norms and values that underlie human actions; to negotiate sustainability values, principles, long-term and immediate goals in the light of conflicts of interest, interrelationships, uncertain knowledge and contradictions.

Strategic competence is the ability to jointly develop and implement innovative activities that provide additional sustainability at the local level and beyond.

The next area is collaboration, the elements of which are learning from others; understanding and respecting the needs, perspectives, and actions of others (empathy); understanding, connecting with and being sensitive to others (empathic leadership); conflict management in a group; support for collaborative and participatory problem solving.

Critical thinking: the ability to question norms, customary practices, and opinions, reflection on one's own values, perceptions, and actions; and resolution in the sustainability discourse.

Self-awareness: the ability to reflect on our own role in the local community and (global) society; to continually evaluate and maintain our motivation to act; and deal with our feelings and desires.

Integrated problem solving: by integrating previous competencies, a comprehensive ability to apply different problem solving frameworks to complex sustainability problems and to develop viable, inclusive and equitable solutions that help sustainable development (UNESCO, ed.: Könczey, 2017:10).

In higher education, we also need a methodology and a learning organization that help to achieve these goals. The key concept of education for sustainability, according to Mária Kováts-Németh, contains responsibility, humanism, self-regulation, self-limitation, independence, freedom and decision-making. *A responsible person is independent, free, decisive, able to recognize his / her needs, at the same time able to keep his / her temper, he / she can work in partnership with his / her fellows, has a basic knowledge of the environment to plan his / her life properly. With the aim of sustainable development, he/she is able to act in a given environment to solve problems.* (Kovátsné 2006: 75-86).

Previously, several studies (Varga, 2006; Kövecsesné, 2009; Major, 2018; Kónya, 2018; Mónus, 2019; Kopasz, 2020) have researched the environmental awareness and attitudes of students, high school students or primary school students in relation to a topic of environmental issues. In the course of our environmental education activities, we also measured the environmental attitudes of students coming to the forest school in several cases with the help of questionnaires, conceptual maps and other methods. Our present study was aimed at first-year students coming to the university. We considered it important to examine young people leaving the system of public education in order to find out how they think about environmental issues, what forms of behaviour appear in their attitudes towards the environment.

In our research, the respondents also gave an answer to the question whether they had studied in an ecoschool during their previous studies. We considered this important because our students, who started their first year in 2019, already had the opportunity to study in an eco-school, where education for sustainability is given a prominent role. *"The eco-school network in Hungary was established in March 2000 on the initiative of the National Institute of Public Education (OKI), with the professional guidance and direction of Péter Havas, the national coordinator of OECD ENSI in Hungary, with 22 institutional members and the Ministry of Education."* (Varga, Könczey, Szabó 2016:9) There are currently around 1,100 institutions who can bear the title of eco-school or perpetual eco-school.

„Any school can become an ecoschool that is committed to enforcing the principles in its operation as much as possible. These principles include the pedagogical principles of sustainability being present in the whole process of education and training inside and outside the school. The principles appear in operation, in feeding, in building partnerships with students, parents and local actors. Leadership should be committed to ecoschool values. An environmentally conscious approach should also influence the activities of non-teaching staff. Sustainability should be present not only in ecological terms, but also in social and economic terms. " (Varga, Könczey, Szabó 2016:9)

One of the most popular forms of practice-oriented environmental education based on experiential pedagogy is the forest school, a network that has expanded enormously since the 1990s, with a number of qualified forest school programs for different ages in all parts of the country. Our faculty also has graduate teachers who participated in a forest school program in 2000 as senior students, have written their dissertation on environmental education, and today, as practicing teachers implement environmental education for young children. The

Forest School Program, formulated between 2003 and 2008, highlighted one of the most important objectives, according to which all children should get to a forest school at least once during their studies. It can be seen from the answers of the respondents that this endeavor did not achieve its goal, as less than half of our students can only report that they participated in a forest school program during their studies. Unfortunately, the national program, which started in 2003, could not be fully implemented, although the first period under the leadership of the Environment and Communication Program Office was very effective and useful.

After János Lehoczky, according to the term officially used in the forest school program, *the forest school is a special educational and learning organization unit based on the conditions of the environment. It is a continuous, multi-day, with a different way of organizing teaching-learning procedure in the school year. Learning is based on pupils'active participation and cooperation of the students. The teaching is related to the natural, man-made socio-cultural environment of the chosen location, both in terms of content and curriculum. Its outstanding educational task is to develop harmonious, healthy living skills and socialization related to community activities.* (Lehoczky, cited by Kövecsesné 2015: 19) Today, unfortunately, in many cases, groups have the option of 2-3 day- programs, which is a problem because the digital generation of the twenty-first century, in our experience, needs 2-3 days to break away from the digital world a bit and get closer to nature.

Fig. 1. Sustainable Development Goals

https://en.unesco.org/sustainabledevelopmentgoals

In September 2015, the 193 member states of the United Nations adopted the new integrated framework for sustainable development, Agenda 2030 (officially Transforming our world: The 2030 Agenda for Sustainable Development), outlines ideas for eradicating poverty, overcoming inequalities, and protecting our Earth's environmental system.One of the main features of the new framework is that, in contrast to previous development cooperation plans, it takes a more comprehensive approach to sustainable development programs, setting targets for each country and region. In the centre of the Agenda there are the Sustainable Development Goals (Fig. 1.), valid for all nations and not excluding anyone from achieving them. (https://www.ksh.hu/sdg)

In our research, we were also curious whether our students met the Sustainable Development Goals, and whether they learned about these areas in details.

56.1% of respondents heard about these goals, 38.5% did not, and 5.4% could not state them. 19.2% of the respondents learned about these goals in more detail, 80.8% are not aware of the meaning and interpretation of these goals. Within the framework of university education, we consider it important to develop projects that can guide students in their own field and in their daily lives, taking these goals into account, and show the system of connections between them.

Szarka (2011: 21) sees the cause of the problems affecting the Earth in the constant increase in consumer demand. This is due on the one hand to population growth and on the other hand to an increase in prosperity. We can clearly say that the growth in consumption will come to a halt in a short time because the Earth's energy, water and soil resources, as well as the amount of some raw materials, are finite. However, this cannot be considered a novelty, as it was already recognized by the English economist Malthus at the end of the eighteenth century. (Mátyás, 1996: 22)

In connection with this problem, a long-awaited question is where the limits of growth are. Where is the boundary from which the consequences of exploitation will become irreversible?

The problems raised in connection with overconsumption are complex and often abstract. It is useful to present the extent and danger of overconsumption through simple, concrete (understandable) examples. A good opportunity for this is the ecological footprint, which has received a lot of criticism however it has a significant role in assessing an individual's lifestyle.

„The ecological footprint is the area that can produce the goods needed for a person's current way of life without damage (i.e. in a sustainable way). It quantifies the impact of our way of life on the environment. " (Rakonczai, 2008:167)

Originally it consisted of the following six elements soil (1) and pasture (2) for food; forests (3-4): for wood and paper consumption, and carbon sequestration due to energy production; sea (5): fish consumption; land (6): for housing.

The results show the level of consumption of the individual, helping to compare individuals, even countries. In addition, it confronts us with the limited capabilities of our Earth and our gradually growing needs. Referring to the individual level can increase the sense of responsibility. (Rakonczai, 2008:168)

2.   Objective of the research

The data collection took place in September 2019 at the nine faculties of Széchenyi István University. The aim of the research was to survey the environmental attitudes of the first-year students coming to the university, to map their knowledge, behaviour and emotions related to sustainability and environmental issues. Among our other goals, we also formulated sample projects after the survey of students, which with the adequate methods and forms of activity of sustainability pedagogy would effectively contribute to the formation of environmentally conscious behaviour, to the sustainable approach to the chosen profession.

In our empirical study, our hypotheses were the following:

H1: The years spent in public education, the results of the effectively implemented environmental education activities can be seen in the students coming to higher education, they are reflected in their behavior and way of thinking. We also need to consider the influences and impacts of family, social media, and social relations, but these areas will be examined later.

H2: There are significant differences in attitudes towards sustainability among young people studying in different disciplines.

H3: The impact system of this institutional system can be perceived in the environmental attitudes of students who have previously attended eco-school.

H4: There is a significant difference in the way of thinking of different age groups in terms of sustainability and environmental awareness.

Our goals included examining what the younger generation do to protect the environment, what sources are used to get information related to the environment and sustainability and what attitudes they have about different environmental issues.

3. Methodological bases of the research

We sent our online questionnaire to the first-year students through the Neptun system and with the help of the Student Government.

Our questionnaire contained 32 questions, of which 9 were open-ended and 23 were closed. An evaluation scale was used with 11 numerical type questions. The compilation of the questionnaire was based on the more than twenty years of environmental pedagogy practice of the Apáczai Faculty. Our central themes were forest education and environmentally conscious living. In addition to these - knowing the effectiveness of the eco-school program - we also formulated questions related to this topic. All this - in our later research - provides us with an opportunity to describe the problem more precisely. To sum up some of the questions focused on environmentally conscious habits and behavior, while others examined the attitudes related to sustainability.

The population was grouped according to several criteria and the studies were performed at the 5% significance level.

In the first case, we organize the population according to the forest school studies (249 people went, 277 people did not go to the forest school).

We first examined by F-test whether there was a difference in the variance of the two samples for each question, and then used a two-sample t-test to detect differences (degree of freedom: 524). The values of the t-tests did not reach the critical value for any of the statements (tkrit = 1.65). We can conclude that this grouping does not cause a significant difference in opinions. We can say that the students of our university have the same attitude towards the environmentally conscious lifestyle.

4. Summary of research results:

In our research, we were also curious whether our students met the Sustainable Development Goals, and whether they learned about these areas in details.

56.1% of respondents heard about these goals, 38.5% did not, and 5.4% could not state them. 19.2% of the respondents learned about these goals in more detail, 80.8% are not aware of the

meaning and interpretation of these goals. Within the framework of university education, we consider it important to develop projects that can guide students in their own field and in their daily lives, taking these goals into account, and show the system of connections between them.

Szarka (2011: 21) sees the cause of the problems affecting the Earth in the constant increase in consumer demand. This is due on the one hand to population growth and on the other hand to an increase in prosperity. We can clearly say that the growth in consumption will come to a halt in a short time because the Earth's energy, water and soil resources, as well as the amount of some raw materials, are finite. However, this cannot be considered a novelty, as it was already recognized by the English economist Malthus at the end of the eighteenth century. (Mátyás, 1996: 22)

In connection with this problem, a long-awaited question is where the limits of growth are. Where is the boundary from which the consequences of exploitation will become irreversible?

The problems raised in connection with overconsumption are complex and often abstract. It is useful to present the extent and danger of overconsumption through simple, concrete (understandable) examples. A good opportunity for this is the ecological footprint, which has received a lot of criticism however it has a significant role in assessing an individual's lifestyle.

„The ecological footprint is the area that can produce the goods needed for a person's current way of life without damage (i.e. in a sustainable way). It quantifies the impact of our way of life on the environment. " (Rakonczai, 2008:167)

Originally it consisted of the following six elements soil (1) and pasture (2) for food; forests (3-4): for wood and paper consumption, and carbon sequestration due to energy production; sea (5): fish consumption; land (6): for housing.

The results show the level of consumption of the individual, helping to compare individuals, even countries. In addition, it confronts us with the limited capabilities of our Earth and our gradually growing needs. Referring to the individual level can increase the sense of responsibility. (Rakonczai, 2008:168)

The questionnaire was completed by 554 people from the 9 faculties. This is 14.5% of all first-year students. 45.5% of the respondents are men and 54.5% are women. 42% of the participants in the research are under 20 years old, 43% are 20-29 years old old, 7% are 30-39 years old, 7% are also 40-49 years old and 1% is 50-60 years old.

Most of the questionnaires were filled in by students of the Faculty of Mechanical Engineering and Informatics (111 people), the Apáczai Csere János Faculty (104 people), the Kautz Gyula Faculty of Economics (95 people) and the Audi Hungária Faculty (79 people). The Ferenc Deák Faculty of Law and Political Science (43 people), the Faculty of Health and Sports Science (43 people) and the Faculty of Architecture, Construction and Transport Engineering (43 people) were relatively less represented. The Faculty of Arts (2 people) and the Faculty of Agriculture (14 people) were also represented, but here we could count on fewer first-year students based on the admission numbers.

Based on the answers of the respondents, it can be seen that 10.5% of the students studied in eco school at the age of primary school, 49.7% did not learn in eco school and 39.8% could not say whether their primary school had this title.

According to the answers, 9.9% of respondents studied in eco school during their secondary school years, 50.1% did not, and 40% did not know if their secondary education institution had this title. In our research, we looked for correlations between whether our students' responses showed a significant difference in whether or not they had attended an ecoschool before.

Participation in the forest school program was also examined as the same background variable. 44.8% of the respondents participated in a forest school program during their previous studies, 50.1% did not, 5.1% do not know, did not hear about what a forest school is.

In our research, we also examined whether the students who completed the questionnaire had already encountered the methodology of measuring the ecological footprint.

According to their answers 34.7% of respondents have already calculated the extent of their ecological footprint in their lifetime, 62.9% have not, 2.4% do not know what the ecological footprint is.

The question *Do you usually read any articles related to environmental protection and sustainability in your free time?* was given „Yes" answer by 75% and „No" answer by 25% . Our questionnaire also revealed that 66.7% of the respondents used to talk about environmental / environmental issues at home in their families.

Fig. 2. shows the sources from which the respondents obtain information related to environmental protection and sustainability. It can be seen that electronic news sites (index, origo) (275 answers) serve as the source of information, followed by the facebook (220 answers) followed by thematic websites (174 answers) and web influenza (154 answers).

Taking into account these data, it is worth considering the possibilities and methods of environmental awareness formation through the surfaces, the messages to be conveyed.
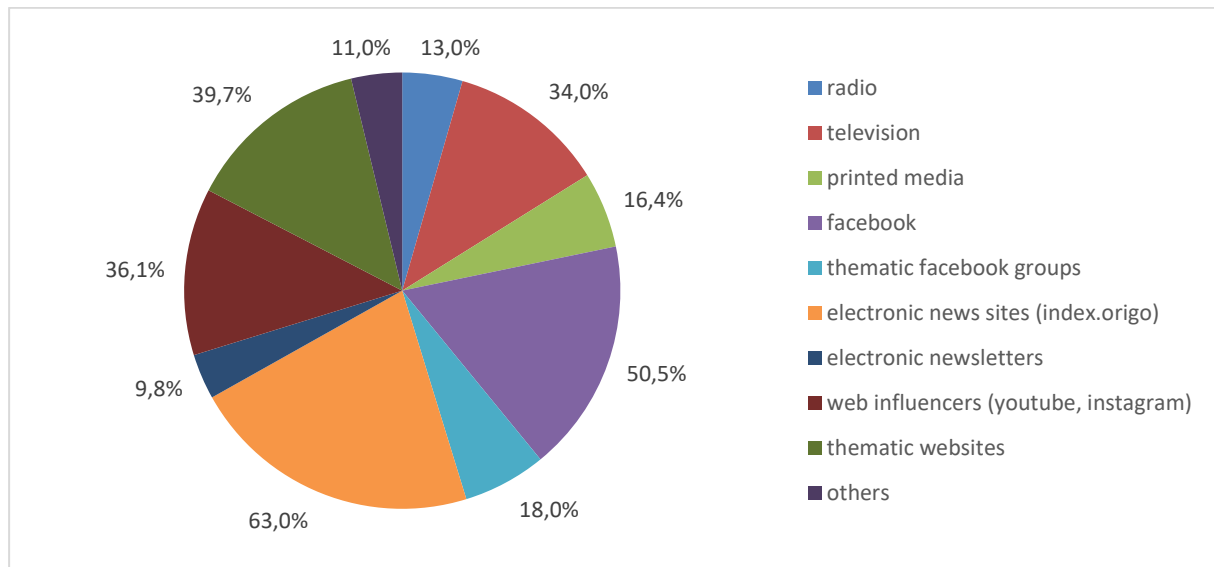
Fig. 2. Sources of information acquisition

The evaluation of the questionnaires also revealed that 32.2% of our first-year students participate in some kind of environmental action in their living environment, 67.8% of them named very few events, only the topics of some events were identified: 87.6% (178 responses) of students participated in a garbage/waste collection program, 9.3% (19 responses) in tree planting, and only one person mentioned the car-free day.

Among the specifically named events the "Take It!", "Take It Yourself!" were the most common (17 responses), and the "Trash Challenge", "Critical mass" were also named. "Greenpeace", for which the program was unfortunately not specified is actively present in several environmental and nature protection topics with campaigns and events.

Students also mentioned (in two cases) the "72 HoursWithout Compromise" program that is a social volunteer action organized by three historic Christian churches. The action calls on the youth of Hungary to collaborate, to work together for others and our environment.

In the questionnaire, students were asked to rate statements along a five-point numerical rating scale similar to the Likert scale, where 1: "strongly disagree" and 5: "strongly agree".

Fig. 3. „The news about climate change is deterrent." data distribution

Fig. 4. "I avoid disposable plastic products." data distribution

Fig. 5. "When I do shopping, I make sure I only buy what I really need." data distribution

Fig. 6. "I am worried that people destroy nature and forests." data distribution

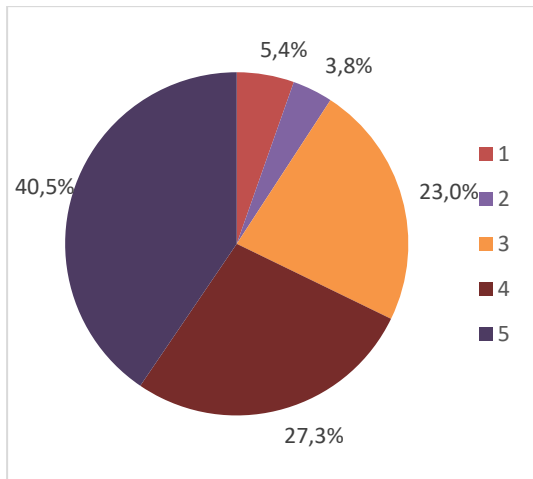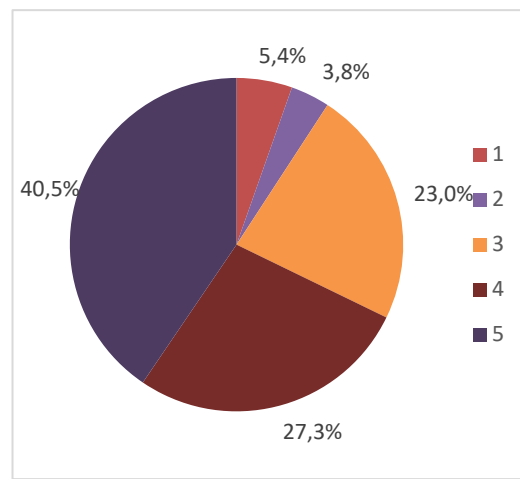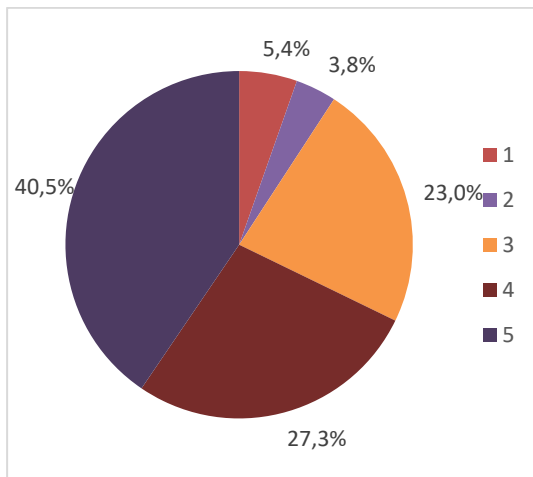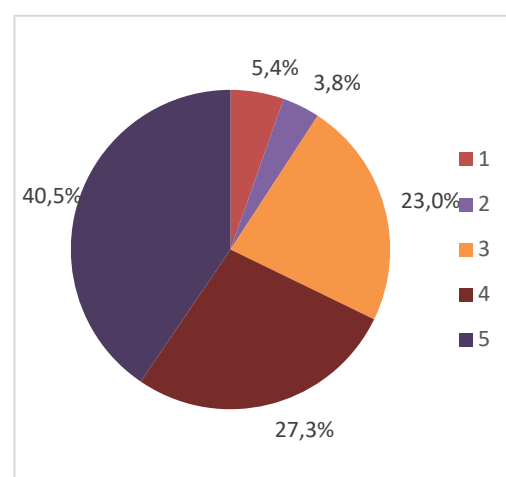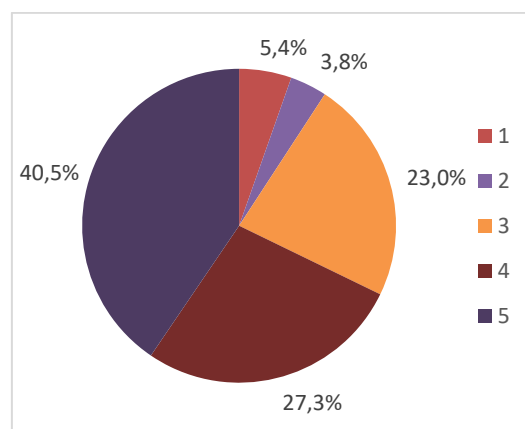Fig. 7. „I try to persuade others to act in an environmentally conscious way." data distribution

In the case of the diagrams made on the basis of the received answers, it can be stated that the students'attitude towards environmental issues and environmental awareness is positive especially in connection with "I am worried that people destroy nature and forests. " (Fig. 5.) and "When I do shopping, I make sure I only buy what I really need."(Fig. 4.) statements where 80% of the students' answers were agree or strongly agree (more than 50%).

Rather positive, but more divided the statement "I avoid disposable plastic products." (Fig. 3.), where "3- I can't decide" reached nearly the same value as the values of 4 and 5 (28-29%). Values 1 and 2 ("strongly disagree" and "disagree") were given by about 10 percent of respondents. "I try to persuade others to act in an environmentally conscious way." (Fig. 7.) is divided similarly to the previous statement. It would be better if the value 5 prevailed, because it would mean that students are not only committed to the environment themselves, but are willing to spread this approach.

5. Results of our hypotheses

5.1. Differences among disciplines

The following statements were formulated on the basis of grouping according to specializations, fields of disciplines (health -22 people, economics - 96 people, law - 44 people, technical sciences - 261 people, pedagogy - 81 people, recreation - 21 people). The test was completed in a wide variety of specialization, which would have fragmented the number of groups, so we opted for grouping by disciplines. ue to the appropriate length of the study, we only highlight the statements for which we found a difference. In this case, several samples had to be compared based on the difference between the mean values of their same variable. Therefore, analysis of variance was used.

The first statement, "The news about climate change are deterrent." shows different opinions among students. There is a significant difference in the opinion of the students in this question. Examining the averages, technically oriented students are less afraid of news about climate change.

The second and third questions - "If the water flows unnecessarily, I will turn off the tap." (91.1% of students fully agreed with the statement). "I collect waste selectively." (49.9% of students fully agreed with the statement, 27.5% to a lesser extent but agreed with the statement, 16.5% were indifferent, 4% partially disagreed and 1.4 % completely disagreed) - did not share the students so much. The answers are not significantly different. The values of

the averages show that water wastage is not tolerated by the students of any discipline; they select and separate the types of waste as much as possible. (Table 1.)

Table 1. "The news about climate change are deterrent." Analysis of variance according to grouping by disciplines

Analysis of variance						
Factors	*SS*	*df*	*MS*	*F*	*p-value*	*F krit.*
Between groups	42,37723	5	8,475446	**7,015499**	0,00002	**2,231383**
Within the groups	627,0055	519	1,208103			
Total	669,3828	524				

The "I avoid disposable plastic products." statement divided the grade to a greater extent. There was a significant difference on this issue. From the data of the averages, we can see that students with recreation and technical orientation agree less with the statement (they produced an average of 3.5 points compared to the average of 4 and above in other disciplines)

Table 2. "I avoid disposable plastic products." Analysis of variance according to grouping by disciplines

Analysis of variance						
Factors	*SS*	*df*	*MS*	*F*	*p-value*	*F krit.*
Between groups	25,71934	5	5,143868	**4,436385**	0,000576	**2,231416**
Within the groups	600,607	518	1,159473			
Total	626,3263	523				

„When I do shopping, I make sure I only buy what I really need." The opinions in the groups according to the fields of disciplines were not the same, and recreational and technical students also feel that they are not environmentally conscious enough in their purchases. (Table 2.)

Table 3. „When I do shopping, I make sure I only buy what I really need." Analysis of variance according to grouping by disciplines

Analysis of variance						
Factors	*SS*	*df*	*MS*	*F*	*p-value*	*F krit.*
Between groups	14,07071	5	2,814142	**3,627045**	0,003105	**2,231416**
Within the groups	401,9045	518	0,775877			
Total	415,9752	523				

„I try to persuade others to act in an environmentally conscious way." In connection with this statement, it can be stated that students, especially those who want to get a career in law, as well as in the pedagogical field, feel that their goal is to convey an environmentally conscious approach.

Table 4. „I try to persuade others to act in an environmentally conscious way." Analysis of variance according to grouping by disciplines

Analysis of variance						
Factors	*SS*	*df*	*MS*	*F*	*p-value*	*F krit.*
Between groups	31,67005	5	6,334011	**5,674948**	0,00041	**2,231518**
Within the groups	574,8098	515	1,116136			
Total	606,4798	520				

In connection with the statement "I don't think we're running out of resources on Earth." students feel that our resources are finite and exploitation must be stopped. (Table 4.)

The responses to the statement - "It is our responsibility how the fate of our planet changes."-, are consistent with the previous idea. Everyone agreed, there was no significant difference between the answers.

Table 5. „I try to be environmentally conscious throughout my work and life." Analysis of variance according to grouping by disciplines

Analysis of variance						
Factors	*SS*	*df*	*MS*	*F*	*p-value*	*F krit.*
Between groups	8,710937	5	1,742187	**2,907872**	0,013365	**2,231416**
Within the groups	310,3482	518	0,599128			
Total	319,0592	523				

The answers given for the statement „I try to be environmentally conscious throughout my work and life." are strange as the results of the students preparing for healthcare careers are the lowest. (4 points on average, which is lower than the average of 4.5 for others, especially those who want to get a career in law and in the pedagogical field).

In connection with the statement „I find the news about climate change a riot." there are differences in the average of the answers, but overall we can state that the statement is rejected in all fields of disciplines. Students are seriously concerned about climate change and its consequences. (Table 5.)

5.2. *Evaluation of results by age groups*

After examining the students' answers based on the ecoschool pre-studies and grouping the disciplines, we considered further grouping suitable for examination. We supposed that different generations have different views on sustainability and environmental awareness. We divided the students into age groups and we examined the opinions of the younger and older students. Our groups are formed as follows: under 19, 20-29 years, 30-39 years, over 40 years. An interesting situation arose with this grouping. We often hear about differences and gaps between generations. This was not reflected in the responses to the questions asked in our study. For two statements - running water and selective waste collection, we obtained a significant difference of opinion. In both cases, the data show a worse attitude of the 20-29 age group towards the topic. (Table 6.)

Table 6. "If the water runs unnecessarily, I turn off the tap." Analysis of variance according to age groups

Analysis of variance						
Factors	*SS*	*df*	*MS*	*F*	*p-value*	*F krit.*
Between groups	2,371756	3	0,790585	**3,443566**	0,016601	**2,621108**
Within the groups	126,2708	550	0,229583			
Total	128,6426	553				

"I collect waste selectively." statement was answered by students over 40 with a higher average. The students of this age group presumably have an organized family life and pay more attention to the cleanliness of their living environment.

Table 7. „I collect waste selectively." Analysis of variance according to age groups

Analysis of variance						
Factors	*SS*	*df*	*MS*	*F*	*p-value*	*F krit.*
Between groups	9,261951	3	3,08731	**3,310655**	0,01986	**2,621108**
Within the groups	512,8969	550	0,93254			
Total	522,1588	553				

It is a common belief that different ways of thinking between the sexes can cause differences in the opinions and actions of men and women. To demonstrate this belief, we also grouped students by gender, but in analyzing our studies, we found no demonstrable difference between men's and women's environmentally conscious thinking. (Table 7.)

„What do you do to protect the environment in your everyday life?" The answers to the open-ended question were categorized according to their content. It can be seen that 67% of the responses were related to the environmentally friendly solutions in connection with

wastehandling. It seems that students basically see an opportunity to protect the environment in this area.
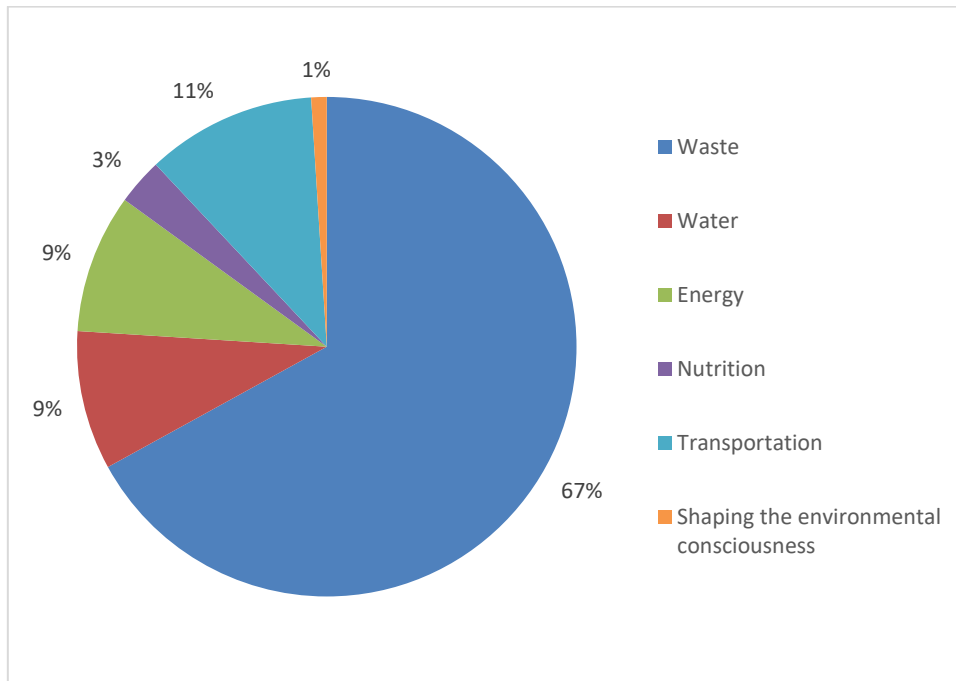
Fig. 8. „What do you do to protect the environment in your everyday life?" Percentage distribution of different topics.
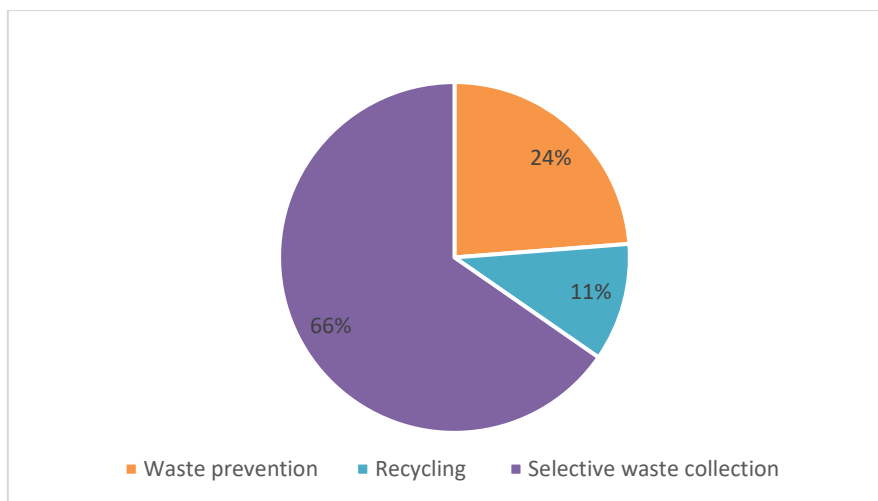
Fig. 9. The percentage distribution of the answers in the topic „Waste"

Within the waste category, unfortunately, waste prevention activities only appear in a quarter of all activities, although this should be number one, because the most effective way to solve the waste problem is prevention. Nonetheless, it should be appreciated that our students pay attention to the selection that contributes to recycling.

5.3. *Good practices of our students in connection with environmentally conscious habits*

There are some examples of the students'actions: "I avoid disposable plastics, I also try to avoid fast fashion stores, second hand shops when buying clothes". Students make sure to choose durable products and prolong the life of each product.

"I use an Ecosia browser, I selectively collect plastic and paper, I use low energy products."

Ecosia is different from other browsers because developers plant millions of trees worldwide from their income. We do not know how many students have ever heard about the Ecosia browser.

 "Researching Zero Waste videos, saving, awareness. I lead a Zero Waste lifestyle and recommend it to everyone. " In this case, the student tries to live a waste-free life. This seems impossible, but fortunately, environmentally conscious people tend to share knowledge, so there is a lot of information about it on the internet (vlog, blog, etc.)

"I grow vegetables and fruit with my family, and we consume them. We strive for chemical-free production we avoid using fertilizers, which can cause many damages to surface waters (eg. eutrophication, etc.) "

"I drink tap water, I don't fly anywhere, because the flight ticket is" cheap ", I don't flush the toilet with drinking water - :). I don't use climate but plant trees that provide shade, I don't eat tropical fruit, etc .. " „Conscious consumption, a conscious lifestyle, part of which is not to let yourself be influenced by advertisements."

 I arrive with Carshareing, although I live in Pécel, but I work in Budapest. Due to my work (engineering), I use a relatively large amount of paper but I print only the most necessary ones. I use "disposable" paper that has been discarded due to a printing error to take notes and make short sketches." It's also good to see when someone realizes that among the conditions that limit our lives and work (distance from the workplace, paperwork for engineering work), we can find the opportunities that we can protect the environment with.

6. Summary

Analyzing the responses of the 554 students, we can state that environmentally conscious approach is important for the students at our University. Taking into account the open-ended questions - which will be evaluated in details in our next study - it can be stated that our first

hypothesis has been confirmed. The results of the years spent in public education, the effectively implemented environmental education activities, the social impact, the media, and the content transmitted by the Internet influence the students coming to higher education, which is reflected in their behaviour and way of thinking. In the majority of their answers, our students agreed with our statements in connection with the topics of water, wastehandling and environmental protection. In the answers given to the open-ended questions, we could read about a number of positive habits. It should also be mentioned that hopefully the questionnaire was completed by students who are already interested in the topic and have a positive attitude towards environmental issues. During the trainings, we definitely consider it important to implement programs that take into account our experience and the existing knowledge of the students, which focuses on the activity and responsibility of theirs in different ways and we can shape the attitude of future intellectuals towards sustainability.

Our second hypothesis, that there are significant differences in attitudes towards sustainability among young people studying in different disciplines, has been partially confirmed. There are only a few aspects between young people studying in different disciplines that show significant differences in attitudes towards sustainability. We can highlight the most significant issues - climate change, the use of disposable plastics, opinions on deforestation.

Our research has shown that students in pedagogical fields feel that one of their priority tasks is to change the attitudes of others. This is very forward-looking that the future generation of teachers is receptive to the topic and education for sustainability is considered an important and responsible task for them.

Regarding our third hypothesis, there is no significant difference in the environmental attitudes of students who have previously attended ecoschool. We must reject this assumption. It seems to be true that environmentally conscious approach is important for the students. This is very gratifying and also shows that schools consider the development of environmentally conscious behaviour to be a priority, and in recent times this system of goals and tasks has been integrated into the pedagogical practice of schools. It is also worth mentioning that there are many factors regarding the title of ecoschool that students cannot see. For example, the processes at the organizational level, in the development of the school, or in its documents, in the development of the buildings go beyond in-class and out-of-class activities. However, further research is needed to examine the background and cause of it.

Our fourth hypothesis - There is a significant difference in the way of thinking of different generations in terms of sustainability and environmental awareness - has only been partially confirmed. There are only a few differences in the way of thinking of different generations in terms of sustainability and environmental awareness. For the older age group, presumably already leading a household, selective waste collection and water consumption are particularly important.

References

Kollarics, T. (2019). Environmental Pedagogical Aspects of Nature Experience Trails – an International Comparative Study 2 In.: KÉPZÉS ÉS GYAKORLAT 2019. 17. ÉVFOLYAM 1. SZÁM 171-179. Retrieved from https://ofi.oh.gov.hu/mi-az-az-okoiskola

Kónya, G. (2018). Tanórán kívüli tevékenységek hatása a középiskolások környezeti attitűdjére. *Journal of Applied Technical and Educational Sciences*, *8*(2), 21-35. Retrieved from https://doi.org/10.24368/jates.v8i2.35

Kopasz, R. A. (2020). Methodology tools in forest school and their impact on the development of ecological identity In: Journal of Applied Technical and Educational Sciences megjelenés alatt

Kovátsné Németh, M. (2006). A reformpedagógiai szemlélet, mint projektmódszer jelentősége a tanárképzésben és a tanártovábbképzésben, In.: Tanulmánykötet, NYME ATFK Győr, 85.o.

Kövecsesné Gősi, V., & Lampert, B. (2018). A környezetpedagógia gyakorlata a tanítóképzésben. *Journal of Applied Technical and Educational Sciences*, *8*(2), 36-54. Retrieved from https://doi.org/10.24368/jates.v8i2.37

Kövecsesné G., V. (2015). A környezeti nevelés gyakorlata az erdei iskolában, Hazánk Kiadó, Győr

Major, L. (2018). Pedagógusjelöltek környezeti attitűdjének mintázata. *Journal of Applied Technical and Educational Sciences*, *8*(1), 25-35. pp. Retrieved from https://doi.org/10.24368/jates.v8i1.19

Mátyás Csaba (1996). A biodiverzitás védelme és az erdőgazdálkodás. In: Erdészeti ökológia. (szerk. Mátyás Csaba) Mezőgazda Kiadó, Budapest, 312 p.

Mónus, F. (2019). Középiskolások környezettudatossága eltérő socio-ökonómiai hátterű iskolákban. *Journal of Applied Technical and Educational Sciences*, *9*(1), 17-27. pp. Retrieved from https://doi.org/10.24368/jates.v9i1.68

Rakonczai János (2008). Globális környezeti kihívásaink. Universitas Szeged Kiadó, Szeged, 202 p.

Szarka László (2011). Globális kihívások. In: Együtt a környezetért (szerk. Kováts-Németh), Győr, Palatia, 21-29. p.

UNESCO: Fenntartható fejlődési célok oktatása - Tanulási célok (szerk. Könczey Réka) (2017).   Retrieved   from https://ofi.oh.gov.hu/sites/default/files/attachments/fenntarthato_fejlodesi_celok_oktatasa_unesco_2017.pdf

Út az ökoiskola felé (2016). (szerk.: Könczey, R., Szabó, M., Varga, A.), Oktatáskutató és Fejlesztő Intézet, BP. Retrieved from http://mek.oszk.hu/13500/13502/13502.pdf; Retrieved from https://juratus.elte.hu/vita-a-fenntarthato-fejlodesi-celokrol-mi-az-ensz-kituzeseinek-valodi-celja/ Retrieved from https://folyoiratok.oh.gov.hu/uj-pedagogiai-szemle/a-kornyezeti-attitudok-mereserol-a-modositott-uj-okologiai-paradigma-skala

Varga, A. (2006). Diákok környezeti attitűdjei Iskolakultúra 2006/9. 58-64. pp.

About Authors

Viktória GŐSI KÖVECSES PhD is an associate professor at the Széchenyi István University, Apáczai Csere János Faculty. Kindergarten teacher, teacher-cultural organizer, has been running forest school programs at the Ravazd Forest School Training Center since 1999, and is involved in environmental education in public education and higher education. She obtained her degree in pedagogy as a pedagogy teacher in Pécs, and obtained her doctoral degree in environmental pedagogy in 2009 at the Doctoral School of Education at Eötvös Loránd University. She is the president of the Northwest Hungary Branch of the Hungarian Pedagogical Society, the member of the Hungarian Ornithological Society, the member of the Forest School Section of the National Forestry Association, the member of the Hungarian Environmental Education Association, the member of HERA. She is involved in several university projects and in the organization of several in-service teacher training

Bálint LAMPERT PhD is a teaching assistant at the Széchenyi István University, Apáczai Csere János Faculty. He is a primary school teacher with specialization in Environmental studies, and since 2000 he has been leading forest school programs at the Ravazd Forest School Training Center. He has planned several projects in full time and postgraduate teacher training. He graduated in pedagogy in Pécs, and in July, 2020 he defended his doctoral dissertation at the Gyula Róth Doctoral School of Forestry and Game Management, University of Sopron, in environmental pedagogy. He is the secretary of the Northwestern Hungarian Branch of the Hungarian Pedagogical Society, the member of the board of the Green City Beautification and Environmental Protection Association, the member of the Hungarian Ornithological Association.

Tiborné PETZ is a teacher assistant at the Széchenyi István University, Apáczai Csere János Faculty. She is a secondary grammar school teacher with specialization in Mathematics and Physics. She graduated in Eötvös Loránd University. She obtained her doctoral degree in mathematics didactics at the Constantine the Philosopher University in Nitra. She is a secretary of the Bolyai Society.

Mrs. Lajosné CSENGER PhD works as a master lecturer at the Széchenyi István University, Apáczai Csere János Faculty. As a primary school teacher, a mentor teacher of English, a deputy head, and a headmistress she worked in public education for 32 years. She considered it a priority to develop the environment- and health-conscious behaviour of the students of the demo school, to obtain the title of ecoschool, and to create a school garden.She graduated in pedagogy from Eötvös Loránd University. She defended her doctoral dissertation at the Gyula Róth Doctoral School of Forestry and Game Management, University of Sopron, in environmental pedagogy. She is involved in university projects and in the organization of post-graduate teacher training. She is the secretary of the VEAB Hungarian Research Working Committee.

jATES

Journal of Applied
Technical and
Educational Sciences

Investigation of the effect of an environmental education package at school age

Anna Krakker

Eszterházy Károly University, Eszterházy Square 1, Eger 3300, Hungary, Krakker.anna@gmail.com

Abstract

The article is focusing on how the application of an environmental educational package affected 3rd and 5th-grade students' relation to environment, nature and well-being. The possibilities of developing environmental awareness using an environmental education package based on experience- centred learning techniques is being demonstrated by the results of annual assessments. The effectiveness of the environmental educational package was investigated by a longitudinal study what compared the result of a study group against a control group. The performance of 3rd-grade participants of 2016/17 were compared to their own results in 5th grade in 2018/19. The result demonstrates the effectiveness of experience-based, differentiated environmental-awareness education within the scope of everyday learning. That there are significant differences in specific areas of knowledge between the study group and the control group. Among the examined topics the group utilizing the education package outperformed the control groups over a long timeframe. Experience-based methods are shown to be beneficial based on their utilization and tracking of the results.

Keywords: education; environmental awareness education package; experiential education

1. Introduction

In the following study I examine how environmental education can be implemented throughout the school year with the help of a complex environmental education package that provides students with knowledge and practical assignments related to environmental issues.

In 2007, Leskó, Katona, Kárász and Lakatos conducted a survey on environmental education teaching packages in Hungary. The survey intended to demonstrate how popular, well known and utilised these packages were from the perspective of the educators.

Their study revealed that 74% of the responding Hungarian educators regularly use or have previously used environmental education teaching packages.

The methodology used convenience sampling of educators willing to answer. Therefore, the answers might be biased towards those who use such education packages.

The evaluation also revealed that according to 80% of who had been surveyed their colleagues would not use a teaching package, despite the fact that the responding teachers would recommend the use of these packages to all teachers (Leskó et al., 2007).

In a series of surveys (Krakker 2016, 2017) since 2013 we were interested in the opinion and development of pupils. I examined whether a teaching package that can be used in everyday teaching could help to preserve a long-term environmentally conscious behaviour.

In the present study the aim is to compare students of the study group who were using an activity-based teaching package against students of the control group who were studying in the same ecoschool but didn't use any environmental education teaching packages. The goal is to see how the students' ecological and environmental knowledge and their everyday habits differ over a two-year long period. I tried to assess whether the number of environmentally conscious actions decrease with age or not. Is there a change in the environmental attitude of the third-grade students presented at the beginning of the study and the same students two years later in fifth grade? Moreover, I would like to see if they would be indifferent towards the environment or how their system of habits in the studied topics is different from the students that do not use the study package

2. Literature Review

2.1. The Concept of the Teaching Package

The concept of teaching packages has been present in the Hungarian educational research for decades. According to István Falus (1980), in order to be called a teaching package a pedagogical aid must contain not only audio-visual, learning and teaching material but printed materials too. Tompa and Falus independently declares that in the case of the teaching packages it is important to distinguish between those that were related to practical activities and those that provided a more general knowledge for students. They identified the time covered by the package and its relationship to the curriculum (extracurricular dealing with complex topics or intracurricular dealing with simple topics) as other key factors. (Tompa, 1982; Falus et al., 1977).

2.2. The concept of environmental education in the second half of the 20th Century

The outcome document of the conference held in Tbilisi in 1977 contains the following:

"Environmental education is a process in which a generation of the world grows up that knows and cares about its wider environment and its problems. This generation has the knowledge,

skills, attitudes, motivation and commitment to work individually and in a community to solve current problems and prevent new ones" (Czippán, Havas and Victor, 2010, p2.).

The notion of environmental education does not only carry the traditional meaning of the transfer of knowledge but also the development of personality, tutoring and upbringing of an individual (Koruoglu, Ugulu and Yorek, 2015).

Thus, it can be stated that environmental education includes the protection of the environment, the development of environmentally conscious behaviour, attitude, and conduct (Victor, 1998). Environmental education can also be defined as a process in which the growing generations can get to know their environment better and recognize the problems. They might gain skills and abilities as a result of environmental education that can help them solve environmental problems in communities or individually and to work on prevention (Czippán, Havas and Victor, 2010).

In addition, Czippán, Mathias and Victor (2004) believe that environmental education involves pedagogical work in which students are introduced to their environment and are taught to be able to act responsibly for the animate and inanimate nature around them. In addition to the transfer of knowledge the versatile development and motivation of children is also important as this can contribute to the development of a positive attitude towards their environment (Shepardson et al., 2003; Gévai, 2011).

In 1992 the World Conference on Environment and Development, organized by the United Nations, was held in Rio de Janeiro where Agenda 21 alias Tasks Regarding the 21st Century was of great importance. This document provides guidance for sustainable development not only at the economic level but also at the social level (Net1, Net2). The United Nations updated the objectives of a conference held in Rio de Janeiro in 2002 and in Johannesburg (UNESCO, 2002).

There are four main areas of environmental education. The first is to get to know the man-made environment, that is, the built environment. The second is getting to know the natural environment such as air, water, soil, animals, or plants. The third is to develop and influence proper lifestyle habits. The fourth is to establish internal needs for both environmental harmony and a sustainable lifestyle (Lehoczky, 1999; Orbán, 2006; Gévai, 2011).

In Hungary, the National Core Curriculum (NAT) defined environmental education in this period. It appeared in 1995 as a common requirement for areas of education (NAT 1995).

In 2003, environmental education appeared as an important task complemented by environmentally conscious behaviour and sustainable development as future goals (NAT 2003).

However, environmental education has really appeared just in a few institutions as it was not specified how it should be implemented (Krakker, 2017; Havas – Széplaki – Varga, 2009).

In 2012 integration into subjects was defined giving priority to both environmental awareness and sustainability (NAT 2012).

The updated NAT introduced in 2020 omits science education from first and second grade and this will definitely impact future studies of the subject. It'll be the responsibility of teachers whether they can integrate introduction to nature and the love of that into the scope of other courses (NAT 2020)

2.3. Types of environmental education at school

Environmental education organized by the school can manifest in traditional and non-traditional classroom activities. Traditional classroom activities include environmental education methods implemented during sessions. Non-traditional classroom activities can be divided into two groups. First, we can talk about extracurricular activities in the classroom, such as the project method, the topic day, or the topic week. The second is the group of extracurricular activities, which includes excursions, clubs, competitions, forest schools and visits to demonstration sites (zoos, educational trails, botanical gardens). If these programs were not organized by the school, non-governmental organizations usually ensured their implementation (Vásárhelyi 2010; Lehoczky, 1999; Orbán, 2006).

2.4. Ecological literacy

The term ecology was conceived by Ernst Haeckel from the Greek words oikos and logos (Haeckel 1866).

Defining the discipline of ecology is not an easy task even today. The term ecology is used in a much broader sense in English-speaking countries than in Hungary where the term is more closely related to natural-history (Juhász–Nagy Pál, 1984, 1986)

The modern science of ecology and the literacy of it is defined by its main goals by Benson:

1.   understanding the working of nature

2.   understanding how humankind affects nature

3.   finding methods that helps us mitigating the effects of both natural and human activities (Benson 2000)

3. The Teaching Package for Environmental Education

The teaching package entitled "Environmental Education and Healthy Lifestyle Education" was created by my family in 2007. The goal of the program is to develop environmentally friendly lifestyle and habits in a playful way during everyday pedagogical activities. The teaching package consists of two parts: a weekly audio material and a related exercise book. In the audio material a fictional figure called Csutka Jutka, (Cob Jude) talks every week about memorable days, folk traditions, and content related to a healthy lifestyle. This module is recommended from third grade. Considering the age-specific features the broadcasts are 3-4 minutes long and cover almost 150 topics in a school year. Each month has a distinctive bird that children get to know more and more every week as their voices are constantly heard during the broadcasts throughout the month, thus helping to get to know the birdlife around us.

The exercise book can be used effectively from fifth grade. It contains many playful, thought-provoking and logic exercises that will complement the material heard in the broadcasts. The exercises help differentiated teaching since those students that have difficulties at school and those that are excellent can both find exercises that are informative and help their development. The teaching package develops skills and abilities such as creativity, problem-solving and observing skills. It helps to develop social relationships or a responsible attitude. As environmental education cannot be linked to just one subject, the material of the teaching package can be integrated into the topics of all subjects or it can be an additional unit of afternoon sessions. The first table shows the covered topics and the content of the teaching package.

Table 1. Abstract of the Education package (source: the author)

Name of the Education package	Recommended age	Type	Topic	Content
Teaching Package for Environmental Education and Healthy Lifestyle Education	8-12 years	complex	experiments, environmental awareness, memorable days, bird of the week, observations, folkways, interesting phenomena	answer book, Environmental awareness workbook, Environmental awareness audio content (audio files, reward stickers)

4. Methodology

The two-year long longitudinal study demonstrates how students' environmentally conscious behaviour can develop in addition to the development of age-specific characteristics. The study includes institutions that are all eco-schools. "B" and "C" institutions are control groups not using the aforementioned teaching package while institution "A" is using it.

We tested three hypotheses:

1.   The ecological literacy of students educated with the help of an environmentally conscious educational package changes positively over the course of two school years.

2.   The environmental attitude of the students who met the teaching package is more positive, they perform more environmentally conscious activities and the ecological literacy of the students is more prominent than that of their peers who did not meet the teaching package.

3.   The previous form of environmentally indifferent behaviour is positively changed for the students that participate in the teaching package program during the two school years.

4.1. Sample

In the 2016/17 and 2018/19 surveys three schools participated in the study with their third and fifth grade students, summing a total of 179 participants. Two schools in Budapest ("A", "B") and one in the countryside ("C") were included in the survey; all three of them are eco-schools. The teaching package was used in school "A", while it was not yet introduced in the other two

institutions during the survey. The second table shows that 75 boys and 104 girls participated in the study, a total of 87 third graders and 92 fifth graders.

During the sampling we tried to select students from grades that study from the same textbook family. We also tried to include classes in the survey that have about the same knowledge. Each class had highly talented students, students with special educational needs, pupils of average abilities, and slow-working students.

Table 2. Number of participants of the questionnaire (source: the author)

Grade of students	School utilizing the teaching package	Schools not utilizing the teaching package		Total
	„A" school	„B" school	„C" school	
3rd	28	29	30	87
5th	30	31	31	92
Total	58	60	61	**179**

4.2. Research Tools

I used my own survey in all four studies. The questions in the survey are mainly close ended, supplemented by some open-ended questions. In the first half of the questionnaire general demographic data were surveyed, while in the second half I focused on students' environmentally conscious habits, ecological literacy, and lifestyle habits. The survey examined seven topics:

- o Transportation
- o Nutrition
- o Leisure and lifestyle habits
- o Environmentally conscious household (waste management, energy sources)
- o Water protection and water consumption
- o Environmentally conscious shopping
- o Emergency

In the study the results of the survey of the topics concerning environmentally conscious shopping habits and emergency are to be presented.

During the processing of the findings, as a result of the Two-Sample T-test of the 23rd edition SPSS statistical software I obtained p-value results less than 0.05 for each hypothesis during

the significance test. In other words, it can be stated that the probability that the differences observed during the survey were created only because of random standard variation of the data is less than 5%.

4.3. Procedure

All sampling was done in regular class in the presence of a teacher, so students could ask any questions they might had. The questionnaire was conducted online at two institutions ("A" and "B") and on paper at "C" school. SPSS and Excel software were used for the mathematical statistical analysis. Primary measurements were always taken at the beginning of the school year and secondary measurements at the end of the school year. The data presented in the study was based on the results of the output measurements of the 2016/17 school year and the output measurements of the 2018/19 school year.

5. Results

The data and analysis presented both show the results of the measurements at the end of the school year. At the end of the third grade, the students of school "A" had been listening to the attitude-forming audio material of the teaching package for a whole school year. At the end of the fifth grade they have been participating in the program for three years. During the last year of those three years, the environmental education program, which can be used in any lesson was supplemented with a workbook complementing the audio material. Schools "B" and "C" did not use any environmental education teaching package but as an eco-school they had an environmental education program.

The first figure shows that as soon as the second half of 2016/17 students in the research group (school "A") performed significantly better than the control groups. The result of the measurement two years later showed that they did not become environmentally indifferent. Moreover, more than 80% of the students chose the environmentally conscious solution instead of plastic disposable bags during their purchases. The feedback from their parents also underlines the outcome of the study. Many reported that they had to return home at the kids request when they forgot the basket before shopping.
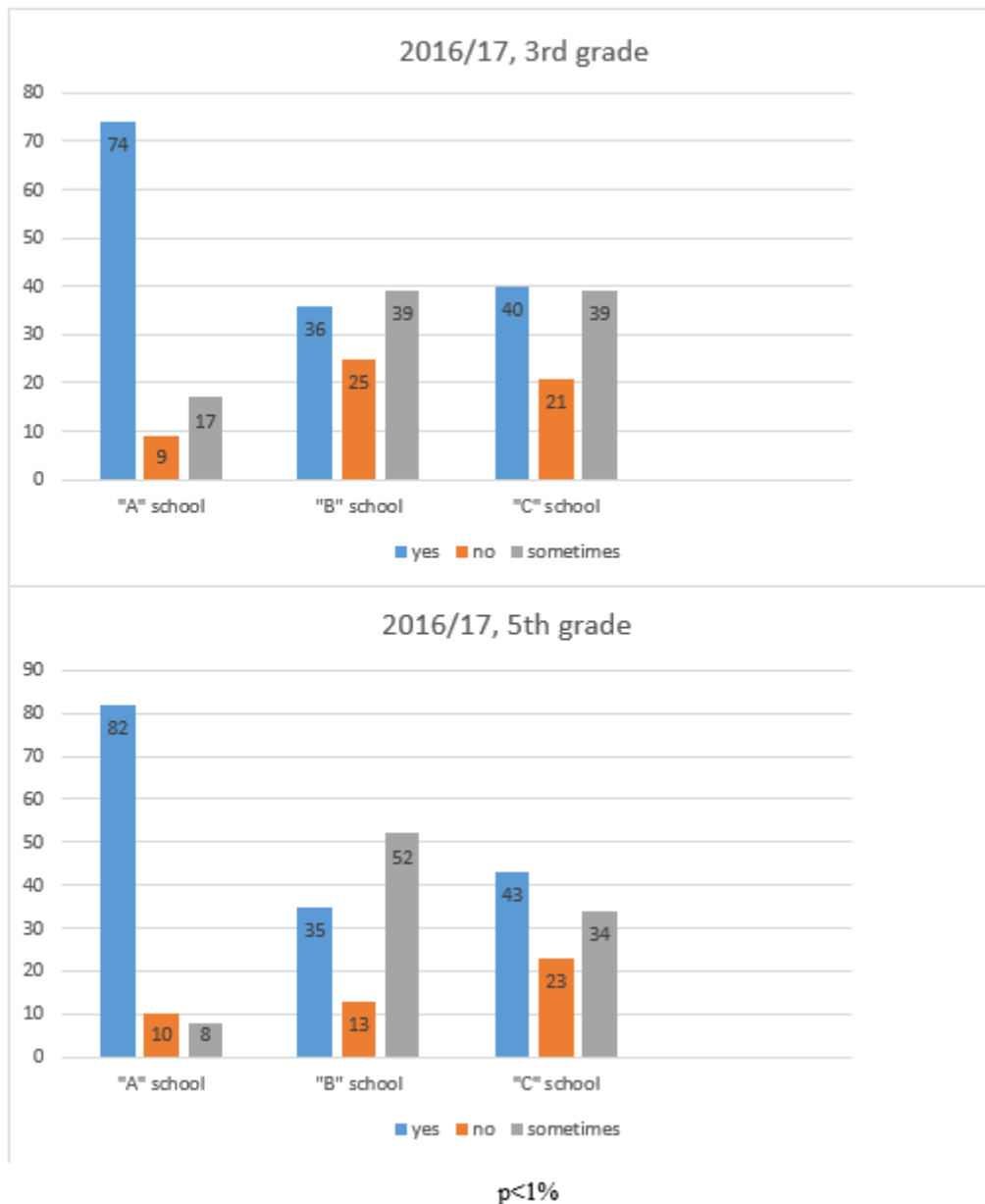
Figure 1. Shopping: Do you bring your own shopping bag, basket for shopping? 2nd term
(source: the author)

The 2. figure shows the results of the measurement of the emergency topic. Hungarian experts consider it important to know the emergency number of the fire fighters, police, and ambulance instead of the single European emergency number. At the headquarters of the fire department, police or at the ambulance station they can be more familiar with the local conditions and help can arrive faster. At the end of third grade only 60% of the students in school "A" and less than 30% of the students in schools "B" and "C" could recall the emergency numbers of fire fighters, police, and ambulance. At the time of the measurement in fifth grade it can already be seen that

although the results of all three schools improved, 92% of the students in school "A" knew the emergency phone numbers correctly.
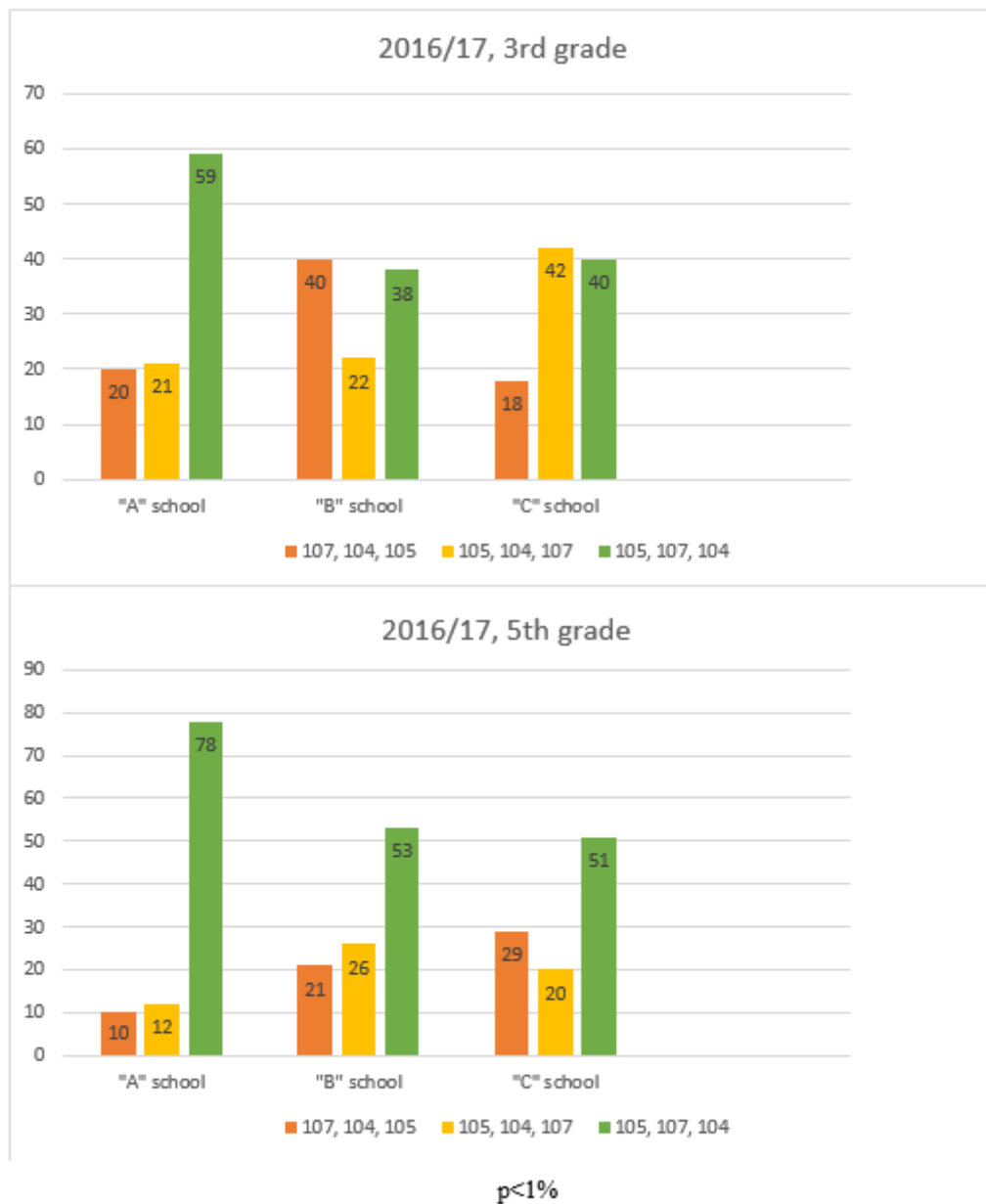
Figure 2. Emergency: What are the emergency telephone numbers of the fire department, police and ambulance respectively? 2nd term (source: the author)

The 3. table shows the measured total percentage of the institutions in the seven examined topics. This shows that the group utilizing the educational package achieved better results than the control groups not only in the two examined topics but in all of them. This was supposedly achieved by long-term, activity-based, emotion-inducing environmental teaching efforts.

Table 3. Results of the examined topics at the end of 5th grade (source: the author)

	„A" school	„B" school	„C" school
Transportation	85 %	70 %	51 %
Nutrition	78 %	51 %	76 %
Customs of leisure time and ways of living	69 %	64 %	65 %
Eco-firendly household (waste management, energy sources)	86 %	55 %	35 %
Water protection and management	80 %	49 %	55 %
Eco-friendly shopping	82 %	35 %	43 %
Emergency	78 %	53 %	51 %

$p < 1\%$

6. Research Limitations

One of the limitations of the research is that sampling pool is small, so we consider it important to elaborate about it. A larger sampling pool would better serve representativeness and make it easier to detect the reasons behind the discrepancies. The tool used has proven to be reliable, but it is still important to interview educators in person about environmental education and the possible reasons for the results obtained. Based on the costs and time factor of the evaluation the online questionnaire proved to be a more favourable solution. However, the inadequate IT equipment of the institutions did not allow the completion of the online questionnaire in every school. The circumstances of the procedure are aggravated by the fact that the financing of the environmental education teaching package no longer necessarily depends on the decision of the schools, thus this should also be taken into account in further research.

6.1. Discussion

In view of the results, it would definitely be recommended to as many institutions as possible to implement environmental education reinforced by experience-based methods. This is important not only because of the development of an environment-centric attitude but also

because of the differentiated teaching of students. The teaching package provides an opportunity for people with outstanding capabilities to obtain even more knowledge but it also includes games and tasks suitable for skills and capability development, thus helping continuous differentiation.

Based on this it can be stated that programs that continuously reinforce environmentally friendly behaviour and attitude while also affecting everyday activities can help changing the habits of whole families. The fact that plastic bags and boxes have been demonstratively buried and later dug out in school "A" for years may also have contributed to the results. At certain intervals, students have the opportunity to examine if the condition of the plastic products has changed or if they have begun to break down. Such activity-based methods that affect emotions may also have contributed to the fact that school "A" far outperformed the other two eco-schools.

This can also be explained by the fact that the exercise book of the environmental education teaching package places great emphasis on this topic and on the practice of situations. Moreover the audio material contains information about the emergency phone numbers that affect the children emotionally.

7. Conclusions

It is shown how the ecological literacy of a class and its relationship to its environment can change over two school years. It has been examined whether these qualities can be influenced in a positive direction with the help of an activity and experience-based environmental education teaching package. Two questions of the research were processed, with the help of which the three preliminary hypotheses were examined. The preliminary hypotheses have been confirmed, thus helping subsequent research as well.

The study found that students who are part of a permanent, long-term environmental education program that provides them with many tasks that assist the integration of the acquired theoretical knowledge into practice achieved better results. The ecological literacy and the number of environmentally conscious actions of these students is higher than that of their peers in institutions that do not use the educational package.

Such methods promote the more informal implementation of environmental education as they are not subject-specific, so they can be used effectively not only in lessons but also in afternoon classes and during day-care.

It is important for educators to be able to deal with both outstandingly talented students and those who are lagging behind in some areas, thus helping them to develop their skills. A long-term teaching package can form a solid base for that.

In the future I plan to expand the sampling pool in order to get more information about the results of environmental education programs in Hungary.

References

Benson K. R. (2000). The emergence of ecology from natural history. Endeavour, Vol. 24, No. 2, pp. 59-62.

Czippán K., Havas P. & Victor A. (2010). Környezeti nevelés a fenntarthatóságért. In.: Nemzeti Környezeti Nevelési Stratégia. Budapest: Magyar Környezeti Nevelési Egyesület. 33-44.

Czippán K., Mathias A. & Victor A. (szerk.) (2004). Segédlet az iskolák környezeti nevelési programjának elkészítéséhez. Budapest: Oktatási Minisztérium (IUCN, 1970).

Gévai Cs. (2011). Nagyon zöld könyv. Budapest: Pozsonyi Pagony Kft.

Havas P. – Széplaki N. – Varga A. (2009). A környezeti nevelés magyarországi gyakorlata Retrieved from https://ofi.oh.gov.hu/tudastar/kornyezeti-neveles-090617-1

Haeckel E. (1866). Generelle Morphologie der Organismen 1-2. Berlin: Verlag von Georg Reimer

Juhász-Nagy P. (1984). Beszélgetések az ökológiáról. Budapest: Mezőgazdasági Könyvkiadó Vállalat

Juhász-Nagy P. (1986). Egy operatív ökológia hiánya, szükséglete és feladatai. Budapest: Akadémia

Koruoglu, N., Ugulu, I., & Yorek, N. (2015). Investigation of High School Students'Environmental Attitudes in Terms of Some Demographic Variables. Psychology 6 (13), 1608–1623.

Krakker A. (2016). Környezettudatosságra és fenntarthatóságra nevelés élményalapú módszerekkel kisiskolás korban. In: Tavaszi Szél – Spring Wind. Budapest: Doktoranduszok Országos Szövetsége, 39-46.

Krakker A. (2017). Élményalapú ismeretszerzés egy oktatócsomag segítségével. In: Tavaszi Szél – Spring Wind. Budapest: Doktoranduszok Országos Szövetsége, 219-227.

Lehoczky J. (1999). Iskola a természetben, avagy A környezeti nevelés gyakorlata. Budapest: RaabeKlett Könyvkiadó Kft.

Leskó G., Katona I., Kárász I. & Lakatos Gy. (2007). A környezeti oktatócsomagok szerepe és hatékonysága a fenntarthatóságra oktatásban. In: Acta Academiae Paedagicae Agriensis, Sectio Pericemonologica XXXIV. Tomus 2, 19-29.

NAT (1995). Nemzeti Alaptanterv. Budapest: Korona Kiadó.

NAT (2003). Nemzeti Alaptanterv. Retrieved from http://www.nefmi.gov.hu/letolt/kozokt/nat_070926.pdf

NAT (2012). Nemzeti Alaptanterv. Budapest: Magyar Közlöny. 66. sz.

NAT (2020). Nemzeti Alaptanterv. Retrieved from https://magyarkozlony.hu/dokumentumok/3288b6548a740b9c8daf918a399a0bed1985db0f/megtekintes

Net1: United Nations: Retrieved from: http://www.un.org/en/events/pastevents/UNCED_1992.shtml

Net2: Plan of Implementation of the World Summit on Sustainable Development. Retrieved from: http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/WSSD_PlanImpl.pdf

Orbán Z. (2006). Közoktatást segítő intézmények a fenntarthatóság–pedagógiában. Elemzés a Nemzeti Környezeti Nevelési Stratégia alapján. Budapest: Magyar Állatkertek Szövetsége.

- Shepardson D. P., Harbor J., Bell C., Meyer J., Leuenberger T., Klagges H. & Burgess W. (2003) ENVISION Teacher as Environmental, Scientist. In The Journal of Environmental Education 34(2):8-11

Vásárhelyi J. (szerk.) (2010). szerk. Nemzeti Környezeti Nevelési Stratégia. – alapvetés – 2010. Budapest: Magyar Környezeti Nevelési Egyesület.

Victor A. (1998). A környezeti nevelés rendszere. In: Sallai R. Benedek (szerk.): Zöldszemmel - Ötlettár környezeti neveléshez. Túrkeve: "Nimfea" Természetvédelmi Egyesület. retrived form: http://www.nimfea.hu/programjaink/zoldszem/fejt.htm

About Authors

Anna Krakker is a teacher in Budapest. She holds a Bachelor's degree in Primary School Teaching (Apor Vilmos Catholic Collge) and an MSc in Teacher of Educational Sciences (University of Eger). Now she is a Ph.D. student at the Doctoral School of Education at Eszterházy Károly University, Eger. Her research area is focused on educational packages for environmental awareness trainings.

Nature, freedom and discovery in Physical Education – Analysis of the implementation of free exploration in nature in PE classes

Sándor Csonka

Eszterházy Károly University, 1 Eszterházy square, Eger, 3300, Hungary, csonka.sandor1991@gmail.com

Abstract

Nowadays, Environmental Education (EE) programs primarily provide opportunities for organized teaching and studying strictly controlled by educators. As far as free explorational experiences in nature are concerned, their positive effects on the development of environmental consciousness are often overlooked. Based on Csonka and Varga (2019), these experiences should be made a very important part of children's life so that they can later develop a strong ecological identity. Interestingly, the firmly structured EE programs are more likely to trigger negative emotions towards nature. Furthermore, the Physical Education (PE) framework for primary schools of the 2012 Hungarian National Core Curriculum requires indirectly the mandatory implementation of free exploration in nature in PE classes (Csonka, 2019). Based on previous findings, the main focus of the present study is the PE Framework Curricula related to the 2020 Hungarian National Core Curriculum in terms of the prevalence of free exploration in nature. As part of a pilot research, the implementation of free exploration in nature was also analyzed regarding grade 1-4 PE classes, sporting events and camps. It can be considered a novel result that the 2020 PE Framework Curricula do not involve the implementation of free exploration in nature, and there have been differences between the previous teaching practices and the 2012 PE Framework Curriculum.

Keywords: Environmental Education; free exploration, curriculum, Physical Education

1. Introduction

Based on the 2019 IPCC Special Report on Climate Change, it is clear that the consequences of climate change hover over our heads like the sword of Damocles. The environmental effects of positive feedbacks tend to be more frequent, extensive and unpredictable nowadays, and this tendency is expected to continue in the coming decades. The responsibility of mankind for climate change and other related ecological problems, such as loss of biodiversity, air pollution, land degradation, fresh water shortages, chemical pollution and wildfires is becoming less and less unquestionable. In order to mitigate our losses we need instant change, for which research results in both Natural and Social Sciences are equally important.

In the case of the latter, pedagogy has the potential to induce radical alterations forming children's environmental awareness from a very early age. Diverse and increasingly effective environmental pedagogical methods can help establish an ecological worldview that can lead to environmentally conscious behaviour in the future. Pedagogical methods implemented by the integration of different subjects can be particularly effective, but they are often either not found in the curricula or, if they are, not integrated into the actual pedagogical practice. This is represented by Vlček et al. (2019), who also found that although the integration of geography and physical education subjects appears as a goal in lower curricula in the Czech Republic and Slovenia, it is not implemented at all in practice. According to Wortley (1994), physical education teachers also have a responsibility to build a positive attitude in students towards the environment, such as the countryside, thereby helping to preserve sports and recreational spaces. However, his curriculum surveys conducted in Britain in the early 1990s did not find integration between the environmental education and physical education, besides this, it would be important to carry out similar analysis in current curricula in as many countries as possible. The current study introduces a lesser-known environmental pedagogical opportunity, previously referred to as free exploration in nature in Csonka and Varga (2019), which can be integrated, among other subjects, principally into PE classes. Free exploration in nature provides the feeling of freedom and discovery in a natural environment. Typical examples to this are outdoor games, family trips, summers in the countryside or lonely walks in the forest. Within the school context it refers to free play and activity in nature under teacher supervision. Csonka and Varga (2019) demonstrated that these experiences should be made a very important part of children's life so that they can later develop a strong ecological identity. Furthermore, the Physical Education framework for Primary Schools of the 2012 Hungarian National Core Curriculum requires indirectly the mandatory implementation of free exploration in nature during PE classes (Csonka, 2019), which further emphasizes the importance of promoting free exploration in nature in education. At the same time, the publishing of the PE Framework Curricula related to the new 2020 Hungarian National Core Curriculum will necessitate the re-evaluation of the Csonka (2019) study. In the present study, after the clarification of the basic concepts and a brief review of the previous results, the new PE Framework Curricula, as well as parts of the 2020 Hungarian National Core Curriculum related to PE are examined in terms of the prevalence of free exploration in nature. As part of a pilot research, the implementation of free exploration in nature was also analysed in grade 1-4 PE classes, camps and at sporting events by using PE teacher interviews. Regarding the application of free exploration in nature, physical education teachers also have an insight into the latter two, which is why these programs

were included in the study besides physical education classes. Although in the present research free exploration in nature has been examined primarily in the context of PE, we should not limit the possibilities of this experience to PE education alone. These could include, among others, geography, biology, ethics, environmental education classes, daycare, Forest Schools, class trips, study trips, and school events. In addition, by examining and comparing several foreign curricula, the analysis of free exploration in nature in an international context should be a priority area of research in the future. The examination of historical changes in the application of free exploration in nature is also an important area of research, which is made possible by a comparative analysis of past and existing curricula. The present study also includes the findings of the comparative analysis of Physical Education in the 2020 and 2012 Hungarian National Core Curriculum and their PE Framework Curricula in terms of the prevalence of free exploration in nature.

2. Ecological identity and free exploration in nature

The formation of ecological identity is not only an extremely important aspect of personality development in environmental education but it also plays an important role in the research related to free exploration in nature. In view of this, one would wonder how ecological identity could be defined. According to Thomashow (1995), „ecological identity refers to all the different ways people construe themselves in relation to the Earth…" (Thomasow, 1995, p.3.). Both social interactions and direct contact with nature can shape our ecological identity. The concept is used to describe the extent of our emotional attachment and sense of unity towards nature. Ecological identity is a kind of collective identity that can determine how much we feel connected to non-human forms of life (Clayton, 2003). Csonka and Varga (2019) examined how the experience of free exploration in nature can influence the development of ecological identity.

Based on the hypothesis outlined in Csonka and Varga (2019), the impact of free exploration on the formation of ecological identity is more significant than that of other factors. Csonka and Varga (2019) compared the experiences of twelve Environmental Studies students to those of twelve Engineering students in using ecological identity scales and narrative interviews.

The first measure Csonka and Varga (2019) used to analyse ecological identity was the Environmental Identity Scale (Clayton, 2003), which consists of eleven statements to be valued by the interviewees on a 1-5 Likert scale. The statements measure the intensity of physical and emotional connectedness to nature together with the willingness to protect it. The second

ecological identity scale used in the research (Csonka and Varga, 2019) was the Inclusion in Nature of Self Scale (Schultz, 2001), in which the interviewees had to choose one of various illustrations that best described their contact with nature. Both scales (Clayton, 2003) (Schultz, 2001) indicated that the ecological identity of the Environmental Studies students were more developed than that of the Engineering students.

Csonka and Varga (2019) used narrative interview method to map the factors determining the professional interests of both student groups (based on: Palmer and Neal, 1994), as well as the their strong emotional experience related to nature (based on: Piskóti, 2015). We can conclude that free exploration, social interactions and education were the most common categories of experience of professional interest in both of the interviewed groups. The second narrative interview (used by Csonka and Varga, 2019) resulted, that free exploration and social interactions being the most common categories of strong emotional experience related to nature in both student groups. Interestingly, it was the group with the less developed ecological identity (Engineering students) that mentioned more organized programs in their interviews, and considered them more of a negative experience.

To conclude, organized programs sometimes contradict our aims in environmental education as they negatively affect ecological identity. Professional interests and strong emotional experience related to nature are principally connected to free exploration rather than to organized programs. A more extended research in this field might be necessary, and in case Csonka and Varga's (2019) results can be confirmed, we should reevaluate the current environmental education methods putting more emphasis on unstructural and free discovery of nature (Csonka and Varga, 2019). Similarly to the study of Csonka and Varga (2019), Palmer and Neal (1994) also found that environmental education teachers most often trace the development of their professional interest to their childhood experiences in nature. Konyha (2011) also draws attention to the importance of leisure activities in nature in the shaping of our environmental attitude, whereas Piskóti (2015) showed the importance of childhood family trips and summers in the countryside in the development of environmental awareness.

It was the previous findings outlined in Csonka and Varga (2019), based on which the implementation of free exploration in nature was later analysed within the 2012 Hungarian National Core Curriculum and its Framework Curricula (see: Csonka, 2019). Although the 2012 Hungarian National Core Curriculum does not involve free explorational activities in nature as obligatory element, they can be found in the PE framework curriculum for grades 1-4. The wording "free movement in nature" in the curriculum implicitly refers to free exploration in

nature. At the same time, the publishing of the new 2020 Hungarian National Core Curriculum and its Framework Curricula will necessitate a re-evaluation of the study to be able to map potential educational trends. In the present study, PE education in the 2020 Hungarian National Core Curriculum and the 2020 PE Framework Curricula were examined in terms of the prevalence of free exploration in nature.

In a pilot research, Csonka (2019) also examined the actual implementation of free exploration in nature for both eco and non-eco-schools, with five institutions having been examined accordingly. Quite surprisingly however, while eco-schools have more environmental education programs, some of which are implemented in nature, they implement less free exploration in nature compared to non-eco schools, but at the same time these programs involve more constraints and less free time in nature. According to Csonka and Varga (2019), the lack of free exploration and strictly organized programs can have, in many cases, a negative impact on the development of ecological identity. Based on Csonka (2019), it would be particularly important to carry out comprehensive research in this field, as in the education system of eco-schools students are increasingly prone to become emotionally detached from nature.

One of the findings of Csonka's (2019) pilot research is that there can be differences between the curriculum and the actual practice. Only one of the interviewed institutions riported free exploration in nature to be part of their PE classes. On the other hand, the results indicated by Csonka (2019) are questionable as no specific questions were included in the interview regarding the implementation of free exploration in nature during PE classes, the research focused merely on the prevalence of free exploration in nature in school programs in general. In order to be able to map potential differences, the present pilot research focuses primarily on the prevalence of free exploration in nature, analysed specifically in relation to PE classes in grades 1-4 of primary schools.

3. Examination of the prevalence of free exploration in nature in grades 1-4 of primary schools

In the following, the prevalence of free exploration in nature in primary schools will be examined for grades 1-4. The reason for the examination, on one hand, is that early childhood experiences play a significant role in the development of ecological identity (Csonka and Varga, 2019), and, on the other hand, it is the PE framework curriculum for grades 1-4 published in 2012, which indirectly involves free exploration in nature as an educational tool (Csonka,

2019). As a result, the new PE Framework Curricula published in 2020 and the previous PE practices were examined in this research.

3.1. Examination of the 2020 Hungarian National Core Curriculum and PE Framework Curricula

3.1.1. Analyzing method

The analysis of Physical Education in the 2020 Hungarian National Core Curriculum and its PE Framework Curricula documents was carried out with keyword search (e.g. free movement, discovery, nature) and perusal of the details of the documents. The relevant findings are included in the next section.

3.1.2. Results

Based on the conducted research, as opposed to the previous PE Framework Curriculum for grades 1-4. neither the section related to Physical Education of the 2020 Hungarian National Core Curriculum nor its PE Framework Curricula cite the implementation of free exploration in nature. Nevertheless, the application of free exploration in nature can contribute substantially to achieving the goals set in the new PE Curricula. Besides encouraging engagement in outdoor activities, it can enhance environmental awareness and education for environmental protection and sustainability, all of which can be found among the goals set in the Physical Education Framework Curricula.

It can also provide various opportunities to obtain empirical evidence, experience acquired by means of the senses, and in the case of pupils in lower grades, in line with the PE Framework Curriculum, it is also suitable to increase independence and improve self-help skills. It can facilitate the development of self-knowledge, self-image and emotions (see Csonka and Varga, 2019 research on ecological identity), and be both an effective recreational and anti-stress tool (see: Kaplan and Kaplan, 1989).

Many of the outdoor activities mentioned in the curricula can be associated with the experience of free exploration in nature, such as hiking or the mere planning of hiking, orienteering, water games, ball games or cycling. In addition, it can be involved in outdoor physiotherapy, help to improve spatial orientation and endure bad weather while doing sports, or can educate children about folk games, facilitated significantly by children living in urban and rural areas casually exploring nature together. Thus, it is clear that despite the fact that free exploration in nature

has been removed from the Physical Education Curricula, it can help to achieve educational goals in so many different ways.

Another conclusion of the study is that this educational element can also help fulfill the requirements of the 2020 Environmental Studies and Ethics Framework Curricula by the development of a positive emotional attitude towards nature and the formation of an environmentally conscious behaviour. Similarly, the Ethics and Environmental Studies Curricula for grades 1-4 were put under the microscope on the grounds of Csonka's (2019) results, who came to a similar conclusion when analysing the Framework Curricula published in 2012. However, the question then arises: to what extent was free exploration in nature prevalent in the educational practice related to PE classes in grades 1-4 during the validity period of the 2012 Hungarian National Core Curriculum? Could this educational element in the Framework Curriculum have had an impact on pedagogical practices? In the following section, the pilot research aimed at obtaining answers to the above will be presented.

3.2. Presentation of pilot research

3.2.1. Research methodology

The prevalence of free exploration in nature in PE classes was examined in a pilot study. The aim of the research was to map the prevalence of free movement outdoors, but not in nature, and free exploration in nature to see how familiar teachers are with this element of the Framework Curriculum. In addition, educators also shared their experiences regarding the potential benefits of the above. It was difficult to reach the teachers during the summer, so in the present research the teachers of sports schools were not specifically interviewed. In the future, it would also be important to conduct research comparing sports schools and regular schools in terms of the prevalence of free exploration in nature.

PE teachers in grades 1-4 and teachers whose job involves, among others, PE education have been interviewed. 10 teachers from 9 educational institutions were interviewed. Some teacher are currently not teaching PE but taught the relevant age group during the validity of the Hungarian National Core Curriculum published in 2012, engage in educational activities in different schools. Educators had to answer 12 questions (see: Appendix) via telephone interviews (in some cases the questions were asked in past tense due to the above).

Regarding some of the questions, a percentage estimate had to be given for the actual implementation of free movement outdoors, but not in nature and free exploration in nature in

PE classes and school programs, compared to strictly organized programs. Other questions concerned the benefits of physical education outdoor, but not in nature, and physical education in nature, and most importantly, the benefits of free movement outdoors, but not in nature, and those of free exploration in nature. The answers to the questions also provide information on the prevalence and potential benefits of free exploration in nature. The time of replies varied widely, respondents spent approximately 15-60 minutes on answering all the questions. One respondent did not answer the second part of question 11. In the following, based on the responses to the interview questions, the results of the hypothesis tests are presented.

3.2.2. Results of pilot research

Based on the interviews, the responding teachers hold, on average, about 40% of Physical Education classes outdoors (but not in nature). Physical Education lessons in nature account, on average, for about 15% of the total number of lessons (including parks and playgrounds close to nature). The prevalence rate of free exploration activities in nature during PE classes is also at about 15%. As a result, on average, only 2 % of PE classes involve free exploration in nature. In educational institutions, free exploration accounts for an average of 30% of sporting events and camps in nature. Among the most typical programs including free exploration, Forrest Schools, class excursions, summer camps, daily sporting events, family days and sports camps are important to mention. One possible reason for the low prevalence rate could be the fact that only six out of the ten respondents were aware that free exploration in nature was an activity included to be implemented in the Physical Education Framework Curriculum published in 2012. While there were respondents who had been informed on this from their school's local curriculum, others had no information at all, but had it as part of their own educational approach.

The interviewed teachers also mentioned the difficulty of incorporating free exploration in nature into the course of education because of various organized programs, timetable constraints, distance from nature, time-consuming preliminary assessments, environmental risks, inactive or problematic behaviour of children, which may also have contributed to the low prevalence rate. The estimates provided to the questions are included in Table 1 below.

Table 1. Summary of the estimates provided to interview questions no. 3., 4., 7., 9.
(source: author)

Interviewees	Rate of outdoor PE, not in nature (relative to the total number of PE lessons - %)	Rate of PE in nature (relative to the total number of PE lessons - %)	Rate of free exploration in nature during PE in nature (relative to the total time of PE in nature - %)	Rate of free exploration in nature during extracurricular programs in nature (%)	Aweraness of free exploration in nature in the 1-4 grade 2012 PE framework curriculum
1.	20	0	0	25	No
2.	65	45	30	10	No
3.	50	0	0	50	Yes
4.	90	45	22	50	No
5.	35	3,5	66	15	Yes
6.	10	20	1	40	Yes
7.	50	1,5	0	27	Yes
8.	60	12,5	30	25	Yes
9.	12,5	20	no estimate	33	No
10.	29	0	0	25	Yes
Mean	**42,2**	**14,8**	**16,6**	**30**	**6 Yes (4 No)**

The interviews revealed that outdoor classes have a number of benefits on children's physical development, including immunity boosts, cardiovascular development, balance development and gait training on uneven ground, joint development by walking on grass and a sufficient oxygen supply in the open air. Larger spaces are more likely to meet children's needs for movement whereas task performance becomes differential involving more creative tools. In addition, outdoor classes can relieve stress, improve spatial orientation and are less accident-prone than indoor classes. Some educators, however, argue that there are more disadvantages to outdoor lessons than advantages. Open air, for example, can be more polluted in cities, asphalt can destroy children's joints, artificial grass tends to get too hot or hard to walk on in the rain while weather, allergens and ticks require special attention, and parental resentment often impedes implementation. In view of the above, it is important to create an accident-free outdoor environment for movement, by, for example, cutting down overhanging branches or using adequate surfaces.

PE classes conducted specifically in nature have numerous advantages including having adequate air quality, being able to move on natural ground, whereas natural landmarks can effectively help develop the sense of balance. In addition, children's ecological identity is enhanced and they get familiar with natural beings. Moreover, they inspire creativity, have a calming effect, enrich children with experiences, and improve concentration by providing countless stimuli to engage children's interest while their guided attention can rest. This is confirmed by Kaplan and Kaplan's (1989) Reshaping Theory of Attention, according to which

our natural environment helps us relax our guided attention, thus making us more focused, relaxed, and less stressful. According to Louv (2005), the lack of experience with nature can also lead to the development of mental health and emotional disorders, as well as attention deficit disorder. At the same time, PE in nature can also develop the ability to overcome fear or adapt to environmental changes, and can develop self-discipline. Orr (1993) also points to the environmental pedagogical importance of dealing with fears and feelings of discomfort related to nature. In his view, the reason for our increasingly prevalent biophobic attitude is the disconnection from our natural environment, in man-made environments there are less and less opportunities to experience nature with an increasing number of negative associations that need to be offset. According to Gill (2011), experiencing nature is important for children because it not only has a beneficial effect on their physical and mental health, emotions, motor, neural and sensory development, but also effectively increases their environmental awareness. Nature can also provide an ideal environment for the implementation of folk games and the development of orientation. It should be highlighted that 2020 PE Framework Curriculum also put an emphasis on promoting folk games and incorporating them into PE classes. However, according to some PE teachers, pure nature is not suitable for the implementation of physical education classes, as attention must be paid to the right ground, UV hazard, and other risks of injuries caused by nature. Movement in nature requires a higher level of teacher supervision, tours must also be conducted with thorough preparation.

Outdoor free exploration (unstructured outdoor play) allows for self-assembly, whereby children's creativity and imagination can develop significantly. Similarly, Hyndman (2018) also underlined the importance of outdoor physical activity in development of children's creativity. They establish and apply specific rules, and consequently, positive processes of socialization can be initiated, such as the development of group dynamics, imitation, independent differentiation, development of adaptability, ranking among each other, development of sportsmanship and the recognition of the performance of others. Herrington and Studtmann (1998) also demonstrated that in man-made traditional playgrounds, physical fitness usually determines the hierarchy between children. In contrast, when playing on natural landmarks, the ranking among children is much more determined by the level of creativity, ingenuity and verbal knowledge, thereby facilitating socialization.

In addition to engaging in play, they can have an aesthetic experience, find joy, achieve self-fulfilment, gain self-knowledge while their personality develops, which can also be observed by the teacher, and they learn to cope with their failures and limitations and obtain self-control.

Free exploration can also be used to relieve stress and relax controlled attention through the experience of novelty and discovery (see the Reshaping Theory of Attention - Kaplan and Kaplan, 1988). Students' physical development can become more differentiated, as young children instinctively feel what forms of movement they need, and their fine motor skills, manual dexterity, and movement coordination develop accordingly. Herrington and Brussoni, (2015) found that unstructured play also has an important role in reducing childhood obesity, however, for the 5 years preceding the study, it was found that overall, children's unstructured play time had decreased. According to one of the educators, as opposed to specific tasks, the role of free movement is far greater in the development of grade 1-4 students, therefore apart from their inclusion in the compulsory PE classes, another 30-60 minutes of free movement a day should be included in the curriculum for grades 1-4. At the same time, it has also been observed that 3rd graders are already more demanding of free play and are willing to use things they have learned before, while first-graders do not yet spend their time actively on their own. It is also important to note that free exploration should be preceded by guided warm-up exercises, and the educator should prevent various disagreements, fights, and adverse effects of environmental risks (e.g., effects of bad quality of air or ground) on time.

As regards free exploration in nature, in addition to the positive impacts outlined above, the effects of environmental education and the development of ecological identity have been highlighted, including learning about natural values and the local environment, creating a sense of unity with nature, experiencing closeness to nature, discovering and engaging in nature and the education for the love and respect for nature (see similar findings in Csonka and Varga, 2019). It was also observed that acquiring knowledge associated with movement can be more effectively cemented, and movement outdoors can expand the knowledge and skills required not only for environmental education but also for many other subjects. In addition, it was also concluded that children coming from rural areas are smarter, more persistent, courageous, practical, and creative due to the large number of free exploration in nature they have encountered. Related findings are those of Özdirenç et al. (2005), which found that urban children in Turkey are generally more inactive than rural children. This is largely due to the fact that the latter get a higher chance to play comfortably outdoor (Özdirenç et al., 2005). Konyha (2011) also pointed out that rural children have a stronger environmental attitude than urban children in Hungary in terms of actual environmental commitment. As opposed to various coordinated tasks, free play in nature, with nature-given landmarks or with each other, seems to correspond much more to the age characteristics of the younger age group, which would

currently need more opportunities for free exploration in nature. More parks should be built to provide opportunities for children living far from nature to play with various wooden toys and games. Free exploration in nature can also lead to differential physical development, for example, the sense of balance and joint development can be enhenced more effectively. Lunchs and Fikus (2013) also demonstrated that in the case of nature-based playgrounds, children play more varied and complex games than in traditional playgrounds. In the case of the latter, children tend to spend longer periods of time queuing and waiting for each playground equipment to use, while in the case of the former the time spent in actual movement and play is considerably longer. Coe et al. (2014) also confirmed that after greening, a significantly higher proportion of children engaged in intense physical activity in playgrounds complemented by natural elements. Diversity of activity is also more prominent in the case of children on natural landmarks (Herrington and Brussoni, 2015), and more diverse and need based forms of movement can develop. A tree, for instance, can be climbed, balanced, jumped, etc. in a variety of ways, while a traditional playground equipment, such as a slide, has a specific purpose. According to Herrington and Brussoni (2015) the "secret ingredient" for children's health and development is nature and play, which is no substitute for anything else. However, particular attention should also be paid to the risks described above regarding free exploration in nature.

4. Conclusion

The most important conclusion to be drawn from the examination of the Curricula is that changes to the implementation of free exploration in nature within the educational framework should be monitored in future studies, as this educational element is no longer included in the relevant grade 1-4 Framework Curricula. It can help achieve the goals of the Curriculum, educators, however, are not required to use it. Nevertheless, the results of the pilot research also suggest that the prevalence of free exploration in nature in PE classes is already negligible due to the reasons described in the previous chapter. As far as Physical Education events and camps out of PE classes are concerned, free exploration in nature seems much more common. Based on the changes to the Curriculum and previous practice, it would be worthwhile to allow more time for free exploration in nature during school events out of PE classes as it neither seems to have been difficult to involve in them, nor it is a compulsory element of the Curriculum as regards PE classes any more. This is not to say that the adequate application of free exploration in nature within PE classes would not bring benefits. Daycare, class excursions, summer camps,

Forest Schools, sports camps, study trips should, however, come to the fore, which could allow educators to organize programs in nature with less restrictions and a fairly long time frame. It is important to make better use of these precious opportunities, leaving enough time for children to move around freely in nature, raising a healthier, more resilient, creative and environmentally conscious generation which is capable of facing the ecological crisis of our time.

Acknowledgement

References

Clayton, S. (2003). Environmental Identity: A Conceptual and an Operational Definition. -In: S. Clayton – S. Opotow (eds.): *Identity and the Natural Environment: The Psychological Significance of Nature*. Cambridge, Massachusetts: The MIT Press, 45–67.

Coe D., Flynn J., Wolff D. & Scott, S. (2014). Children's physical activity levels and utilization of a traditional versus natural playground. *Child Youth Environ*. 24(3), 1–15.

Csonka, S. (2019). Természeti szabad explorációs élmények szerepe a magyar közoktatásban (The role of free outdoor explorational experiences in the hungarian public education). *OxIPO – interdiszciplináris tudományos folyóirat*, 2019/4, 51–65. doi:10.35405/OXIPO.2019.4.51. web: http://real.mtak.hu/105320/1/OxIPO_2019_4_051_Csonka.pdf (Retrieved September 10, 2020)

Csonka, S. & Varga, A. (2019). Terepi szabad explorációs és irányított tanulási élmények szerepe az ökológiai identitás fejlődésében (The role of outdoor free exploration and directed learning experiences in the evolution of ecological identity). -In: E. Juhász – O. Endrődy (eds.): *Oktatás-Gazdaság-Társadalom*. Debrecen, Hungary: Hungarian Educational Research Association (HERA), (2019), 91-105. doi: 10.13140/RG.2.2.17550.82242. web: https://www.researchgate.net/publication/331703743_TEREPI_SZABAD_EXPLORAC IOS_ES_IRANYITOTT_TANULASI_ELMENYEK_SZEREPE_AZ_OKOLOGIAI_I DENTITAS_FEJLODESEBEN (Retrieved September 10, 2020)

Frame Curricula related to HNCC (2012). Retrieved September 10, 2020, from https://www.oktatas.hu/kozneveles/kerettantervek/2012_nat

Frame Curricula related to HNCC (2020). Retrieved September 10, 2020, from https://www.oktatas.hu/kozneveles/kerettantervek/2020_nat

Gill, T. (2011). *Children and nature: a quasi systematic review of the empirical evidence*. London: Greater London Authority.

Herrington, S., & Brussoni, M. (2018). Beyond Physical Activity: The Importance of Play and Nature-Based Play Spaces for Children's Health and Development. *Curr Obes Rep* 4, 477–483. doi: 10.1007/s13679-015-0179-2

Herrington, S. & Studtman, K. (1998). Landscape Interventions New Directions for the Design of Children's Outdoor Play Environments. *Landscape and Urban Planning*, 42(2-4), 191-205.

Hungarian National Core Curriculum (2012). Retrieved September 10, 2020, from https://ofi.oh.gov.hu/sites/default/files/attachments/mk_nat_20121.pdf

Hungarian National Core Curriculum (2020). Retrieved September 10, 2020, from https://magyarkozlony.hu/dokumentumok/3288b6548a740b9c8daf918a399a0bed1985d b0f/megtekintes

Hyndman, B. & Mahony, L. (2018). Developing creativity through outdoor physical activities: a qualitative exploration of contrasting school equipment provisions. *Journal of Adventure Education and Outdoor Learning*, 18(3), 242-256. doi: 10.1080/14729679.2018.1436078

IPCC Special Report on Climate Change (2019). Retrieved September 11, 2020, from https://www.ipcc.ch/srccl/

Kaplan, R., & Kaplan, S. (1995). *The experience of nature: A psychological perspective*. Cambridge: Cambridge University Press.

Konyha, R. (2011). „Zöldebb" családokat! – Fiatalok környezeti attitűdje. *Új pedagógiai szemle*, 61(1-5), 484-498.

Louv, R.(2005). *Last child in the woods: Saving our children from nature-deficit disorder*. Chapel Hill, NC: Algonquin Books.

Luchs, A & Fikus, M. (2013). A comparative study of active play on differently designed playgrounds. *J Adv Educ Outdoor Learn Routledge*. 13, 206-222.

Orr, D.W. (1993). Love it or lose it. The comming biophilia revolution. -In: S.R. Kellert - E.O. Wilson (eds.): *The biophilia hiphotesis*. Washington DC: Island Press, 415-440.

Özdirenç, M., Özcan, A., Akin, F. & Gelecek, N. (2005). Physical fitness in rural children compared with urban children in Turkey. *Pediatrics International*, 47, 26-31.

Palmer, J. A., & Neal, P. (1994). *The handbook of environmental education*. London: Routledge.

Piskóti, M. (2015). *The Role of Environmental Identity in the Development of Enviromental Conscius Behaviour*. Budapest: Corvinus University. web: http://phd.lib.uni-corvinus.hu/858/2/Piskoti_Marianna_den.pdf (Retrieved November 08, 2018.)

Schultz, P. W. (2001). The Structure Of Environmental Concern: Concern For Self, Other People, And The Biosphere. *Journal of Environmental Psychology,* 21(4), 327-339. doi:10.1006/jevp.2001.0227

Thomashow, M. (1995). *Ecological Identity: Becoming a Reflective Environmentalist.* Cambridge, Massachusetts: MIT Press.

Vlček, P., Svobodová, H., & Resnik Planinc, T. (2019). Integrating Physical Education and Geography in elementary education in the Czech Republic and the Republic of Slovenia. Compare. *A Journal of Comparative and International Education*, 49(6), 868-887.

Wortley, A. (1994). Physical Education. -In S. Goodall (eds.): *Developing Environmental Education in the Curriculum.* London: David Fulton Publishers

About Author

Sándor Csonka is an expert in Applied Environmental Studies and Human Ecology. He received his BSc and MSc from Eötvös Loránd University in 2015 and 2018. He is a PhD student in the Doctoral School of Education of Eszterházy Károly University. As a student of the Environmental Pedagogy Module, he conducts research mainly in the field of free exploration in nature, development of environmental attitude scales and light pollution.

Appendix

Pilot research interview questions:

1. Please provide the name of the primary school you teach PE at.

2. Is the institution a certified sports school? Where is the institution located?

3. What is the approximate percentage of lessons a school year that involve education outdoors but not in nature (e.g., on outdoor sports fields)?

4. What is the approximate percentage of lessons a school year that involve education in nature?

5. What programs are tipically implemented in nature as part of Physical Education classes?

6. Is it common in your institution that a program is implemented in nature under teacher supervision with children engaging in self-directed free play or physical movement, free to choose the way they spend their time?

7. What is the approximate percentage of free programs and controlled activities, such as tasks, specific sports games, competitions, etc., during PE classes which take place in nature?

8. Does the school usually organize extracurricular sports events and camps in nature? Please provide an example of these.

9. Please give an estimate to the percentage of the prevalence of free exploration in nature within the above mentioned extracurricular programs besides organized activities (separately within each mentioned program).

10. What, in your view, are the benefits of having PE classes outdoors but not in nature? What could be the benefits of Physical Education in nature?

11. What, in your view, are the benefits of free play outdoors but not in nature and those of outdoor play in nature?

12. Were you aware that the free movement in nature element is part of the PE Framework Curriculum for grades 1-4 related to the 2012 Hungarian National Core Curriculum?

Environmental education in light of the digital culture

Éva Karl[a], György Molnár[b]

[a] *Master Teacher of Engineering (Engineering Information Technologist), IT specialist, Várkerti Primary School and Associate Schools, 8100 Várpalota, Hungary, karl.eva@mikrobisuli.hu*

[b] *Budapest University of Technology and Economics, Budapest,1111 Budapest, Műegyetem rkp. 3., Hungary, molnar.gy@eik.bme.hu*

Abstract

The importance of environmental education cannot be stressed enough as humanity populated the majority of the Earth and its activity effects the whole planet. Environmental education is lifestyle education that cannot be started early enough. The point is not only to properly provide scientific knowledge besides personality development. It is essential that children discover and understand cause and effect relationships so they will understand the processes on the whole. The processes leading to the solutions of environmental questions and problems can link different subjects, can build a global point of view suitable to be supported by digital culture for more reasons. The present article in addition to the definition of concepts of environmental education and its practical implementation, describes the accentuated role and possibilities of the digital culture subject in the process of education for sustainability and it provides concrete tasks by age groups along with detailed methodological guidance.

Keywords: sustainable society; environmental education; legal regulation; educational roles; digital culture; thematic project tasks; global point of view; STEM; robot programming; scratch

1. Introduction and the relevant professional context

The idea of environmental education was first formulated in developed Western societies. The ever-increasing population density has resulted not only in unmanageable amounts of waste, but also in serious health problems due to air and water pollution, among other things. The unsustainable situation needed immediate and effective remedy. Environmental movements were born, later interventions on the legislative level were needed to avoid even more serious problems.

Hungary was hit by this so-called "green wave" in the early 1990s. Environmental and nature protection movements and associations were organized, and the promotion of environmentally conscious thinking affecting all areas of life began.

Today, environmental education is widely known and accepted. It can be found in all areas of education, which is particularly important because environmental education provides the basis

for understanding and clarifying the short - and long - term consequences of consumer society. And this can never be started early enough.

In addition to the transfer of scientific knowledge, environmental education should also promote civic education and personality development purposes.

According to Pál Rókusfalvy, personality development is realized in environmental education through the solution of similar tasks as in any other field, such as mother tongue and mathematics education. The respective tasks include:

1. knowledge provision,

2. attitude formation,

3. behaviour formation.

"Without the provision of knowledge and the formation of attitudes, however, requiring action is merely an ineffective dressage, just as in the absence of a correct, orderly approach, the provision of knowledge remains a mere verbalization. The learner must learn to think so that he can do the right thing using his knowledge." (Rókusfalvy, 2000)

In my article, I examine solution options related to an environmental education program in a primary school in light of the support provided by the subject of digital culture. With these three areas in mind, I would like to present such procedures and methods that show that the institutional environmental education program can be effectively implemented within the framework of the subject of digital culture.

I believe that primary school environmental education is of paramount importance, as it is perhaps the best opportunity to instil in children the spirit of a sustainable society, to familiarize them with its practical foundations. On the other hand children will be the conscious consumers of the future, so the evolution of society's environmental values depends on them, consequently early environmental education is essential!

Perhaps one of the biggest challenges education is facing is to achieve that children's environmentally conscious behaviour stems from unconditional, full inner conviction. Therefore educational processes must steer their thinking in the direction that their daily actions also serve sustainability. Thus, educators have a prominent role in training environmentally conscious citizens, making environmental protection their most important priority.

2. Theoretical background

2.1. *Purpose and importance of environmental education*

The aim of environmental education is to develop environmentally conscious behaviour and to establish a lifestyle that is responsible for the environment. In addition to expanding the knowledge that can be developed about the environment and society, it also aims to shape the behaviour, values and emotional attitudes connected to it The intellectual and moral foundation of the system of customs that respect nature, the environment and man is aimed at the preservation and maintenance of the biosphere - and human societies in it. (Havas, n.d.)

The aim is therefore to develop an environmentally conscious view, skills, abilities and relevant positive attitudes. It is visible that this is a complex task that is not limited to a single field, as it may have scientific, artistic and other aspects too. In conclusion, it cannot be linked to a single subject; it can be incorporated into the material of natural science subjects as well as into the subjects of humanities. Environmental education is effective if it permeates the whole personality, if - in addition to the acquisition of knowledge and experience - it also exerts its effect in the field of attitudes, sentimental orientation and behaviours. It should also arouse interest and curiosity, unfold the imagination, allow time for joyful wonder, admiration, and enjoyment of beauty. (Orgoványi, n.d.)

As János Lehoczky (1999) put it:

"The goal of environmental education is multi-layered, not just the transfer of environmental knowledge. It seeks to influence the whole of the personality, including consciousness through knowledge, sentiments through experience, and the will through purposeful activities."

Environmental education is vital for the preservation of the natural environment, but also for the development of the child's whole personality, as it also helps to develop self-image and a sense of personal responsibility. Environmental education should be a value mediator where, in addition to knowledge, feeling is also present. The goal is for the child to pay attention to the beauty of nature, and its fragile balance, while developing a sense of compassion, regret, admiration, and love. This kind of knowledge helps the child to understand his place in nature. He realizes that he is also part of nature and does not exist out of it. This recognition not only enriches the child's personality, but can also contribute to the preservation of the values of nature. (Wilson, 1994)

Recognition of natural values and the ability to deal with environmental problems also serve the development of ecological culture.

It is therefore essential to pass on knowledge that is new and has ecological point of view via education. It is extremely important that the accumulated knowledge, experience and values are passed on to future generations. The content of education cannot refer only to the past. An essential element must be the establishment and development of the skills and abilities needed to plan and live for the future. As can be seen, this already points in the direction of the so-called sustainability education, where orientation to the future appears as an important feature.

2.2. *Education for sustainability*

Sustainable development is a relatively well-known term. In reality, however, it is an extremely controversial concept, so let us address the definition itself before discussing education for sustainability. According to the 1987 Brundtland Report of the United Nations sustainable development is a process that "meets the needs of the present without compromising the ability of future generations to meet their own needs".

It has the further task of determining the outlines of environmental protection, but it must "achieve this without sacrificing the needs of either economic development or social equality and justice." (Wikipedia)

The principle of sustainable development has been widely criticized, as it does matter from which angle we examine and use the phrase. Economic development presupposes the constant consumption of resources, but many resources, such as oil and natural gas, are consumed by humanity at a much faster rate than they are naturally regenerated, resulting in dwindling supplies. From another point of view, it can be considered a counterargument holding that sustainability cannot be applied to the current kind of economic development. Another possible interpretation by a social group implies sustained economic growth, but since the economy is based on the use of natural resources, this is not possible in principle, as the Earth is of finite size.

It therefore seems more appropriate to use the term sustainable society, which aims to create a system in which natural, social and economic goals are not achieved at the expense of each other, but in support of each other.

Perhaps one of the most important messages in the definitions of sustainable development, of a sustainable society, is that we all have to respect natural values here and now, all of us have to be more frugal with the raw materials of our planet here and now.

That is why we all need to do something here and now. (Láng, 2002) We must live without restricting the living conditions of future generations, depriving them of the opportunity to live a life of at least the same quality, or possibly even better than we do. To do this, we need to fundamentally rethink our current way of life, our values, the relationship between man and his environment. It should be understood that value can not only be expressed in money or be something that is purchased. We must not use nature's raw materials in such a way that, from its source, through production and use, it becomes exclusively waste and can no longer be used. We produce and use our goods in a way that fits into the natural cycles, allows existing material to be reused again and again, and does not lead to the final depletion of natural resources. (Kiss, 1999)

Every person can do something for this, but we have to realize that it is very difficult to change a comfortable lifestyle, fixed habits. The solution is in the individual, in the family, in small groups who feel responsible for each other and our environment. (Havas, n.d.)

2.3. The role of the individual, the society and the institution in sustainability

Nowadays, there are many channels that can be used to draw the attention of all members of society to the importance of sustainability, just think of the possibilities of the media, jobs and many community activities. According to Ágnes Kertész, individuals can contribute to sustainability, among other things, by cultivating themselves continuously throughout their lives, studying the environmental, social and natural values that determine their daily lives. (Kertész, 2010) Despite the fact that parents pass on their acquired knowledge to their children, the values and attitudes of individuals can be very different. This is why there is a need for intervention at the institutional level, which is one of the very important stages of education for sustainability.

In the course of education for sustainability, it is necessary to understand the essence of the concept of a sustainable society, i.e. the relationship, connections and interdependence of man and his environment. The key step of the process is the acquisition of knowledge in various fields.

Sustainability has to emerge in all areas of life, and thus play a key role at all levels and in all forms of education. (Kiss, 1999)

Environmental education is a process where not only knowledge and skills need to be developed, but also environmental awareness, value judgment, responsibility, behaviours and sensitivity. Accordingly, the pedagogy of sustainability expands the main guidelines of environmental education with a number of factors, emphasizes attention to the actions of the present and their expected future consequences. The aim is to create a set of values that highly classify sustainability-related activities as attractive and desirable for the future. An important aspect in education is to reflect the different cultural approach to sustainability. (Juhász and Radócz, 2000)

According to the National Core Curriculum, aspects of environmental education must be reflected in all subjects. However, this alone is not enough. As Péter Havas explains in one of his works, in terms of sustainable development, subjects at all levels of education must be closely interrelated. (Havas, 2001)

By focusing on solving a given problem, the boundaries between different disciplines disappear, as we examine the same problem only by approaching it from several different aspects. At the same time, it is necessary to incorporate the elements essential for teaching the environment and sustainability into the knowledge base, methodology and daily practice of teachers. Consequently, the development of teachers' competence is also essential for successful environmental education.

2.4. Legal regulation of environmental education

Pursuant to Section 48 (3) of the Hungarian Act LXV of 2003 Amending Act LXXIX of 1993 on public education, schools must also prepare their environmental education program as part of their educational program. The law also defines the purpose of environmental education and its elements.

"The overarching goal of environmental education is to promote the development of students' environmentally conscious behaviours and lifestyles in order to enable the growing generation to prevent the deepening of the environmental crisis, promoting the survival of living nature and the sustainable development of societies." (243/2003. (XII. 17.))

"In the course of environmental education, students should learn about the current processes that result in the environmental crisis phenomena on our planet. Students should recognize the positive and negative environmental consequences of socio-economic modernization via

concrete domestic examples. Students should be involved in preserving and enriching the values of their immediate environment. Respect for nature, responsibility and the prevention of environmental damage should become decisive in their way of life. Students should gain personal experience in cooperation, joint management and resolution of environmental conflicts." (243/2003. (XII. 17.))

With the introduction of the National Core Curriculum, the guarantees of institutional environmental education were created. (Orgoványi, n.d.) The NAT-2020 document reflects a number of modern pedagogical principles and meets internationally relevant requirements for the expectations of 21st century education. (Nahalka, 2020)

The content specified in the law must gradually appear in primary school education, as a result of which, after leaving school, students can be expected to understand and be able to integrate into their own lives and everyday lives such concepts as the principle of sustainability, the limits of growth, recognizing and understanding interdependence, the principle of precaution, or basic human needs.

3. Practical implementation of institutional environmental education

3.1. Institutional environmental education

The aim of environmental education is to train people who are environmentally conscious, pay attention to their environment, live in harmony with it, and have the appropriate knowledge, attitude and motivation to do so. The task of the environmental education process is therefore to provide the knowledge, skills and commitment needed to protect the environment. Its main goal is to develop a corresponding value system and pattern of behaviour in people.

In the case of institutions, environmental education prevails as defined in the pedagogical program. As an example, in the following few lines, I present the environmental education program of the Várkerti Primary School and Associate Schools.

„We strive to create a nature-friendly microenvironment at school. We want to make our students sensitive to the state of their environment. This is also our priority as an ECO school.

Our goal is to enable our students to protect the environment, thereby promoting the survival of living nature and the sustainable development of societies. Respect for nature, responsibility and prevention of environmental damage should become decisive in their lifestyle.

The rising generation needs to know and appreciate the rich diversity of life forms in nature and culture. They need to learn to use resources consciously, sparingly and responsibly, with regard

to their regenerative capacity. The aim is environment-friendly, value-based, and sustainable behaviour based on knowledge and love of nature and the environment to become decisive for students. The institution should endeavour that students get acquainted with the economic and social processes that can cause changes and crises, furthermore help them to get involved in the preservation and enrichment of the values and diversity of their immediate and wider environment.

Our long-term goal and vision is for our students to become environmentally conscious citizens.

In order to this we need to develop in our students:

- environment conscious behaviour and lifestyle

- environmentally friendly, frugal behaviour and lifestyle based on personal responsibility

- responsible behaviour towards the values of the environment (natural and artificial), the need and will to preserve it

- love and protection of the natural and built environment, preservation of diversity

- system approach

- scientific ground for understanding global contexts

- the need for a healthy lifestyle and to master the techniques and methods leading to it.

We consider our pivotal task to shape the attitude of the students, to form and consolidate their love of the environment and nature." (Pedagogical program of Várkerti)

3.2. *Sites of practical implementation*

The practical implementation of environmental education is determined by the local programs of schools (Havas, Széplaki, Varga, 2004). All Hungarian schools are affected by the environmental education program, as it is regulated by law. The schools, however, determine individually which students will receive environmental education, when and how. As a result, we may even encounter significantly different environmental education practices from school to school.

For example, the environmental education arenas of the Várkerti Primary School and its member schools are listed below (Pedagogical Program of Várkerti):

a) lessons, out of classroom lessons

b) extracurricular activities

- day care activities

- study group promoting environmental awareness

- nature research camp

- excursions, study trips, field trips

- forest school

- celebration of special days

- quizzes, environmental education campaigns, academic tender competition

- school garden, schoolyard

- cleanliness and order of classrooms

3.3. Environmental education in light of the digital culture

Undoubtedly, one of the most defining trends of today is digitalization, which also reforms education and the process of acquiring knowledge. Although the possibilities for learning and research experience and effectiveness seem limitless today, putting these possibilities into practice is currently a real challenge. Generation Z members who are true "digital natives" have appeared on the scene of education. They grow up so that the major achievements of the recent technology are now readily available to them (Prensky 2001). Therefore we can understand that they have new expectations in relation to education, and we can address and reach them in a different way than before. For them, learning does not end in frontal classroom work exclusively within the walls of the institution, but takes place informally, through the incorporation of interactive processes.

One of the essential aspects of environmental education is the acquisition of scientific knowledge, but perhaps even more important is the educational process aiming at exploring connections. The discovery and understanding of cause and effect relationships leads to the discovery of problems that may arise during the processes, to their complex understanding and then to their effective solution. The development of STEM skills - i.e. the ability to ensure the coordinated application of the four disciplines: science, technology, engineering and mathematics - and the development of closely related competencies and characteristics directly contribute to the promotion of environmental awareness and attitude.

The latest Vocational Training 4.0 strategy reiterates that the Hungarian economic sphere needs engineers, and experts with informatics and natural science background. Graduates with MTMI skills can be prepared to achieve success in the labour market via STEM oriented skill development programs delivered by enterprises. Such training programs and the latest vocational training-related initiatives aim to achieve a 40% rate in the enrolment in such programs among students applying to higher education (Molnár et al, 2019).

The particularity of the digital culture subject is that it is especially suitable not only for the development of STEM skills, but also for the establishment and development of algorithmic thinking, which are indispensable elements for the recognition and effective solution of environmental issues and problems. During the lessons, the development of visual education, technique, creativity, logic and thinking in three dimensions will play a role. In the field of sustainability, the children work with thematic project tasks, in the solution of which the boundaries between the different disciplines disappear, the global vision is formed, connections and interrelationships become apparent, through which the interoperability between subjects is realized (Lükő, 2017).

During particular tasks related to environmental education, the main goal is to develop students' awareness of the environment and their way of life: pay more attention to their daily habits regarding the environment, such as energy or water consumption, waste management, and their relationship with living nature in general. It is important that all these activities are driven by intrinsic motivation.

The digital culture subject appears in the 3rd year of primary school education, so it can support the process of education for sustainability already in the lower grades.

Based on the content of the subjects, the possibilities of environmental education in the lower grades can be expressed mostly in the subjects of environmental knowledge, visual culture, technique, lifestyle and practice, but of course it can also play a role in other subjects at different levels. In the upper grades, natural sciences, physics, chemistry, biology, our earth and environment, as well as technology and lifestyle subjects have the opportunity to expand environmental education.

Within the framework of the digital culture subject, we can support environmental education in the younger age groups typically by creating simpler digital texts and figures, as well as presentations about the topic of nature and the environment. In case of upper grades, our toolbox is already expanding considerably, as we can use the help of block programming, robotics and

possibilities of other software applications, such as simple data processing, creation of graphs and charts.

There are plenty of subjects and topics related to the protection of environment and health. The question may arise that which topics are worth processing in digital form in the first place.

Knowledge acquired through the senses is essential for the development of symbolic thinking. All this plays a crucial role in getting to know the environment. It is necessary to involve all the senses in the process, because only in this way does the student receive complex information about the interaction and its elements. Knowledge is contained in the feelings received through the senses; from here it is transformed into knowledge during logical processing, and then into understood, independently constructed knowledge. (Nagy, 2018)

Today, there are plenty of technological tools that can help the teaching-learning process as the digital equipment of schools is constantly improving. A digital tablet, desktop computer, laptop, tablet, smartphone, VR goggles, floor robot, smart gloves, 3D printer and many more devices can be available.

With sufficient wisdom, these tools can significantly improve the efficiency of the learning-teaching process. However, we must not forget that even the most advanced digital technology cannot fully represent reality itself!

Digital tools used as tools in the process of scientific cognition (observation, experiment, measurement) can make processing and application more efficient, but they cannot provide more and easier to process knowledge than the living natural environment itself.

Knowing these, it is worth thinking about when digital technology can be used effectively in the teaching of individual topics.

Considering the aspects described, digital technology can be used well to review each topic and to systematize the knowledge. It allows students to create relationships more quickly, a process that also serves fixing. The most expedient method is to create a digital presentation or drawing related to the chosen topic. The relevant tasks are in the sections of the annexes entitled 'A. Task".

Demonstrating the relationship between learned knowledge and the interactions of everyday life is essential for understanding. In this case, too, a live, action-oriented presentation should be preferred, but the space and time constraints, or the content and extent of the curriculum, do

not always allow for this (e.g. the surface construction and destruction of rivers, the operation and effects of power plants, etc.).

In such cases, the support provided by digital tools helps to show the correlations related to everyday life and to the interactions that take place in nature.

In the case of the topic of the second annex (water cycle, forms of appearance in nature), the mentioned content and extent can be a fundamental obstacle, but with the help of the proposed application we can make it simple and easy to understand. For the lower age group, the GCompris application helps the understanding; in the upper grade we can optionally model the process with the help of program code.

Fig. 1. Paddleboat, Source: GCompris

In case of the fourth (observation of wildlife in the immediate environment) and ninth (transport) topics, space and time constraints and narrowing of opportunities may hamper the process of full understanding. In this case, we can also support the acquisition of the curriculum, even by creating program code. Moreover, in connection with this, as a toolbox of experiential pedagogy, we can enrich the relevant topic with a robotics task.

Fig. 2. LEGO BOOST, Source: Mikrobisuli accredited talent development workshop / robopet project / own image

There are cases where the demonstration of an interaction is dangerous or costly, such as the possibilities of material creation (annex 5), in which cases the applicability of digital technology is also clear.
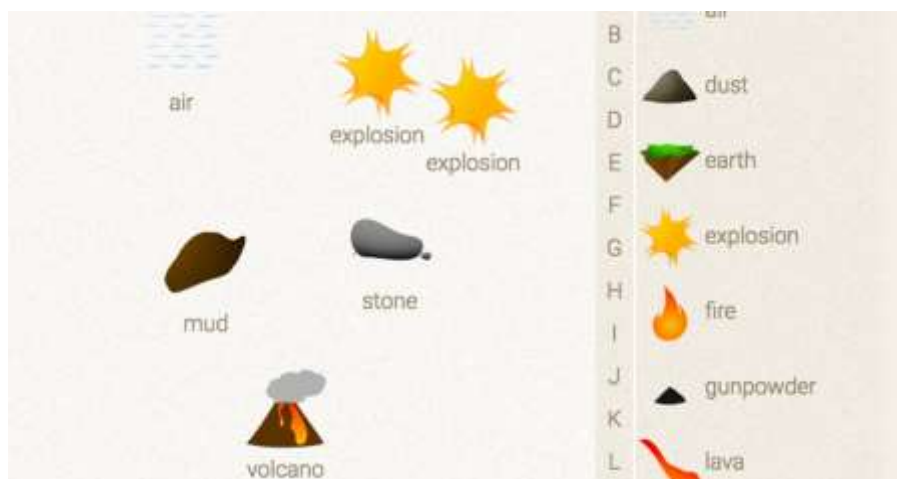
Fig. 3. Crazy Game, Source: crazygames.com

Digital technology can also be optimally used in cases where, on the one hand, a relatively long process has to be monitored and continuously evaluated, and on the other hand, where the inclusion of a measuring device is recommended, followed by data processing, evaluation and, in some cases, representation. A great example of this is the content of the topic of the first appendix with a weather study, and the content of the topic of the third appendix related to plant development. Mention may also be made here of the processing for examining the transparency of the water in the seventh topic.

Fig. 4. Plant development project, Source: Mikrobisuli accredited talent development workshop, own image

3.4. *Methodological particularities of digital culture education, analysis of the applied methods*

Featured task of the course is to develop the ability to acquire and apply knowledge independently. A combination of methods should be used in education that is suitable for developing self-learning and application skills, practical work skills. These skills create the conditions for later self-education and help students to acquire the knowledge they need to solve problems arising in their lives. (Gál, 2011)

When choosing the applied methods, the content of the teaching, the didactic task to be solved, as well as the characteristics of the students (age, abilities, existing knowledge) must be taken into account.

The topics in the appendices are also included in the curricula of the previously mentioned subjects and offer a great opportunity to deepen environmental education in connection with the subject of digital culture. The methods for acquiring the tasks in the annexes are only a recommendation, as each institution, like each group of learners, is different, so the levels and tools available may be different. Any available digital aid or target software can be used to complete the tasks. It is primarily recommended to use the Scratch development environment to complete programming tasks.

Each topic contains a so-called "A. Task". These are typically aimed at creating a digital drawing or presentation, which, in addition to helping to systematize, understand, and interpret each process, is not only easy to implement — meaning it can be issued to any age group from

grade 3 onwards — but it can also be characterized by a high degree of creativity and can be linked to any topic in any curriculum.

„B. Task" refers to an activity that is used to track a longer process through a digital work. Its huge advantage is that it shows the phases of an activity spanning a larger time interval in overall. It is especially useful for students who do not have the patience to wait for the process to happen in a natural way, or can more easily interpret and process the data with the help of a spectacularly displayed result.

Another type of task is code generation, where we solve certain tasks using program code or an application.

The advantage of the method is that it allows space for imagination and creativity, in addition to developing many skills, abilities and competencies - here we can think of information and communication technology, or even mathematical, logical abilities, and such personality traits as independence and accuracy. All of these may be accompanied by other "*additional tasks*" that serve a deeper understanding and further development.

In some parts, students may also encounter robot programming as part of the experiential teaching method. The application of robotics has many advantages, as it not only serves the application of algorithmic thinking, but also creates a connection between the individual subjects. In addition, it develops many competencies and personality traits through cooperative activity, think only of STEM skills, communication and cooperation skills, personality traits of spatial vision, perseverance, purposefulness, helpfulness, but of course we could list them for a long time.

The advantages of the methods have already been discussed, now let us mention the possible disadvantages. No matter how advanced the technology is, it will never be able to replace reality! It is not possible to process topics related to environmental education only with digital methods, since - especially in the field of natural and environmental education - the goal is primarily to receive and experience the senses in nature and the environment. Digital technology can only communicate audio-visual knowledge, which is even snatched from its original environment.

No matter how playful and simple is the chosen task, we will not necessarily achieve a goal with a humanities-minded student. It is necessary to recognize that not everyone is receptive to digital culture, in which case you have to think through the possibilities and the expected consequences.

As we have seen, the inclusion of the subject of digital culture in the field of environmental education can at best be only in the form of an additional feature or teaching session. Its effectiveness thus depends to a large extent on the teaching of other subjects related to environmental education, where it is particularly important when and at what level the given topic is taught to children. Digital culture is best able to perform its task in relation to environmental education if the given topic is taught at the same time and, of course, in the appropriate depth, in consultation with the teachers of the other subjects.

3.5. Development of digital and other competencies

Acquiring algorithmic thinking using IT tools is best suited for developing STEM skills. In the process, not only the children's information and communication technology skills develop, but also the mathematical and natural science skills, in addition to that the tasks related to coding and robotics further strengthen the acquisition of the given way of thinking and the development of the engineering approach. As a positive return, creative methods can relieve children's initial anxiety about science subjects.

It is extremely important that not only STEM skills but also closely related competencies and personality traits are developed during the sessions.

During the solution of project tasks, logical thinking and problem-solving skills develop. Interoperability between subjects is achieved, as children have an excellent understanding of processes and in many cases the solution requires the evocation and complex application of additional knowledge related to mathematics, science and other subjects, for example, we can think of some tasks related to robots. As a result, their performance in related subjects may also improve.

In addition to digital competencies, the following areas are improved in the digital processing of topics supporting environmental education:

- critical thinking and problem solving
- creativity
- logical thinking
- organizing ability
- overviewing ability
- trying new ideas, solutions
- numerical thinking

- problem exploration analysis

- planning

- checking ability

- communication skills

- cooperation skills

In effective education, the learning process goes hand in hand with personality development, so the following personality traits can also be developed excellently during the selected tasks:

- curiosity

- adaptability

- accuracy

- independence

- responsibility

- helpfulness

- empathy, tolerance

- perseverance failure tolerance

- motivation capability

- spatial vision

- purposefulness

3.6. *Differentiation and talent management*

There is a vast difference between the most talented students in an elite school and a school of students with special educational needs. Moreover, there may be significant differences between two parallel classes of an arbitrarily chosen school. At the same time, due to the heterogeneous composition of classes and groups, there are also students in each community who are able to perform better than the local average, or who are lagging behind their peers. Dealing with differences usually requires a differentiated approach which can be realized by giving different tasks to talented, average and less able students, or by having different accounts or reports for the same task. Motivation is a prerequisite for effective learning in all cases. "Personalized" or group-based tasks that require creativity help maintain interest. Monotonous, sometimes over-thought-out tasks often lead to a loss of motivation. To this day, the extent to which talent depends on the child's innate abilities and the role of the environment and upbringing are not precisely defined. However, it is a fact that the most important elements of

talent - skills, creativity, commitment to the task - can be developed. From the point of view of commitment to the task, motivation, it is important to make a well-thought-out choice of practice tasks. (Gál, 2011)

Digital exercises are typically of a reproductive nature, where a pre-prepared, possibly collected document or presentation has to be made repeatedly for the student.

Each element of the document or presentation, its appearance and position are determined by the detailed instructions of the task description. For students with lower abilities, meticulous formulation of tasks can provide security. With some practice, they get experiences of success, they can achieve good results. Therefore, in the case of weaker students, it is advisable to supplement the presented exercises with comprehensive instructions that cover all aspects.

For more talented students, these tasks, in addition to not developing creativity, greatly destroy motivation. For them, it may be sufficient to formulate the task in a single sentence. However, assignments that do not provide a detailed description and allow students to be creative can only be published in this form if students are already aware of the basic rules for making a presentation, gathering and organizing information, and know the expectations of the specialist teacher. (Gál, 2011)

In the case of intermediate students, of course, it is necessary to move between the two endpoints of the scale set up in this way, sometimes assessing what is the minimum set of instructions that is absolutely necessary to solve the task.

4. Summary

As long as the future could have been roughly estimated from the present, and there was little difference in the lifestyle, the transfer of knowledge wrapped in the curriculum was suitable for everything. Today, however, the world is changing at an almost untraceable pace. Emotions and attitudes towards our environment change faster than generations follow each other. It is inevitable to understand the factors and processes that affect the state of our environment, to find the connections between adverse changes and the human activities that create them. We need to find an answer as soon as possible on how to prevent environmental disasters, how to live in a way that has the least, but still acceptable, environmental impact, and our decisions at what cost - effecting the environment as well - can sustain our economy. Environmental

problems can exclusively be solved if we respond in a timely and meaningful manner, and if we grow up and educate with the purpose and importance of environmental education in mind.

In this article, presenting the purpose and importance of environmental education, I dealt with sustainability education and the roles related to it and I extended my inquiry to the legal regulation and institutional implementation of environmental education.

The section on the practical application of the subject of digital culture, which is especially suitable for supporting environmental education, in addition to the effects of digitization and STEM skills also discusses which topics are suitable to be processed in digital form. The methodological peculiarities of teaching the subject of digital culture are discussed below, and the methods used for the support are also analysed, together with the presentation of the advantages and disadvantages. The topic of developing digital and other competencies, as well as differentiation and talent management were also included in the article. The annexes contain a series of good practices with detailed task descriptions and solution guidelines. Of course, the range of topics can be expanded at will. The processing recommendations given in the study show a possible approach to the problem, and a number of additional or different tasks can be presented for the mentioned topics.

Appendices

Appendix 1

Topic: Observation of the elements of the weather

Task B: prepare a calendar of weather supported by digital tools.

Guide:

1.   Edit the elements of the weather: wind, sun, cloud, precipitation. Each element has several forms of appearance.

2.   Create a template where you can insert an item specific to that day.

Additional tasks:

-      We record not only one element by day, but more, sectioning it to two or three parts.

-      Measure several properties a day - temperature, precipitation, humidity - which are recorded in the template.

-      Prepare diagrams based on the recorded data.

Appendix 2

Topic: The water cycle, its manifestations in nature

Task A: Prepare presentation or digital drawing about the topics listed below:

-      Waters of the settlement and its surroundings.

-      Types and appearance of stagnant and flowing waters.

-      Investigation of different types of precipitation.

Coding: Use the GCompris application or create a program that illustrates the water cycle

Guide:

1.   Create the characters: sea, sun, cloud, river, water tower, water treatment plant house.

2.   Program the process: The sun makes the seawater start to evaporate. The vapour forms clouds. Rain starts to fall from the cloud. The level of the rivers is rising. River water is transported by pumps to a water tower and from there to a water treatment station. The purified water gets into the houses also through pumps.

Appendix 3

Topic: Observation of plants in the immediate environment

Task A: Prepare presentation or digital drawing about the topics listed below:

- Basic knowledge of plant care.

- Observation of cultivated plants.

- The role of our vegetal foods, vegetables and fruits in a healthy diet.

- Investigation of environmental conditions essential for plant life.

- The impact of environmental changes on plant life.

Task B: Creating a plant care calendar with the support of digital devices.

Guide:

1. Sprout and then plant a bean.

2. Monitor the development of the plant, record the data at regular intervals, take photos, videos, sound recordings as desired.

3. Create a calendar or presentation from the available files.

Additional task: Make a diagram from the recorded data.

Coding: Create a program that demonstrates the development of a plant

Guide:

1. Create the characters: drawings of the plant at each stage of development or different stages of growth of a plant growing on soil or in pot.

2. Place each developmental stage in a circle on one edge of the screen. The developing plant is in the centre of the screen.

3. Indicate the stage of development we are at and then develop the plant accordingly. Make the sections follow each other every two seconds.

Appendix 4

Topic: Observation of fauna in the immediate vicinity.

Task A: Prepare presentation or digital drawing about the topics listed below:

- The difference between the lives of wild, farmed and pet animals.

-        The diversity of wildlife, interesting animals

-        Comparison of animals based on a chosen criterion.

-        Protected plants and animals

-        Presentation of the typical bird species of the landscape in a few sentences with pictures and accompanying bird sounds.

-        Keeping and caring for a pet

Coding: Create a program that introduces farm animals

Guide:

1.   Draw the characters: horse, cow, hen, pig, sheep, goat

2.   Place the characters, then at a click on any of the characters, display a few sentences about it, a picture, and the voice of the animal in a new program window.

Coding: Create a program in which a puppy can be cared for

Guide:

1.   Draw the characters: dog with multiple costumes, feeding bowl, sleeping basket, leash, ball

2.   Place the dog in the centre of the screen, while the characters needed for care in the four corners of the screen.

3.   By clicking on a chosen character, the dog should go to that location and perform the selected action.

Additional task: Clicking on the ball should lead to a choice from several games. Optionally take the dog through an obstacle course or get out of a maze.

Robotics task:

Robopet: build a robot kitten or robot dog and get it to move, if possible make a sound as well.

Appendix 5

Topic: Properties and relationships of substances in the environment

Task A: Make a presentation about the process of the formation of a selected substance

Coding: Use Little Alchemy application or create materials with program code!

Guide:

1.   Create the four primordial elements as characters

2.   Make the program to create a new material by dragging two chosen characters on top of each other in case of a right combination

Additional task: The created new materials could also be used to create other new materials. To simplify the program, we recommend that a maximum of ten materials could be created.

Robotics tasks:

Search for the sun: the task of the robot is to determine the direction from which the highest light intensity can be measured, and then to turn any device in that direction.

Windmill: operate a windmill with the help of a robot!

Measure humidity: use a digital tool to determine the humidity of the soil.

Appendix 6

Topic: The main features of our life.

Task A: Prepare presentation or digital drawing about the topics listed below:

-      Creating the right agenda: learning, outing, moving, resting, eating time.

-      Proper behaviour in nature.

-      * The most common harmful effects of the environment on our body.

Appendix 7

Topic: The cleanliness and pollution of our environment.

Task A: Prepare presentation or digital drawing about the topics listed below:

:

-      Sources of pollution in the environment, the impact of pollution on humans and creatures.

-      Possibilities of prevention, defence.

-      Process of cleaning water, soil and air

Robotics task:

Water testing: examine the transparency of the water using a digital device.

Appendix 8

Topic: Our household appliances, recyclable materials, waste collection.

Task A: Prepare presentation or digital drawing about the topics listed below:

- Getting to know different energy consuming devices, comparing their energy consumption.
- Environmentally friendly consumption habits, waste management, water saving.
- What are the recyclable materials, what can be made of them
- How a modern waste processing plant works
- Waste collection

Coding: Create a program in which selective waste collection can be implemented.

Guide:

1.   Create the characters: at least four different types of garbage and four bins

2.   Solve it with a program to get a warning message in case you try to put the selected trash in the wrong bin!

Robotics task:

Cleaning robot: build a robot capable of pushing aside or grabbing smaller objects. Get the robot to either push the garbage in its path aside, or collect it to a designated place.

Waste separation: build a robot that can distinguish between scrap metal, paper or PET bottle.

Appendix 9

Topic: Traffic

Task A: Prepare presentation or digital drawing about the topics listed below:

-    Cycling, getting to know signs, lights, road signs

-    Modern means of transport and their pollution

-    Environmentally friendly modes of transport, energy saving vehicles.

-    The electric car

Coding: Create a quiz program with traffic signs topic

Guide:

1.   Create the characters: look for pictures of traffic signs and create characters from them adding three possible answers with the letters "a", "b" and "c".

2.   The program will display the characters one after the other and ask for the letter of the correct answer. Do not proceed to the next traffic sign until the user has found the appropriate definition for that traffic sign.

Appendix 10

Topic: Our habitat and our objects

Task A: Prepare presentation or digital drawing about the topics listed below:

-      Presentation of the advantages and disadvantages of urban life

-      Presentation of village life

-      Crafts and their products. The process of making a product.

Appendix 11

Topic: Data collection

Task A: collect digital content links for the topics below:

-      Nature films

-      Plant and animal identifying online applications

-      Games related to nature and environment

-      Interactive tasks related to nature and environment

References

243/2003. (XII. 17.) Korm. Rendelet a Nemzeti alaptanterv kiadásáról, bevezetéséről és alkalmazásáról (Gov. decree on the issuing, introduction and application of the National Core Curriculum)

Gál T. (2011). Tehetséggondozás és informatika. (Talent management and informatics) MFPI, Budapest.

Havas P. (2001). A fenntarthatóság pedagógiája II., (The pedagogy of sustainability II) Új Pedagógiai Szemle, 10/2001.

Havas P. (n.d.). A környezetvédelmi tudatformálás színterei és módszerei. (Sites and methods of shaping environmental awareness) http://korlanc.uw.hu/download/kornyezet.doc

Havas P. - Széplaki N. - Varga A. (2004). A környezeti nevelés magyarországi gyakorlata, (Environmental education in Hungary) Új Pedagógiai Szemle, 1/2004.

Juhasz L. – Radócz L. (2000). Oktatás a fenntartható fejlődésért. (Education for sustainable development) Mezőgazdasági Szaktudás Kiadó, Budapest.

Kertész Á. (2010). A környezeti nevelés lehetőségei egy általános iskolában (Environmental education options in an elementary school)

Kiss F. (1999). Fenntartható fejlődés. (Sustainable development) http://www.nyf.hu/others/html/kornyezettud/mm/ff/Nyitolap.htm

Láng I. (2002). Környezetvédelem - Fenntartható Fejlődés. (Environmental protection – sustainable development) http://kornyezetbarat.hulladekboltermek.hu/files/pdf/dr_lang_istvan_a_kornyezetvedelem%20_es_a_fenntarthato_fejlodes_kialakulasa.pdf

Lehocky János (1999): Iskola a természetben avagy A környezeti nevelés gyakorlata.(School in nature, the practical aspects of environmental education) Raabe Klett Könyvkiadó Kft., Budapest.

Lükő I. (2017), Oktatás és fenntarthatóság az ENSZ Fenntartható Fejlődési Célok (SDG 2016-2030) rendszere alapján, (Education and sustainability according to the Sustainable Development Goals System of the UN, SDG 2016-2030) EDU, Vol. 7, No. 3, pp 7-31.

Molnár, Gy. - Szűts Z. -Orosz B. (2019). From drawings to digital devices - Additives to the history of content and methodological development of engineer training in Hungary, In: Nagy, Balázs Vince; Murphy, Mike; Jarvinen, Hannu-Matti; Kálmán, Anikó (szerk.) Varietas delectat... Complexity is the new normality, Budapest, BME, pp. 795-805.

Nagy Gy. (2018). Digitális kihívások a környezetismeret oktatása terén. (Digital challenges in environmental education) https://doi.org/10.17165/TP.2018.4.7

Nahalka I. (2020). Vélemény a NAT-2020 természettudományos nevelést érintő részeiről. (Expert opinion on the natural science section of the National Core Curriculum) https://nahalkaistvan.blogspot.com/2020/02/velemeny-nat-2020-termeszettudomanyos.html

Orgoványi A. (n.d.). Művészet és természeti nevelés (Art and Environmental Education)

http://www.tabulas.hu/cedrus/1998/04/merito2.html

Prensky, M. (2001). *Digital Natives, Digital Immigrants*. On the Horizon, 9, 1-6. o.
Rókusfalvy P. (2000). Mi a környezetpszichológia? I. rész, (On environmental psychology) Új Pedagógiai Szemle, 4/2000.

Ruth W. (1994). A rácsodálkozás képességének kialakítása a kisgyermekkorban. Wilson, Ruth A.: Fostering a Sense of Wonder During the Early Childhood Years (Columbus, OH : Greyden Press, 1994). Fordította: Adorjánné Farkas Magdolna.

http://www.tabulas.hu/cedrus/index1.html

Várkerti Általános Iskola pedagógiai program. (General pedagogical program of the Várkerti Elementary School) http://varkerti.hu/home/iskolai-dokumentumok/

Wikipédia. Fenntartható fejlődés (Sustainable development) . https://hu.wikipedia.org/

About Authors

Éva Karl works as an IT and mathematics teacher at the Várkerti Primary School and Associated Schools in Várpalota, and also runs the Mikrobisuli accredited IT talent management workshop. As a programmer, she also participated in the development of a satellite data communication system related to digital television, and also worked in high school as an IT teacher and system operator. She completed her higher education at the Széchenyi István University of Győr's master's degree program in teacher-engineering with a summa cum laude

qualification. Her field of research is the possibilities of developing STEM skills with the help of IT tools.

György Molnár is an associate professor, electrical engineer, teacher of engineering, medical biologist engineer, pedagogue with special qualification examination in the field of public education manager, who works at Budapest University of Technology and Economics (BME), Faculty of Economic and Social Sciences, Department of Technical Education, and Budapest University of Technology Teacher Training Centre.

The graduation from BME as an electrical engineer in 2000 was followed by gaining a multidisciplinary university medical biologist engineer degree at BME. Followed by this, having entered the world of work as an engineer, he started new studies in the field of pedagogy as a teacher of engineering from 2001. From this time on, his academic studies and teaching activities have been carried out at the Department of Technical Education, successor of the ever-prestigious Institute of Pedagogy. He also applied for his doctoral PhD programme at this department, and finished that at the Eötvös Loránd University Doctoral School of Education. He has been teaching at the Department of Technical Education since 2001. He habilitated in 2018 on digital pedagogy. His fields of research include the basic aspects of ICT, the methodological and innovative issues of vocational teaching which have enabled him to research new, atypical and electronic teaching-learning paths.

Comparative analysis of the methods of teaching geography in different types of schools

Sándor Rajmond Simonyi, Erika Homoki

*Eszterházy Károly University, Institute of Geography and Environmental Sciences
Leányka street 6. Eger 3300 HUNGARY,*

sandor.simonyi95@gmail.com, homoki.erika@uni-eszterhazy.hu

Abstract

As an entrant teacher, it has been a major issue for us to identify the problems and circumstances of teaching geography in various schools. We have been interested in the opinion of teachers about the state of education, their practical experience and solutions. As part of our research, lessons were observed in five different types of schools and semi-structured interviews were conducted with the teachers afterward. We complemented these with an online survey which was filled out by 122 geography teachers throughout the country. A diagnostic measurement and an attitude research took place in the monitored classes, where the sample included 131 people. Mostly close-ended questions were applied where Likert Scale types were significant in order to analyse the results of the survey more efficiently. The results of the diagnostic tests did not indicate significant difference. However; the survey denoted that applying diverse methods results in acquiring a deeper knowledge. Furthermore, not the type of the school, but the personality of the teacher was the most determining in knowledge transfer and student activity during class.

1. Introduction

Nowadays, parents are able to choose from a wide range of types of high school for their children. It is important for the entrant teachers and the professors of methodology to know all of these possibilities in order to adjust to the workplaces where they will work in the future. The point of view of the future colleagues who have more experience can give an interesting insight into the work that takes place in the schools. Furthermore, their suggestions for solving the already emerged problems deserve special attention. The opinion of students about the classes of the interviewed teachers can give even more details about the situation. Which is the teaching method and form of student participation in class that is enjoyable for both students and teachers while providing an effective learning progress? Choosing the school is the main

decisive factor, or is it about the applied methods, different ways of teaching, personality of the teacher and the attitude of the students?

2. The aim and goal of the study

This current education system has problems that needs be solved. According to our opinion and the concerning literature, these can be summarized as follows: (Forgó, Kis-Tóth, Hauser 2008; Homoki, 2017):

1. Various abilities and skills of the students (learning method, pace, comprehension, etc.).
2. Different fields of interest, attitudes of mind (humanities or STEM, theory or practice – all of these can be found in geography).
3. Personality and know-how of the teacher with his pedagogical culture.
4. Diverse educational framework which – according to international surveys - significantly influences the quality of teaching (equipment, teaching staff, quality of service). This results in the fact that peripheral areas lag behind.

In the course of the research we examined different school types: two public high schools, a special, a practicing, and a private one. These were located in various types of settlements: capital, county seat, city, and village. With respect to our aim, we collected and compared the following data: teaching methods applied in different institutions, which of these methods are dominant, how much these methods correspond to the didactic function of the class, and lastly, how much the students can perceive the knowledge that is delivered to them in this manner.

These were our hypotheses of the research:

1. The application of diverse methods leads to more effective acquisition of knowledge and/or skills.

2. Illustration positively influences the comprehension of material and the attitude of students towards learning. On the other hand, the lack of infrastructural equipment can degrade the standard of education and makes it harder to acquire knowledge.

3. Based on the abovementioned, our assumption was that the „rank" of the school is insignificant and the determining factor is the personality of the teacher.

3. Methods

Within the research, we applied the methods of school attendance and classroom observation, interview and survey in order to have the answers for our questions. We drew a conclusion about the school methods mainly from classroom observations and the interviews with the teachers. For the preparation of examinations we used the works of Babbie (2003), Falus, Ollé (2000), and Falus (2007) from the field of pedagogical research methodology. The online survey was filled out by 122 geography teachers throughout the country. Furthermore, 131 people were included in the diagnostic measurement and attitude research in the monitored classes. The applied methods are both qualitative and quantitative which include classroom observation, interview, survey for teachers and the measurement of the attitude of students. Simonyi Sándor, entrant teacher performed all of the data collection.

An informal monitoring took place during the classroom observation in order to collect empirical data. The defined goals of the observation were to note the applied methods and to inspect the attitude of the teacher. The classroom observations happened in arranged times and the entrant teacher was a passive observer. Different topics were covered in the classes during these observations. This pre-arrangement led to the disadvantage that the teacher did not always behave and teach naturally, as he usually does. The methods of these visits were causal and comparative (Lengyelné, 2013), since the aim was not only to collect data but to reveal the causal relationship and to compare the different types of schools. Reports which were made about every visit were standardized in question groups and quantified finally.

The semi-structured, individual interviews were another part of data collection where the subjects answered open-ended and close-ended questions. Mainly open-ended questions were used where the subject could reply with his own words. Therefore, we could assess the subject's point of view and way of thinking on the given topic (Lengyelné, 2013). A soft atmosphere was created by the behaviour of the interviewer where the missing information could be acquired with follow-up questions (Babbie, 2003).

4. Results

We highlight the applied methods from the results (Table 1). Teaching methods are classified into three main groups: classical (illustration, explanation, lecture, discussion), interactive (debate, presentation) and new-generation method (project, cooperative work) (Falus, 2007).

Table 1: Summary of the frequency of methods used in the different types of schools (self-edited)

Classified methods	Primary school	Practising high school	High school in a smaller city	High school in the capital	Private school
Narration					
Lecture	x	x		x	x
Question method	x	x			x
Explanation	x	x	x	x	x
Discussion	x	x	x	x	x
Part summaries, repetitions	x	x		x	x
Student's presentations			x		
Debate	x				
Homework	x				x
Creating an outline (using the board/projector, by dictating)				x	x
Self-reliant work	x			x	x
Audio-visual devices		x	x	x	x
Illustration	x	x	x	x	x
Complex Instruction Program	x				
Cooperative method					
Simulation, roleplay, play					
Project method					x
Total amount (pc):	10	7	5	8	11

During the observations, we examined the application of verbal methods, individual methods, illustration and the frequency/occurrence of new methods (Table 1). These results can be correlated with the efficiency of the diagnostic measurement. By this measurement, it can be declared that the school which used the most methods performed the best. The efficiency of the schools was measured with a diagnostic test. This was applied in order to compare methods of the schools with student performance. Only the private school did not participate in filling the test, therefore, we acquired information from 131 students from 4 different schools. The test contained tasks of various levels with major topics of the general curriculum of Geography. The compilation was based on the PhD thesis of Erika Homoki, the GCSE (General Certificate of Secondary Education) of Geography, coursebooks of Hungarian Institute for Educational Research and Development, PISA surveys, and was supplemented by our own questions. We paid attention to completion of the test so it could be done during the time of one lesson, and the participants were from classes 10th or 11th. Only one 8th class was involved in writing the test due to the special CIP teaching strategy at the school. This did not arise any problem since only those topics of Geography appeared in the test which had already been discussed in class, due to the lineo-concentric arrangement of the subject Geography. We aimed to have various types of questions and tasks with different levels of knowledge.

According to the data of Table 2, the tasks for application level of knowledge succeeded best, although these were relatively less present. Actually, tasks concerning identification level of knowledge had the best results, since guessing plays an important role here, especially in case of alternative choice questions or a quantity comparisons (Table 2). Denomination and reproduction level tasks were the weakest. These surveys are intended to be repeated for acquiring more objective results with a larger number of samples. In addition, we consider it important for tasks with different level of knowledge to be more proportionate in the diagnostic test.

Table 2: Results of the diagnostic test based on levels of knowledge (%)

Type of school	Identification	Naming	Reproduction	Application
Special primary school	63	63	53	77
Practising high school	63	63	34	83
High school in a smaller city	61	66	38	89
High school in the capital	68	44	45	83

In the case of the diagnostic measurement, a statistical relation existed. Moreover, classroom observations showed that the verbal methods are still dominant in schools and that new methods (CIP, cooperative techniques, heterogeneous grouping of students) can only be observed in special primary school and in private school. Additionally, the methods were used in the most diverse way in these latter types of schools. In addition, the practical application of ICT devices was only experienced in those schools, as well.

We grouped the 26 questions of the interviews: firstly, the circumstances of teaching (tools, classroom), secondly, the applied method and lastly, innovation. We created a word cloud from the most frequent expressions, the following contains the analysis of its content (Figure 1).

Figure 1: Word cloud made of the interview answers

If we summarise the answers of the interviews, we conclude that the most frequently used method of the interviewed teachers is the board with chalk or pen, as schools cannot afford to invest in **interactive boards**. There are schools with interactive boards; however, their functions are not always fully utilized (Makádi, 2011) or the necessary software is not installed on the computer in the classroom. Accordingly, the board is only used as a projector. A reason for this may be the lack of competence for proper use (Farsang, 2011). As a solution, there are further trainings in some schools.

We highlighted the analysis of the use of maps which is a significant tool in geography. Surprisingly, none of the schools uses atlas and only three of them work with wall maps. The lack of atlas was explained by the fact that students usually do not bring them to class. According to the interviews, wall maps are not used since there are no specialized classrooms for them and due to insufficient financial resources for buying a new or changing old, outdated or torn ones. Where wall maps are applied, teachers have to bring them to every single class during the year as a geographical name or notion can occur anytime which can be shown to the students. Every school works with online/electronic maps. Its main advantage is that they can use it in case of a missing wall map and the continent can be shown by PowerPoint or even Google Earth.

Most of the schools do not possess a specialized classroom (in case of the observed schools only two out of five have it and both of them are in the capital), even though teachers say it would be important. Collecting all the tools (literature, workbooks, maps, etc.) and storing them in a systematic way would result in accessibility and a more effective usage. Experiments could be done more frequently and efficiently, even interactive boards would have a proper place. On the other hand, according to our classroom observations and the literature (Fűzi, 2015), a Geography lesson can be successful with the diverse use of simple methods (Makádi, 2005).

Teachers could **draw on the board or create an outline**. They have considered it important to involve students into the process of drafting or drawing. Creating an outline at the board is sometimes substituted with ppt presentations; however, several teachers use both techniques side by side. For demonstrating geographical processes, drawing on the board is said to be significant. In their opinion, a well-prepared geography teacher builds the lessons logically so that knowledge transfer succeeds even with a single chalk. Any kind of verbal method of explanation and revelation of the causal relationship is essential because it helps the students understand and create the logical connections and in their minds.

Teamwork is applied and appreciated in almost all of the schools. The teams are created mostly by the teachers, who use several kinds of methods for this. Summing up the answers of the interview subjects, we can say that they group students into teams differentially and randomly. Sometimes they create homogenous and heterogeneous teams in order to reach the common outcome. Occasionally, students can choose who they would like to work with. It is essential for the teamwork to be playful at the same time, and that children could help and improve each other. It also must be taken into consideration that there cannot be any conflict among those who are in the same team. Besides teamwork, pair work and student pairs are used as well. Moreover, cooperative teamwork and project works take place once or twice a year.

As the results show, responding to the research questions, we can state that **the use of diverse teaching and working methods lead to a more effective acquisition of knowledge in the examined schools**. It was proved by the average of diagnostic measurements of schools and the summary of the methodology acquired from class observations. The best result appeared at a high school in the capital where during the observed lesson, the teacher adopted eight kinds of methods with dominant illustration, besides using the 45% of verbal methods. Ten methods were applied in the special primary school. However, most of them were verbal (75%), but illustration was significant there, too. The results of the other schools were weaker which can be explained by the less diverse methods.

The infrastructural equipment and the performed illustration positively influences the comprehension of the material and the students' attitude towards learning. At the end of the classroom observations, the participant students had to fill in a three-question survey measuring their attitude and how they felt themselves during the lesson. 61% of the students are rarely or never bored during geography classes. However, one third of the students (32%) usually or always find the lessons boring, the remaining part (7%) also feel this way frequently. In spite of, more than 51% of the students have a positive attitude towards the education of geography, although students in high school of smaller cities are more likely to get bored.

The following question was how much they liked geography. We state that 76% of students like it, 23% do not, ten students did not answer this question. Viewing it in details at different types of schools: 90% of special school, 83% of practicing school, 47% of high school in a smaller city and 70% of high school in county seat or the capital like geography lessons. Thus, students who are not bored like the lesson, and there are some scholars who also like it even though they consider it to be boring. This contradiction may stem from the compulsion to conform constraint towards the expectation of teachers (Fűzi, 2015). The answers are consistent only in case of high school in smaller cities.

In our opinion, the teacher's personality had the largest influence on the students' achievement and attitude towards the subject in the examined schools. However, we can talk about other influencing factors as well, like the infrastructural equipment or an interactive board. Since there is no significant difference between the results of diagnostic measurement and the teaching methods, this leads to a conclusion that the teacher's personality can have an impact on the activity and achievement during the lesson. It means the „rank" of the school may be insignificant and the personality of the educator is what matters. The positive attitude of the students (teacher's personality) makes the process of the teaching the subject more successful. Sutton's research (2005) also confirms that a beloved teacher with a positive attitude and personality, who has consistency in teaching and clear requirements can result in more productive dialogs and less common for students to avoid assignments (Fűzi, 2015; Rotgans, Schmidt, 2011).

5. Summary

Lifelong learning is necessary in the teaching geography as geographical processes are constantly changing (countries, borders, society, and economic process), and the inquiring children need answers for their emerging questions so that educators have to be up-to-date. It

is of utmost importance to keep pace with the development of technology, as it was said by the interviewed teachers. In those schools that possess an interactive board (four from the observed ones), students enjoyed the lesson more as they could use the board themselves. According to them, it helps them memorise and classify new material, for instance in case of summarizing. However, not all of the schools can afford such an equipment so they use other devices, for example computers or projectors that enable the demonstration of videos and pictures. There are some schools that do not have projectors in all of the classrooms that is why the teachers have to arrange the lessons in advance and decide which teacher can use the given classroom and when. Unfortunately, frontal teaching is still the primary method in most of these places which is compensated by teamwork. In the interviews, teachers replied they use this frontal method because they feel it is the best way of teaching the most material without illustration and any additional equipment. Although, these days more researches proved it to be – at least partially – false (Merényi, Szabó, Takács, 2006). The worst achievements took place in those schools where there was no opportunity of using an interactive board and there were only a few projectors; moreover, where the teaching methods were less diverse. This is proved by the result of the diagnostic test as well.

It can be concluded that it is not the rank of the school that can make the process of teaching successful, but its environment, atmosphere, equipment and the values and attitude of the teachers working there. Furthermore, the location of the school in the country is irrelevant. Nonetheless, due to the regional division of society, we cannot ignore the spatial situation of the school, the attitude of the student, motivation and commitment towards learning. This field of public education needs strong developments in order to eliminate these problems.

Acknowledgement

References

Babbie, E. 2003. A társadalomtudományi kutatás gyakorlata. Balassi Kiadó. Budapest. p. 564.

Falus I. (szerk.) 2007. Didaktika. Nemzetei Tankönyv Kiadó. Budapest. p. 550.

Falus I., Ollé J. (2000). Statisztikai módszerek pedagógusok számára. OKKER Kiadó. Budapest. p. 372.

Farsang A. (2011). Földrajztanítás korszerűen. GeoLitera. Szeged. Az információs - Kommunikációs Technológiák (IKT) és a földrajzoktatás 149-155.

Forgó, S. Kis-Tóth L., Hauser Z. (2008). Az oktatás problémáiról. MÉDIAINFORMATIKA A multimédia oktatástechnológiája. EKF LÍCEUM KIADÓ, EGER 2008.

Fűzi B. (2015). Didaktika és oktatásszervezés. Letöltve: https://regi.tankonyvtar.hu/hu /tartalom/tamop412b2/2013-0002_didaktika/tananyag/00-borito-150604a-halvanysarga-14-Fuzi.Beatrix.html

Homoki E. (2016). Content and educational conditions of geography as a subject reflecting the comparision of some Central European countries. Analele Universitatii Din Oradea Seria Relatii Internationale Si Studii Europene. VIII. pp. 99-112.

Lengyelné Molnár T. (2013). Kutatástervezés. Eszterházy Károly Főiskola. Eger. Az interjú. p. 109-117. http://mek.oszk.hu/14400/14492/pdf/14492.pdf

Makádi M. (2005). Földönjáró : Módszertani kézikönyv gyakorló földrajz tanárok és hallgatók részére: I. kötet. Budapest: Stiefel-Eurocart Kft.

Makádi, M. (2011). A földrajztanárok módszertani kultúrája. Földrajzi Közlemények, 135(2), 125-133.

Merényi Á., Szabó V., Takács A. (Szerk.) (2006). 101 ötlet innovatív tanároknak Jedlik Oktatási Stúdió Bt. https://sites.google.com/site/vzsuzsa/kiemelt-fejlesztesi-terueletek/a-tanulas-tan/oetletek-fejleszto-anyagok/101-oetlet-innovativ-tanaroknak

Rotgans, J., Schmidt, H. (2011). The role of teachers in facilitating situational interest in an active-learning classroom. Teaching and Teacher Education, Vol. 27 pp. 37-42.

Sutton, R. (2005). Teachers' Emotions and Classroom Effectiveness: Implications from Recent Research. The Clearing House, Vol. 78. No. 5. pp. 229-235.

About Authors

Sándor Rajmond, Simonyi, fifth-year student at the Eszterházy Károly University in the programme of Teacher of German, History and Civics. In 2018, he got second place in the Student Research Societies (TDK) contest of the Institute of Geography and Environmental Sciences which enabled him to take part in the National Scientific Students' Associations Conference (OTDK) in 2019. The topic of his research was the comparative analysis of the methods of teaching geography in different types of schools. His consultant was Erika, Homoki PhD. Since February 2020, he has been the educational demonstrator of the Institute of Geography and Environmental Sciences at the Eszterházy Károly University.

Erika, Homoki PhD, is the associate professor of the Institute of Geography and Environmental Sciences at Faculty of Natural Sciences at the Eszterházy Károly University. She is the methodologist of teaching Geography, in charge of the teacher training in Geography, and she is also the educator of most of the optional cultural courses. She participated in higher education at the University of Debrecen and acquired there her doctorate level, as well. She is a high school teacher of Geography and Biology. She is a geographer with landscape/environmental management and regional development specializations. The title of her PhD research (2016) and her research field is: „The connection of geographical knowledge, skills and the everyday life according to the examination of different social groups".

Measuring inhabitants' knowledge on technical features and physiological effects of light pollution

Mika, János[a]; Apró, Anna[a]; Balogh, Szabolcs[b]; Hankovszki, Mónika[a]; Kertész, Alex[a];

Novák, Richárd[a,c]; Pintér, István[a]; Sütő, László[a]

[a]Eszterhazy Karoly University Institute of Geography and Environment, 3300 Eger, Hungary,
[b]Debrecen University, Doctoral School of Geosciences, 4032 Debrecen, Hungary
[c]Bukk National Park, Directorate, 3304 Eger, Hungary.
E-mail: mika.janos@uni-eszterhazy.hu, apro.anna@uni-eszterhazy.hu, balogh.szabolcs@science.unideb.hu,
monci961114@gmail.com, imphilipmorris@gmail.com, novakr@bnpi.hu, istike9805@gmail.com,
suto.laszlo@uni-eszterhazy.hu

Abstract

Light pollution is a new environmental challenge. We emit more light than necessary, and this is often done at wavelengths that are disturbing and even harmful to human health. In this situation, Dark Sky Parks, where there are no artificial light sources that burden the environment, have been established. Two of these parks are located in BAZ County, near Répáshuta, and in Hajdú-Bihar County, near Hortobágy. The present study reports on a questionnaire survey conducted in Répáshuta and in Hortobágy, inhabitants of which are informed about light pollution, and in Cserépváralja and Újszentmargita villages, located near the previous pair of settlements, not directly warned about the problem. With a direct on-site survey, we asked 21 questions to over 30-41 persons in the four settlements, and received answers taking full account of anonymity of the respondents. Recruitment took place in April-May, 2019 and November-January, 2020. The questions of the questionnaire are focused on the effects of lighting, the lighting habits, the relation of responding persons to the stellated sky, and additional knowledge on energy saving. The survey took place between November 2019 and January 2020. In the present study we have space for detailed presentation of eight questions.

Keywords: light pollution; lighting modes; human health; animals; astronomy

1. Introduction

Light plays a very important role in life on Earth, since there is no biosphere without it (Csörgits and Gyarmathy 2006; Kolláth 2009; Gyarmathy 2016). Organisms have adapted to the life cycles through historical geology by their evolution with various behavioural processes and characteristics: light is an essential source of energy for plants by photosynthesis; it is a key factor in the orientation of some birds, movement of insects, and feeding of mammals (Csörgits 2000; Csörgits and Gyarmathy 2006). As a biological being, people are affected through their

biorhythm, which is often completely deviated by artificial lighting, risking the physical and mental health in long-term (National Sleep Foundation 1 2020).

The use of light in the perception of visual stimuli is a process that can be learned, which is called light adaptation (Estefánné Varga et al. 2001). Separation of light and darkness is learned quickly as a child, but the emotional processing of it has a negative point as night-time anxieties. The intensity and the direction of the light source are also found instinctively, but the perception of different shapes, colours and movement in detail is a more complicated process.

However; we also know that the length and depth of rest phases also affect learning, especially for growing children; while the rest phases are also greatly influenced by the use of light in the pre-sleep period (National Sleep Foundation 2 2020).

Nowadays, the determination of the extent of disturbance and pollution is the main direction of the researches, which is analysed by various disciplines using different methods. One of the best-known indicators is the Human Influence Index (HII), created by the Institute of Earth Sciences at Columbia University and the Society for the Conservation of Wildlife (WCS - CIESIN 2005). This is significant for our study because a parameter of the complex HII is based on the NASA's light pollution model which represents the spatial extent and intensity of artificial light (NASA 2017).

The OTÉK (National Settlement Planning and Construction Requirements) (1997) defines light pollution as "Artificial disturbing light which illuminates above the horizon, or not exclusively on and in the direction of the surface to be illuminated, or at an inappropriate time, causing glare, artificial glare of the sky or adverse physiological and environmental effects, including adverse effects on wildlife.

In terms of ecosystems, the negative effects of light pollution are described on the lives of plants, insects and birds. In the case of the human body, it has a serious impact on the reduced production of the melatonin hormone known as "the hormone of darkness". This natural hormone plays an important role in regulating the functioning of the body. (Lelkes, 2013).

In the case of birds, three effects can be observed:

- choice of breeding or wintering area: as far as possible from the illuminated facilities.
- migration: disruption of orientation has a negative effect, which can lead to a location other than the intended landing area or a collision with buildings
- biorhythm: in areas where it is not possible for birds to avoid artificial lighting, their biorhythm is disturbed. Daytime species are also active at night.

In the insect world, light pollution can have the following adverse effects:

- lure from their habitats, including reproduction and feeding places;
- separation of reproductive partners;
- greater exposure to predators;
- direct or indirect death of individuals; -
- local extinction, population collapse (Kolláth and Gyarmathy, 2015).

In natural landscapes, astronomers encountered difficulties in studying the starry sky, which led to the question that the starry sky, such as the sight of the Milky Way, would not play a significant role in the lives of people today. In order to stop this harmful process, a new program was launched as an initiative of the International Dark Sky Association (IDA). The point is to create starry sky parks around the world in areas where natural features can be preserved due to the negligible presence of light pollution. The IDA homepage (IDA 2020) lists 82 Dark Sky Parks worldwide, and provides links to the homepages of the individual Parks. According to its definition "An IDA International Dark Sky Park (IDSP) is a land possessing an exceptional or distinguished quality of starry nights and a nocturnal environment that is specifically protected for its scientific, natural, educational, cultural heritage, and/or public enjoyment."

Hungary boasts starry sky parks in Zselic, the Hortobágy and Bükk National Parks, all acknowledged by the above mentioned IDA homepage. The parks offer a wide range of programs with astronomical and nature exhibitions, guided night tours, and take an active role in informing the population about in the significance of light pollution. We can read about their work, but many other related national activities in two new Hungarian summaries (Ministry of Agriculture 2020, Elektrotechnika 2020).

2. The questionnaire and process of data collection

The aim of the present study is to establish whether, or not the inhabitants of those settlements know more about light pollution and they apply more healthy and contemporary sources of light which are the centres of a Dark Sky Park, compared to those which are not. The difference may be caused by the informative programs sometimes held for inhabitants of the Dark Sky Park settlements, only. In the Bükk region this key settlement is Répáshuta, whereas Cserépváralja is chosen for control. For Hajdú-Bihar the key settlement is Hortobágy, with Újszentmargita chosen for control.

To provide more insight about the location of the settlements and their light pollution, a pair of maps was edited with ArcGIS software, as presented in Fig. 1. They are based on the light pollution layer of the Human Influence Index, mentioned in the Introduction. The map for the Bükk has already been edited by previously by Balogh et al. (2018), whereas the other map has been created for the present study.
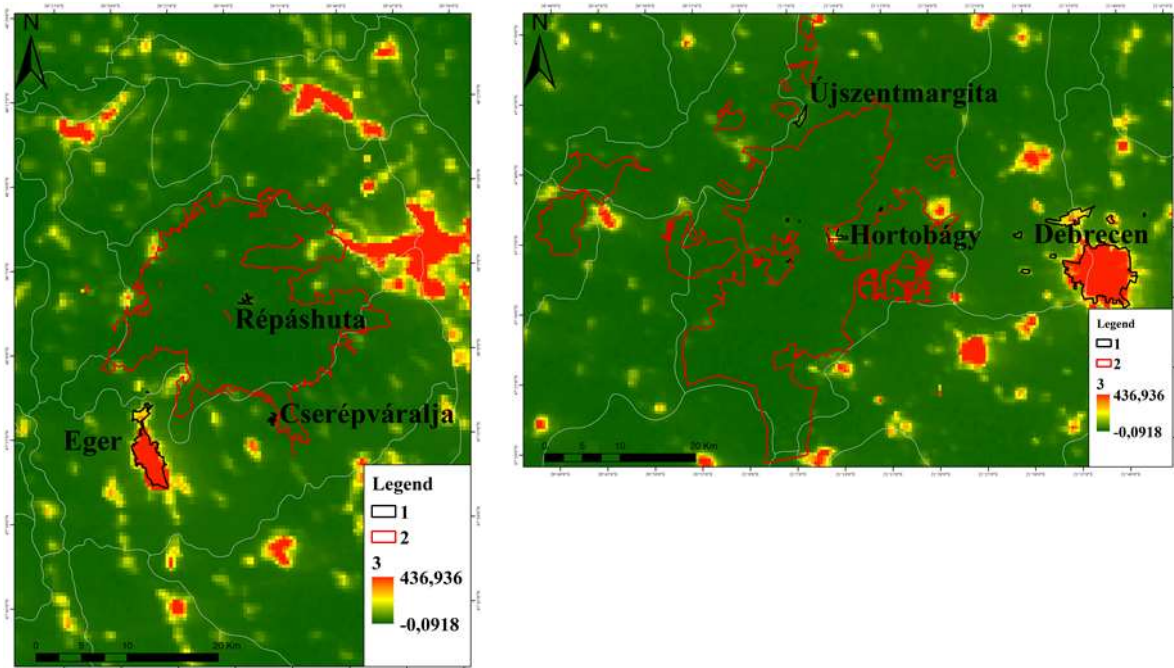

Figure 1. Maps of the Dark Sky Parks and the investigated settlements in the mirror of light pollution. Legends: 1 – settlements, 2 – National Parks, 3 – administrative regions. The unit of the coloured radiances is 10^{-9} W/cm^2 *Sr. Note 1: identical distance proportions are kept, this is why size of the two maps is different. Note 2: Eger and Debrecen are marked just for orientation.

Population data of the selected settlements located in one of the districts of the country are presented by Tab. 1 according to the Central Statistical Office (CSO) of Hungary. (Districts are administrative units of Hungary since 2013. Present number of districts is 174.)

The absolute numbers of people who responded to the questionnaire and their proportions to the settlements' population can be found in Tab. 2.

Table 1. CSO number of inhabitants and population density in 2019 (http://nepesseg.com/)

Target settlement			Control settlement		
Settlement	District	Inhabitants/ population rate head/km^2	Settlement	District	Inhabitants/ population rate head/km^2
Répáshuta	Miskolci	441/ 26	**Cserépváralja**	Mezőkövesdi	410 / 28
Hortobágy	Balmazújvárosi	1470/ 5	**Újszentmargita**	Balmazújvárosi	1473/15

Table 2. Number of the filled questionnaires and their rates compared to the population

Target settlement			Control settlement		
Settlement	Number of responses	Rate of responses	Settlement	Number of responses	Rate of responses
Répáshuta	33	7,5%	**Cserépváralja**	30	7,3%
Hortobágy	41	2,8%	**Újszentmargita**	36	2,4%

We tried to find equal number of responders from the five age groups *(19-30, 31-40, 41-50, 51-60 and over 60 years)* but we were not able to fulfil it due to the asymmetric age distributions and rare availability of younger people even on the week-ends when the questionnaires were exclusively collected. In the settlements of Bükk the survey was performed in March-April of 2019, while the same period in Hajdú-Bihar was November 2019 – January 2020. The inquiry took place in person, each household was represented by maximum one response.

The questionnaire contains 21 questions from which eight questions will be presented in detail, together with the possible alternatives. Short, unequivocal answers were expected in cases of open ended questions. The answers were written to the questionnaire sheets by the students who performed the surveys and finally entered into an Excel based numerical evaluation program, elaborated by one of the authors (JM). Before the survey, a preliminary trial was also performed in Egerbocs (Heves County) which led to reduction of the originally 30 questions to 21.

3. Results

3.1 Lighting habits

In the Figures of this sub-section the questions included into Tab 3 will be presented. Concerning the first question of this Table, we should mention another one which is the very first question among the 21 ones illustrated by Fig 2. The rate of good answers to the question testing the knowledge of present lighting devices was 91% in Répáshuta with only 50% in its control settlement. The same proportions were 72% in Hortobágy but 86% in its control settlement! It means fair average knowledge (75% i.e. 3 good answers from the four possible).

compact lamp   standard lamp   LED   halogen lamp

Figure 2. The first question to answer in the questionnaire: "Please find the right pairs of the technical expressions among the drawings!"

Table 3. Questions about lighting habits and optional alternatives

Which of the following light sources do you use in your home? (more than one answer indication is also possible)
_ standard filament lamp _ halogen lamps _ compact fluorescent lamps _ LED _ I don't know _ other:
Please indicate 3 main features that affect your purchase when buying a new lamp?
_ luminous flux (lumen - lm) _ wattage (watt - w) _ luminous efficacy (lm/w) _ colour temperature _ colour class (warm white, natural white, white) _ technology (halogen lamps, LED, compact fluorescent lamps) _ lifespan _ energy savings' _ polluting effect _ manufacturer/brand, country of origin _ price _ servicing _ design _ other:
Which of the following light sources do you use in your workplace/school? (more than one answer indication is also possible)
_ standard filament lamp _ halogen lamps _ compact fluorescent lamps _ LED _ I don't know _ other:
What do you think about the street lighting in your place of residence?
_ fully adapted to the degree of illumination required _ lower than the required lighting, it should be increased _ higher than the required lighting, it should be reduced _ I don't know _ other:

In Fig. 3 lighting habits of the homes are firstly evaluated. The traditional bulbs and LED lamps lead the list in both settlements surveyed in the Bükk-mountains. In Répáshuta both types are represented by identical 70% frequency, whereas in Cserépváralja almost all homes use traditional bulbs, with slightly over 40 % appearance of the LEDs. Frequency of halogen and compact lamps is 10-20% in these to settlements. Traditional lamps are the most popular in Hortobágy and Újszentmargita, as well. Almost all households use this type, whereas frequency of use for contemporary technologies varies between 10 and 40 percent.

The product characteristics that are considered when people buy a new bulb into their lamps are fairly similar in both regions: wattage, nominal life span and price are most often mentioned in two settlements of Hajdú-Bihar, whereas technology is also important in the Bükk. The remained 11 or 10 other characteristics, specified in Tab 3, together got similar "votes", only.
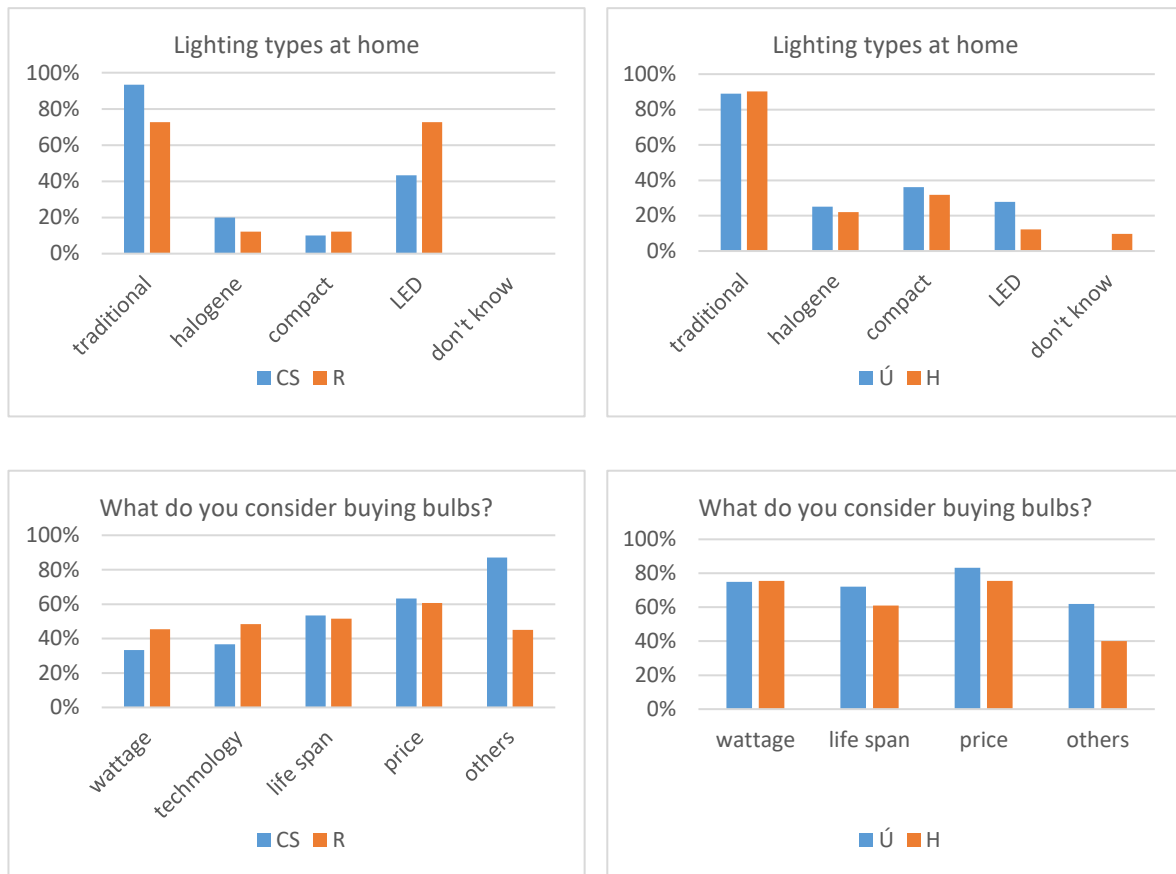
Figure 3. Types of lighting at home (upper pair) and points of view in buying a new bulb (lower pair). Figures of Bükk are found left, those of Hajdú-Bihar to the right. Répáshuta (R) and Hortobágy (H) are target settlements, Cserépváralja (CS) and Újszentmargita (Ú) are controls.

Lighting types of the workplace (Fig.4) are less considered, as it is concluded from the even distribution of responses and high proportion of 'I do not know' and 'something else' responses.

Communal lighting for the streets of Répáshuta is based on a new and modern system ensuring low energy consumption and healthy return to the yellowish light, realised at lower light intensity. At the start of this development a dissemination forum was held for the settlement to inform the inhabitants. Almost 100% of the responders are satisfied with the new system at Répáshuta. In its control settlement, where no innovation happened, more than half of the responders are satisfied with lighting of the settlement. Too few light is mentioned by 30 % whereas complains about too much light count a few percent, only.

Over the half of Hortobágy inhabitants found the communal lights too few, with the same proportion of satisfied responses in its control settlement. Personal experience of the students working with the questionnaires supports the opinion on insufficient lights in Hortobágy.
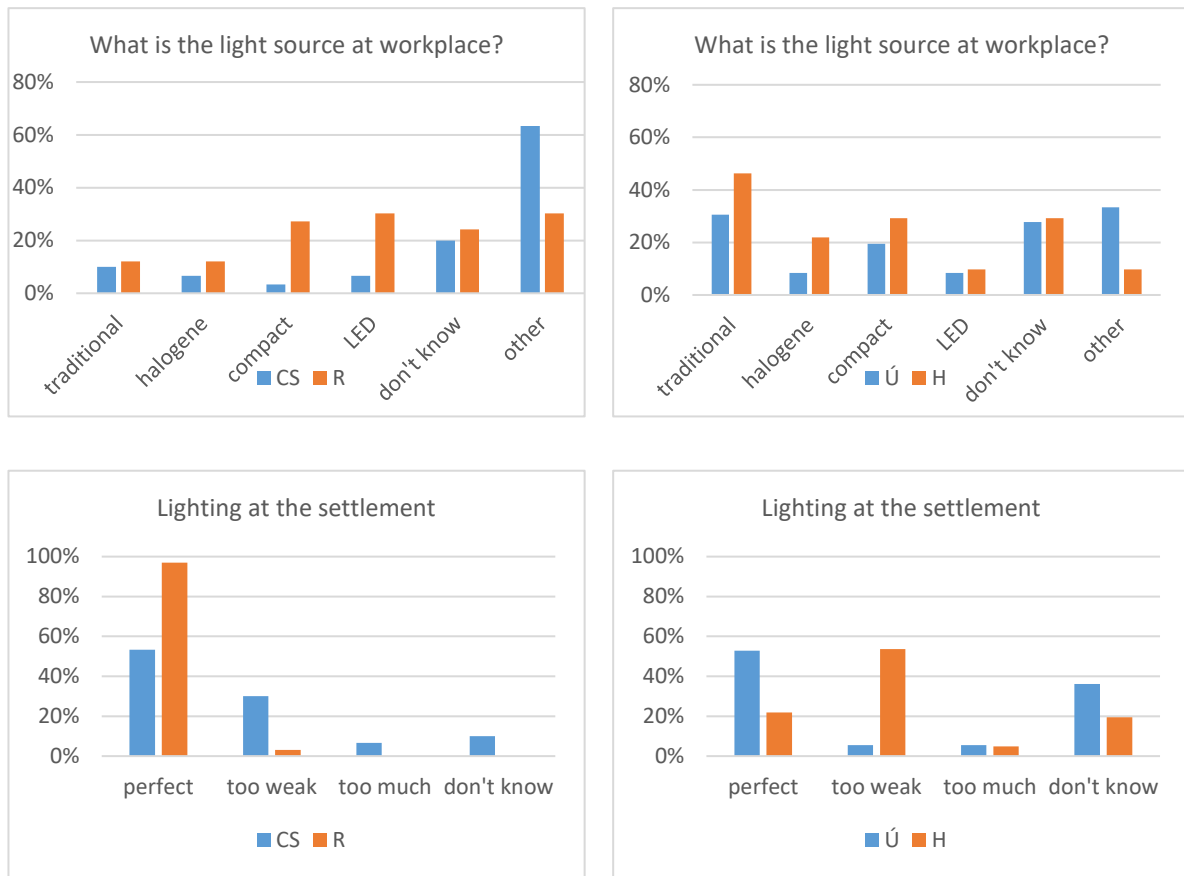
Figure 4. Types of lighting at work (upper pair) and quality of lighting in the settlement (lower pair). Figures of Bükk are found left, those of Hajdú-Bihar to the right. Répáshuta (R) and Hortobágy (H) are target settlements, Cserépváralja (CS) and Újszentmargita (Ú) are controls.

3.2 Knowledge of the impacts

Figures of the present sub-chapter comprehend the responses to the questions included into Tab. 4, together with the possible alternatives also included in the Table.

Table 4. Questions about effects of light pollution and optional alternatives

What can be eliminated by dimming artificial night lights? (more than one answer indication is also possible)
_ squandered energy _ glare-inducing effects _ disturbance of wildlife _ starry sky sink out of sight _ artificial light isn't harmful _ other:
Do you think that nightlife animals are affected by artificial light sources?
_ yes, all in a favourable direction _ yes, all in an unfavourable direction _ no _ I don't know _ other:

Do artificial night lights affect a person's health?
_ yes, with serious health risks _ yes, but it only makes it harder to fall asleep, which is why we wake up more tired the next day _ has no effect on human health _ I do not know _ other:
Do you usually admire, explore the starry sky?
_ often _ rarely _ no

In the upper lines of Fig. 5 evaluation of the harmful effects is seen. Among them waste of energy and disturbance of animals is mostly accepted, whereas in the settlements of Hajdú-Bihar the loss of starry sky is often mentioned, as well.
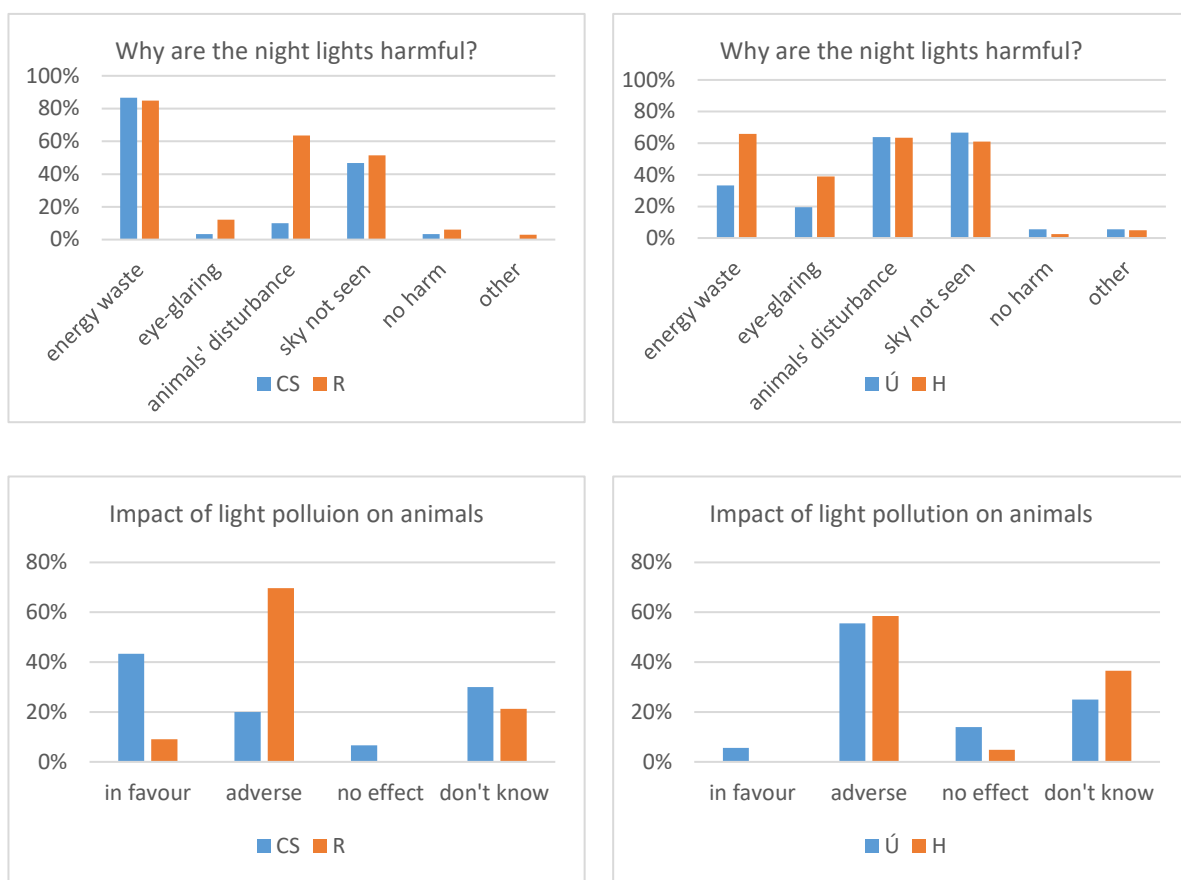

Figure 5. Harms of night lights (upper pair) and impact of light pollution on animals (lower pair). Figures of Bükk are found left, those of Hajdú-Bihar to the right. Répáshuta (R) and Hortobágy (H) are target settlements, Cserépváralja (CS) and Újszentmargita (Ú) are controls.

Effect of light pollution on animals is not denied by any Répáshuta inhabitant and almost 70% considers the effects as negative. The opposite opinion is represented by a few percent of the responders. In Hortobágy the situation is similar: very few responses denies this impact, and over 50% think that it is negative. Proportions of vacillating responses are always smaller in the target settlements than in the control one, in this question.

Fig. 6 evaluates impacts of light pollution on humans. In Bükk, almost 25% of responders from Répáshuta is not sure about the existence of impact on humans. One third of the responses definitely denies such an effect. In Cserépváralja the sum of vacillating and denying answers is similar, but the latter is as frequent as 40%. In Répáshuta strong multiple effect is attributed to the light pollution, while inhabitants of the control complain on sleeping, only. In Hortobágy the numbers are even worse: almost the half of the responders is not sure about any effect on humans and 25% definitely denies it. Strong effect is attributed by few people but according to almost 50% of the control settlement responses sleeping is disturbed by light pollution.

Figure 6. Impact of much light on humans (upper pair) and frequency of sky exploration (lower pair). Figures of Bükk are found left, those of Hajdú-Bihar to the right. Répáshuta (R) and Hortobágy (H) are target settlements, Cserépváralja (CS) and Újszentmargita (Ú) are controls.

Last line of Fig. 6 indicate how strong is the loss of starry sky which depends mostly on how often one tries to explore it. Almost 90% of responders often admires and enjoys it. In its control settlement 50% does it often and 40% rarely. In Hajdú-Bihar only 1/3 of the responders often enjoy the non-cloudy sky, with ca. half of the responses 'rarely'.

4   Conclusion

The above investigations may have double importance for education. On one hand they indicate how successful the thematic education, performed in connection with the Dark Sky Park, was. On the other hand they may be useful in creation of any education program concerning light pollution. Most likely not the answers, but the questions will be useful if the education is planned for different settlements.

The presented results indicate that inhabitants of Répáshuta i.e. the target settlement in the Bükk region know more about the light pollution, and use more modern light sources than inhabitants of its control settlement. At the same time, Hortobágy, i.e. target settlement in Hajdú-Bihar has no advantage over its control settlement either in aspect. It is very likely that existence of a nearby Dark Sky Park and occasional knowledge dissemination is just one of the factors. The topical knowledge may also depend on the age of responders, as well, as on their degree of education and economic status. In a further study these aspects should also be included.

References

Balogh Sz. - Sütő L. - Rózsa P. (2018): Antropogén bolygatottság a Bükk-vidéken. In: Fazekas István, Kiss Emőke, Lázár István (szerk.): Földrajzi Tanulmányok 2018. Magyar Földrajzi Konferencia kötete 2018.11.09-11. Debrecen: MTA DTB Földtudományi Szakbizottság 239-241 p.

Csörgits Gábor (2000): Composition and long-term changes of the invertebrate macrofauna in two streams of the Pilis Mountains. Opusc. Zool 32. 27-49 p.

Csörgits Gábor – Gyarmathy István (2006): A fényszennyezés természetvédelmiökológiai aspektusai. Elektrotechnika, 99/9. 22-24 p.

Elektrotechnika (2020): Betekintés a 25 éves Világítástechnikai Társaságkutatási és tevékenységi területeibe. 2020/4 szám http://www.mee.hu/files/files/et2020-4.pdf

Estefánné Varga Magdolna – Dávid Mária – Hatvani Andrea – Héjja-Nagy Katalin – Taskó Tünde (2001): Pszichológia elméleti alapok. https://uni-eszterhazy.hu/hefoppalyazat/pszielmal/az_rzkels_s_az_szlels_kztti_klnbsgek.html (Last visited: May 26, 2020)

Gyarmathy István (2016): A fényszennyezés ökológiai-természetvédelmi aspektusai, csillagoségbolt-parkok. In: Tájhasználat és tájvédelem – kihívások és lehetőségek, ELTE TTK Környezet és Tájföldrajzi Tanszék, 34-41. p.

Kolláth Zoltán (2009): Lehet-e száz év múlva is Csillagászat Nemzetközi Éve? Magyar Tudomány, 170/10. 1213-1220. p.

IDA 2020: International Dark Sky Association homepage. https://www.darksky.org/our-work/conservation/idsp/parks/ (Last visited: September 9, 2020)

Kolláth Zoltán, Gyarmathy István (2015): Fényszennyezés és természet, Természetbúvár, 70. 4. PP.4-7.

Lelkes Zoltán (2013): A fény hatása a napszaki ritmusra és az alvásra. In: Világítástechnikai évkönyv, Világítástechnikai Társaság, Budapest, pp. 108-110.

Ministry of Agriculture (2020): A fényszennyezésről – világosan! Agrárminisztérium−Hortobágyi Nemzeti Park Igazgatóság, Budapest. 82 p. http://www.termeszetvedelem.hu/fenyszennyezesrol_vilagosan

OTÉK: 253/1997. (XII. 20.) Korm. rendelet az országos településrendezési és építési követelményekről.

https://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=99700253.KOR#lbj182id51f

(Last downloading: October 13, 2019)

NASA (2017): https://www.nasa.gov/feature/goddard/2017/new-night-lights-maps-open-up-possible-real-time-applications 2017.12.11 (Downloaded: November 6, 2018)

National Sleep Foundation_1 (2020): Melatonin and Sleep, http://www.sleepfoundation.org/article/
sleep-topics/melatonin-and-sleep (Downloaded: June 26, 2020)

National Sleep Foundation_2 (2020): Children and sleep, https://www.sleepfoundation.org/articles/children-and-sleep (Downloaded: June 26, 2020)

WCS – CIESIN (2005): Wildlife Conservation Society - WCS, and Center for International Earth Science Information Network - CIESIN - Columbia University: Last of the Wild Project, Version 2, 2005 (LWP-2): Global Human Influence Index (HII) Dataset (Geographic). Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). https://doi.org/10.7927/H4BP00QC

About the Authors:

János MIKA is climate researcher, Doctor of the Hungarian Academy of Sciences, professor. His main area of research is climate change, its regional characteristics and impacts. His scientific work was recognized by the World Meteorological Organization with the Norbert Gerbier Mumm Prize in 1999. In his current duty at Eszterházy Károly University (EKU) he also deals with teaching methodology issues since 2008. Together with his colleagues and PhD students, he contributes to educational aspects of climate change, renewable energy and sustainable development. He directs the Environmental Pedagogy module since the opening of the EKU Doctoral School of Education in 2012.

Anna APRÓ is PhD student graduated from Károly Eszterházy University in 2017 as a teacher of geography and mathematics. She is currently pursuing her studies at the Doctoral School of Education at the University, in the Environmental Pedagogy module. She writes her doctoral dissertation on pedagogical aspects of light pollution, which is a lesser-known form of environmental damage, but also a present problem. So, it is necessary to include it into education in a gap-filling manner.

Szabolcs BALOGH is PhD student graduated from Eszterházy Károly University in 2018 as a Regional Manager Geographer. He is currently pursuing his studies at the Doctoral School of Earth Sciences of the University of Debrecen in the Landscape Protection and Climate program. He is the student associate at the Department of Mineralogy and Geology. His main research field is GIS modelling of landscape changes of human origin and land use. He has the following geo-informatics skills: ArcGIS, Global Mapper, QGIs, Google Earth Pro, and GNSS System.

Mónika HANKOVSZKI qualified as a Geographer (BSC) at Eszterházy Károly University in 2019. She is currently pursuing her studies to the degree of Master of Science in Geography of University of Debrecen. Her specialisation is Regional and Urban Development. She is interested in the methods for analysing the situation of settlements and regions, and for preparing concepts, strategies and programs. She writes her MSc thesis on the territorial patterns of crime in Szabolcs-Szatmár-Bereg county and Hajdú-Bihar counties. She participated in the research by filling the questionnaires as the inhabitants of the targeted settlements responded, and by digitisation of its results.

Alex KERTÉSZ is a BSc student of Eszterházy Károly University. He started his studies in the Faculty of Science as a geographer. Actually he studies recreation at the same Faculty. He participated in the research by filling the questionnaires as the inhabitants of the targeted settlements responded, and by digitisation of its results.

Richárd NOVÁK working at the Bükk National Park Directorate for almost a decade. His professional background is geography and environmental conservation. He deals with environmental education, ecotourism and the dissemination of astronomical knowledge. He is the vice-president of the largest green organization of Eger. One of the most outstanding works of his activity is the acquisition of the internationally recognized title, the Bükk Starry Sky Park title. He completed his studies at Eszterházy Károly University, University of Miskolc and the New University of Lisbon. He also works as researcher at the Eszterházy Károly University in a project on light pollution.

István PINTÉR is BSc student of the Eszterházy Károly University, who learned geography from 2017 to 2020. He is currently writing his dissertation on mineralogy to pass the state exam. He intends to continue in the distant future in the field of GIS and renewable energy sources. He has now been admitted to the same University to continue his studies in biology. He participated in the research by filling the questionnaires as the inhabitants of the targeted settlements responded, and by digitisation of its results.

László SÜTŐ is a geomorphologist and landscape geography researcher. He received his MSc as geographer and geography teacher in 1998, and PhD from Earth Sciences at the University of Debrecen in 2007. He is an associate professor at the Institute of Geography and Environmental Science of the Eszterházy Károly University. He also deals with teaching and methodological issues since 2002. His main research fields are anthropogenic geomorphology, landscape geography, geo-heritage, geo-tourism and their teaching methods. He has been the member of the Environmental Education and Awareness Sub-program of the EKU Doctoral School of Education and of the Earth Sciences Doctoral School at Debrecen University. He has been the vice leader at the Earth Science, Physics and Mathematics Section of the National Council of Student Research Societies (OTDT).

Introducing light pollution through nature trails

Éva Fodor [a]

[a]Eszterházy Károly University, 3300 Eger, Eszterházy square 1., eva.fodor.31@gmail.com

Abstract

This study aims to present possible options for introducing light pollution through nature trails to the citizens. The first part of the study grants a general introduction about light pollution by explaining the concept, forms and sources of the phenomenon; as well as by describing possible ways of its reduction and prevention. The second part gives a summary about nature trails, based on general and certain special characteristics of the facilities. The goal of the third part is twofold: presenting possible ways of introducing light pollution through nature trails, as well as examining the different types of trails that might be appropriate for introducing the topic to the visitors.

Keywords: environmental education; light pollution; nature trail.

1. Introduction

Light pollution is considered as one of the least noticeable, but at the same time the most widespread environmental hazard caused by human acts (Sciezor, 2019). It is a serious international concern: according to the World Atlas of Artificial Night Sky Brightness (2016) 80 percent of the world's population lives under skyglow, which prevents people from experiencing a natural night (https://www.darksky.org/light-pollution/). Based on the aforementioned facts, it is important to inform citizens about the complex phenomenon and reduction of light pollution.

Nature trails have multiple functions. Their primary goal is to increase the environmental consciousness amongst the visitors by introducing and conserving values belonging to a certain landscape. Nature trails are important tools for citizens regarding recreation, health prevention, and entertainment; hence they can be considered as tourist attractions, too (Kiss, ed., 2007). Nature trails provide pleasant experience for the visitors within a natural environment (Cullen, 1995), resulted by their multifaceted characteristics.

Considering the necessity of informing citizens about light pollution, and the above listed qualities of nature trails, these facilities seem to be appropriate venues to fulfil the task. In order to examine this assumption, present study aims to answer the following research

questions: can the topics of light pollution being presented on nature trails for the citizens? What are the possible ways of introducing light pollution through nature trails? What types of nature trails are appropriate to inform the visitors about light pollution?

2. Light pollution

2.1. The concept of light pollution

"Light pollution is one of the most widespread but at the same time least noticeable environmental hazards resulting from human activity" (Sciezor, 2019, p. 129.). It is considered as a side effect of industrial civilization, resulted by the inefficient, overly bright, poorly targeted, improperly shielded, and, in many cases, completely unnecessary outdoor lightning sources. It is a serious international concern; hence according to the World Atlas of Artificial Night Sky Brightness (2016) 80 percent of the world's population lives under skyglow, in the United States and Europe 99 percent of the public can't experience a natural night (https://www.darksky.org/light-pollution/).

The phenomenon of light pollution was observed first in the 1970's (Riegel, 1973), since in recent decades there has been a rapid increase in the brightness of the night sky in nearly all countries (Cinzano et al., 2000).

Light pollution is considered as the rapid proliferation of electric lights has drastically reordered nightscapes across the globe, in terms of both light intensity and light spectrum. The increase in night sky brightness is one of the most noticeable effects of light pollution (Cinzano et al., 2000).

"Due to the continuous growth of nighttime artificial lighting, this problem is increasingly debated and many localities have developed regulations to constrain the wasteful loss of light into the sky and environment" (Falchi et al., 2011, p. 1.). The International Dark-Sky Association makes several attempt and effort in order to raise awareness in citizens around the globe. This requires knowledge regarding the "condition of the night sky across large territories, recognition of vulnerable areas, determination of growth trends, and identification of the most polluting cities" (Cinzano et al., 2000, p. 641.).

Light Pollution means the inappropriate or excessive use of artificial light (https://www.darksky.org/light-pollution/), or in other words the alteration of natural light levels in the night environment due to artificial light sources (Cinzano et al., 2000; Falchi et al., 2011 and Sciezor, 2019). The phenomenon can be described also as the nuisance of

artificial lighting caused by an excess of light coming from improperly designed light sources (Sciezor, 2019).

2.2. *The forms of light pollution*

According to the classification of the International Dark Sky Association, light pollution is the inappropriate or excessive use of artificial light. The components of light pollution include: glare, which is considered as a visual discomfort caused by an excessive brightness; skyglow, which is the brightening of the night sky observable over inhabited areas; light trespass, known as an unintentional or unnecessary falling of lights; and clutter, which means the confusing and excessive groupings of certain light sources (https://www.darksky.org/light-pollution/).

Sciezor, 2019 explains the abovementioned forms of light pollution in detail. Glare can be described as "when the light source is directly visible and the contrast between it and the surroundings causes disturbance to the nocturnal vision of living organisms is one such form of light pollution" (Sciezor, 2019, p. 130). It includes street lightning, advertising installations, billboards, sky slopes, etc.). Skyglow is considered as the most widespread category of light pollution, because the dispersed light reaches those areas where the other forms of light pollutions are not even present. Skyglow arises "from the dispersion of artificial light on atmospheric aerosols" (Sciezor, 2019, p. 130), which is caused by city glows, shielded lamp filaments and wrongly inclined lamp holders. Light trespass means the violation of property boundaries, "it occurs when the light source illuminates not only the dedicated area, but also the surrounding area" (Sciezor, 2019, p. 130). This form of light pollution includes the disturbance caused by street lamps or our homes or in the surroundings of certain illuminated places. Clutter means the unnecessarily increased number of light sources in a certain area. Clutter appears mostly in urban areas, tourist areas, recreation centres and sport facilities.

Light pollution involves a changing occurrence and a changing spectrum of light (Gaston et al., 2014). The changing occurrence of light means that "artificial light at night has been introduced in places, times and at intensities at which does not naturally occur" (Gaston et al., 2014, p. 918.). It is mostly caused by urbanization and major centres of human population. The changing spectra of light arise from the fact that artificial lights have different bandwidths and wavelengths as natural sources – such as the sun, moon and the stars (Gaston et al., 2014)

2.3. The sources of light pollution

Light pollution appears in residential, commercial and industrial areas: skyscrapers, streetlights, motorways, fishing boats, cruise ships, security lights, vehicles lamps, offshore oil platforms flares, undersea research vessels (Azman et al., 2019).

Gaston et al., 2015 expands the abovementioned sources with advertising lighting, architectural lighting, security lighting, domestic lighting and vehicle lighting.

Árgay, ed., 2020 describes five sources of light pollution: public lighting, outdoor lighting of premises, decorative lightning, lighting of sport and social facilities and advertising lighting. Public lighting involves the lighting of public places through transport, public order and property security. Outdoor lighting of premises includes the lighting of premises caused by compulsory work, security, promotional and advertising goals, as well as the lighting connected transport infrastructure for not public use. Decorative lighting can be described as the lighting of frontages and buildings with an aesthetic purpose. The lighting of sport and social facilities includes the occasionally illuminated facilities used by the population for recreational and social purposes. Advertising lighting can be described as advertising installations constantly or periodically illuminated or emitting own light.

2.4. The reduction of light pollution

The harmful impacts of light pollution can be reduced. It is important though, that in order to avoid unnecessary lighting, efforts need to be made both on social and individual level.

"Theoretically, light pollution is one of the easiest anthropogenic pollutions to be addressed. The simple logic in reducing light pollution is to efficiently light the needed space, and leaving the rest naturally dark as it is" (Azman et al., 2019, p. 5.).

Citizens individually are also capable of reducing light pollution by learning more about the topic, use lighting only when and where it is necessary, installing detector lights and timers, shielding properly all outdoor lights, and keeping the blinds drawn in order to keep the light inside (https://www.darksky.org/light-pollution/).

Education and awareness campaigns might be useful tools to inform citizens about the negative impacts of light pollution, as well about the possibilities of decreasing the unnecessary lighting.

3. Nature trails

3.1. General characteristics

The definition of nature trail is not unified, since the concept and its terms are quite diverse. According to the results of the comparison of international and Hungarian concepts for nature trails, it can be stated that the meanings are much diversified. In different countries the definition of nature trails broadens with different functions and content, though there can be described several similarities as well (Kollarics, 2015).

Considering the different types of nature trails; the international similarities and differences; as well as the goals of present research, the author is emphasizing the environmental educational function of nature trails, especially the impact of shaping the visitors' environmental consciousness.

According to the abovementioned facts, a summing, yet non-exhaustive definition of nature trails can be described as follows: nature trails are considered as fundamental tools for outdoor education. The most important goal is to provide the visitors a pleasant experience within a natural environment (Cullen, 1995). Nature trails develop the citizens' environmental consciousness by introducing and conserving values belonging to a certain landscape (Kiss, ed., 2007), since they reveal the components of nature in their reality, as well as the relations and processes in natural circumstances (Kárász, ed., 2003).

3.2. Special characteristics

This section provides a non-exhaustive summary about certain qualities of nature trails presenting the multifaceted functions and numerous advantages of the facilities according to the research goals.

3.2.1. Accessibility and affordability

Nature trails are multifaceted venues, yet they are easily accessible for most the visitors:

In order to visit a nature trail there is no special equipment or preparation needed. Citizens can choose the time, duration and the way of the visit, as well as the company; the trails can be visited several occasions, getting new information and experiences each time (Kárász, ed., 2003).

3.2.2. Organized and directed introduction of the environmental values

One of the most advantageous qualities of nature trails might be the one making possible the citizens to visit the facilities and gain the knowledge independently. In order to ensure this, the interpretation of the vales needs to be organized:

Nature trails provide a pleasant experience within natural environment and controlled context to the visitors (Cullen, 2015). Nature trails ought to provide opportunities to the visitors by gaining experience in a directed way (Oelsner & Rosemann, 2008). Nature trails have stations, connected on a marked route. The presented values are not independent from each other, they are connected by a defined idea. Visitors acquire knowledge in an independent and active way, since even there is no guide on the trails, organized interpretation takes place via boards or exercise books (Kiss, ed., 2007).

3.2.3. Multiple functions

According to nature trails, four main functions can be described: environmental education, nature protection, recreation and tourism.

Nature trails may help to develop a concern about nature, hence open the visitors' eyes to *nature conservation*. Nature trails are especially appropriate to develop the citizens' environmental consciousness: visiting nature trails can result an emotional bonding to nature, which is essential for nature protection (Kárász, ed., 2003). All introduced themes on different trails have a common message, namely presenting the valuable landscape and emphasizing the importance of nature conservation (Kiss, ed., 2007). Conservation means the conservation regarding heritage, culture and environment (The State of Western Australia, 2014).

Nature trails can be considered as *recreational* venues. The recreational function of nature trails involves walking, cycling, horse riding, hiking, bird watching and studying of nature (The State of Western Australia, 2014), as well as facilitating the relaxation and entertainment of the visitors (Kiss, ed., 2007). Nature trails should be available for the disabled as well (Oelsner & Rosemann, 2008).

One of the main functions of nature trails is *tourism. N*ature trails contribute to tourism as well, by giving "(…) eco-tourism opportunities for both interstate and overseas visitors and local groups and individuals" (The State of Western Australia, 2014, p. 6.). Kedra's (2003) approach describes educational tourism, combining two different functions of nature trails: "It teaches man discipline and co-existing in a group, builds a sense of responsibility and

practical skills, allows us to personally sites of great historic events, monuments of civilisation and culture, as well as developing ecological awareness and comparative thinking and sensational skills" (Kedra, 2003, p. 236).

Several sources of relevant literature emphasize that one of the most essential function of nature trails is *environmental education*. The most important function of nature trails is the educational one: raising attention towards nature, transmission of the information and knowledge (Kiss, ed., 2007); as well as educating citizens about history, culture, environment heritage and health (The State of Western Australia, 2014). Nature trails allow "(…) children to acquire knowledge in a fun and interesting way. It is a good integration of math and science knowledge, observation, and reasoning skills" (Lee & Ensel Bailie, 2009). Families are an important target group of nature trails, hence it is essential to pay attention to the needs of children by designing the facilities (Heimerl, 2002).

3.2.4. Contribution to evolve significant life experiences amongst the visitors

Chawla (1998) conducted a review in the topic of significant life experiences. The author summarized the findings of early researches by analysing several surveys, interviews and questionnaires carried out by different researchers (Tanner, 1980; Peterson, 1982; Palmer, 1993; Peters-Grant, 1986; James, 1993); Sward, 1996; Chawla, in press [published later in 1999 – remark by the author]). Results indicate that spending time outdoors, in natural environment is the leading factor of facilitating significant life experiences amongst the citizens. Other factors occurred, such as environmental education, influence of adults or friends, job opportunities, etc.; yet the primary source of the major experiences leading people to adult environmentalism was the time they have spent in nature.

Since most nature trails are situated in natural environment, they might be excellent venues for gaining outdoor experiences leading people to an environmentally conscious, nature-friendly way of living (Kárász, ed., 2003). Nature trails build a connection between nature and humans by having a significant impact on the visitor, shaping the citizens' behaviour, and they introducing real values to people (Kollarics, 2015).

4. The introduction of light pollution through nature trails

As already stated before, light pollution is one of the least noticeable, though at the same time the most widespread environmental hazard caused by human actions (Sciezor, 2019). This indicates the need of informing citizens about the topic. Nature trails, as outdoor

environmental educational facilities might be appropriate venues to facilitate the citizens' – especially children's and youth's – understanding towards light pollution. There are various ways of connecting the topic of light pollution with nature trails. In the following chapters the author explains certain options in order to achieve this goal.

4.1. Possible ways of introducing light pollution through nature trails

According to the characteristics of nature trails, as well as the contents regarding light pollution, there are certain ways of connecting these two fields, so that the visitors could benefit the most. Once the goal is to inform citizens about the aspects of light pollution leaning on nature trails, there are three main opportunities: presenting the topic of light pollution through nature trails; integrating nature trails into the facilities engaging in informing citizens about light pollution; and considering the reduction of light pollution by designing and establishing nature trails.

4.1.1. Presenting the topic of light pollution through nature trails

Since light pollution is a complex phenomenon, there are more aspects worth presenting to the citizens while visiting nature trails. There are general contents that can be presented on any trails, irrespective of the individual characteristics of the facility; yet there are special contents depending on the special characteristics of each trail.

As *general contents* might be considered:

- the concept of light pollution;

- the sources of light pollution;

- the forms of light pollution;

- general impacts of light pollution on the vegetation;

- general impacts of light pollution on animals;

- species endangered by light pollution;

- general ways of preventing light pollution;

- general ways of reducing light pollution;

- general damages of light pollution;

- general possibilities to restore the damages caused by light pollution.

As *special contents* might be considered:

- the impacts of light pollution on the vegetation of the nature trail's area;

- the impacts of light pollution on animals of the nature trail's area;

- presentation of species endangered by light pollution in the nature trail's area;

- possibilities of preventing light pollution in the nature trail's area;

- the ways of reducing light pollution in the nature trail's area;

- damages caused by light pollution in the nature trail's area;

- possibilities to restore damages caused by light pollution in the nature trail's area.

By all means, paying attention to provide practical suggestions and advices to the visitors might be essential. In order to facilitate an environmentally conscious behaviour, it is helpful to provide people with specific and concrete steps towards acting. It is necessary to notice though: visitors could connect the introduced problems with smaller solutions on their everyday level, thus can be an improvement facilitated on a societal level.

4.1.2. Integrating nature trails into facilities engaging in informing citizens about light pollution

There are certain facilities concerned with preventing or reducing the harmful impacts of light pollution, as well as informing citizens about the topic. As a part of their programme, nature trails might serve as good alternatives to introduce the main aspects of the phenomenon.

The most suitable facilities for this goal might be the *dark sky parks*. The main idea about dark sky parks is that visitors would be able to enjoy the vision of the dark sky, without the disturbing effects of light pollution. "Less than 100 years ago, everyone could look up and see a spectacular starry night sky. Now, millions of children across the globe will never experience the Milky Way where they live. The increased and widespread use of artificial light at night is not only impairing our view of the universe, it is adversely affecting our environment,   our   safety,   our   energy   consumption   and   our   health" (https://www.darksky.org/light-pollution/).

International dark sky parks, according to the criteria of the International Dark Skye Association are "(…) a land possessing an exceptional or distinguished quality of starry nights and a nocturnal environment that is specifically protected for its scientific, natural, educational, cultural heritage, and/or public enjoyment. The land may be publicly owned, or

privately owned provided that the landowner(s) consent to the right of permanent, ongoing public access to specific areas included in the IDA designation" (https://www.darksky.org/our-work/conservation/idsp/parks/).

Establishing nature trails with the most important aspects of light pollution might be beneficial for dark sky parks as well, since most of these facilities are open at daytime and have daytime programme for the visitors. Some dark sky parks offer daytime trips to the neighbouring forests as part of their environmental education programme. During these trips visiting a nature trail might be a valuable part of the programme; moreover it can facilitate the environmental consciousness of the visitors, with special emphasis to the younger ones.

4.1.3. Reducing light pollution while designing and establishing nature trails

As presented in the former chapters, providing information and everyday solutions to citizens about light pollution might be an efficient way to achieve an ecologically conscious behaviour. It has to be noted though, that nature trails, which are not designed well for preventing wildlife from unnecessary light pollution, might have the opposite effect on their visitors.

According to the designing process of nature trails, there are certain recommendations which might be worth of consideration: not using lighting of the trail at all or reducing the disturbance on wildlife caused by lighting.

The following recommendations are based on the second and third chapters of Árgay's book (Árgay, ed., 2020, pp. 19-30, pp. 31-43.) about the possible reduction of light pollution.

Avoiding the use of lighting on nature trails involves:

- avoiding the use of night trails;

- avoiding the use of lighting on nature trails at night;

- avoiding the use of unnecessary lighting at daytime, dusk or dawn;

- avoiding the use of equipment on nature trails emitting illumination.

Reducing the disturbance of wildlife means that in the case of daytime trails it is advisable:

- avoiding colour temperatures of lighting which are less tolerable for wildlife;

- avoiding lighting sources which are less tolerable for wildlife;

- limiting the period of the illumination as much as possible;

- limiting the intensity of the illumination as much as possible;

- limiting the size of the illuminated surface as much as possible.

4.2. Appropriate types of nature trails for introducing light pollution

According to the classification of nature trails, there are certain types of trails which might be more appropriate for introducing light pollution to the visitors.

Nature trails can be classified through different factors. According to the research goals, the author based her classification on two sources. The classification along *methodological goals* of nature trails is based on Hoff (2010, in; Bundesamt für Naturschutz, 2010); whereas certain additional aspects regarding the *physical characteristics* of nature trails are based on Kiss (ed., 2007).

The reason of choosing Hoff's work is the didactical diversity of the types regarding nature trails in the German literature. However it needs to be noted, that the translation of certain trails' names might not reflect properly the original, German expressions; hence they might not properly reflect the difference between the different types of the trails either. In order to avoid emerging misconceptions, there will be a short explanation given by each trail's name.

The approach of Kiss is appropriate to complete the aforementioned classification with certain physical characteristics of nature trails, since the aspects described in the following chapter apply to all sort of trails in general.

4.2.1. Classification of nature trails regarding the methodological goals

Hoff (2010, in Bundesamt für Naturschutz, 2010) defines the following types of nature trails according to the methodological goals:

- nature educational trail;

- interpretational trail;

- interactive trail;

- sensational trail;

- experience trail;

- artistic trail;

- spiritual trail;

- barrier-free trail;

- spectacular trail;

- media-supported trail.

In the case of *nature educational trails* the written and pictorial information is highlighted. These trails assure the interpretation through boards and poles, sometimes brochures and exercise books as well. Visitors gain knowledge through reading or answering the questions of the exercise books. *Interpretational trails* are meant to build a connection between the visitors and the introduced values of the trail. There is a main idea introduced to the visitors through boards or in certain cases through demonstrations or action-elements. *Interactive trails* provide a playful and enjoyable way of learning, because of the interactive elements and additional components of the facilities. The target groups in this case are children and families. *Sensational trails* bring visitors close to nature on the stations through sensation and sensory organs. Transmitting of the knowledge takes place with sensory experiences, texts and written presentations are secondary. Excellent examples of this type are barefoot trails. *Experience trails* are considered as the combination of all the detailed trails above. Most of the stations have interactive and sensory elements, facilitating the visitors to explore the contents of the trails through an interactive and sensory way. The target group of this trail are children and families. *Art trails* are artistically constructed facilities which introduce the contents of the given landscape to the visitors. *Barrier-free trails* are nature trails designed especially for the disabled, so they could enjoy the opportunities nature trails can offer. *Spectacular trails* are often tourist attractions, providing an extraordinary experience to the visitors about a certain landscape. Treetop trails, skywalks, etc. are considered as the most common forms of spectacular trails. (Hoff 2010 in; Bundesamt für Naturschutz, 2010). *Spiritual trails* and *media-supported trails* are not relevant regarding introducing light pollution to the visitors.

The main difference between the aforementioned types of nature trails is the didactical approach they represent, following a certain developmental tendency. They follow each other in a chronological order, starting from the primitive to the methodologically most diverse one.

The aforementioned types of trails are all appropriate to present the aspects of light pollution to the visitors, yet the ones using playful, experiential and interactive methods might be the most effective ones for shaping the visitors' environmental consciousness. Considering a

barrier-free solution by establishing nature trails might be preferably advisable by any sort of trail.

4.2.2. Classification of nature trails regarding their physical characteristics

Hoff's classification needs to be complemented with certain physical characteristics of nature trails. Based on Kiss (ed., 2007) there are some additional aspects worth considering by informing citizens about light pollution through nature trails.

Kiss (ed., 2007) defined certain characteristics regarding nature trails, from which the author describes this time only the physical ones:

- location (trails introducing local or general knowledge);

- transportation (walking, biking, horse riding and rowing trails);

- length (walking and hiking trails).

Regarding the location, the knowledge can be transmitted on *trails introducing local or general knowledge*. Regarding the transportation there are *walking, biking, horse raiding and rowing trails*. According to the length, there are *walking* (no longer than 2 km) *and hiking* (longer than 2 km) *trails*. In the case of walking trails there is a minimal fall, yet their difficulty is considered to be easy. Hiking trails contain stages with harder stages and fall.

Nature trails introducing local and general knowledge might be both appropriate to inform citizens about light pollution. The first type can provide general information; as long as the second one enables visitors to gain more specific details about the topic (see both in chapter 3.1.1.). According to the transportation, walking trails might be the most suitable choices, since the speed of the visitors is slower than on biking or horse riding trails. In the case of biking, horse riding and rowing trails – with some special modifications – elements presenting light pollution can be implemented. Regarding to the length of nature trails, walking and hiking trails might be both appropriate for introducing light pollution to the visitors. Walking trails might be more effective though, since they are suitable to most of the visitors. People not having sufficient fitness level, or having smaller children, also the elderly or the disabled, etc. might not able to complete longer and more difficult hiking trails; yet for a smaller percent of the visitors hiking trails might be just as much appropriate, as walking trails.

According to the aforementioned facts, walking trails introducing general, as well as local knowledge might be the most suitable ones for the majority of the visitors.

5. Conclusion

Present study aimed to answer the following research questions: can the topics of light pollution being presented on nature trails for the citizens? What are the possible ways of introducing light pollution through nature trails? What types of nature trails are appropriate to inform the visitors about light pollution?

According to the characteristics of nature trails, there are possible ways of introducing light pollution through these facilities: presenting the topic of light pollution through nature trails; integrating nature trails into the facilities engaging in informing citizens about light pollution; and considering the reduction of light pollution while designing and establishing nature trails.

According to the *presentation of light pollution through nature trails*, there are general and special contents to be introduced. General topics might be the concept of light pollution; the sources of light pollution; the forms of light pollution; general impacts of light pollution on the vegetation; general impacts of light pollution on animals; species endangered by light pollution; general ways of preventing light pollution; general ways of reducing light pollution; general damages of light pollution; and general possibilities to restore the damages caused by light pollution. Special contents might be the impacts of light pollution on the vegetation of the nature trail's area; the impacts of light pollution on animals of the nature trail's area; presentation of species endangered by light pollution in the nature trail's area; possibilities of preventing light pollution in the nature trail's area; the ways of reducing light pollution in the nature trail's area; damages caused by light pollution in the nature trail's area; possibilities to restore damages caused by light pollution in the nature trail's area.

Nature trails can be *integrated into certain facilities, which are engaged in preventing or reducing the harmful impacts of light pollution, as well as informing citizens about light pollution*. As a part of their programme, nature trails might serve as good alternatives for introducing the main aspects of the phenomenon. The most suitable facilities for this goal might be dark sky parks.

By *considering the reduction of light pollution while designing and establishing nature trails*, some recommendations are listed, all based on Ágray (ed., 2020, pp. 19-43.). There are two possible opportunities described: avoiding the use of lighting on nature trails; and reducing the disturbance on wildlife on daytime trails. *Avoiding the use of lighting on nature trails* involves avoiding the use of night trails; avoiding the use of lighting on nature trails at night; avoiding the use of unnecessary lighting at daytime, dusk or dawn; and avoiding the use of

equipment on nature trails emitting illumination. *Reducing the disturbance on wildlife on daytime trails* includes avoiding colour temperatures of lighting which are less tolerable for wildlife; avoiding lighting sources which are less tolerable for wildlife; limiting the period of the illumination as much as possible; limiting the intensity of the illumination as much as possible; and limiting the size of the illuminated surface as much as possible.

Table 1. Possible ways of introducing light pollution through nature trails

Source: own edition, the part 'Reducing light pollution while designing and establishing nature trails' based on Árgay, 2020

Presenting the topic of light pollution through nature trails		Integrating nature trails into facilities concerning light pollution	Reducing light pollution while designing and establishing nature trails	
General contents of light pollution	**Special contents of light pollution**		**Avoiding the use of lighting**	**Reducing the disturbance on daytime trails**
concept	concept		night trails	colour temperatures
sources	sources			
forms	forms			
general impacts on the vegetation	general impacts on the vegetation	dark sky parks	on nature trails at night	period of the illumination
general impacts on animals	general impacts on animals			
endangered species	endangered species		unnecessary lighting at daytime, dusk or dawn	intensity of the illumination
prevention	prevention			
reduction	reduction		equipment on nature trails emitting illumination	the size of the illuminated surface

Nature trails might be appropriate venues for introducing light pollution to their visitors. Based on the categorisation of Hoff (2010 in; Bundesamt für Naturschutz, 2010), according to the *methodological goals* the following trails can be named: nature educational trails; interpretational trails; interactive trails; sensational trails; experience trails; artistic trails; spiritual trails; barrier-free trails; spectacular trails; and media-supported trails. Spiritual trails and media-supported trails might not be relevant by introducing light pollution, yet all the other ones are all appropriate to present the aspects of light pollution to the visitors. It needs to be noted though, that the ones using playful, experiential and interactive methods might be the most effective ones regarding shaping the visitors' environmental consciousness. Considering a barrier-free solution by establishing nature trails might be advisable in the case of any type of trails if possible.

The categorisation has been expanded with certain *physical characteristics* of nature trails, based on Kiss (ed., 2007): location, the way of transportation; and length. According to the location, there are trails introducing local or general knowledge. Regarding the transportation, walking, biking, horse raiding and rowing trails can be named. Based on the length, walking and hiking trails can be described. All of the aforementioned trails might be appropriate to introduce light pollution to the visitors, yet the most suitable ones for the majority of the visitors might be walking trails introducing general, as well as local knowledge.

Table 2. Appropriate types of nature trails for introducing light pollution

Source: own edition; based on Hoff, 2010 in Bundesamt für Naturschutz, 2010 & Kiss, ed., 2007

Methodological goals	Physical characteristics		
nature educational trail	location	transportation	length
interpretational trail	trail introducing general knowledge	walking trail	1. walking trail
interactive trail			
sensational trail		biking trail	
experience trail			
artistic trail	trail introducing local knowledge	horse riding trail	2. hiking trail
barrier-free trail			
spectacular trail		rowing trail	

In summary: it can be stated that according to certain characteristics of nature trails, the facilities are theoretically appropriate for introducing light pollution to the citizens. It is important to notice though, that various types of trails provide different opportunities to inform citizens about general or specific contents of the topic.

Acknowledgements

References

Árgay, Z. (Ed.). (2020). *A fényszennyezésről - világosan!* Budapest: Agrárminisztérium Környezetügyért Felelős Államtitkárság.

Azman, M. I., Dalimin, M. N., Mohamed, M., & Abu, B. (2019). Brief Overview on Light Pollution., *IOP Conf. Series: Earth and Environmental Science 269 012014*, pp.: 1-7.

Chawla, L. (1998). Significant Life Experiences Revisited: A Review of Research on Sources of Environmental Sensitivity. *The Journal of Environmental Education, 29*(3), 11-21.

Cinzano, P., Falchi, F., Elvidge, C. D., & Baugh, K. E. (2000). The artificial night sky brightness mapped from DMSP satellite Operational Linescan System measurements. *Monthly Notices of the Royal Astronomical Society, 2000*(318), 641-657.

Cullen, S. (Szerk.). (1995). *Környezeti nevelési gyakorlatok: játékok és kísérletek kisdiákok számára.* Budapest: Peace Corps Hungary.

Fabio, F., Cinzano, P., Elvidge, C. D., David, M. K., & Haim, A. (2011). Limiting the impact of light pollution on human health, environment and stellar visibility. *Journal of Environmental Management, 92*(10), 2714-2722.

Gaston, K. J., Duffy, J. P., Gaston, S., Bennie, J., & Davies, T. W. (2014). Human alteration of natural light cycles: causes and ecological consequences. *Oecologia, 2014*(176), 917–931.

Heimerl, W. (2002). *Qualitätskriterien für Lehrpfade und Wanderwege.* Wien: Österreichischer Universitätslehrgang für Tourismuswirtschaft an der Wirtschaftsuniversität Wien.

Hoff, M. (2010). Themenwege zur Kulturlandschaft. In *Wege zu Natur und Kultur: Leitfaden zur Erstellung interdisziplinärer Wege zu Kultur- und Naturschutzthemen.* Bonn: Bundesamt für Naturschutz.

Kárász, I. (Ed.). (2003). *Természetismereti tanösvények Észak-Magyarországon.* Eger: Tűzliliom Környezetvédelmi Oktatóközpont Egyesület.

Kedra, M. (2003). The need to establish educational nature trails in the region of Podhale. In W. Kurek, *Issues of tourism and health resort management.* Cracow: Institute of Geography and Spatial Management Jagiellonian University.

Kiss, G. (Ed.). (2007). *Tanösvények tervezése.* Eger: Bükki Nemzeti Park Igazgatóság.

Kollarics, T. (2014). A tanösvények szerepe a fenntarthatóságra nevelésben. *Gyermeknevelés, 2*(1), 16-23.

Kollarics, T. (2015). *A tanösvények szerepe a környezeti szemléletformálásban - tervezés, hatékonyságvizsgálat és módszertani vonatkozások.* Sopron: Nyugat-Magyarországi Egyetem, Erdőérnöki Kar, Kitaibel Pál Környezettudományi Doktori Iskola.

Lee, C. K., & Ensel Bailie, P. (2019). Nature-based education: using nature trails as a tool to promote inquiry based science and math learning in young children. *Science Activities, 4*(56), 147-158.

Oelsner, G., & Rosemann, D. (2008). *Lehrpfade und Lehrgärten: Arbeitsmaterialie Agenda-Büro Nr. 47.* Karlsruhe: LUBW Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg.

Riegel, K. W. (1973). Light pollution – outdoor lighting is a growing threat to astronomy. *Science, 4080*(179), 1285-1291.

Sciezor, T. (2019). Light pollution as an environmental hazard. *Technical Transactions, Environmental Engineering, 2019*(8), 129-142.

The State of Western Australia (2014). *Delivering on the vision: 20 years of modern recreational trails in Western Australia 1994-2014.* State of Western Australia, Department of Sport and Recreation.

Website of the International Dark Sky Association. (2020. 07. 01.). Forrás: https://www.darksky.org/light-pollution/.

Website of the International Dark Sky Association. (2020. 09. 15.). Forrás: https://www.darksky.org/our-work/conservation/idsp/parks/.

About Author

Éva FODOR received her M.Sc. from Eötvös Loránd Universtiy in 2010 and started her PhD studies in 2016. She is a PhD student at the Eszterházy Károly University. Her research interests include sustainability education, youth environmental activism and nature trails.

Journal of Applied Technical and Educational Sciences jATES

http://jates.org

jATES
Journal of Applied
Technical and
Educational Sciences

Light pollution as environmental problem appearance in national core curriculum and in other educational documents

Anna, Apró

Eszterhazy Karoly University, Institute of Geography and Environment, Leányka Street 6. Eger 3300, Hungary, apro.anna@uni-eszterhazy.hu

Abstract

The paper presents the elaboration of light pollution environmental problems, the partial results of which can be seen in the National Core Curriculum (2020) (NCC in the following) i.e. the most relevant content of pedagogy in Hungary. Concepts related to the topic rarely appear in the analysed documents. The unified structure of the topic, the exploration of the causes and consequences of light pollution, and the students' understanding of their role are equally missing. In the course of this approach, efficient lighting can be introduced and cost-effective methods can be developed. We have sought out professional workshops on research topics that, due to their current activities, contribute to the integration of light pollution into education.The study presents some of the key elements of the National Core Curriculum. The first part describes the content regulation and regulation levels of school education, the learning and educational goals, the principles of learning and teaching, and the educational stages. The second half of the description deals with competence development, learning areas and knowledge contents. During the characterization, issues related to light pollution also appear.

Keywords: light pollution; National Core Curriculum; education; sustainability; competences

1. Introduction

It is a kind of expectation of our modern society to illuminate the night with artificial light sources. When we emit more light than necessary, we cause the phenomenon of light pollution, which has a detrimental effect on our environment and health. Light pollution can also be considered as one of the new environmental challenges of our time, the reduction of which also depends on the inhabitants of the settlements.

Teaching the problem is also justified in the educational institutions for which science subjects are best suited. The complex approach to light pollution in the educational sciences is closely related to the subjects of geography, physics, chemistry, biology. Interdisciplinary relationships in science play an important role in seeing the relationship between theoretical and practical knowledge, and in developing, applying and using knowledge. It is advisable to record the topics, tasks, knowledge that can be related to the teaching of light pollution. As a result, it is

possible to create knowledge systems and relationship systems that promote understanding and application. The study presents some of the key content of the National Core Curriculum (NCC, 2020).

NCC defines and ensures:

- content issues in school education,

- learning content,

- interoperability between schools,

- the content of basic education.

The goal of public education is to support students in the areas of self- and others' acceptance, community responsibility, initiative, and active participation.

2. A new environmental problem and its challenge

Light pollution can be a problem for human health, wildlife, the magnitude of energy consumption, and thus global warming, and research into the night sky (Muhamad, Nur Nafhatun, & Zety, 2019).

However, light is not only a source of energy but also determines the rhythm of life in the biosphere. Wildlife has adapted to changes caused by day-nights of varying lengths, moon phases, and seasons (Taylor, 2017). During evolution, species that lived by day and night lifestyles were separated, which evolved in response to changes in the light of nature. The characteristic daily rhythm of the production of the hormone melatonin produced by the pineal gland can be detected, which shows the highest level in the evening. The hormone itself is present in our body as a kind of antioxidant, in the activity of which activity can be detected in order to prevent the development of cancer. Light has an inhibitory effect on its production. Its low concentration promotes the appearance of cancerous diseases (Muhamad, Nur Nafhatun, & Zety, 2019). Studies have shown that the incidence of breast cancer among women working shifts and breast cancer has increased (Bashiri, 2014).

However, the widespread use of artificial light sources can also be confusing for wildlife, such as birds. This can manifest itself in a disturbance of their orientation, such as the fact that during their journey, artificial light sources disturb their orientation in their orienteering, which can lead to a landing different from the intended location.

At the same time, in areas where it is not possible for birds to avoid artificial lighting, their biorhythms are upset, meaning that daytime species are also active at night (Kyle, eds., 2019).

However, it can also affect a lot of the entire ecosystem, as many insects are attracted to artificial light, but it can also be a fatal attraction for them. Declining insect populations have a negative impact on any species that relies on insects for food or pollination. Some predators take advantage of this attraction and affect the food web in unexpected ways.

The issue of light pollution also raises serious sustainability issues. The answers to these questions can be found in the previous thoughts. Another possible way of raising awareness is in education. In the next chapter, we first review the general objectives of the National Core Curriculum, the areas related to the topic of sustainability, and then the content sections on light pollution.

3. *Learning and educational goals*

In this chapter, a special role is given to the promotion of social, economic and intellectual development and the coordination of social and individual needs. Due to the rapid changes in technological development, it is becoming difficult to define requirements in the field of education. Complex environmental changes, such as climate change, pollution, etc., are challenging humanity and wildlife.

We can distinguish several learning and educational goals, such as:

   - physical and mental health education: lifestyle habits that help to establish physical and mental health, such as the importance of a healthy diet and prevention

   - education for self-knowledge, human knowledge: the focus is on self-expression and healthy self-esteem. It can be achieved through the development of emotional intelligence and the application of positive social behaviours, such as honesty, justice, fairness.

   - education for cooperation and mutual respect in social relations: the learner knows that he/she can build relationships based on reciprocity and ethical behaviour, increase his / her independence, recognize those in need, find solutions, become compliant.

   - education on communication culture and media use: the use of infocommunication channels is closely linked to everyday life. In the traditional form of communication and infocommunication, it is necessary to follow a polite, eclectic and cultured style. Awareness is also important when using digital tools. It is important for students to be able to select from

websites that do not describe reality. This is a difficult task despite the fact that the young age group is open to receiving all the information that can be connected to the digital world.

- education for autonomous learning and conscious career building: the learner has the opportunity to develop the most effective way of learning for his or her age. In order to promote development, he/she develops his/her skills and becomes able to make decisions about further learning and, if necessary, modify it. The teacher and the parent, as well as their relationship, also have a special role to play, as the parents can support the student in accordance with the educational institution in order to facilitate the above.

- education for patriotism and active citizenship, democracy: students are involved in community programs such as the living environment is cultural, traditional opportunities, environmental protection, charitable activities. The importance of emphasizing sustainability can also play a central role here, in which both educators and parents can be actively involved, primarily by setting a personal example.

- commitment to a sustainable present and future: The goal is to develop learners' sense of responsibility for sustainability and environmental awareness. It can be achieved by organizing various project days and theme weeks, activating students, and joining national and international programs. Local specificities are also becoming important at both the social and cultural levels. It is important to develop a sense of responsibility that is relevant to the future of communities and that learners understand that they are actors in their environment who are involved in the processes that shape the future. Parents' and teachers' views on sustainability are also authoritative, as if family and school habits are consistent in educating about sustainability, it facilitates effective integration into students' lives.

3. Educational sections and special educational tasks

The aim of the first stage of primary education (grades 1-4) is to transfer the child from pre-school activities to school-based learning activities. It is important to develop the basic abilities and skills to solve creative tasks and problem-solving tasks in the meantime. Understanding, cognition can be developed, students can be aroused interest in learning, responsibility, perseverance and independence.

In the second phase, the foundation of the basic competencies, skill sets and knowledge contents necessary for effective learning will be continued, and active learning will be supported. The

learning style in grades 5 and 6 is different. It is also necessary to apply the learning methodology of the lower grades and raise it to a higher level. In grades 7-8, it is also possible to try new types of learning in order to learn the methods of active knowledge expansion. A key goal is for students to become more responsible and independent. In the course of motivation, continuous acquisition of knowledge and problem solving, we can connect this stage of education with sustainability.

In the third stage (grades 9-12), learning pathways are differentiated according to school choices. Vocational high school education and training, which also provides professional qualifications, lays the foundation for meeting the requirements for graduation. It must be possible to enter higher education even after graduating from a vocational high school. With regard to high school education, students should be given the opportunity to enter various vocational training instead of (or in addition to) higher education. In the case of vocational secondary schools, it is necessary to create the acquisition of knowledge that will enable the continuation of studies after the vocational qualification. During the four grades of secondary education, the learner undergoes a number of changes in both cognitive and emotional as well as personality development. Career orientation appears as a priority pedagogical task.

4. Special rules for certain tasks and institutions of the public education system

Kindergarten education plays a significant role because addressing sustainability issues proves to be more effective the earlier we start addressing it at an earlier stage in life. According to the NCC, science education appears as one of the priority tasks of public education, namely according to the following definition:

In the learning-teaching process of science, it is essential to get to know the problems and real-life situations relevant to the student, which the subject can achieve by discussing the problem in an integrated way, with the active participation of students, planning, carrying out, observing and analyzing simple experiments, even at home. el. It is very important to supplement all this with field activities, which are not only studies in nature, but can even take place in an urban environment (NCC, 2020, p. 369.).

The foundation of science thinking in education can begin in the first stage of primary education with the help of Mother Tongue Communication and Literary Literacy. This can continue within the Natural and Geography learning area in the subject of Environmental Education. One of the aims of the subject of environmental education is to get to know the phenomena and

events of the environment in a narrower environment and then in a wider environment, according to the age characteristics. Another aim is to thematically structure the knowledge and emphasize the importance of the observer role, to develop a sensitivity to the problems, and to establish a natural science literacy for the expansion of their later studies. Building on current, directly experienced problems is effective in processing the curriculum. To create this, the local curriculum is best suited for this purpose. The exploration of the causal connection (e.g. the functioning of the human body), the systematization (living and inanimate natural phenomena), the need to apply the acquired knowledge become more and more important. The process helps to lay the foundations for science literacy. Pupils get to know the sights of Hungary in a wider environment and in a narrower environment, or the natural endowments of a chosen national park / landscape protection area. Examining the relationship between man and nature in the spirit of the environment and sustainability, students learn why nature conservation is important, how our ancestors met their nutritional needs, how they took care to protect their immediate environment. National parks or nature reserves play a role here.

5. Competence development, learning areas and knowledge contents

In the first stage of primary education, the conditions necessary for the development of key competencies are created in public education institutions. Acquiring basic competencies makes it possible to acquire usable knowledge as a result of acquiring a system of knowledge, skills and attitudes *(Table 1.)*. The following are some examples of learning processes that play a major role in developing applicable knowledge:

- observation: learning about the signs of phenomena that can be detected by the senses, ie gathering information. In the process, students try to move forward in the formation of ideas, relying on their existing knowledge. Proper application of experience and method of illustration provides a basis for the conceptualization process.
- analysis: this phase can also be called the process of conceptualization. In terms of its design, we distinguish between inductive (moving from the concrete to generalization) and deductive (moving from the general approach to the concrete) modes. The next step requires the right conceptualization, otherwise there will be failure and misunderstanding in the application of knowledge.
- application: skill and skill development required. Students will be able to apply known algorithms (Teperics, 2015).

Table 1. Relationship between competency types and light pollution

Competence types	Knowledge	Skills	Attitude	Nature of connection to light pollution
Basic Competence	speaking, writing, reading, calculation	getting information	self-confidence, openness, decision-making	A, B, C, D, E, F, F
Learning competencies	self-knowledge, field of interest	learning objectives, strategies	initiative, sense of responsibility	A, C, E
Communication competencies	basic vocabulary, knowledge of verbal and nonverbal communication	socially connecting, correct use of language, active hearing, persuasion	open, sensitive and critical attitude towards the opinions and arguments of others	A, B, D, E
Digital competencies	operating systems, digital forms of communication, protection of personal data	use of software, information retrieval, collection and processing	ethical use of digital technologies	D, E, F
Competences of thinking	models, data analysis tools, recognizing the differences between scientific and pseudo-scientific claims	drawing conclusions based on facts, recognition of correlations	interest, identification of problems	A, F
Competences in social participation and responsibility	society's values, moral norms, ethical behaviour	following social rules and moral norms	taking responsibility, keeping with tradition	A, B, C, D, E, F
Personal and social competences	identification of own abilities, mental and emotional health, recognition of community standards	teamwork, critical consumer approach	own and social health awareness, compromise, active way of life	A, B, C, D, E, F
Competences in creative creation, self-expression and cultural awareness	knowledge of the main elements, traditions and cultural products of the cultural heritage of countries, nations, Europe and the world	engaging in creative activities	considers openness to culture to be valuable	A, C, D
Employee, innovation and entrepreneurial competencies	future shaping, understands the evolution of labour market opportunities	adaptation in the world of work, creativity, problem solving and critical thinking, objectives	flexible adaptation to changing roles, sense of responsibility, cooperation	A, B, C, D, E, F

In the following, characteristics that define the knowledge, skills, and attitudes associated with core competencies that support the acquisition of usable knowledge about light pollution are defined. Abbreviated in the table, their initials are shown.

A: Apply knowledge of the problem can circle

B: The presence of energy saving in everyday life

C: Knowledge of the harmful effects of light pollution on the environment

D: Encouraging active action to mitigate the problem

E: Distinguish between physiologically favorable and unfavorable light sources

F: Use of reliable and modern lighting methods

6. Another possible occurrence of light pollution within the framework of some of the studied subjects

In the framework curricula of the subject of biology 11-12. Examining the relationships between material flow and energy flow in the ecosystem thematic unit, the exploration of its quantitative relations in living communities, results in the exploration of local problems with students, including light pollution. In the 10th grade textbook, the analysis of animal communication focuses on the function of light and pheromone traps in insects. In the year, the Hortobágy National Park and the star shop established there will play a role in the discussion of national parks on the topic of Hungarian living communities.

Within the framework of the subject of physics, light pollution in general schools is dealt with in the chapter Our Environment and Physics, where energy saving possibilities are examined in households, schools and residences. In the chapter Optics, astronomy, the relationship between man and light comes to the fore, where the concept of light pollution and the light pollution of our country appear. These will also appear later in the grammar school framework curricula. As stated in the NCC, in Class 8, the above also appears in textbooks. In grades 9 and 11, on the topic of Models of the Solar System, the message of the Starlight appears in the curriculum as a reading of the Earth Hour event.

In geography, in the name of cultural heritage, light pollution can be mentioned in connection with the systematization of cultural values, national parks and world heritage sites and values, and in the case of global challenges in exploring the territorial characteristics of the urbanization process and the essence of energy management. It also appears in textbooks, as in 7th grade the night lights of Eurasia can be seen on a light map during the population density of Asia and the study of its settlements. In 8, the Zselic Star Shop Park is mentioned in terms of the protection of Hungary's values. In the first year of high school, the chapter from the Edge of the Universe

to the Sun emphasizes light pollution, star shop parks, and in the 10th grade, the night lights of cities appear in the form of tasks.

In chemistry, in terms of the history of science, we can explore the history of light sources within the framework of a project work. In the chemical aspects of environmental systems, we can approach light pollution from the candle to LED bulbs from the point of view of the history of science.

In general, it can be said that in the light of science subjects, the causes and socio-economic effects of the teaching of global problems can be explored in the causal contexts of light pollution in the energy and infrastructural topics of the subjects. Following the science side, in the processing of the harmful effects on the living world, including those that occur due to the behavioral patterns that appear in the age group of the students. The topic is also suitable for comparing the development of countries and learning about future solutions.

7. Summary

Due to the proliferation of environmental problems, environmental education is one of the outstanding tasks of public education; nowadays it includes the pedagogy of sustainability, the education of the "environmental citizen". This pedagogical practice covers human coexistence, the relationship between man and nature, physical and mental health education, and the development of social skills. The core competencies and their characteristics were initially highlighted individually. In this analysis, core competences for social participation and responsibility may have come to the fore as an area that also emphasizes sustainability and light pollution. Almost all of these include the importance of the appearance of light pollution in educational settings, awareness of the energy-saving uses of artificial light sources, and the physiological impact of these light sources on the entire ecosystem. Overall, the concepts and phenomena closely related to the topic, although with a small number of mentions, occur in the analyzed documents. However, there is a lack of a unified structure of the topic, therefore, the exploration of the causes and consequences of light pollution in the geographical topics, and the understanding of the students' own role and possible solutions in the knowledge of them.

References

5/2020. (I. 31.) Korm. rendelet: A Nemzeti alaptanterv kiadásáról, bevezetéséről és alkalmazásáról szóló 110/2012. (VI. 4.) Korm. rendelet módosításáról. *Magyar közlöny 2020* (17), pp. 290-373. Letöltés (2020. 07. 20.)

https://magyarkozlony.hu/dokumentumok/3288b6548a740b9c8daf918a399a0bed1985db0f/letoltes

Bashiri, F. (2014). Light Pollution and Its Effect on the Environment. *International Journal of Fundamental Physical Sciences (IJFPS), 4*(1), 8-12. doi:https://doi.org/10.14331/ijfps.2014.330061

Kyle, G. H., Cecilia , N., Benjamin , M., Frank , A., Adriaan , M., & Andrew , F. (2019). Bright lights in the big cities: migratory birds' exposure to artificial light. *Front Ecol Environ, 17*(4), 209– 214,. doi:doi:10.1002/fee.2029

Muhamad, F. S., Nur Nafhatun, S. M., & Zety, H. S. (2019). The Risk of Light Pollution on Sustainability. *ASM Science Journal, 1*(12), 134-142. doi:ISSN 1823-6782

Taylor, S. (2017). Light Pollution: A Case Study in Framing an Environmental Problem. *Ethics, Policy & Environment, 20*(3), 279-293. doi:DOI:10.1080/21550085.2017.1374010

Teperics, K. (2015). A földrajztudomány/földrajztanítás szerkezete, egyedi vonásai, hatásuk a földrajztanítás folyamatára. In K. Teperics, E. G. Sáriné, G. Németh, L. Sütő, & E. Homoki, *Földrajztanítás - válogatott fejezetek* (pp. 29-34). Debrecen: Debreceni Egyetem Kiadó.

About author

Anna Apró PhD student graduated from Károly Eszterházy University in 2017 as a teacher of geography and mathematics. She is currently pursuing her studies at the Doctoral School of Education at the university, in the Environmental Pedagogy module as a chosen doctoral subject area. She writes her doctoral dissertation on the topic of environmental pedagogical aspects of light pollution, which is a lesser-known form of environmental damage, but also a present problem, so it is necessary to include it into education in a gap-filling manner.