

Digital Technologies in Environmental Education

Peter Brečka, Monika Valentová, Ivana Tureková

Department of Technology and Information Technologies, Faculty of Education, Constantine the Philosopher University in Nitra, Dražovská cesta 4, 949 74 Nitra, Slovakia

Abstract – The study responds to the current goal of environmental education in Slovakia, which is to create a functioning integrated system of environmental education, instruction and awareness, using innovative tools while maintaining the principles of sustainable development. Many schools already have innovative didactic tools or technology, but the lack of interactive software on environmental education remains a problem. There is also a need for uniform methodological materials for teachers, using teaching strategies based on the effective development of pupils' environmental competences through digital technologies. This case study aims to present an analysis of the current state of environmental education and a digital support model for pupils' environmental education. The authors refer to the proposed and practically tested teaching material created in the Smart Notebook software.

Keywords – digital technologies, environmental education, primary education, Smart Notebook software.

1. Introduction

Environmental education has had its place in the updated Slovak State Educational Programme (SEP) since 2015. It represents a cross-cutting theme in the education conditions, which is incorporated into the curricula of several subjects according to the given educational programme (Figure 1).

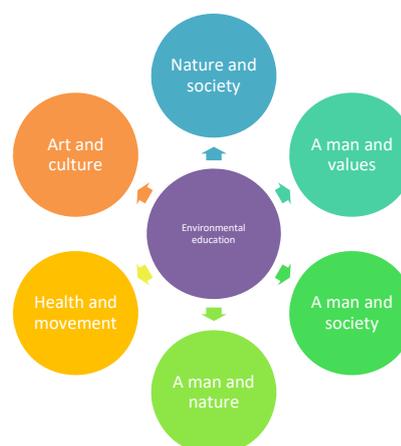


Figure 1. Schematic diagram of the implementation of the cross-cutting theme within the educational areas [SEP]

In practice, this means that environmental education cuts across educational areas and can be applied in several forms - as an integrated part of the educational content of teaching subjects or as a separate subject within elective lessons [1].

Digital technologies play an essential role in the cross-cutting environmental theme. They make it possible to use up-to-date data on the state of the environment and simulate certain events while stimulating interest in solving environmental problems [2]. Thanks to them, it is possible to capture phenomena of the local and remote environment, collect data, establish contacts, share and exchange their findings [3] within the country, the EU countries and the world.

DOI: 10.18421/TEM112-28

<https://doi.org/10.18421/TEM112-28>

Corresponding author: Peter Brečka,
*Department of Technology and Information Technologies,
Faculty of Education, Constantine the Philosopher
University in Nitra, Nitra, Slovakia.*

Email: pbrecka@ukf.sk

Received: 09 February 2022.

Revised: 14 April 2022.

Accepted: 20 April 2022.

Published: 27 May 2022.

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Digital technologies are also crucial in the sustainability awareness process [4]. It is the concept of sustainability that is beginning to emerge in the area of the phenomenon of happiness in public space [5].

Digital technologies primarily include computer-based learning and multimedia materials and networks and communication systems to support learning [6]. We can also include interactive or electronic whiteboards in digital technologies. These are large touch-sensitive surfaces that control a computer connected to a digital projector or stand-alone panels [7].

Digital technologies offer a wide range of operations and activities that can make learning engaging, experiential and, above all, interactive.

Environmental education can use images and texts stored on the computer, projecting them onto a large screen where the teacher can manipulate them to emphasise points made during the lesson [8].

It is possible to demonstrate natural phenomena and elements in the safety of the classroom, e.g., with short video demonstrations. The teacher or pupil can manipulate the projected texts directly on the screen, using a tool or his/her finger [9]. The interactive whiteboard (IWB) is a teaching and learning tool that has already produced several good results in teaching and learning with primary school pupils in different countries [10], [11], [12], [13]. The interactive whiteboard in environmental education has increased environmental awareness and cooperation, better test scores, and increased willingness to study science [14].

Therefore, in the present study, we focused on applying digital technologies to environmental education through developing gamified digital learning material. The application was carried out with primary school students, as this period is considered the most important in promoting environmental and responsible behaviour [6].

2. Objectives

In the preparatory phase of the case study, we focused on determining the problem that the study addresses, mainly the lack of teaching materials and educational methodology in applying innovative digital technologies. For this reason, we aimed at achieving these objectives through the developed teaching material.

The study's main objective is "to present a proposed and practically validated digital teaching material, for the field of environmental education, compiled in the Smart Notebook software."

We validated the teaching material with the pupils of the 2nd year of selected primary schools in the Slovak Republic. In the selected schools, environmental education was implemented as a separate subject.

The validation of the teaching material included an in-depth qualitative analysis of the current state of provision and implementation of environmental education teaching in the selected schools.

3. Methodology of Creating Teaching Material

The main principle of teaching material creation was to develop pupils' personalities comprehensively, i.e., development in knowledge, skills and attitudes /values. In the requirements for the educational objectives, it was also necessary to pay attention to the requirements, which include:

- consistency (subordination of higher goals to lower ones),
- appropriateness (orientation to the pupils' abilities with a special approach to pupils with ADHD),
- unambiguity (formulation of short and unambiguous terms),
- measurability (it is crucial to set objectives in such a way that their results can be assessed in practice),
- temporality (objectives must be time-bound) [15].

We compiled the teaching material in Smart Notebook 16.2, which represents an ideal way to create digital teaching content. Using this program, it was possible to easily and efficiently create interactive gamified learning activities (teaching aids) with the possibility of using digital intermediaries (e.g., in the case of technology available to pupils in the 2nd year via an interactive whiteboard or display). The program in question provides creative ideas and the possibility of setting specific parameters for an individual approach to each pupil, i.e., it is a suitable teaching material for pupils with learning difficulties.

The created material aimed to consolidate the acquired knowledge of pupils in environmental education, make the teaching process more effective and introduce new elements through digital technologies into teaching.

We have divided the teaching material into three thematic units: Animals; Trees-Shrubs-Flowers; Vegetables and Fruits. We mediated it through an interactive whiteboard (Figure 2., Figure 3., Figure 4.).

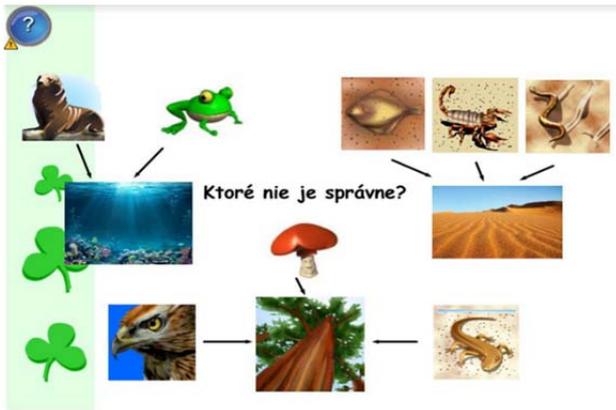


Figure 2. Sample activities from the thematic unit Animals



Figure 3. Sample activities from the thematic unit Trees

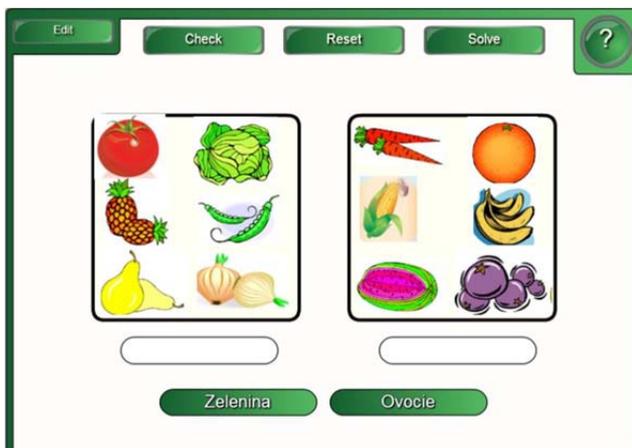


Figure 4. Sample activities from the Fruit and Vegetables thematic unit

4. Results and Recommendations

The validation of the teaching material took the form of a case study in primary schools, which are among the few schools in Slovakia with fully organised environmental education, conducted as a separate subject. We also focused on environmental education's current state, conditions, strengths, and weaknesses as part of the validation.

We see the integration of environmental education into the educational programme at these schools as an excellent positive. On the other hand, it is necessary to express a critical attitude towards these schools' content and quality of teaching.

In terms of the application of teaching aids, despite the good equipment of schools, we noted shortcomings in their application in teaching. Although schools have sufficient software, teachers hardly use it in teaching. They prefer traditional teaching aids (books, textbooks) and didactic technology (interactive whiteboard).

Teachers teach environmental education lessons using developed methodological procedures, using their own themes. They prefer memorisation strategies in their teaching, which was evident in the pupils' work with the teaching material. Pupils had acquired theoretical knowledge about waste separation but less about the reasons for waste separation. Pupils do not know how to assess the impact of pollution on the environment, human health, and organisms living in nature.

These deficiencies result in poor quality of lessons focused on raising pupils' awareness of environmental behaviour.

However, we positively evaluate the involvement of schools in projects in which pupils are encouraged to participate in various practical activities such as bottle separation, sorting and cleaning up waste in school premises.

Our findings showed that teachers do not lead students to any project-based activities.

Of the extra-curricular forms, nature trails appear to develop environmental thinking and sensitivity effectively. They allow pupils to be in close contact with nature and to acquire interesting natural and cultural knowledge directly.

Finally, we were interested in students' and teachers' attitudes towards the developed teaching material.

From the practical validation, we can positively state that the pupils were interested in learning new knowledge. They were more active in the tasks than in traditional teaching (Figure 5.).



Figure 5. Example of pupils' work with teaching material

The teaching material also included tasks that led them to be competitive and cooperate with others. The pupils' cooperation in solving the tasks was very intense. Class teachers and the environmental education teachers confirmed the improvement in the quality of the teaching process and the increased activity of the pupils.

During the interviews, teachers noted that they would welcome similar teaching materials in the classroom because they stated they do not have enough space and time, and ultimately not enough competence, to prepare them.

From our findings, we extract the following recommendations for the implementation in practice:

1. To improve environmental education through the introduction of digital technologies. Digitally assisted learning effectively helps students acquire the awareness of relationships between subjects and concepts they have difficulty understanding [16]. Digital technologies, mobile applications, and virtual reality can provide new ways of engaging pupils in environmental education, so-called bridges in teaching pupils, and preparing young people to think globally and behave in an environmentally responsible way [6]. Human responsibility is proving to be a real challenge in the 21st century [17].
2. Systematic support and development of digital competencies of teachers [18]. The lack of professional development is a severe challenge associated with technological integration and a problem that cuts across curriculum areas such as environmental education, multicultural pedagogy, and the promotion of intercultural understanding. Professional development can better serve the needs of both teachers and pupils within a unified approach [19].
3. Incorporation of environmental education into regular classes. Environmental education should become separate teaching subject to deepen teaching and learning [20]. At present, it does not have sufficient importance.
4. To ensure the implementation of educational activities in the natural environment, using direct contact with nature and with environmental phenomena and processes [21]. We also recommend implementing nature trails, nature activities, school trips.
5. To develop a comprehensive reform that considers social and economic circumstances and teachers' ability or willingness to integrate digital technologies into their teaching practices.
6. To motivate schools to create and present projects. Environmental education requires different integrated and project-based approaches to teaching and learning [22].
7. To implement environmental activities in nature and with pupils' parents. It is fundamental to create prerequisites for pupils' healthy orientation towards environmental issues in the home environment. Parents' positive relationship with nature helps children develop their positive relationship with nature [23].
8. To change the curriculum of practical environmental education teaching in schools. This recommendation assumes that all the activities we recommend are not possible without changing the educational system in schools. Therefore, the curriculum for teaching environmental education needs to be changed to match the educational standards' content and incorporate more practical learning in the natural environment.

We based the above recommendations on the analysis and evaluation of the current management of environmental education in the school environment of the selected schools. The recommendations are intended for the primary schools we analysed and for all primary schools with practical environmental education teaching. A major problem of current education is the lack of teachers' competence and the lack of time to implement the above activities. For this reason, we directed our last recommendation to change the educational system in all schools in the Slovak Republic.

5. Conclusion

The primary task of environmental education is to teach pupils to understand the importance of life on the Earth, develop their positive relationship with nature, so they have a natural interest in protecting all organisms living in nature and understand the importance of this act for the future generations. For this understanding, they need, in particular, direct contact with nature. However, the subject's current status as a cross-curricular topic in the teaching process gives primary schools limited opportunities to use direct contact, which is why digital technologies appear to be an effective solution. We think these proposed recommendations could improve the teaching process and introduce better and more effective teaching of environmental education in selected primary schools and those schools where environmental education is implemented only as a cross-cutting topic.

Acknowledgements

This paper was written within solving the project ZML-2020/8148:34-A1101 Support for the development of practical skills of UKF students in Nitra and the project Kega 014UKF-4/2020 Innovative educational e-modules for occupational safety in dual education.

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