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IMPLEMENTATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE EDUCATION OF STUDENTS WITH PHYSICAL DISABILITIES: ANALYSIS OF PRACTICE AND TEACHERS' PREFERENCES

Abstract. Today, information and communication technologies play an increasingly important role in the educational process. Modern digital tools and technologies create new opportunities for increasing the accessibility of educational content, individualizing learning and engaging students in learning activities more effectively. Technologies such as interactive whiteboards, specialized software, digital textbooks, or communication applications allow students to work at their own pace, use visual and auditory support, and thus reduce barriers that might otherwise limit their access to education. The importance of information and communication technologies is also evident in the context of inclusive education, which emphasizes equal opportunities and active participation of every child, regardless of their health or social disabilities. In this context, information and communication technologies are not only a technical tool, but also a pedagogical resource that helps to bridge differences and contributes to a more equitable and inclusive

educational environment. This topic is extremely relevant and important in light of current trends in education, which are moving towards digitalization, personalized learning, and improving the quality of education for all students. However, the effective use of information and communication technologies requires not only proper technical equipment of schools, but also systematic professional development of teachers, access to quality educational software and methodological support for the integration of these technologies into daily teaching practice. The article analyzes the implementation of information and communication technologies in the educational process of students with disabilities in the Slovak school system. The survey was conducted in the form of a questionnaire to find out the technical equipment of schools with ICT, the types of interactive tools used, the areas and forms of learning supported by ICT, the educational programs and software used, and the time required by teachers to prepare didactic materials.

Keywords: information and communication technologies, students with physical disabilities, teacher, computer, digital games, interactive aids, educational software

1. INTRODUCTION

Statement of the problem. The use of information and communication technologies in education depends primarily on the technical equipment available at the school. It is advantageous to invest in devices and software solutions that genuinely meet the needs of teaching. Equally important is the availability of quality hardware and software, as well as the digital competencies of both teachers and students (Bobot, Jakubeková, Rurák, 2012).

Modern teaching using information and communication technologies changes the lives not only of students but also of teachers. It is a process carried out with the active participation of both teachers and students. Together, they strive to achieve a common goal. The teacher's role is to facilitate students' work through explanations or discussions, to justify solutions, and to implement various activities such as group or individual work. Teaching with new technologies is no longer boring. It develops and supports the creativity and self-realization of students with disabilities. The aim of modern teaching is to encourage students with disabilities to express their own opinions and ideas and to foster a sense of responsibility for the work done collectively (Záhorec, 2020).

Schools should play a crucial role in the modern education of students. A modern school must aim to create new opportunities for all students who

otherwise would have little or no access to digital technologies in their environment. Just as learning to read, write, and count is a fundamental skill for students at school, developing digital literacy is essential for modern society. Digital literacy is a key prerequisite for further education and lifelong learning (Neumajer, Rohlíková, Zounek, 2015).

Thanks to digital literacy, we are able to use information and communication technologies more effectively in our work, at any level of study, as well as in real life. A fundamental pillar in the process of informatization is that every individual attains at least basic digital literacy (Tináková, 2007).

Information and communication technologies are increasingly penetrating education today, bringing many changes and assisting teachers in organizing the teaching process. They become a tool not only for students but also for teachers to acquire information and enable students to work with various programs. They allow teachers to use presentations during lessons to enhance students' understanding and imagination (Karolčík, Čipková, 2020).

From a pedagogical perspective, it is necessary to understand information and communication technologies as a means and method that support teaching, the cognitive process, and educational activities. ICT can be used as a tool for acquiring information, evaluating the teaching process, or as a means of communication with others (Burgerová, Piskura, 2019).

Information and communication technologies enhance learning by engaging as many of the student's sensory organs as possible. It is important to choose appropriate teaching materials and technologies that align with the learning objectives. If a teacher wants to introduce new skills to students or expand their existing abilities during lessons, they must first use *illustrative methods* (experiment, example, demonstration) and *practical activities* (manipulation with objects, worksheets, didactic games, movement in space). Only then can a computer program be used to provide the necessary tasks (Ištoková, 2015).

A teacher can increase the efficiency of their work by using information and communication technologies—facilitating lesson preparation and making the teaching process itself more effective (Bobot, Jakubeková, Rurák, 2012).

It is true that no technology can replace the human factor. However, it must be said that the digital transformation of education is not an end in itself, but merely a means of teaching, and it makes sense especially where the student progresses thanks to this development (Mitchell, Sutherland, 2020).

In today's schools, digital tools such as computers, laptops, tablets, data projectors, interactive whiteboards, as well as printers and the internet are used (Kachman, 2021).

Information and communication technologies are used in the school environment in various educational activities and tasks, as well as through games (Šmída et al., 2019).

Contemporary modern society prefers new electronic materials, modern didactic technology, and tools for online communication in the teaching process. The foundation of student education is therefore to acquire the skill of using this technology. Teachers use information and communication technologies when preparing their own materials or aids and adapt them according to their needs (Adámek et al., 2010).

Worksheets are a useful aid in the education of students with disabilities. They help students better understand and practice the learning material. Worksheets can take the form of crosswords, fill-in-the-blanks, coloring pages, or cut-outs. A worksheet serves as a guide or a step-by-step technological procedure for making a product, animals, or other aids. When creating a properly designed worksheet, it is necessary to select only the essential content, consider the target group of students, choose appropriate fonts, and provide enough space for writing answers or drawing pictures (Mitchell, Sutherland, 2020).

Computers

Computers are among the most frequently used technologies by students. A computer is a device that is important for students to work independently or in groups. Schools designate computer labs for working with computers, where not only informatics but also other subjects are taught (Held, 2014).

Computers and the internet play an important role in the education of not only students with special needs but also typically developing students. Students can use computers for independent learning and actively solve individual tasks and experiments. Computers are a great benefit for the education of students with special needs (Kachman, Tkáčová, 2021).

Interactive whiteboard

The interactive whiteboard holds an important place in the educational process. It is a didactic tool that innovates the educational process. It develops students' skills and their personality. The core of the interactive whiteboard is a computer to which the board is connected. It allows the position of a pen, finger, data projector, or other device to be detected. Using the interactive whiteboard and computer, we create active communication between the teacher and the student. The goal is to ensure maximum clarity of the content. With its help, the teacher presents lessons, visual materials, or video clips. It captures students' attention more effectively when learning new material.

During the explanation, the teacher can write, draw, or highlight anything on the materials prepared for the lesson (Brečka, Červeňanská, 2013).

The use of the interactive whiteboard is a good way to enhance imagination, clarity, and understanding of the subject matter. Through the interactive whiteboard, students with disabilities become more engaged in the teaching process.

Digital games

Games can be a useful tool for students in education and acquiring new knowledge. Through educational games, students are better able to focus, perceive new material, and try to imitate the real world and human behavior. By using digital games in education, students become more motivated to learn and communicate. They learn patience, attention, and the ability to achieve success (Mago, 2020).

Educational or learning games are often used in the educational process. Through games, students acquire knowledge and skills in a playful way. Games can be a helpful tool in teaching various subjects. They can better teach students mathematics, science, or foreign languages. Through games, students expand their vocabulary. Educational games are considered merely a way to make the teaching process more engaging. They are not used regularly for acquiring knowledge and experience (Held, 2014).

2. THEORETICAL BASIS OF THE STUDY

Current state of the issue. Research on the use of information and communication technologies (ICT) in special education is gradually developing in Slovakia. For example, Hladush, Bendíková, Kovačová, and Čarnická (2023) analyzed the use of IT-supported didactic tools in teaching geography at special schools in Slovakia, emphasizing the need to adapt teaching materials to the needs of students with intellectual disabilities. Similarly, Jelínková (2020) examined the potential of ICT in teaching English to students with autism spectrum disorders, highlighting the importance of an individualized approach and adaptation of teaching methods.

At the international level, research focuses on various aspects of using information and communication technologies in special education. Iskrenovic-Momcilovic and Momcilovic (2022), in their study, analyzed the use of ICT in teaching students with intellectual disabilities, identifying key factors that influence the effectiveness of these technologies in the educational process. These studies suggest that effective use of ICT requires not only technical equipment but also professional training for teachers and adaptation of teaching methods to the individual needs of students.

Aim of research. In our survey, we focused on the possibilities of using information and communication technologies in the educational process of students with physical disabilities.

Research methods. The organization of the research included a review of professional literature (analysis and synthesis of scientific and specialized publications, journals, and online sources). The next step involved conducting a survey using an electronic questionnaire, which was sent to teachers of special primary schools in the Banská Bystrica and Prešov regions. The final part consists of the evaluation and interpretation of the collected data.

3. RESULTS AND DISCUSSION

Survey Evaluation. The total number of completed questionnaires was 57. The majority of respondents were women, with 52 (91.23%), while 5 respondents (8.77%) were men. Regarding teaching experience, 3 respondents (5.26%) had more than 25 years of experience, 10 respondents (17.54%) had 21-25 years, 13 respondents (22.81%) had 16-20 years, 6 respondents (10.53%) had 11-15 years, 13 respondents (22.81%) had 7-10 years, 8 respondents (14.04%) had 4-6 years, and 4 respondents (7.02%) had 1-3 years of teaching experience.

We investigated the question of *the school's information and communication technology (ICT)* equipment using a scale from 5 (excellent) to 0 (insufficient). Excellent ICT equipment was reported by 41 respondents (71.93%), very good equipment by 9 respondents (15.79%), and good equipment by 7 respondents (12.28%). No respondents indicated poor or insufficient equipment.

The findings indicate a relatively high level of satisfaction with the technical equipment of schools, which may be a result of systematic support for the digitalization of education or initiatives focused on inclusive education.

The fact that none of the respondents rated the equipment as poor or insufficient suggests that in the environment where education for students with physical disabilities takes place, at least basic conditions exist for the implementation of information and communication technologies in the educational process.

However, it is important to consider in further interpretation that the quality of information and communication technology equipment does not automatically guarantee its effective pedagogical use, which also depends on teachers' professional training, methodological support, and the availability of suitable software.

For the question *"How many students with physical disabilities and of what age are educated at your school with the help or support of information and communication technologies?"* we received the following responses. Out of a total of 53 students with physical disabilities (100%), the use of information and communication technologies in their education is as follows: 8 students (21.62%) aged 6-7 years, 11 students (29.73%) aged 8-9 years, 4 students (10.81%) aged 10-11 years, 6 students (16.22%) aged 12-13 years, 7 students (18.92%) aged 14-15 years and 1 student (2.70%) aged 16 years.

The results show that the highest usage of information and communication technologies is in the younger age groups (6–9 years). This may indicate that schools implement these technologies most intensively in the early years of primary education, thereby supporting the development of digital skills from an early age.

The gradual decrease in the number of students in the older age groups may be related to several factors – changing schools, individualization of approaches, lower availability of information and communication technologies in higher grades, as well as the specifics of the disability's development and the need for other forms of support.

For the question *"What interactive aids do you use in the educational process for students with physical disabilities?"*, respondents had the option to provide multiple answers. The results are presented in Table 1. The most commonly used interactive aids are: interactive whiteboards and projectors, used by 100% of respondents, worksheets, used by 98.25% of respondents, exercises, used by 92.98% of respondents and other interactive aids, used by 3.51% of respondents.

Table 1

Interactive aids (Source: author's own elaboration)

Interactive aids	Number of respondents	Percentage (%)
Interactive whiteboard	57	100,00 %
Worksheets	56	98,25 %
Exercises	53	92,98 %
Projector	57	100,00 %
Other interactive aids	2	3,51 %

The data suggest that the interactive whiteboard and data projector represent fundamental and universal tools in the educational process for students with physical disabilities. Their 100% usage in practice indicates a high level of integration of these technologies into teaching.

We agree with the opinion of Stoffová and Havelka (2018), who point out that all the possibilities of the computer can be effectively utilized by connecting it with a digital interactive whiteboard. Moreover, such a

connection allows for obtaining feedback, increasing the interactivity of the applications and student activities used, thereby making the entire educational process more effective. These features likely contribute to the popularity of the interactive whiteboard as an information and communication technology used in special schools.

Worksheets and exercises also have a very high usage rate, being used by more than 90% of respondents. This fact highlights the importance of practical exercises and interactive activities in the educational process of students with physical disabilities.

The respondents also answered the question about *how much time per week they dedicate to preparing teaching materials using information and communication technologies for students with physical disabilities*. More than 5 hours per week are spent on preparation by 2 respondents (3.51%), 29 respondents (50.88%) spend 4-5 hours per week, and 26 respondents (45.61%) spend 2-3 hours per week on preparation.

The analysis of the collected data shows that the majority of respondents recognize the importance of teaching materials for the successful education of students with physical disabilities and are willing to devote a significant amount of time to their creation. At the same time, there is a clear need to provide teachers with systematic support, for example, through shared databases of teaching materials, professional training focused on digital teaching, or the availability of prepared templates and educational modules that would facilitate their work and increase the efficiency of preparation.

In the next question, we investigated *in which areas of the educational process for students with physical disabilities the respondents use information and communication technologies*. Respondents could select multiple options. The most frequently mentioned area was the use of ICT in instructional and explanatory presentations, indicated by 98.25% of respondents. This was followed by games with review or explanatory themes (89.47%), tests and tested workbooks (85.96%), and demonstrative and opinion presentations (68.42%).

The findings suggest that instructional and explanatory presentations are the most frequently used form. This indicates that teachers prefer visual and systematic delivery of the curriculum through information and communication technologies.

The second most frequently used form are digital educational games, which indicate teachers' interest in engaging students in learning through interactive and playful methods. This supports their motivation and activity.

Equally significant is the proportion of respondents who use information and communication technologies for testing and assessing

knowledge. This indicates that digital tools are also perceived as an effective means of verifying acquired knowledge.

A smaller, yet still significant proportion is represented by demonstrative and illustrative presentations, which serve for visual or contextual mediation of more complex subject matter. This approach is especially beneficial in the education of students with physical disabilities.

These results confirm that information and communication technologies are used not only as technical support but also as part of a deliberate didactic strategy that enriches, enhances, and individualizes the teaching process.

In response to the question *"For what purposes do you use the computer in the classroom?"*, respondents could select multiple answers. The results are presented in Table 2. All respondents (100%) reported using the computer for educational activities. 91.23% of respondents use the computer for creating presentations, 85.96% for writing administrative works, and 82.46% for displaying and editing images. Access to the internet for playing music was mentioned by 54.39% of respondents, drawing in the Paint program is used by 28.07%, and 21.05% of respondents indicated other forms of computer use in the classroom.

Table 2

Classroom use of computers – purpose (Source: author's own elaboration)

Classroom use of computers – purpose	Number of respondents	Percentage (%)
Educational activities	57	100,00 %
Administrative work	49	85,96 %
Presentations	52	91,23 %
Drawing in the Paint program	16	28,07 %
Displaying and editing images	47	82,46 %
Internet for playing music	31	54,39 %
Others	12	21,05 %

The findings show that computers are an integral part of the educational process in classrooms with students with physical disabilities. All respondents confirmed their use primarily for educational activities, highlighting the key role of computers as tools supporting the learning process. The high percentage of computer use for creating presentations (91.23%) and writing

administrative documents (85.96%) also reflects the demands placed on teaching staff regarding effective lesson preparation and organization.

Editing and projecting images (82.46%) play a significant role mainly as visual support in teaching, which is especially important when working with students with special needs. A lower, yet still relevant, use of computers is accessing the internet to play music (54.39%), which can serve as relaxation or background during work.

A smaller percentage of respondents use the computer for drawing in the Paint program (28.07%) and for other purposes (21.05%), which indicates the variety of possibilities and creative ways to integrate information and communication technologies into teaching.

In the questionnaire, we investigated *whether students with physical disabilities had prior active experience with a personal computer before starting education in a school supported by information and communication technologies*. Out of a total of 37 students with physical disabilities (100 %), 28 students (75.68 %) had experience with a personal computer. Six students (16.22 %) reported having some experience, while three students (8.11 %) had no experience with a personal computer before starting school.

The results show that 75% of students already have experience with computers; these students may have been stimulated preschool to develop digital skills, which can facilitate their further progress and use of technology during lessons. At the same time, the 16% of students with partial experience represent a group with the potential to develop their skills further if they receive sufficient motivation and support. Conversely, the 8% of students without any prior computer experience highlights the need for targeted and systematic support from teachers and assistants when introducing information and communication technologies into teaching. This group requires an individual approach and adaptation of educational methods to prevent potential barriers in acquiring digital competencies.

Overall, the results emphasize the importance of early contact between students and information and communication technologies as a factor that can positively influence their academic success, digital skills, and motivation to learn. Digital literacy represents a key competency for life in today's society, where modern technologies play an increasingly important role. Students encounter these technologies on a daily basis— whether in acquiring information, education, or communication. As Záhorec (2020) points out, technologies today enable intensive interaction between students and teachers also through various online educational

platforms and programs, which significantly expand learning opportunities beyond the traditional school environment.

In response to the question *"In what form do students with physical disabilities learn at school with the help of information and communication technologies?"*, 47.37% of respondents indicated a preference for independent student work. Working in pairs with the teacher was preferred by 40.35% of respondents, and 12.28% of respondents favored students working in pairs with a teaching assistant.

The respondents' answers indicate that almost half (47.37%) prefer independent work by the student using information and communication technologies. This data may suggest confidence in the students' ability to work independently with technology, as well as an effort to support their autonomy and digital literacy.

Working in pairs with the teacher (40.35%) represents an almost equally significant approach, highlighting the need for direct support and methodological guidance from the teacher, especially for individually adapted tasks or when practicing specific skills. Support from a teaching assistant (12.28%) as a form of education is less represented, which may be related to limited staffing capacities but also to the nature of the students' needs - they may be capable of managing educational tasks without constant assistance.

These results point to a plurality of approaches in integrating students with physical disabilities into the educational process and emphasize the need for an individualized approach based on the level of digital skills, type of disability, and the organizational possibilities of the school.

In the following question, we investigated *the number of computers used in a single classroom for implementing information and communication technologies in the educational process of students with physical disabilities*. The results show that 92.98% of respondents use one computer in the classroom, 5.26% of respondents reported using two computers, and only 1.75% of respondents have three computers in one classroom.

The data point to limited material and technical conditions for the use of information and communication technologies in classrooms with students with physical disabilities. The high proportion of classrooms equipped with only one computer (nearly 93%) may reduce the possibilities for individualized approaches and limit the active involvement of all students in digital learning activities. This situation highlights the need for systematic support of schools in the area of technical provision. As Žovinec et al. (2023) emphasize, effective education of students with disabilities

requires ensuring adequate material, technical, and organizational conditions.

In the final question, we investigated *which educational program/software the respondents prefer to use in the educational process of students with physical disabilities*. 5.26% of respondents prefer the educational software Boardmaker, 10.53% prefer the program *Writing - analysis and synthesis of reading and writing*, 21.05% prefer the program *TS Slovak Language 1*, 15.79% prefer *TS Slovak Language 2*, 12.28% prefer the interactive educational program *ALFÍK*, 14.04% prefer the program *Science Through Play* (Prírodoveda hrou) and 21.05% prefer the program *Alík - Fun Math* (Alík - veselá matematika).

The diversity of preferences suggests that a wide range of digital educational tools is used in the educational process of students with physical disabilities, with no single software significantly dominating. The most frequently mentioned programs were TS Slovak Language 1 and Alík - Fun Math (both at 21.05 %), indicating a strong emphasis on developing language and mathematical competencies through interactive digital tools.

As Obročníková (2014) states, educational programs represent an effective tool to support the teaching of students with special needs because they allow for adapting both the content and the form of learning to the individual abilities and pace of the students. Their use brings several benefits - from increased motivation, through support for independent learning, to providing immediate feedback and objective performance assessment. The most commonly applied strategies when working with these programs are the trial-and-error method, which is based on the natural learning process, and the instruction-based learning method, both of which significantly contribute to effective knowledge acquisition.

4. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

The results of our survey clearly confirm that information and communication technologies represent a significant part of the educational process for students with physical disabilities. Most schools have good to excellent technical equipment, which teachers actively use in various areas of teaching - from educational presentations, through interactive games, to testing and demonstrative activities.

Respondents most frequently use interactive whiteboards, data projectors, worksheets, and various exercises, with a significant portion dedicating several hours per week to preparing teaching materials. This

indicates a high level of engagement and a commitment to quality and effective lesson preparation.

The findings also suggest that a large portion of students with physical disabilities had experience with personal computers prior to starting school, which may positively influence their adaptation to the use of information and communication technologies in education. The form of education most commonly focuses on independent student work, with significant support provided by teachers or assistants.

Computers in classrooms are primarily used for educational activities, creating presentations, administrative tasks, working with images, and internet access, which confirms their versatility and indispensable role in the modern educational process.

The selection of preferred educational software indicates an effort to personalize and tailor the educational process to the individual needs of the students.

Overall, the survey confirms the importance and effectiveness of using information and communication technologies in special education, while also highlighting the need for further development of technical support and methodological guidance for educators. These measures are essential to ensure maximum efficiency and accessibility of quality education for all students.

A prospect for further research could be to study the effectiveness of ICT use in special and inclusive school lessons.

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УПРОВАДЖЕННЯ ІНФОРМАЦІЙНО-КОМУНІКАЦІЙНИХ ТЕХНОЛОГІЙ У НАВЧАННІ УЧНІВ З ФІЗИЧНИМИ ПОРУШЕННЯМИ: АНАЛІЗ ПРАКТИК ТА УПОДОБАНЬ ВЧИТЕЛІВ

Анотація. Інформаційно-комунікаційні технології сьогодні відіграють все більш важливу роль в освітньому процесі. Сучасні цифрові інструменти та технології створюють нові можливості для підвищення доступності навчального контенту, індивідуалізації навчання та ефективнішого залучення учнів до навчальної діяльності. Такі технології, як інтерактивні дошки, спеціалізоване програмне забезпечення, цифрові підручники або комунікаційні додатки, дозволяють учням працювати у власному темпі, використовувати візуальну та аудіальну підтримку і, таким чином, зменшують бар'єри, які в іншому випадку могли б обмежити їхній доступ до освіти. Важливість інформаційно-комунікаційних технологій також очевидна в контексті інклюзивної освіти, яка наголошує на рівних можливостях та активній участі кожної дитини, незалежно від її стану здоров'я чи соціальних вад. У цьому контексті інформаційно-комунікаційні технології є не лише технічним інструментом, а й педагогічним ресурсом, який допомагає подолати відмінності та сприяє створенню більш справедливого та інклюзивного освітнього середовища. Ця тема є надзвичайно актуальною та важливою у світлі сучасних тенденцій в освіті, які рухаються в напрямку діджиталізації, персоналізованого навчання та

підвищення якості освіти для всіх учнів. Однак ефективне використання інформаційно-комунікаційних технологій вимагає не лише належного технічного оснащення шкіл, а й систематичного підвищення кваліфікації вчителів, доступу до якісного освітнього програмного забезпечення та методичної підтримки для інтеграції цих технологій у повсякденну практику викладання. Стаття присвячена аналізу впровадження інформаційно-комунікаційних технологій у навчальний процес учнів з обмеженими фізичними можливостями в системі шкільної освіти Словаччини. Опитування проводилося у формі анкетування, метою якого було з'ясувати технічне оснащення шкіл ІКТ, типи інтерактивних засобів, що використовуються, напрями та форми навчання, що підтримуються ІКТ, освітні програми та програмне забезпечення, що використовуються, а також час, необхідний вчителям для підготовки дидактичних матеріалів.

Ключові слова: інформаційно-комунікаційні технології, учні з обмеженими фізичними можливостями, вчитель, комп'ютер, цифрові ігри, інтерактивні засоби, навчальне програмне забезпечення

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