DEVELOPMENT OF DIGITAL COMPETENCES IN TEACHING GEOGRAPHY THROUGH THE CREATION OF MULTIMEDIA EDUCATIONAL MATERIAL IN THE H5P APPLICATION

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ABSTRACT

In today's modern age, digital technologies are an essential part of everyone's life, so students must learn to use them in primary school. The specific competences defined in the European Digital Competence Framework DigComp 2.1 (2017) are divided into six areas. The Ministry of Education of the Czech Republic has subsequently drawn on this document to add digital competences to its Framework Education Programme (FEP). For this reason, a research experiment was conducted in the context of primary school teaching, which included the design of several specific lessons. The aim of this experiment was to test the research question of whether online collaboration between students using the BYOD model would lead to the acquisition of the subject curriculum, as well as the acquisition of selected digital competences. Therefore, the aim of this paper is to present a design of a Geography teaching method in which students develop not only their subject knowledge but also selected digital competences, using the H5P application and the creation of a multimedia learning object, and to present the results of the research carried out. The paper includes a description of the individual lessons, the tasks set for the pupils and the methodology for the teachers.

1. INTRODUCTION

Every school should prepare students for life in society. It doesn't matter what the individual is good at or what field he or she will pursue. Every person, without distinction, must be able to integrate into society. These skills, which are supposed to prepare a student for life in society, are called competences. In each culture, country or society, these skills may vary slightly, but the principle remains the same. Each individual must be able to communicate, for example, or to learn new things. Nowadays, these basic skills are being supplemented by a new competence, namely the mastery of digital technologies.

In 2017, the European Digital Competence Framework DigComp 2.1 was published, summarising all the areas of digital competences that primary school pupils should learn. However, these competences should not be acquired by pupils primarily in Computer Science classes, but should occur across all subjects from Geography, to Humanities, to Mathematics or Physics. Many teachers, however, had and still have some problems with this area, not only because of their lack of experience with the use and integration of digital technologies into teaching or the actual manipulation of them, but also because some lack inspiration, an example of what digital technologies offer and what they can be used for in the classroom actively, but above all effectively.

For this reason, we decided to create a lesson plan and test our research question, i.e. whether online collaboration between students using the BYOD model will lead to the acquisition of the subject matter, and at the same time to the acquisition of selected digital competences. For the purpose of the experiment, we also created a multimedia object that contains not only the assignment tasks for the pupils, but also short educational videos, sample solutions, but most importantly a detailed description of the teaching, which is divided into five lessons of 45 minutes each. This proposed lesson is intended for Geography lessons, but every teacher can be inspired by this proposal and create a similar form of teaching for their own subject, e.g. History, Mathematics, Physics, or Natural History.

The original intention was only to test the possibilities of engaging students in online learning and activating them during group work, which was a very topical issue in the time of covid. However, in the end, a comprehensive proposal for project-based learning was created, which can be easily used not only in online learning, but also in the traditional face-to-face form of teaching using the BYOD model. Thus, in this paper, we present the instructional design and the created multimedia object, which contains all the assignments for students as well as educational materials and develops selected digital competencies and subject matter knowledge of students. The proposed teaching meets the requirements set by the Ministry of Education of the Czech Republic and is based on the theoretical foundations of general didactics. The proposed teaching has also been practically tested at the second level of primary school in the Czech Republic.

2. DIGITAL COMPETENCE

As already mentioned, according to the *DigComp Digital Competence Framework 2.1* (2017), digital competences can be divided into six different areas. Each area then contains several points that fall here. These areas are information and data literacy, communication and collaboration, digital content creation, security, problem solving and technological competences. As well as other competences such as learning, communicative or work competences, pupils need to acquire digital competences in all subjects in primary school.

The proposed project-based learning is primarily designed to develop the areas of communication and collaboration, digital content creation, but it also develops information and data literacy and, of course, technological competences. As the titles suggest, pupils are to learn how to use digital devices to create files of various types, from simple text, to graphics and sound files, to videos or directly multimedia objects. They should also learn how to interact with each other and share different types of files using technology, as well as how to use digital technologies effectively to obtain different types of information, which they must be able to access critically, while respecting copyright when sharing this information. To acquire these skills, students must, of course, learn to operate the digital devices themselves and other necessary hardware and software, and be able to deal with a variety of technical problems. And, as with most activities in human life, there is a need for safety when working with digital technologies, both in terms of physical health (associated with, for example, excessive use of digital technologies) and mental health (which can be compromised by, for example, cyberbullying), and avoiding data loss and other attacks or computer viruses.

3. METHODS

In order to implement our intended research experiment, it was necessary to create a lesson plan, which we had to base not only on the RVP of Czech education, but also on many professional didactics, for example, Modern Teaching G. Petty (2013) and R. Čapek's Modern Didactics (2015), from which we had to draw information for the choice of appropriate methods and forms of teaching, the formation of groups, the motivational and final part, the evaluation of group work and the overall organization of the teaching. It was necessary to set a goal for the students to reach during the teaching, set a timetable and create a detailed methodology describing the individual tasks, group formation and the whole project-based learning. Most importantly, however, was to create a multimedia object that is the centre of all this project-based learning, see below.

3.1 Application

In the creation of the multimedia object, not only the text editor Microsoft Word was used, in which all the information had to be written, i.e. the assignments of the tasks and some teaching materials, but above all the methodology itself for the teachers. In the editing of the photographs, several graphic editors or applications used to work with photographs and other graphic objects were used. These were PhotoFiltre and the online tools Photopea and Polarr. The DaVinciResolve application, which is freely available for download but still offers professional video work at the level of applications such as Premiere Pro from the well-known Adobe company, was used to create individual video tutorials. The main part of the creation of the multimedia object took place in the H5P application.

3.1.1 H5P

This is a web-based application that can be accessed from anywhere, but only with internet access. This application is used to create interactive materials that have great potential in teaching. Registration and use of the basic features of this application is available for free, but the full version, which contains a wide variety of different types of interactive content, is chargeable. New users can at least try the full version for free for 30 days. Some of the files that can be created in this app include interactive images, videos, quizzes, books and much more.

The advantage of this app is not only that it is very easy to use and learn for both teachers and students, but also that the resulting interactive files used in lessons motivate and awaken students' interest in the subject matter and contribute to greater understanding and retention of the material.

For the purpose of the proposed project-based learning, a multimedia object (see below) containing text as well as images and videos was created in this application. The Image hotspots file type was used for this multimedia object. This file type works by placing a cover image, which can be anything from a photograph to an infographic. Subsequently, individual hotspots are inserted on top of this cover image, which then contain other files. This can be classic text (Figure 2), other images, or even a video (Figure 1), which can be uploaded directly from a computer, or by using a link from an existing video on the internet, e.g. from youtube.com. The user can then modify the appearance of these points, both in terms of colours and the symbol displayed on the points themselves.
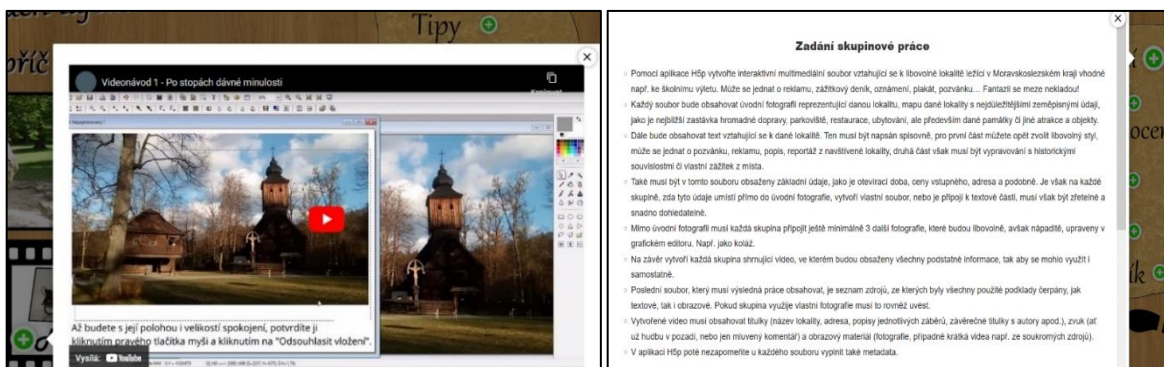

Figure 1. Clicked point with video tutorial   Figure 2. Clicked point with text

3.1.2 Graphic Editor

The graphic editor was the most frequently used tool in the creation of the documents for the proposed project-based learning, for this reason not only one program was used. Three photo editing applications were used in turn, but each offered different functions that were needed for the final form of the photographs used. All the image material, especially the photographs used, was sourced in-house, so there can be no problem of copyright infringement. The resulting files are then licensed under CC BY-SA 4.0.

In the first stage of the work it was necessary to use the online application Polarr, which is used to work with filters. This allows you to adjust the brightness, contrast, light, shadows, colour tone and so on in a given photo. In the second phase, the work was done with the PhotoFiltre application, which is available for free and works on a similar principle to other graphic editors, but the main difference is that this application does not allow working with layers and mask, which can have its advantages and disadvantages. If it was necessary to work with layers, another online application Photopea was used, which offers many interesting features, and its environment is similar to working in the well-known Photoshop from Adobe. The advantage of all these applications is their availability for free, their ease of use and the abundance of necessary features.

3.1.3 Video Creation

For better clarity and clarity, it was also necessary to create short video tutorials used to introduce the different applications that the students had to work with. Thus, three videos were created. One video introduces the pupils working with the H5P application itself, in which the pupils had to create their own multimedia object of the Image hotspots type. Another video focuses on working with a graphical editor, specifically working

with the PhotoFiltre application. This video explains the complete basics, which are the same for all graphic editors, so it would not be a problem if the students chose a different graphic editor for their work. The last video then introduces working in Windows' MovieMaker. This introduces the basic features that can be used to create a video. This program is used by most primary schools in the Czech Republic, but even here it would not be a problem if the pupils chose another program to create their own videos, as these programs are based on a similar principle.

3.1.4 File Sharing

The most challenging aspect in terms of preparation was to figure out how to communicate the created multimedia file to the pupils and to choose a file sharing platform for the pupils to work in during the project-based learning. The first method that was tried was to create a custom website using Google Sites, where all the necessary materials, the multimedia object and the final quizzes were placed. Unfortunately, a month before the practical verification of the teaching, technical problems occurred in this application and the multimedia object created there stopped working. The replacement solution was the Moodle application, which is widely used especially in Czech universities. In this application, a special course was created (Figure 3), which again contained all the necessary materials created for this project-based learning. Another great advantage is that students can access this course using the "guest login" function and do not need to create accounts. This course can be found at https://amos.pdf.osu.cz/moodle/course/view.php?id=424.

Within the framework of the implemented teaching, the school itself was left free to choose the appropriate application for online collaboration between students, but it was assumed that the school would choose one of the two most widely used platforms for online learning in the Czech Republic, which are Microsoft Teams and Google Classroom. This school eventually chose Google Classroom, which the pupils were already used to working with and where all pupils had already created their accounts.
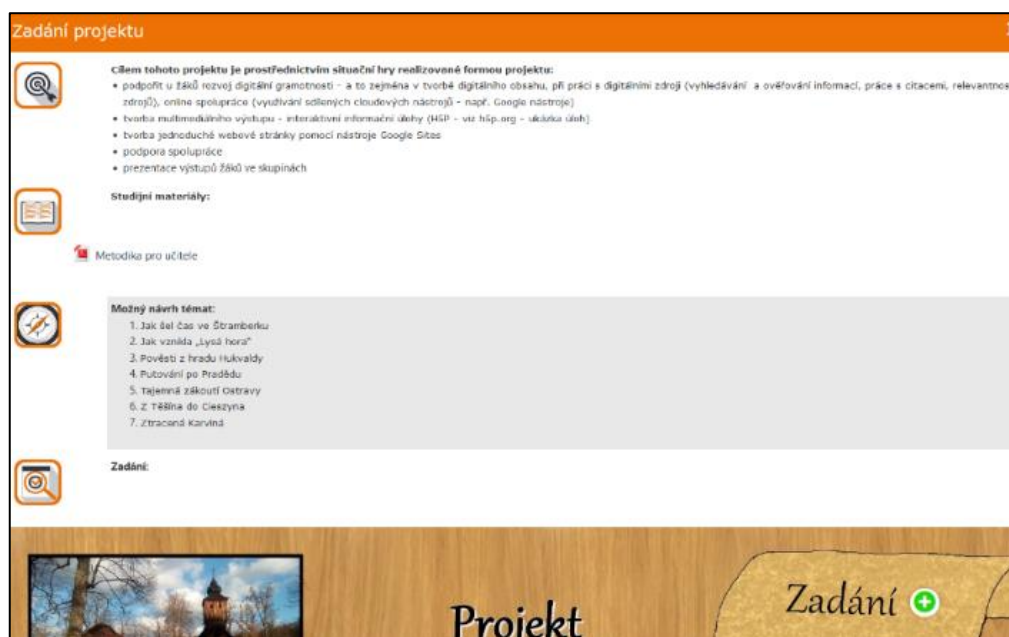

Figure 3. Project entry in Moodle

3.2 Multimedia Object

The multimedia object created is the core of the whole project-based learning. This multimedia object (Figure 4) is divided into three parts. On the top right there are the assignments for all the tasks, the evaluation criteria for the whole project-based learning, tips that students can use to create their own materials, a final quiz and a

questionnaire used to evaluate the designed project-based learning. At the bottom there are teaching materials. Some of the learning materials are text-only, some are in the form of video tutorials. On the top left there is a sample solution that students can use for inspiration when creating their own multimedia object.

The main task of the students is to create the same type of multimedia object. Each group has to choose a suitable title image and creatively edit it. Each group must then place a text describing the location, several other images from around the location and a short video to serve as an advertisement for the location.

Figure 4. Multimedia object

3.3 Lesson Plan

The entire project-based learning is designed to take five lessons. In each lesson, the students complete different tasks, which are interconnected, and finally combine everything into one coherent set using the H5P application. Throughout the project-based learning, working with shared storage and shared documents is important, with pupils working in groups all at the same time on a given task and saving the files they have created on the shared storage. Pupils are also able to choose which digital devices they use for their work, so that they can all use their own mobile devices, following the BYOD model. Our original lesson plan also included the inclusion of a field trip where students could use their mobile phones to take their own photos needed to create a multimedia object. Unfortunately, this plan had to be cancelled for organizational reasons.

In the first lesson, the pupils are introduced to the whole project through appropriate motivation, which is an essential part of project-based learning. In this case, it was a situation where the pupils became employees of a travel agency for which they had to create advertising files for a selected location in the Czech Republic. The pupils were divided into groups by the teacher based on his experience with the class. In these groups, they then chose their own tourist area, about which they collected the necessary data using the Internet and wrote it down in a coherent form. This lesson was thus designed to acquire and deepen knowledge of the Czech language, Geography, but especially digital competences in the field of information and data literacy, digital content creation and technological competence.

The second lesson focuses on working with a graphic editor. Also in this lesson, the students had to find the necessary photographs and other visual material they wanted to work with, taking into account the respect of copyright. From the photographs obtained, the pupils had to create an introductory image, which had to be representative, and three other photographs to be used at different points in the multimedia file. In this lesson, the pupils again deepened their knowledge of Geography and skills in the digital competences of digital content creation, information and data literacy and technological competences and now also their knowledge of Computer Science.

In the next lesson, pupils followed the same process. This time, however, they created their own promotional video, for which they could use both photographs and other short videos.

The following lesson is dedicated to map work. Now the pupils were asked to explore the area around the monument using online maps and to create their own map with important places such as a bus stop, a parking lot, a restaurant or important landmarks of the area. In this lesson, in addition to specific knowledge about the area, pupils were also acquiring general knowledge of Geography, specifically cartography. Again, they were deepening their digital competences.

In the last lesson, the pupils were given the space to complete the whole project, inserting the individual files into the H5P application and creating the final Image hotspots file. The main part of this lesson, however, is the presentation of each pupil's work, which each group has to present to the other pupils and introduce them to the site. In the last part of the lesson there is a space reserved for discussion of the results of the group work, feelings, impressions, knowledge gained, etc. After this discussion, the pupils then fill in the quizzes that they could have prepared for the others during the project-based learning, but if they did not manage to create these quizzes, they can use the already prepared quizzes (Figure 5), which focus on the general knowledge that the pupils should have acquired during the project-based learning.
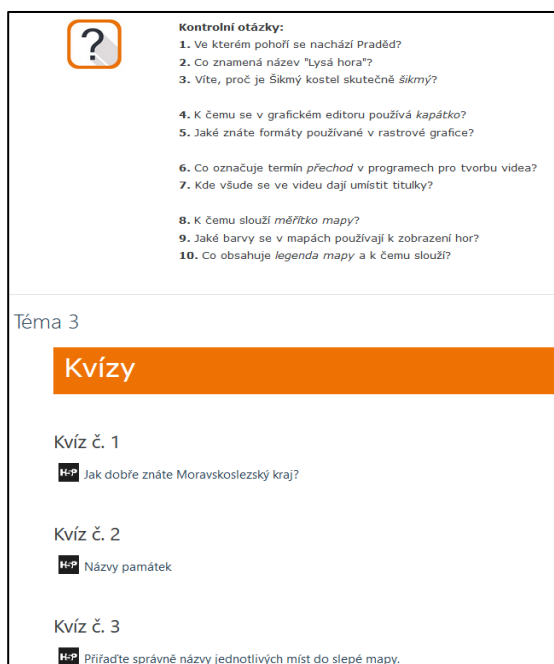
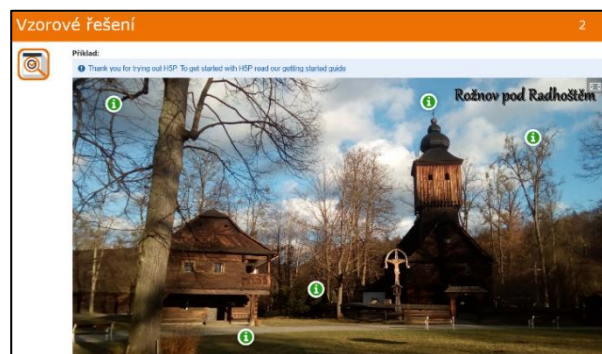Figure 5. Review questions and quizzes in Moodle   Figure 6. Sample solution in Moodle

Thanks to the Moodle course, the pupils had at their disposal at all times a multimedia object which, as already mentioned, contains detailed assignments for all the tasks, a proposal of possible topics, sample solutions (Figure 6), criteria for evaluating group work, quizzes and detailed instructions, hints and tips.

4. RESULTS

After the practical verification of the proposed project-based learning, the students were asked to fill in a questionnaire to determine the effectiveness of the proposed learning. In addition to this questionnaire, the teacher who had implemented this teaching was asked to evaluate the proposed teaching and his/her professional opinion on the course and results of the teaching.

The questionnaire contained thirty-two questions, which were divided into four thematic headings on questions related to group work and the chosen topic, acquired knowledge in the field of Geography, Czech language and digital competences.

The results of the questionnaire show that 66.7% of the pupils perceived the atmosphere in the groups as rather pleasant, which is always important for the pupils to acquire the necessary knowledge and skills. The involvement of all group members was perceived differently by pupils. 83.4% of pupils were satisfied with the involvement of other group members, but less than 20% were not satisfied with the involvement of other members. Overall, the results of the survey show that pupils enjoyed working in groups, but at the same time had some problems with it, which may be due to the fact that pupils do not work in groups very often in this class. In terms of the topic, 80% of the pupils liked the topic, 15% of the pupils would have preferred a topic focused on zoology and 5% of the pupils were not interested in the topic. The chosen topic thus contributed again to a higher motivation of the pupils due to this high popularity.

On average, 75% of the pupils found the materials comprehensible, but the majority of pupils (83.3%) turned to their teachers or found the information they needed on the Internet. The overall success rate for group work and final quizzes was greater than 70%. For the quizzes, pupils were on average 75% successful and for the individual assignments, pupils were on average 79% successful. The success rate of the designed instruction was on average 6% higher than the learning outcomes of the class in the regular instruction.

All pupils (100%) agreed that they had gained new knowledge in Geography, both in cartography and within individual geographical locations. Half of the pupils (50%) also reported that information relating to copyright was new to them. Pupil responses varied in the area of Computing and Digital Competence, with each pupil learning something different. Some pupils learnt how to share files, others learnt how to search the internet, some pupils improved their skills in using a graphic editor, and other pupils improved their skills in video production.

The teacher who participated in the implementation of the proposed project-based learning evaluated the proposed learning rather positively. From his point of view, the pupils were most interested in the creation of the video, although this activity was the one that caused the pupils the most problems. He was very positive about the H5P application, which he found simple and intuitive. In his opinion, working in this application motivated the pupils. The teacher evaluated the created multimedia object as understandable and the project-based learning as suitable for the chosen age category of pupils. Compared to the usual way of teaching (in the case of this teacher, without the use of digital technologies, mobile devices and online collaboration between pupils), the proposed way of teaching was more motivating and the pupils were more actively involved in the lesson, which generally contributes to a deeper understanding of the curriculum. In his view, the proposed teaching fulfilled its purpose, as the pupils acquired the necessary knowledge in Geography, Czech language and Computer Science, but especially in the area of digital competences.

5. CONCLUSION

The aim of our research was to find out whether online collaboration between students using the BYOD model would lead to the acquisition of the subject matter, as well as the acquisition of selected digital competences. To this end, we created a learning design together with a multimedia object that was intended to develop selected digital competences of the students together with the specific subject material. Thus, based on the results of our scientific experiment, it can be said that the designed teaching met the set objectives and online collaboration between students is possible and leads to the development of selected digital competences together with the subject knowledge, while offering effective cross-curricular relationships. Thanks to data sharing, pupils could work from their own mobile devices, not only at school but also at home, but especially all members of one group at the same time, which made this group work more effective.

In this paper, a lesson plan designed for teaching Geography at the second level of primary schools was presented, but it can also be used as a general model for teaching any subject, whether it is Physics or Civics. And if the possibilities of the school or the organisation of the lessons allow it, the pupils can go on a trip and, thanks to the work with their own mobile device, take their own photographs as a basis for their work.

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