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USING A DIDACTIC TOOL WITH IT-SUPPORT FOR TEACHING GEOGRAPHY IN A SPECIAL SCHOOL IN SLOVAKIA

Abstract. The article tells about the peculiarities of using electronic didactic tools in teaching special school students in Slovakia. The staff of the Department of Special Pedagogy, Catholic University in Ružomberk (Slovakia), together with teachers of special schools prepared a didactic manual with IT support considering the modern requirements for the level of knowledge and skills of students with intellectual disabilities. The purpose of the manual was to increase the level of success in learning geography. The content of the didactic guide is based on the typical curriculum for 9th grade students of a special school approved by the Ministry of Education and Science of Slovakia. As an example, the article briefly highlights the essence of the preparatory stage and the specific sequence of the teacher's work when studying one section «Slovakia». In the course of preparing the didactic guide, the peculiarities of psychophysical development of children in special schools, the problems of perception and understanding of new educational information were taken into account. To showcase the effectiveness of our innovative approach, we conducted an experimental test using the developed electronic textbook with IT support in one of the special schools in Slovakia. During this study, we analyzed and compared the level of geography knowledge among students over a span of 6 academic years (2016 – 2018 – traditional education, 2019 – 2021 – education using e-Learning). Based on the statistical data, a noteworthy improvement in academic performance was observed. To validate these results, considering the limited research sample due to the unique nature of special schools' educational process, we employed nonparametric tests such as the Kruskal-Wallis and Dunn's tests for multiple comparisons. These tests were utilized to ensure the reliability and significance of the findings. The results of the mathematical processing of the materials convincingly confirmed a significant increase in the level of academic achievement over the six years of the educational process in a special school. Thus, the electronic didactic guide for studying geography by 9th grade students of special schools proved to be quite effective. The idea of preparing and using such a didactic guide can be used in practice by teachers of other social studies subjects in special schools.

Keywords: IT-supported didactic tools; information and communication technologies; geography; special school.

1. INTRODUCTION

The problem statement. The current range of Didactic tools (DTs) encompasses a diverse array of auditory, visual, pictorial, and technical aids commonly used in classrooms. However, a comprehensive understanding of DTs in teaching extends beyond mere demonstration. While practical experience reveals that DTs are often implemented to support the didactic principle of demonstration, it is vital to recognize that effective, high-quality, and well-targeted DTs serve as a rich source of learners' knowledge, skills, and habits. This stems from the direct integration of theoretical knowledge with practical experience, resulting in heightened interest and dynamic, effective teaching methods that progressively elevate students' thinking processes. This modern experiential teaching approach modifies the educational process and fosters increased engagement. Based on these observations, it is evident that DTs hold a justifiable and irreplaceable role at all stages of the educational process, spanning social and natural science subjects, as well as technical and practical training. E. Petlák [1, p.151-152] encapsulates the functionality of teaching or didactic aids, outlining their significance, meaning, and functions.

Didactic tools play a crucial role in consciously and deliberately enhancing the educational process, with the primary objective of stimulating and enriching students' knowledge, skills, and habits. It is incumbent upon every creative teacher to actively incorporate these tools into their pedagogical practice, seeking innovative ways to bring about effective changes within the teaching process. By doing so, teachers can create optimal conditions that facilitate better understanding of the subject matter for their students. Having a diverse portfolio of well-chosen didactic aids not only elevates the teacher's credibility but also reflects positively on the entire school or educational institution. It demonstrates a commitment to providing a dynamic and engaging learning environment, fostering the students' intellectual growth and overall development. Ultimately, embracing and implementing effective didactic tools contribute to the success of both individual educators and the educational institution as a whole.

Digital technologies have permeated every aspect of contemporary life, making them an integral part of our daily existence. These modern tools have seen significant advancements and are continuously being integrated into various sectors and domains, sometimes surprising us with their ever-expanding reach. The 21st century is now widely recognized as an era characterized by new digital frontiers, virtual experiences, multimedia innovations, and the continuous evolution of technology, including robotics.

In this context, education must also not be left behind and as such reacts and must dynamically respond to the external influences of society and implement new elements in the educational process that will materially but also procedurally modernize education. Information and communication technologies (ICT) and the associated didactic aids are becoming a stable addition to education, which rationalize and qualitatively stabilize teaching, thus qualifying our education system as one of the most advanced modern school systems in Europe and the world.

From the didactic-pedagogical point of view, it is known that high quality DTs are an effective supporting tool in the educational process. They carry the potential of students' interest in the curriculum, which is a very crucial factor in terms of continuous and, above all, fixative stability of the curriculum. It modifies the monotonous process of education into a dynamic and effective means, which students generally accept with increased interest. It is important, however, that the DTs incorporates modern elements of education and that it is factual, up-to-date, easy to grasp, technically sound and didactically balanced.

Analysis of recent studies and publications. Many scholars have written about the peculiarities of using computer technologies for the creative development of the individual. In particular, M. Koehler, P. Mishra, and V. Cain [2] recommend combining content, pedagogy, and technology in the formation of didactic tools. The works of S. Wright, A. Fuget, and

F. Kaputa [3] demonstrate the similarities and differences in reading performance and content comprehension in digital and paper formats. The views of the vast majority of researchers on didactic tools and their classifications differ significantly. For example, I. Pesek, B. Zmazek, and G. Mohorcic define an e-textbook as a didactic tool that differs from e-books. The program elements of an e-textbook, in particular interactive ones, can effectively promote self-education of subjects [4]. Scientists G. Le, C. Messom, A. Kok-Lim [5], considering an electronic textbook as a didactic tool, emphasize that e-Textbook is a digitized (or electronic) form of a textbook. Once approved by higher education authorities, it is an important didactic tool in the educational process.

Starting in 2009, with the support of the European Union, the Slovak Republic introduced a curriculum (ITMS kód Projektu: 26140230002). The purpose of this educational and research project was to improve and innovate the interdisciplinary professional competence of teachers necessary to apply new knowledge in the field of interactive teaching methods for effective learning. To support the implementation of the program, leading Slovak scientists (G. Novacká, J. Hnáťová, E. Fryková, 2011; V. Bobot, 2012; D. Kostrub; P. Brečka, 2013; D. Gogotová, 2013; I. Kalaš and kol., 2013;) prepared and published a number of educational and scientific works, which were methodological in nature and of great practical importance for practitioners in the process of implementing this project [6], [7], [8], [9], [10], [11].

At the present stage, the research of Ukrainian scientists and practitioners (S. Romanov, O. Tsykan) [12], who highlighted the peculiarities of using an interactive poster in the educational process of a modern secondary school, is of great importance. The starting point was the postulate that in the study of the Humanities (philological disciplines), in addition to basic competencies, students can and should develop skills related to the information and communication sphere. The purpose of the study is to test the effectiveness of using an interactive poster in teaching the subject of «Foreign Literature» in general secondary education. The authors justified the choice of the Thing link service, which created opportunities to combine images and interactive videos, pictures, music, text content, etc. They propose a methodology for creating an interactive poster designed for foreign literature lessons on the topic of Modernism. The algorithm of this work is revealed through the peculiarities of the basic didactic interaction "teacher - student", where the emphasis is on the student's personality.

A number of scholars have studied the problem of using electronic textbooks and books as important means of learning and obtaining additional analytical information. J.Kodliuk and I. Chekriy [13] emphasize the comprehension of the essence and purpose of an electronic textbook based on the research of UNESCO scholars. This research pertains to the advantages of utilizing electronic textbooks in the classroom, along with the arguments supporting their use for students, teachers and parents. N.Myslitska, V.Zabolotnyi, I.Slobodianiuk [14] showed the features of using an electronic educational and methodological complex in physics for students of social and humanities classes and theoretically substantiated the methodological feasibility of using Microsoft Power Point application software to develop multimedia support for topics and sections of the high school physics course. I.Vorotnykova [15] highlighted the possibilities of introducing e-textbooks at school as a tool of digital pedagogy for the realization of quality education.

Scientific research on the capabilities of secondary education institutions to organize the educational process in extreme conditions is of practical value. N. Mospan and S. Sysoieva [16] identified and analyzed trends in the digital adaptation of schools during the COVID-19 pandemic. The research findings show that the emergency integration of EdTech in school education has changed the way of teaching and learning. It encourages teachers to develop new methods to meet Net generation students' needs in a virtual educational environment. As a result, students perceive distance learning as an exciting and beneficial format. From their

perspective, using digital resources such as video and online learning games would improve teachers' instruction.

V. Oliynyk, P. Grabovskyi, O. Konoval [17] substantiated and described the criteria and indicators for the selection of the necessary software tools by an educational institution for the implementation of e-learning.

J. Markiewicz-Patkowska, S. Pytel, P. Oleśniewicz, and K. Widawski [18] review the utilization of computer technology and explore how stereoscopy can leverage this platform through the incorporation of LCD shutter glasses. Modern technology offers considerable opportunities, while posing ever-increasing demands, which are mentioned in the paper, too. Teaching is most effective when information is received through multiple channels, combining verbal and visual messages. Thanks to 3D images, the recipients grasp more information details, remember them longer, and are more interested in the message content. Creating didactic presentations with the use of three-dimensional photographs or films is presented as a way of arousing interest, allowing direct participation in the cognitive process, and facilitating the reception of the transmitted content.

For the system of special education and inclusive education, research on the problems of using IT-supported didactic tools in the teaching and upbringing of children with special educational needs is relevant. In particular, G. Mytsyk [19] studied the peculiarities of using didactic games in the prevention of reading disorders in older preschool children. The author emphasizes her perspective on a partial solution to the prevention of dyslexia by utilizing digital games to offer corrective and developmental support. Additionally, she underscores the significant benefits of employing information and communication technologies for predictive purposes.

In their study, O. Dmitrieva and O. Chopik [20] investigated the unique aspects of information and communication technology (ICT) utilization in educational practices within contemporary general secondary education institutions that implement inclusive education, as well as special schools catering to children with intellectual disabilities. The researchers aimed to assess the attitudes of high school students with typical development and their peers with intellectual disabilities towards studying in a general secondary education setting.

Y. Kosenko, O. Boryak, and O. Korol investigated the methodological and organizational aspects of the use of computer didactic games in teaching children with intellectual disabilities in an inclusive educational environment. The potential of the LearningApps.org platform in creating educational games centered around historical subjects for students in inclusive classes with intellectual disabilities is emphasized. The distinctive characteristics of cognitive activity among children in this group are highlighted, including uneven maturation rates of higher mental functions, underdevelopment of emotional and personal motivational aspects, delayed speech development, and reduced efficiency. These factors contribute to the challenges in comprehending historical knowledge among students with intellectual disabilities [21]. These authors also analyzed the methodological aspects of forming abstract concepts in students with intellectual disabilities using digital technologies. The potential of the ArcGIS and Google Earth programs in creating educational materials that facilitate the development of abstract concepts and the expansion and deepening of their understanding among children in this category is emphasized [22]. The authors acknowledge the effectiveness of teaching abstract concepts to children in this category through an interdisciplinary approach that enables the integration of data from history, geography, natural science, fundamentals of jurisprudence, social and practical orientation, as well as music and fine arts.

H. Shcherba [23] notes that electronic applications, which are considered to be user computer programs that allow solving specific applied tasks, have a certain potential in the inclusive educational space. The author provides specific didactic applications in accordance with the special educational needs of high school students with cerebral palsy.

The scientific article by O. Ovcharuk, O. Tovkanets, O. Pinchuk, I. Ivaniuk, O. Hrytsenchuk, and S. Trikoz is of great methodological importance at the present stage. The authors examined the processes of digital transformation of learning environments in general secondary education institutions (GSEIs), including those with inclusive education. Their proposed model contains the following components: goals and objectives of the information and digital environment of the information and digital environment (IDE) of the GSEI, target groups, content component, organizational and activity component, social and communication component, technological component, component of monitoring the quality of the information and digital environment of the IDE of the GSEI. The development and functioning of the model of the GSEI IEC should be based on the following main conditions for successful functioning: accessibility, pedagogical feasibility, technological saturation, web-oriented, user-friendly, competence-based, personality-oriented, democratic, friendly environment, multiculturalism [24].

The preparation and implementation of IT-supported didactic tools in teaching the subject of Geography in special schools in Slovakia is relevant today.

2. IMPLEMENTATION

Presentation of the themes of the thematic unit «Slovakia»

On the basis of the curriculum and the thematic educational plan for the subject of geography, 9th grade, we will create a set of illustrative materials about Slovakia through a *PowerPoint* presentation, which will consist of individual partial topics of this thematic unit.

Knowledge quiz on Slovakia

Drawing upon educational electronic materials, the knowledge quiz will function as a dynamic diagnostic tool for assessing students' comprehension of the given thematic unit. It will be composed of cards with questions from the thematic unit and the answers to them will be interactive and visualized in *PowerPoint*. The didactic tool and the knowledge quiz will be processed as a whole into one common presentation with hypertext linking, which will simplify and clarify the movement and orientation in the electronic part of the DTs. The DTs will also include a comprehensive and detailed manual for the use of both the DTs and the knowledge quiz.

Question Bank

In *MS Word*, we will formulate quiz questions within the designated question bank. These questions, which will be selected from the bank and integrated into the DTs, can take various forms, including:

- a. multiple-choice questions,
- b. true/false questions,
- c. correct – incorrect questions,
- d. completion questions,
- e. ordering questions,
- f. matching questions.

1. Each paper question will contain a serial number, a question and, where appropriate, a choice of answer (all the elements of the question will be distinguishable by colour),
 - in order to make the quiz questions reusable, the printed format with the questions will be laminated in a laminating machine before cutting.

2. The electronic part of the didactic aid
 - the DTs will have precisely defined ground rules,
 - the DTs is intended to arouse the students' interest in the subject matter,
 - the DTs should contain illustrative representations,
 - the DTs should be an effective and beneficial educational tool,

- the DTs should be fun,
- the DTs should hold attention,
- the DTs should be positive or enjoyable,
- the DTs should be flexible, variable in questions,
- the DTs should be technically usable under different conditions.

3. The third part of the DTs will be a short manual detailing the technical and instructional use of the DTs.

The following didactic technique will be needed for the effective use of DTs:

1. Interactive whiteboard (IWB) or interactive touch screen monitor.
2. Stationary computer (SC) or laptop with updated MS Windows operating system, on which MS Office (PowerPoint) is installed.

3. A classical school chalk board or a marker board – a flipchart for markers. The whiteboard will be used as a pre-prepared record of the quiz's intermediate results and final result, respectively, it will be an important part of the final evaluation of the quiz.

At present, this didactic technique is a standard part of every primary school in the Slovak Republic.

The first slide of the PowerPoint DTs is the introductory slide. On it we planned to place and illustrate a motivational illustration symbolically focused on the thematic unit «Slovakia». We created the slide by choosing a suitable background (in this case a picture of Central Europe). We then chose the font Calibri and used it to insert the subject «Geography for Year 9» and the name of the thematic unit «Slovakia». The font size of the first text was set to 40, and the text color was adjusted to a deep red with dark shading to ensure good visibility. Furthermore, the title of the thematic unit was emphasized with a font size of 72. The author's name is placed in the bottom left corner and the action button «Home» in the right corner.



Fig. 1. Initial snapshot of the DTs

The second slide of the didactic aid is the «Table of Contents». We have symbolically set the background of this and the following slides to the colours of the Slovak tricolour, i.e. white, blue and red, through the format, the transition fill and the colour dial. After creating the background, we inserted the planned topics of the given thematic unit (Calibri 19, colour blue) in the slide area in three columns side by side, which later after creating the DTs and the electronic knowledge quiz we will link by hypertext linking and pairing the given slides with the names of the topics in the table of contents. The content topics are as follows: The origin of the Slovak Republic, Constitution of the Slovak Republic, State symbols of the Slovak Republic, Location of the Slovak Republic, Extent of the Slovak Republic, Surface of the Slovak Republic, Climate of the Slovak Republic, Waters of the Slovak Republic, Lakes and reservoirs of the Slovak Republic, Vegetation of the Slovak Republic, Animals of the Slovak Republic, Protected territories of the Slovak Republic, Population of the Slovak Republic,

Agriculture of the Slovak Republic, Mineral resources of the Slovak Republic, Industry of the SR, Transport of the SR, Bratislava - capital city of the SR, Bratislava – landmarks, District towns of the SR, Territorial division of the SR.

The third DTs slide is a slide with significant and important historical moments associated with information and images of Slovakia. The title of the topic (Calibri 44, dark blue) and the information on the topic with a short description (Calibri 22, white) were appropriately placed on the slide. In the bottom right corner we placed the action buttons. Slides 4 – 31 were created similarly to slide 3. After creating the individual slides, we paired and interlinked them through hyperlinks in the manner of Insert, Hyperlink, Place in this document, link and confirm with the OK button.

Obsah		
Vznik Slovenskej republiky	Živočíšstvo SR	Územnosprávne členenie SR
Ústava SR	Chránené územia SR	Bratislavský kraj
Štátne symboly SR	Obyvateľstvo SR	Trnavský kraj
Poloha Slovenska	Poľnohospodárstvo SR	Nitriansky kraj
Rozloha SR	Nerastné bohatstvo SR	Trenčiansky kraj
Povrch SR	Priemysel SR	Žilinský kraj
Podnebie SR	Doprava SR	Banskobystrický kraj
Vodstvo SR	Bratislava – hlavné mesto SR	Košický kraj
Jazera a vodné nádrže SR	Bratislava – dominanty	Prešovský kraj
Rastlinstvo SR	Okresné mestá SR	Vedomostný kvíz

Fig. 2. Snapshot with DTs content



Fig. 3. Snapshots of DTs with learning topics

In the next stage of the DTs development, it was necessary to create a bank of relevant, easy-to-understand questions on the given thematic unit or themes. Thus, from a set of potential pre-prepared problems, we selected and formulated 35 suitable questions.

Another component of the DTs is the answers to a knowledge quiz supported by illustrations. As this is an electronic component of the DTs in the form of slides of a PowerPoint presentation, we did not create another presentation, but linked and connected it to the already created teaching aid. The process of constructing this electronic component of the DTs, or the knowledge quiz, followed a continuous workflow that unfolded as follows: The first slide of the PowerPoint illustration, or slide 32, is the introductory slide of the knowledge quiz. In it, we planned to create background information for the quiz. We created it by choosing an appropriate background (in this case, a transition fill of blue-white). Then we chose the font Calibri and through it we inserted the subject «Geography» and the title, «Knowledge quiz about Slovakia». The font size in both cases was chosen 50 and the colour of the text was adjusted in terms of good visibility to a deep red with a white border. The author's name is placed in the bottom left corner and the action button in the right corner «Home».

The second slide, slide 33, is an important part of the quiz because it details the competition rules according to which the knowledge quiz is conducted. This slide was

constructed quite simply. We inserted a blank slide into the presentation and copied the given pre-prepared rules from MS Word. We then chose an appropriate font (Times New Roman), font color, background, and because the content is quite extensive, we adjusted the slide to the font size (15 points). Finally, we aligned the text on both sides, i.e. in a block.

Slide 34, which is the third slide of the presentation, holds significant importance as a pivotal point for maintaining orientation throughout the presentation. On this slide we have placed the numbers in a circle from 1 to 35. All the numbers are parallel to the cards on which the questions are, that is, the card that the students choose has the question on it and the electronic form has the illustrative answer. The numbers in the presentation are thus hyperlinked to the given answer to the selected question of the knowledge quiz. As a general guideline, let's consider an example: the captain of the first team collaborates with their team to determine the desired point value for selecting a question. Following this, they select a competition question card – for instance, card number 8. After the agreement of the team, the team captain or a member of the team authorised by the team captain presents the answer. After the answer is given, the answer is then confronted with the correct answer, which is displayed on the interactive whiteboard or on the monitor after clicking on the given number. If the answer is correct, the points will be added to the team's score in the competition. However, if the answer is incorrect, the points will be deducted. Once the question has been confronted and solved, the number rings are returned to the home button and the next team continues with the question selection. In this way, the cognitive domain is significantly strengthened in the students' educational process.

The next 35 slides of the presentation (slides 35-69) are the answers to the quiz questions related to the topic, which the students choose on printed cards. We have processed them sequentially by selecting questions from the question bank. The first question was: «Which countries does Slovakia neighbour with?» The image that has been recently added was sourced from freely available resources using the Google search engine. We specifically selected an image in JPG format. The emphasis was on a clearly recognizable image of a map of Central Europe. We then pasted this into the presentation and resized it to the exact size of the presentation slide. We then visualized the neighbouring countries by inserting elliptical shapes coloured in red. We placed the number of the selected question in the upper right corner and the «Home» action button in the lower right corner.

We followed a similar procedure to create additional illustrative answers from the selected quiz question bank and to illustrate the answers in a quiz presentation. It is worth mentioning that we simplified our work when processing each slide by copying the action buttons as well as the question numbers to the next slide. However, when copying the number, we were careful not to forget to overwrite it to the sequentially correct one. The benefit of this technical approach is that we consistently maintained the placement of the number and action button in the same location as the previous slide, thereby preserving the intended layout of each slide. To mitigate the risk of inadvertent computer malfunctions, we took the precaution of regularly saving the presentation onto the computer's disk after inserting and processing each slide.

The aim of the experiment is to test the effectiveness of an electronic textbook in teaching special school students in Slovakia, on the example of implementing one section of the curriculum of the subject "Geography for Grade 9".

3. RESEARCH METHODS

In order to meet the stated educational objectives, we used different types of methods to conduct empirical research. The research methodology and organization were chosen to appropriately test the validity of the stated main hypothesis. The research involved employing

the following methods and techniques of empirical research:

- Method of content analysis of pedagogical documents. When studying the literature, attention was focused mainly on current professional books, scientific and professional publications, proceedings, journals, Internet sources.
- The method of evaluation statements, their processing and sorting.
- Natural pedagogical experiment - as the main research method.
- Quantitative and qualitative methods (Kruskal – Wallis, Dunn's) were used in the processing of data and results within the framework of the implemented pedagogical experiment.

4. RESULTS AND DISCUSSION

Evaluation takes many forms and focuses. In pedagogical practice, assessment focuses on the cognitive, affective and psychomotor aspects of personality. It is therefore a comprehensive assessment of a student or students. It should be stressed that the teacher should give priority to positive elements in partial, intermediate, final or comprehensive assessments, based on the student's strengths and assets, and set the assessment in a truthful, objective but positive way, i.e. it should be a positively oriented assessment. Assessment affects the most sensitive area of a person – his/her self-esteem. The ways in which students are tested, graded and evaluated are part of the assessment of the effectiveness of schools and, ultimately, of individual teachers. Therefore, in an attempt to objectify the evaluation of students' performance, we have used a point-percentage system of evaluation. Every student's performance, including written papers, oral responses, homework, and independent in-class work, was assessed using a points-based system. The number of points awarded aligned with the complexity of the task being evaluated. For example, a test following a thematic unit might earn 10 points, an oral response on a new topic could receive.

A grade was recorded in the format: total possible points/points obtained, and the grade was calculated as follows:

1. the total number of points that the student could obtain and the number of points he/she obtained were added together,
2. divide the points obtained by the total possible points, and then multiply the result by 100,
3. the resulting percentage represents the final mark according to the scale in Table 1:

Table 1

Percentage of student performance

Mark		Percentage rating	Point rating (5p)	Point rating (10 p.)
Excellent	1	100 – 86	5	10 – 9
Praiseworthy	2	84,9 – 70	4	8 – 7
Good	3	69,9 – 55	3	6 – 5
Sufficient	4	54,9 – 40	2	4 – 3
Insufficient	5	39,9 – below	1	2 - 0

Only students who have missed a maximum of 5% of the total points have the chance to revise their final grade. The revised answer or test must encompass all the covered material, and if the grade is to be adjusted, the final score of the test or answer must correspond to the percentage aligned with the desired grade the student aimed to achieve.

It is advisable to space out all written assignments and tests over a minimum of grading periods within a school year. The advantage of this type of assessment is, among other things, that it can more accurately express the degree of knowledge acquired, since in the classical assessment there is no difference between, for example, a weak and a good «B» and the classification regulations do not allow for grades of 1/2, 1–, 1+, etc.

In case this system would be of interest to other teachers, the individual methodological associations (hereinafter referred to as MA) or subject committees (hereinafter referred to as SCs) can agree on a uniform assessment, which can be subsequently incorporated into the curriculum.

After the assessment, the grade is recorded in the gradebook. It is advisable to manage the evaluation using tools like MS Office spreadsheet (Excel), asc-agenda, edupage, or other electronic applications. Keeping statistical metrics for individual subject units and classification periods within school years is recommended. These data can then be analyzed and compared against teaching innovations or the integration of new teaching resources. This approach offers an internal perspective on the effectiveness and qualitative progress in teaching a specific subject during a school year.

On the basis of this documentation, we present the effectiveness of the thematic unit Slovakia in the subject of geography for 9th grade at the Dobšiná School of Education. In Table 2 (school years 2016/2017, 2017/2018, 2018/2019) are the results achieved by students in lessons without the use of didactic aids and in Table 3 (school years 2019/2020, 2020/2021, 2021/2022) are the results achieved by students in lessons with the use of the didactic aids in question. The results for each year are shown in Fig. 4 and Fig. 5.

Table 2

Accomplishments of the thematic unit during the school years 2016/2018

The school year 2016/2017					
	Answer	small written test	large written test	the resulting percentages	the final score
1. learner	-	5 / 5	10 / 6,5	76,67%	2
2. learner	-	5 / 3	6 / 6	60,00%	3
3. learner	5 / 4	5 / 3,5	10 / 7,5	75,00%	2
4. learner	-	5 / 4	10 / 5,5	63,33%	3
5. learner	5 / 2,5	5 / 2	10 / 4	42,50%	4
6. learner	5 / 4	5 / 2	10 / 6	60,00%	3
7. learner	5 / 4	5 / 3	10 / 5,5	62,50%	3
average	20 / 14,5	35 / 22,5	70 / 41	62,40%	2,86
The school year 2017/2018					
	Answer	small written test	large written test	the resulting percentages	the final score
1. learner	5 / 4	5 / 3	10 / 6	65,00%	2
2. learner	5 / 4,5	5 / 4	10 / 8,5	85,00%	1
3. learner	5 / 4,5	-	10 / 9	90,00%	1
4. learner	5 / 3	5 / 4	10 / 6	65,00%	3
5. learner	5 / 3,5	5 / 4	10 / 7	72,50%	2
6. learner	5 / 3	5 / 3	10 / 7,5	67,50%	3
7. learner	5 / 2	5 / 1,5	10 / 5	42,50%	4
8. learner	5 / 4	-	10 / 6,5	70,00%	2
9. learner	5 / 3,5	5 / 4	10 / 7	72,50%	2

learner	45 / 32	35 / 23,5	90 / 62,5	69,41%	2,22
The school year 2018/2019					
	Answer	small written test	large written test	the resulting percentages	the final score
1. learner	-	5 / 5	10 / 8	86,67%	1
2. learner	5 / 4	5 / 4	10 / 9	85,00%	1
3. learner	5 / 3,5	5 / 3	10 / 6	62,50%	3
4. learner	-	5 / 3,5	10 / 7	70,00%	2
5. learner	5 / 3,5	5 / 4	10 / 7	72,50%	2
6. learner	5 / 4	5 / 3	10 / 7,5	72,50%	2
7. learner	5 / 4	5 / 2	10 / 3	45,00%	4
8. learner	-	5 / 4	10 / 7	73,33%	2
learner	25 / 19	40 / 28,5	80 / 54,5	70,34%	2,13

Table 3

Accomplishments of the thematic unit during the school years 2019/2022

The school year 2019/2020					
	Answer	small written test	large written test	the resulting percentages	the final score
1. learner	5 / 4	5 / 5	10 / 9	90,00%	1
2. learner	-	5 / 4,5	10 / 10	96,67%	1
3. learner	5 / 4	5 / 3	10 / 7,5	72,50%	2
4. learner	5 / 4,5	5 / 4	10 / 9	87,50%	1
5. learner	5 / 4	5 / 3	10 / 8	75,00%	2
6. learner	5 / 3	5 / 3	10 / 6	60,00%	3
7. learner	5 / 5	5 / 4	10 / 8	85,00%	1
8. learner	-	5 / 5	10 / 9	93,33%	1
9. learner	5 / 3,5	5 / 4	10 / 7	72,50%	2
10. learner	5 / 4	5 / 4	10 / 8	80,00%	2
11. learner	-	5 / 4	10 / 9	86,67%	2
12. learner	5 / 4	5 / 2	10 / 6,5	62,50%	3
learner	45 / 36	60 / 45,5	120 / 97	79,33%	1,75
The school year 2020/2021					
	Answer	small written test	large written test	the resulting percentages	the final score
1. learner	5 / 4	5 / 3,5	10 / 8	77,50%	2
2. learner	5 / 4,5	5 / 3,5	10 / 9	85,00%	1
3. learner	5 / 4	5 / 3	10 / 7,5	72,50%	2
4. learner	-	5 / 4	10 / 7	73,33%	2
5. learner	-	5 / 4,5	10 / 9	90,00%	1
6. learner	5 / 4	5 / 5	10 / 8,5	87,50%	1
7. learner	5 / 4	5 / 2	10 / 7	65,00%	3
8. learner	-	5 / 4	10 / 9	86,67%	1

learner	25 / 20,5	40 / 29,5	80 / 65	79,31%	1,63
The school year 2021/2022					
	Answer	small written test	large written test	the resulting percentages	the final score
1. learner	5 / 4,5	5 / 4	10 / 8,5	85,00%	1
2. learner	-	5 / 5	10 / 8	86,67%	1
3. learner	5 / 4	5 / 3	10 / 8	75,00%	2
4. learner	5 / 4	5 / 4,5	10 / 9	87,50%	1
5. learner	-	5 / 4	10 / 7,5	76,67%	2
6. learner	-	5 / 3	10 / 7	66,67%	3
7. learner	5 / 4	5 / 4	10 / 7,5	77,50%	2
8. learner	-	5 / 4,5	10 / 6	70,00%	2

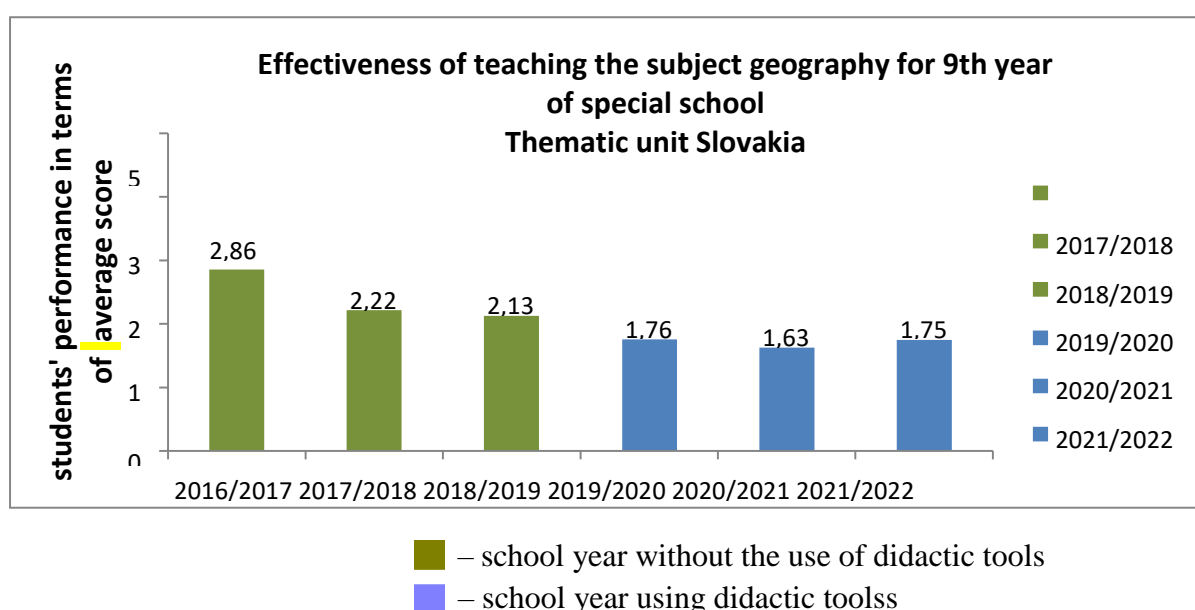


Fig. 4. Statistical, graphical comparison of teaching effectiveness without and with DTs

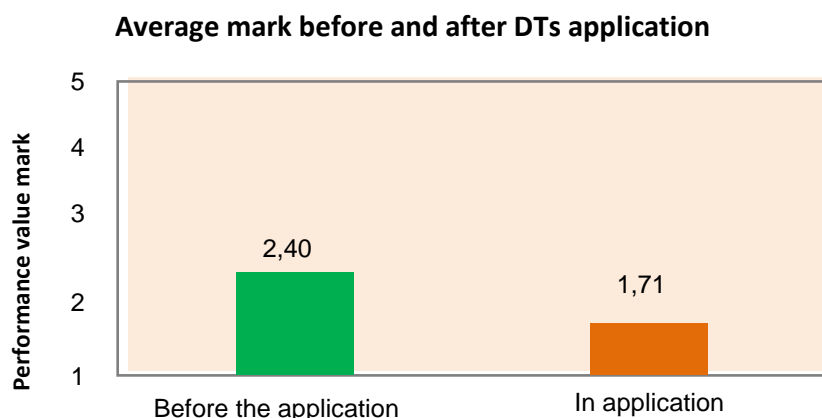


Fig.5. Graphical comparison of grades before and after application of DTs

Students taught with the use of electronic didactic aids with IT in the thematic unit Slovakia achieve better results in the assessment than students taught without EDT and IT. This difference will be statistically significant in favour of students taught with EDT with IT support. The hypothesis aimed to examine whether there was an enhancement in students' performance over the years, particularly during the school years when EDT (Electronic Teaching Devices) was introduced into the classroom. The most important indicators of descriptive statistics of the test results from each year are summarized in Table 4 below.

Table 4

Selected descriptive statistics indicators

	School year					
	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Average	62,86	70	70,94	80,14	79,69	78,13
Median	62,50	70	72,50	82,50	81,25	77,09
Standard deviation	11,32	13,46	13,10	11,77	8,92	7,72
Number	7	9	8	12	8	8

Although the individual samples showed a normal distribution, due to the very small sample sizes, we used a non-parametric statistical test for comparison. Since the sets in each school year were made up of different students and thus were not dependent on each other, we chose the Kruskal-Wallis test for comparison. This is a non-parametric multiple choice test, which is a non-parametric analogue of the one-factor analysis of variance and allows us to test the hypothesis H_0 that k ($k \geq 3$) independent sets come from the same distribution, and thus are not statistically significantly different from each other.

Table 5

Result of Kruskal – Wallis test

Median	Number	p-value
62,5	7	0,0275
70	9	
72,5	8	
82,5	12	
81,25	8	
77,085	8	

Since $p(0.0275) < \alpha(0.05)$, there is a statistically significant difference between the subgroups compared. However, from the test result, we cannot ascertain which specific groups are involved. To identify differences between subgroups, we employed Dunn's test.

Table 6

Comparisons using Dunn's test

Group 1	Group 2	p-Value
2016/2017	2017/2018	0,288416655
2016/2017	2018/2019	0,223769948
2016/2017	2019/2020	0,00447847
2016/2017	2020/2021	0,007755824
2016/2017	2021/2022	0,017552484
2017/2018	2018/2019	0,845582828

2017/2018	2019/2020	0,063978012
2017/2018	2020/2021	0,082766659
2017/2018	2021/2022	0,153137497
2018/2019	2019/2020	0,113606523
2018/2019	2020/2021	0,134470071
2018/2019	2021/2022	0,230521061
2019/2020	2020/2021	0,954250911
2019/2020	2021/2022	0,788137075
2020/2021	2021/2022	0,765941948

The results are interpreted in a standard way by comparing the p-value with the chosen significance level $\alpha = 0.05$. Dark values that are less than the significance level indicate a statistically significant difference between the indicated school years. Significant differences can be seen between the 2016/2017 school year and the last three school years in which EDT was implemented. This increase can also be seen in the following box plot (Fig. 6).

A box plot is an ideal way to display the results of comparing the means and medians of two or more groups. The bottom and top line coming out of the boxes is a representation of the minimum and maximum values occurring in each set.

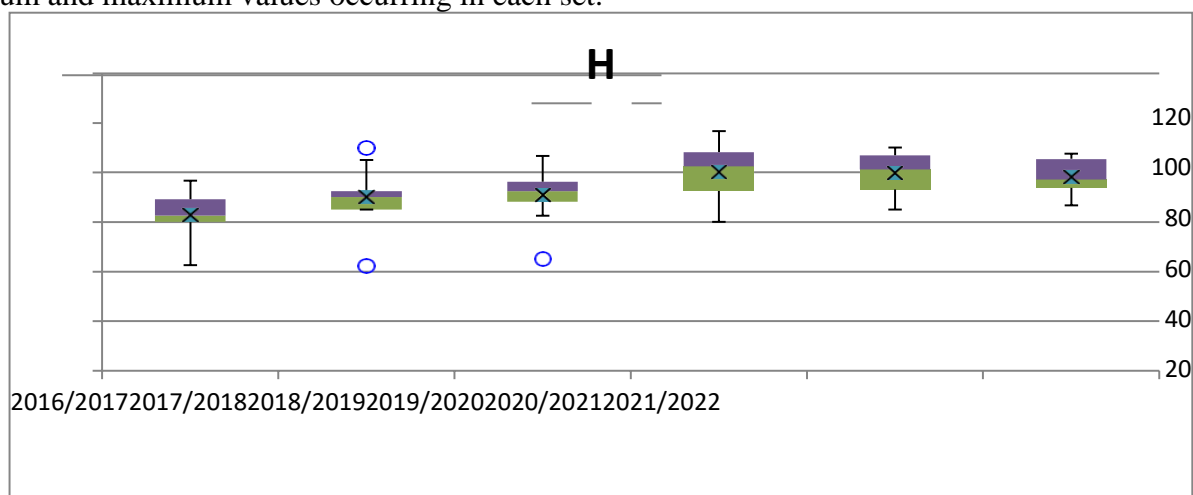


Fig. 6 Graphical representation of H

The colored grey-yellow interface is the level of the medians for each selection. The cross indicates the median value achieved by students in the tests. The lower and upper boundaries of the box indicate the lower and upper quartile of values for a given selection.

4. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

The results of the study have convincingly shown that the use of the proposed electronic didactic guide with IT support in teaching the subject «Geography», in the thematic unit «Slovakia», in the 9th grade of a school for students with mental disabilities has a statistically significant impact on the success of learning in the subject.

The didactic guide for social studies subjects in special schools created by us is an important content material that, due to its complexity, stimulates new ideas for continuous improvement of the quality of teaching not only in special primary schools, but also in other types of schools in the school education system of the Slovak Republic. However, it is important to note that in order for a teaching aid to be an effective and progressive tool and fulfill its

mission, it is necessary for the teacher to be ready to use such tools and to have a thorough knowledge and assessment of the cognitive potential of the students for whom the teaching aid is intended.

We hope that in the future this didactic tool will be widely recognized among teachers of social studies subjects in special schools in Slovakia. The further direction of our research will be the issues of professional readiness of special school teachers to use digital learning tools.

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ВИКОРИСТАННЯ ДИДАКТИЧНИХ ЗАСОБІВ З ІТ - ПІДТРИМКОЮ ДЛЯ НАВЧАННЯ ГЕОГРАФІЇ У СПЕЦІАЛЬНІЙ ШКОЛІ В СЛОВАЧЧИНІ

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Анотація. У статті розглядаються особливості використання електронних дидактичних засобів навчання учнів спеціальної школи Словаччини. Враховуючи сучасні вимоги до рівня знань і вмінь учнів з інтелектуальними порушеннями працівниками кафедри спеціальної педагогіки Католицького університету в Ружомберку (Словаччина) разом з учителями спеціальних шкіл підготовлено дидактичний посібник з ІТ-підтримкою. Посібник створено з метою підвищення рівня успішності засвоєння знань з географії. Його зміст сформовано на основі типової навчальної програми для учнів 9-х класів спеціальної школи, затвердженої Міністерством освіти і науки Словаччини. У якості прикладу в статті коротко висвітлено сутність підготовчого етапу та конкретну послідовність роботи вчителя при вивченні одного розділу «Словаччина». Під час підготовки дидактичного посібника враховувались особливості психофізичного розвитку дітей спеціальних шкіл, проблеми сприймання та усвідомлення ними нової навчальної інформації. Щоб показати ефективність інноваційного підходу, здійснено експериментальну перевірку розробленого електронного ДП з ІТ-підтримкою в одній із спеціальних шкіл Словаччини. Досліджено, проаналізовано та порівняно рівень знань учнів з географії впродовж 6-ти академічних років (2016 – 2018 рр. навчання традиційне, 2019 – 2021 рр. навчання з використанням ЕДЗ). Статистичні дані

показали, що результати успішності суттєво змінились на краще. Для підтвердження результатів з огляду на невелику дослідницьку вибірку (специфіка освітнього процесу спеціальних шкіл) використано непараметричний тест множинного вибору Kruskal – Walls та Dunns test. Результати математичної обробки матеріалів переконливо підтвердили вагоме підвищення рівня успішності учнів упродовж шести років навчання у спеціальній школі. Тож електронний дидактичний посібник з вивчення географії учнями 9-х класів спеціальних шкіл виявився досить ефективним. Ідею підготовки такого дидактичного посібника можуть запозичити вчителі інших суспільствознавчих предметів спеціальної школи та використовувати укладений посібник на практиці.

Ключові слова: дидактичні засоби з ІТ-підтримкою; інформаційно-комунікативні технології; географія; спеціальна школа.



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