

ICT Equipment in the Kindergartens for Sustainable Education from Kindergarten Principals' Perspectives in the Czech Republic

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Abstract - With the rapid development of the technology in 21st century, education sectors try to make good use of the ICT effectively. Therefore, the schools have rapidly been equipped with modern ICT tools to sustain education effectively. The purpose of the research was to map the equipment of ICT for sustainable education. 143 kindergarten managers participated in the research from four Czech Republic regions. They were interviewed by the questionnaire prepared by the researchers. In the study 3 hypotheses were tested via the quantitative method. In conclusion, it shows that the kindergartens seem to ideally have a lack of ICT tools in kindergartens in the Czech context for sustainable education.

Keywords - sustainability, ICT, technological equipment, early childhood education, COVID -19 pandemic.

1. Introduction

The preschool period is called the magic years of life in which all domains develop rapidly in the child's life.

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Technology, on the other hand, makes it sustainable by helping children use the knowledge and skills gained through education better, more efficiently, and apply them more consciously. Information technologies such as tablets and computers may be appropriate as preschool children are in a period when they are very curious and eager to learn everything. For this reason, it is stated that technology will attract the attention of preschool children and provide more permanent and sustainable learning. In addition to contributing to the development of language and concept, motor and mental abilities of children, information technologies can also encourage social interaction and group activities if used appropriately in pre-school institutions. Therefore, the stimulating materials around them, the quality of the child's interaction with these materials, and the quality of education they receive are very effective on their early academic skills. While we are choosing these materials, we can go to an education system with more appropriate visual richness by putting them on a more solid foundation with the technology that is becoming widespread today. For this reason, technological development, which also affects kindergartens, provides many benefits not only in the field of education but also in terms of the sustainability of the administrative work of the institution. The use of technology is an issue that all principals and teachers attach importance to during education. It can be said that they use new-generation information technologies effectively in all educational environments and play an important role in maintaining a digital life. Teachers, who provide information exchange between students and parents, can make instant and long-term comments and status statements with the kindergarten mobile application users, and families can be informed about the current status of their children at school. Using technology resources and actively using more than one sensory organ of children is extremely important in terms of sustainable education. It is known that preschool children learn by applying what they observe and by

copying in a way. Moreover, they record almost everything they see around them in their memory and repeat these behaviors as they learned. The rich experiences that can be provided to the children during this period affect their developmental domains positively. Information technologies are becoming more and more widespread every day and have become a part of sustainable living. It is known that technological infrastructure and equipment are extremely important in terms of sustainable education amidst of the COVID -19 process. For this reason, technological development, which also affects kindergartens, provides many benefits not only in the field of education but also in terms of the sustainability of the administrative work of the institution. The use of technology is an issue that all principals and teachers attach importance during education. It can be said that they use new-generation information technologies effectively in all educational environments and play an important role in maintaining a digital life. Teachers, who provide information exchange between students and parents, can make instant and long-term comments and status statements with the kindergarten mobile application users, and families can be informed about the current status of their children at school.

2. Theoretical Background

In recent years, teachers as well as students who are planning to become teachers have begun to change their perceptions regarding the use of technology for sustainable education [12]. The rapid advancement of Web 2.0 technologies has made virtual learning and teaching a modern way of acquiring and transferring knowledge for sustainability [21]. While thinking about digital literacy, Poore [17], mentions the basic idea that we have to realize first; to find out how we will use digital technologies in teaching. He considers this to be a key element in considering the development of digital literacy, as well as the question of the development of digital literacy of the teachers themselves and the resulting meaningfulness of the activities for pupils for sustainable education [18]. The need to integrate 21st-century competencies was emphasized as well - collaboration, communication, digital literacy, citizenship, problem-solving, critical thinking, creativity, and productivity – into the curriculum at the stage of teacher training [20]. Teachers themselves need to learn how to bring modern technology closer to children to benefit them in the educational process. However, there is one important assumption that digital literacy will not be taken as a separate area, but will be included in the curriculum as an integral part of it for sustainable education.

Proponents of modern technology emphasize that the technological and digital equipment of schools is the primary task of the Czech Republic, as science, research, and everyday life are under their influence. The Strategy of Digital Education in the Czech Republic until 2020 also supported meaningful digital education as a state concept, i.e., how to work with technologies and how to move in the online environment (Strategy of Digital Education in the Czech Republic until 2020). It was said that teachers seeking to survive in an era of cloud pedagogy that provides more affordable technology than before are encouraged to gain knowledge of technology, pedagogy, and content to be able to fully participate in the educational process [10]. As was stated developing the digital readiness of pre-school teachers helps them to support children's digital skills. However, at the same time [7], it was revealed that early childhood pre-school teachers had very limited opportunities to use digital technologies in ways that were based on children's needs and interests [9].

It was also concluded that the implementation of ICT in education is effective, based on the experiment [2], [3]. However, there is one crucial condition that the authors point out - the basis of any implementation is resources that include access to a sufficient amount of technology, time for teachers and students to learn how to use technology applications, and generally have adequate technical support. This comprises the idea that teachers who internally adopt digital solutions in their lives will be better equipped to engage technology in their classrooms [1]. Furthermore it was added that the positive use of digital technology is the development of fine motor skills, cognitive and mental abilities, observation exercises, concentration, and memory, ensuring access to digital technologies and therefore preventing possible exclusion or bullying, support for the disabled children, and building self-confidence [6].

The issue of developing creativity and independence within the digital age was also mentioned [5]. On the one hand, technologies are perceived as dangerous, especially due to the content from which children should be protected. Adults determine what is correct, and children and young people are seen as consumers of what adults allow. On the other hand, technologies are perceived by children as an element of empowerment and liberation, enabling children and young people to be active according to their needs and interests. Technologies offer unique opportunities for children to move beyond the control of adults and to style themselves in different roles. Therefore, children become technically free. However, some research shows that there is considerable concern regarding

the digitization of kindergarten education. For example, it was suggested that educators feel that using technology in early childhood, whether as "play with technologies" or a "learning-by-game technology" can limit a child's imagination [6].

The study was published to focus on the qualitative monitoring of children aged 0-8 years showing how they work with technologies, how parents mediate the use of technologies and sought to identify the potential benefits and risks associated with the use of technologies [4]. The study involved 70 families from six European countries including the Czech Republic. He states that the interaction of children with technologies is shaped primarily by the values of parents, the proximity of older siblings, the extended family. Most children have basic operational and safety skills, some even advanced digital competencies, but they lack the maturity needed to engage reflectively.

The broader view of the issue shedding a light is based on a survey of more than 8,000 respondents, which included kindergarten pupils and pupils up to the 3rd grade of primary school [11]. Results show that access to computers at school, their use at home and school, and the use of the Internet are positively correlated with learning outcomes. On the other hand, frequent use of reading software on a PC has a negative correlation with reading results. In terms of the availability of technology in pre-school education, insufficient equipment was shown as one of the main barriers to development [14]. In this way, it supports the previously published conclusions [15], one of the factors limiting the successful implementation of ICT in education as "lack of equipment", hiding the following under this collective name: outdated, incompatible or unreliable computers, lack of computers, lack of internet access or the internet is not easily accessible, lack of equipment funding, and lack of good educational software.

3. Research Methodology

The primary purpose of the research was to map the equipment of kindergartens in terms of information technology for sustainable education. For this reason, we have approached a quantitative design that is in line with our intention [8].

3.1. Research Goals and Questions

The research aim was to map the technological equipment of kindergartens for sustainability. The partial goal was to find out whether there are certain dependencies of kindergarten technological equipment and the size or location of the kindergarten.

We asked ourselves the following research questions:

- How does kindergarten equipment relate to its size in terms of technology for sustainability?
- How does kindergarten equipment relate to its location in terms of technology for sustainability?

Based on the research questions, the following null hypotheses were established:

- H₀₁: There is no dependence between kindergarten equipment related to its size in terms of technology for sustainability.
- H₀₂: The interactive whiteboard equipment is not related to the size of the kindergarten for sustainability.
- H₀₃: The teacher's computer equipment is not related to the size of the kindergarten for sustainability.

3.2. Research Method

A structured interview was chosen as a research method concerning the aim of the work, which was conducted with the principals of kindergartens. The interview contained a total of 16 closed questions comprising classroom techno-educational devices. The researcher developed 16-item questions that validated participants' responses to the questionnaire used for the quantitative part. The 16-item questions focused on the topics were already presented in the method section. It was primarily focused on kindergarten equipment in terms of technology, specifically the number of interactive whiteboards, interactive displays, televisions, data projectors, teacher computers (laptops), children's computers, radios with CD players, cameras, tablets, smartphones, laptops, printers and internet connection via WiFi. This type of question was chosen concerning the type of research method and the descriptive goal of the research. Due to the pandemic situation (COVID-19), the interviews were conducted online via MS Teams and Google Meet to make the contact with the respondents audio-visual. The interviews were realized in the period February - April 2021. To ensure valid and reliable responses from the participants, validity, and reliability of the questionnaire were established. The validity of the research tool was ensured based on a focus group within the pre-research with 10 respondents who are experts in the field of early childhood education and ICT, and they were asked to validate the revised questionnaire. It was presented to experts for some suggestions and recommendations. Experts' suggestions and recommendations to improve the items were followed and included in the final draft. The obtained reliability coefficient of 0.81 shows that the research instrument is reliable to a high degree.

3.3. Research Sample

The research group respondents were addressed in four Czech Republic regions - Hradec Králové, Pardubice, Liberec, and Central Bohemia. The restriction to these four regions is due to geographical proximity and accessibility. At the same time, we believe that this selection is sufficiently representative from the viewpoint of the entire Czech Republic.

Research group selection was carried out based on intentional selection [8]. This should ensure that the findings are sufficiently relevant. A total of 143 kindergartens were involved in the research, and 143 kindergarten managers were interviewed. The size of the school ranged from one class to eight classes (Figure 1).

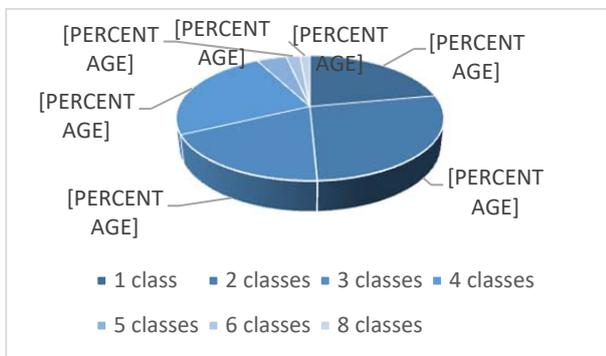


Figure 1. Distribution of kindergartens by number of classes

3.4. Data Analysis

NCSS 2010 software was used for statistical data processing and the chi-square independence test and the Spearman correlation coefficient calculation were used due to the nature the data. When testing the hypotheses, we based this on the chosen significance level $\alpha = 0.05$.

3.5. Research Limits

The research we carry out is designed carefully so that its results can be considered representative. Nevertheless, we are aware of several partial limits. The first of them is the unrepresentativeness of the selection of regions where the research was carried out. However, based on previous research experience, we believe that the selected regions represent the situation sufficiently throughout the Czech Republic.

We understand the limited number of interviewed schools as the second limit. Although the selection of the research setting was made based on a random selection, we are aware that it is possible to find small deviations in the results stemming from the nature of statistical data processing. However, concerning testing hypotheses at an acceptable level of significance, we believe that this limit is not critical.

4. Results

In this research, the kindergarten size given by the number of classes was taken as an independent variable while the dependent variable was constructed by the technologic equipment.

Hypothesis H1: There is no dependence between the kindergarten equipment in terms of technology and its size.

Within H1, we considered the number of all technologies available to teachers and children as equipment. As is known the kindergartens generally have more than one class and they are considered to be equipped with interactive whiteboards and in more classes teachers and children will use tablets. Spearman's correlation coefficient was 0.2239, which at the significance level $\alpha = 0.05$ corresponds to the dependence of the variables. However, due to the nature of the variables, we assumed a closer relationship (higher value of the correlation coefficient). The results show that even though the kindergarten has several classes, one interactive whiteboard is used usually in the ward with the oldest children, and for example, 5 laptops are borrowed between classes. The result exposes a dependency, but not proven closer relationship between the classes.

Hypothesis H2: The interactive whiteboard equipment is not related to kindergarten size, and it was tested using the chi-square independence test.

Table 1. Interactive whiteboards by number of classes

Number of classes	Observed frequencies		Expected frequencies	
	YES	NO	YES	NO
1	23	10	21.9	11.1
2	24	14	25.2	12.8
3	14	12	17.3	8.73
4	34	12	30.6	15.4

The relationship between kindergarten size and the equipment in the form of an interactive whiteboard was not confirmed ($\chi^2 = 3.34$; $p = 0.342$) (Table 1). Figure 2 shows the equipment of kindergartens with interactive whiteboards.

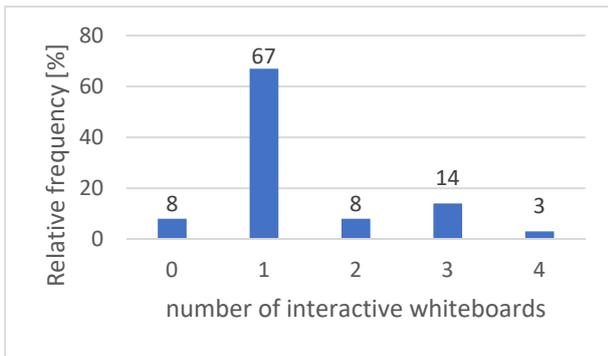


Figure 2. Equipping kindergartens with interactive whiteboards

Fig. 2 shows that two-thirds of kindergartens are equipped with one interactive whiteboard. It is interesting to note that 14% of kindergartens, use 3 interactive whiteboards and in 3% they use four interactive whiteboards. According to a more detailed description of kindergartens, these are entities that are located in more than one building. 8 kindergartens do not have an interactive whiteboard. These are one-class small kindergartens with a maximum of 20 children.

Also, hypothesis H3: The teacher's computer equipment is not related to the kindergarten size, it was tested using the chi-square independence test.

Table 2. Teacher's computer equipment by classes

Number of classes	Observed frequencies		Expected frequencies	
	YES	NO	YES	NO
1	10	22	10.5	21.5
2	16	22	12.5	25.5
3	8	18	8.55	17.5
4	13	34	15.4	31.6

The relationship between the kindergarten size and the teacher's computer equipment was not confirmed ($\chi^2 = 2.14$; $p = 0.544$) (Table 2). Details on equipping educators with a computer (here we mean a desktop computer or laptop, but only for educators) are shown in Figure 3.

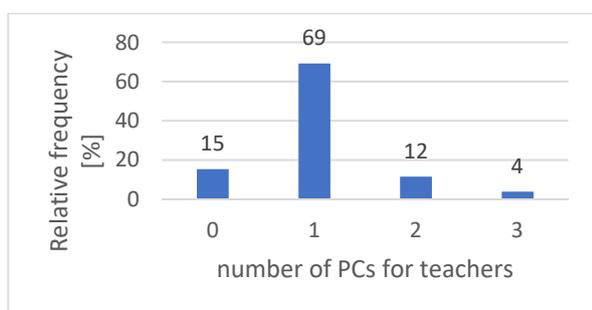


Figure 3. Equipping teachers with a computer (PC or laptop)

In 69 % of kindergartens, teachers have only one facility. If we relate to the school size, then schools with two or more classes predominate (1 class - 22%)

and therefore there are 3 or more teachers in the school (Figure 3). Therefore, they have to work on one device.

If we focus on other digital technologies, 69% of kindergartens have at least one computer or laptop for children's work. This device is mainly used for viewing photos taken or in conjunction with a digital magnifying glass, which is currently the most acquired technology for school together with robotic toys.

Due to the possibility of using European projects, kindergartens have been able to equip themselves more with tablets in the last 5 years (Figure 4).

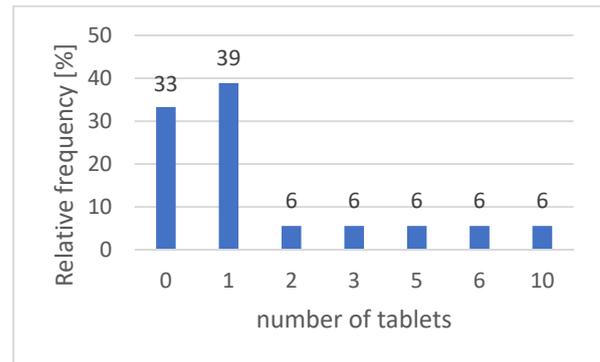


Figure 4. Kindergarten tablets

Therefore, it can be stated that one-third of kindergartens do not have tablets and only 18% of schools have five or more tablets. Tablets are mainly used individually for speech correction (speech therapy applications) for children with special needs education (SEN).

5. Conclusion and Discussion

The primary purpose of the research was to map the equipment of kindergartens in terms of information technology for sustainable education. ICT literacy of the children has gained more importance amidst of the COVID -19 pandemic. Moreover, it urges both teachers and principles of the kindergartens to operate and manipulate ICT effectively for online teaching and distance education. COVID- 19 pandemic has made the digital age bring earlier than it is planned. Therefore, considerable part of the societies nearly all over the world have had to use technological tools to carry out their duties including the jobs from teaching and learning to trading and business. COVID -19 pandemic has proven us how the ICT has vital importance in human lives for sustainability. Without the ict support, it has seemed to be impossible to lead a sustainable lives in the societies in the world as ICT has realized soft transmission of the hard times of COVID -19 pandemic without cutting the social ties in the world in 3 pillars of the sustainability. According to the declaration of The United Nations Decade on Education for Sustainable

Development from 2004 to 2015, every nation should set out the principles of sustainable development in all national curriculums [19]. Early education and education for sustainable development (ESD) have much in common [16]. From the viewpoint of education, it is important to consider the learning of children in a sustainable way for the sustainable use of materials, food, energy, and water. Many educators believe in the immense potential of ICT as a sustainable tool to skyrocket learning. As a sustainable tool, ICT should be involved in the curriculum in two ways as supporting the instructional process, and, being a significant part of the content of the curriculum [13]. Moreover, ICT can also facilitate learning and practical knowledge, while empowering the poor and marginalized to raise their voice for their rights. As is seen, ICT is the sine qua non for children's education in kindergartens and the importance of the ICT has dramatically increased amidst of the COVID- 19 pandemic. From the preschool to the university level everybody could understand the importance and the advantage of ICT tools by implementing online and distance education. By using various tools and digital learning objects in schools or outside schools, children can involve in real-life problems, studying stories, case studies, websites or videos, and developing activities. As the first step to social life, all the kindergartens, whatever size it is, should be equipped with ICT to sustain the training of all children by following up the principle "No child left behind". In this study, the survey results showed that the kindergarten equipment is not related to kindergarten size. Digital technologies are gradually penetrating pre-primary education, but it is not a massive increase and use. As witnessed in the COVID- 19 pandemic, the disasters never give us free time to take measures. In H1, H2, and H3, it shows that the kindergartens seem to ideally have a lack of interactive whiteboards, computers, and technological tools in Czech context. The COVID-19 pandemic has proved that tomorrow is too late to take measures we should immediately take as necessary precautions just today in respect of children's education for sustainability. Furthermore, there should be an internet connection throughout the kindergarten and at least one multifunctional printer. Concerning children, the kindergartens should also have at least five tablets for the oldest children to work in groups.

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