DIGITAL TECHNOLOGIES IN MATHEMATICS TEACHING AT PRIMARY SCHOOLS

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Abstract

Modern technologies increasingly influence our lives and they have found their place in education. Computers, tablets and other means of technology have become an integral part of teaching in different educational institutions. Tablets at school are a tool for educators in the digital education world to support teaching staff in the use of mobile touch devices in teaching. The use of modern technology can help pupils better understand the curriculum, and it could be more stimulating for pupils than traditional teaching. Digital technologies in mathematics teaching at primary schools belong to innovative methods and activity forms. The Ministry of Education, Youth and Sports in the Czech Republic supports these activities. They place emphasis on practical digital technology used in mathematics teaching. Mathematics teachers familiarize pupils at primary schools with available software that is usable in mathematics teaching. In our paper, we focus on mathematics teachers’ experience with digital technologies and the use of mathematics applications in mathematics classes. Empirical research is implemented by exploring methods (questionnaire, discussion, and interview). In our paper we focus on understanding of pedagogical situation and mathematics teachers’ gained experience in educational process (in class, family, in a group of schoolmates) while using digital technologies.

Keywords: Digital technologies, mathematical applications, mathematics teaching.

1 INTRODUCTION

Digital technologies affect people's thinking and help them achieve educational aims. People are in a situation where they could not do without digital technology in both personal and professional lives. Digital technology needs to be used efficiently and well. Pupils need to be encouraged to use digital technologies at schools to help them grow personally and help them achieve their goals. Digital technologies also help educate disabled pupils. The efficient use of digital technologies is undoubtedly a prerequisite for both quality education and the smooth functioning of the school in administrative work, in communicating with the public and with the pupils’ parents. Modern digital technologies affect our lives and have found their place in pedagogy. Computers, tablets and interactive whiteboards have become part of teaching and learning. The use of modern technology can help pupils to better understand the curriculum, and it can also be more stimulating for pupils than traditional teaching.

Currently, the “Digital Education Strategy”, called “Digital Literacy”, is being implemented in the Czech Republic. The Digital Education Strategy required a change to the existing “Framework Education Program” and “Teacher Standards”. The use of digital technology in teaching mathematics at primary schools is essential and brings a number of benefits.

2 DIGITAL TECHNOLOGIES IN MATHEMATICS EDUCATION

One option is to use an interactive whiteboard in mathematics lessons. The teacher can make various adjustments to the preparations for individual lessons and can save the adjustments. The teacher can also store pupils' work. An interactive whiteboard can be used to explain the given subject matter and also to practice it using various activities. The big advantage is that the teacher can also save links to various websites in preparation for the lesson. We can repeatedly return to the individual topics with the pupils. If the teacher is preparing a lesson with a new curriculum, he/she can use various graphs and tables. Preparation for lessons is time consuming. The teacher can use the prepared lesson plan for teaching parallel classes. The teacher prepares lesson plans using the interactive whiteboard throughout his or her professional practice. The use of SMART lab cloud activities is very useful because their efficiency in the lesson is huge. In the article we also present some SMART lab activities that can be used in mathematics lessons. These are:

- Fill in gaps. In this activity, pupils and students drag words or numbers into empty spaces. This activity teaches pupils and students a deductive approach to solving a mathematical problem.
This activity can be used when introducing new concepts and definitions to pupils and students, such as the Pythagorean theorem, the definition of a circle, the set of points of a given property, the Thales’ circle.

- Rotate cards, a Memory Game-like activity. This activity teaches pupils to work together, practicing the memory of pupils and students and expanding their vocabulary. With this activity, pupils and students can create the right pairs, such as the names and symbols of mathematics quantities or conversions of units of measurements.

- Uncover labels, such as image labels. This activity teaches students to describe specific parts of a picture. This activity develops the memory of pupils and students. The activity can be used, for example, for a numerical axis when adding the missing numbers, or for naming numerical orders.

- “Assign to yourself” teaches pupils and students to create the right pairs. This is a pairing activity that develops collaboration between pupils and students and practices their memory. This activity is used in lessons in which e.g. knowledge of formulas, unit conversions, numbers opposite to given numbers, or inverted fractions are practiced.

- Sorting is an activity where pupils and students order items, learning to compare and understand sequences and arrangements. It is used for sorting numbers, sorting results of examples, sorting units, etc.

- Super gear. This activity teaches pupils and students to sort items into two categories, it teaches classification and grouping. These include sorting of positive and negative numbers, sorting patterns, etc.

- The Monster Quiz is a progressive quiz with questions offering to choose the right answers. Pupils and students work on their gadgets in teams. This activity can be run on tablets, mobile phones or computers. Pupils are categorized by computer randomization. Each pupil responds at his or her own pace and points for the team are added together. Then the answers are evaluated. Pupils and students are familiarised with the correct answers and the right results are explained.

- Response 2 - students answer multiple choice questions. It may also be questions with short answers – true or false. This activity is very advantageous for testing pupils and students. At the end of the test, the students will be given a quick test evaluation. The pupils are informed which questions they answered correctly, which ones they answered incorrectly and which ones they did not answer. They are acquainted with a comprehensive test evaluation. All these answers are recorded in a table that the teacher saves. The tests are quick and immediately evaluated. The teacher only saves the results on the computer. Again, this activity can be done using mobile phones, computers or tablets.

- Get involved. In this activity, pupils and students use their devices to send results or images. This brainstorming activity is designed to create tentative results. We can also use mobile phones or tablets in mathematics classes.

- "Acceleration" activity is a competition quiz with questions offering to choose the right answer. This activity develops competition and quick thinking. The activity is popular among pupils and students. The activity can be practised on an interactive whiteboard. At a time, up to 4 pupils can participate in the activity. The activity can also be performed on tablets.

Mathematics teachers use various activities to practice the curriculum. We no longer practice these activities only on an interactive whiteboard, where a maximum of one pair of pupils is working, but we also use tablets to practice them. Pupils are very fond of these activities because they allow them to check the correct answer instantly. Pupils and students can use the applications they have installed on their tablets to learn mathematics. In this article, we present applications that support mathematics teaching and are used by primary and secondary school teachers. These applications are:

- Geogebra is an application that is a tool for creating geometric structures. It combines geometry, algebra and mathematical analysis. It is a dynamic mathematical program that allows the user to create geometric designs. Graphs of functions that can be interactively changed can also be displayed in Geogebra. Geogebra also allows the user to directly enter equations and coordinates via the command line. Numbers, vectors, point coordinates, derivations, integrals, zero points, and function extremes can be calculated. All is displayed in a geometric and algebraic window. The program is freely available for non-commercial use.
• Geometryx is an application that allows the user to quickly and easily calculate the most important values and parameters of planar and spatial features. Geometryx is a simple calculator that uses trigonometric functions, Pythagorean theorem and Thales’ theorem. Geometryx also includes the most important geometric formulas and equations to help pupils and students solve various geometry problems.

• Shapes - 3D Geometry Learning is another application that can be used on tablets. The application menu presents four categories - prisms, pyramids, Plato solids, and the option to display or rotate solids. A three-dimensional object can be zoomed in or out or rotated using the application features offered. The application teaches students to explore different types of solids in 3D and helps them understand 3D geometry in an illustrative way. The application develops the spatial imagination of pupils and students.

• Mathematics - Tests is one of many applications that can be used by mathematics teachers at primary and secondary schools to assess pupils' knowledge. It contains a large number of tests divided according to the year in which the pupil or student is.

The big advantage of using an interactive whiteboard or tablet and SMART Notebook is that pupils and students can do tasks in groups that work at their own pace. Pupils learn to work in a group. The ability to work in a group will be required from pupils and students in their professional lives.

3 MATHEMATICS AND CLIL AS A FURTHER USE OF DIGITAL TECHNOLOGY IN TEACHING MATHEMATICS

In the European context, the CLIL teaching method has expanded very rapidly in two forms. One of them is the so-called hard CLIL method, according to which part or all of the curriculum of one or more of the educational fields is taught in a language other than the pupils’ mother tongue. This form is implemented by teachers of non-language subjects. Appropriate implementers of the CLIL method are teachers trained in the field and in a foreign language. In practice, CLIL is often implemented by teachers of a vocational subject (non-language) with very good language skills. CLIL is also implemented by foreign language teachers who teach a foreign language on selected content. The CLIL creators believed that this was an innovative approach to education and that it would have a long-term impact on the quality of education. In 1995, the European Commission adopted the White Paper on Education, which highlights plurilingual education in Europe. Here, experts agreed that CLIL can play an important role in this endeavour. At that time, the advantages of the CLIL method for the development of pupils’ foreign language skills were emphasized. We now know that it also brings considerable benefits and innovation to teaching non-language subjects, especially in the context of the traditional education system.

4 METHODOLOGY

The examined sample of respondents consisted of teachers who teach mathematics at the second level (6th to 9th grade) of these primary schools: Valašské Klobouky Primary School, 28th October Primary School in Tišnov, Svaté Zdislavy Primary School in Kopřivnice, Vyškov Primary School (Morávkova 40), Vyškov Primary School (Tyršova 40). In addition to these primary schools, the questionnaire was also published on Facebook pages for teachers. The respondents were provided with a link to the prepared electronic questionnaire. The survey was also conducted for the above-mentioned set of respondents. In January - March 2018, a total of 27 respondents sent back the completed questionnaires. The questionnaire was used to find out how many teachers in this area are familiar with the method of teaching CLIL. 13 respondents from a total of 27 respondents were informed of the CLIL method while 14 respondents do not know this method of teaching. The CLIL teaching method is mainly known to teachers under 35 years of age. Another question in our research was whether mathematics teachers would be interested in teaching part of the lesson in English, such as a short activity, a didactic game, an exercise, and a word problem. 17 respondents answered this question positively. 63% of teachers agree to teach mathematics in English.
Benefits of CLIL:

- Increased demands placed by CLIL on students’ cognitive processes, which are not commonly contained in foreign language textbooks.
- Effective development of communication skills.
- Work with real content and information usable in everyday practice.
- Increased chances with respect to the employment of the students on the labour market (as well as abroad) and their better preparation for further education.
- Enlargement of students’ intercultural competences.
- Improvement of teachers’ professional qualification.

5 RESULTS

The use of digital technologies was studied in a Ph.D. dissertation by K. Dvořáková. In the framework of her research she addressed 1450 teachers of mathematics, especially teachers at grammar schools. Teachers were addressed via e-mail. 168 teachers answered the questionnaire. (Dvořáková: Digital Technology in Mathematics Teaching). K. Dvořáková stated the following facts. The above data relate to Dvorak's research that explored the use of digital technologies in teaching. The digital teaching materials used most often are static presentations in PowerPoint or Libre Office (used by 41.9% of teachers). A total of 95.2% of teachers use computers or other means of ICT not only for preparation but also during their lessons. (Dvořáková: Digital Technology in Mathematics Teaching).

6 CONCLUSIONS

Digitization in teaching develops the knowledge and experience of pupils, students and teachers. Teachers learn how to create presentations for teaching in the digitization process, create office programme documents and spreadsheets, create interactive whiteboard presentations and use e-learning methods. Pupils and students learn to work with mathematical programmes and mathematical applications. Pupils and students develop their communicative and professional knowledge and they learn to work in a group. Creating digital learning materials will be a common part of every teacher's training in the future.
REFERENCES


