H5P INTERACTIVE DIDACTIC TOOLS IN EDUCATION

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Abstract

Interactive didactic tools are important for both teachers and students. Moreover, technological development has made them even more important. Based on the HTML5 language, H5P interactive multimedia tasks are a freely available and effective solution for teachers at all school levels, helping them create didactic tools, share them with others, reuse them or modify them with respect to the curriculum. This idea is consistent with society’s vision of implementing digital technology into education, making it available to those who participate in the education process in accordance with copyright laws. The study responds to the need for innovative didactic materials that would improve the education process; it introduces ways to create, edit and distribute H5P interactive didactic tools in the web environment and educational systems such as the LMS Moodle. H5P tasks are analyzed and then divided into categories, which represent the individual stages of the learning process — motivation, exposition, fixation, diagnosis and application. Each category includes practical examples of how interactive tasks can be used in the education process. The study results show that these educational materials, which meet requirements for innovative educational resources, have a wide range of uses.

Keywords: H5P, Interactive Content, Interactive didactic tool, Multimedia, Teaching Process.

1 INTRODUCTION

Interactive teaching implies active two-way communication/interaction of a student with the technological device, a computer system or an application which should facilitate instruction. Interactive teaching is considered a promising form of teaching [1].

Therefore, the available modern means not only encourage the involvement of interactive technologies in instruction, but also in creating interactive teaching materials. The reasons supporting this include:

- stimulating student's interaction,
- making learning more attractive,
- increasing motivation to learn,
- supporting the clarity of the subject matter,
- supporting self-managed learning,
- the possibility of increasing the quality of learning.

Interactive elements are also used in the MOOC (Massive Open Online Course). E.g. Kolas et al. [2] present the use of interactive modules in MOOC as a means of motivating and activating students through interactive videos and interactive presentations. When using interactive activities in class, students can more easily engage multiple senses at once. Interactive elements allow both parties – teachers and students – to actively enter instruction, to influence it and adapt it to their respective current needs and also the whole class [3]. E.g. an interactive workbook can allow a student to view the correct answers, or provide other forms of feedback or provide additional multimedia content in the form of videos or animations.

Among the significant technologies (means of didactic technique) that meet the requirements of interactive learning are interactive whiteboards, mobile devices, an interactive floor known as the Magic Box (used mainly in pre-primary education) as well as new interactive displays or projectors. Used together with these devices are authoring tools for creating interactive activities and exercises. Popular tools include SMART Notebook application or open source OpenBoard. Interactive content H5P poses another option.

Creating one’s own interactive learning materials requires, in addition to professional pedagogical knowledge, time and, at the least, basic computer skills for working with technology. The level of
adoption may have an impact on the resulting quality of the produced material. Creating one’s own teaching resources often appears to be both technically challenging and time consuming for teachers [4]. The time adequacy should correspond to the efficiency and effectiveness of the creation of own materials. Therefore, many teachers turn to a shared public repository (the so-called Learning Objects Repositories; LOR) of already created digital learning materials. In the Czech Republic these resources can be found at www.dumy.cz, www.veskole.cz, dum.rvp.cz, www.eduribbon.cz. Despite this, many teachers point out the lack of teaching materials, for example interactive textbooks, interactive activities and exercises [3]. Therefore, the creation of shared versatile and innovative hardware and software learning resources is supported.

2 BACKGROUND

The National Institute for Education by way of a strategy document of the Czech Republic [5] defines the quality criteria for digital educational resources. Emphasis is placed on ensuring the following requirements:

- copyright,
- technical requirements,
- professional requirements (professional accuracy, pedagogy and didactics).

Firstly, the copyright requirements define the conditions of use. Naturally, such digital teaching resources are supported that can be shared with others, i.e. they can be "reproduced, disseminated, displayed and communicated in their original form"; as well as those that can be adapted to learning needs or used commercially. Teaching resources should be covered by a public license – such as Creative Commons [6], which defines six ways of using free digital materials. Information about how to use each individual resource is part of the metadata.

Secondly, the technical requirements should ensure that the digital material:

- is freely available on the public Internet,
- includes metadata labels,
- is stored in an appropriate format ensuring openness and interoperability, for example:
  - web interface – HTML5,
  - text, spreadsheet and presentation documents – txt, docx, xlsx, pptx, odt, ods, odp, odi,
  - image files - PEG, PNG, GIF, SV,
  - video files - MPEG4, WebM,
  - audio files - MP3, FLAC, Ogg Vorbis,
- can be technically processed (for example aesthetic, graphic and typographic requirements)

Thirdly, the last requirement is to ensure professional accuracy which is consistent with other curricular documents in the given area of educational activities. Equally important is the appropriate level of didactics and methodic of the created resource.

3 OBJECTIVE OF THE STUDY

The object of the study is to introduce the Interactive Content H5P (abbreviated as H5P) based on HTML5 as an accessible didactic tool for creating interactive materials. Furthermore, to categorize individual types of tasks based on the learning process and give examples of their usage. It is assumed that the scope of application possibilities of some tasks is such that they can be applied across multiple stages of the learning process.

4 H5P INTERACTIVE CONTENT

Interactive content H5P is free an open source HTML5 based tool. Benkada et al. [7] define H5P as “an open-source content collaboration framework based on Javascript focused on the creation of interactive HTML5 content and particularly videos.”

It is used to facilitate creation of different types of interactive tasks that can be integrated not only into their own web environment. Using embed code, that is a block of HTML code, which is embedded in
the page source, interactive content can be integrated in a variety of different software tools for teaching or preparing didactic materials, such as PowerPoint and SMART Notebook. Therefore, H5P can be seen as a flexible, mobile responsive and versatile tool that promotes an innovative way of linking teaching resources and multimedia elements. H5P is supported by any VLE with LTI support like Canvas, Brightspace, Blackboard and LMS Moodle. It is also available as a free plug-in for the content management framework Drupal or Wordpress or LMS Moodle [8]. LMS Moodle, in particular, is a very popular online educational e-learning tool in the Czech Republic used at all levels and types of schools.

4.1 Creation of interactive content H5P

It is possible to create interactive H5P content directly in your own web pages after installation, or also at h5p.org. When creating interactive content you can choose from over 40 diverse types of multimedia tasks, such as pairing, dragging images, interactive presentation, filling in words, creating timelines, virtual tours, memory games, etc. Since the source code is open, future development can be expected. The teachers can rehearse creating the tasks on the website, then download and apply them to instruction. The last option is to create the tasks directly from the environment of the selected supported platform (e.g. LMS Moodle) where H5P is pre-installed.

The difficulty of creating tasks varies with the type of the selected task. However, the process of creating interactive learning tasks does not require extensive teacher expertise. The uniform structure of tasks can be expressed using two basic components:

- content,
- settings:
  - behavioral settings,
  - text overrides and translation,
  - H5P options.

The first component, the sub content, that is the texts, images, videos or audios are inserted into predefined fields from which the task is subsequently generated. Each type of task is characterized by a certain dominant multimedia element, in some cases several multimedia elements can be integrated at the same time. Also included in the content component is the Overall Feedback module where teachers can set their own rating scale and verbal feedback, or respond to the correct or incorrect answers. Thus, the H5P tasks support several feedback mechanisms that can have a significant impact on improving both the quality of learning and the efficiency of teaching [9]. As Koštálová [10, p. 8] et al. states “feedback is becoming an inseparable part of learning.”

The second component, Behavioral Settings, contains customizable behavioral attributes of the tasks, such as whether the students can perform the task repeatedly, whether the incorrect answers are penalized, etc. The individual settings vary depending on the type of the selected task. In the panel Text overrides and translations, the teachers can set their own means of expression in the desired mother tongue. The last block H5P options (see Fig. 1) allows the choice of which attributes will be displayed with the task (Download button, Embed button, Copyright button). Thus, the teacher can decide whether the created task will be openly accessible to other learners (either through downloading the task or generating an embed code) or whether references to the used sources and licenses will be published.

Interactive educational content H5P can be assigned to a group of so-called digital learning objects, which Rambousek [11, p. 19] defines as “a digital entity that can be used, reused or cited in electronically supported learning.”
4.1.1 H5P vs. quality criteria for digital educational resources

The H5P tasks designed for HTML5 support openness and interoperability. Interactive content created through h5p.org is publicly available. The H5P content can be distributed by the means listed previously, that is:

- downloading a task,
- generating an embed code.

In the case of the first option, the task can be uploaded to a supported platform environment where the H5P was pre-installed. Then, the content of the task can be further edited, such as changing the behavior of the task (in accordance with the license used). In order to ensure compatibility, it is recommended to keep the system and the H5P plugin up to date. In the case of the second option, the embed code, the task cannot be further edited. However, this option offers a wide range of possibilities for placing interactive content into the web environment, such as a school e-learning platform or embedding into electronic didactic materials (for example presentations).

Each task contains metadata labels that are filled in by the author. The metadata also includes the choice of an open license, such as Creative Commons which promotes spreading free resources.

The professional competence that is consistent with didactic and working principles (e.g. the principle of clarity, interconnection of theory and practice, adequacy, timeliness, feedback and others; [12]) is guaranteed by the author of the content, who is also responsible for the quality and originality of the created material.

4.2 Phases of instruction

The teaching process is divided into individual sequences, called variable moments of instruction that are present in every lesson. However, these individual sequences cannot be understood only as isolated, individual, closed time periods [13]. On the contrary, the individual sections can mutually overlap. In terms of didactics, we distinguish a total of 5 phases of instruction, that is (1) motivation, (2) exposure, (3) fixation, (4) diagnostics and (5) application.

The motivation phase aims to arouse the student's interest and motivate him to learn. Each teacher has his own strategy that is his own way to motivate students. Also the unconscious cues that teachers translate into teaching can be a part of motivational strategies [14]. The teacher's ability to motivate the students to learn is also important in creating a state of mutual trust and an open and positive atmosphere [15]. Zormanová [16] draws attention to the need of student's motivation throughout the whole teaching unit. There are several ways how to influence the students'motivation, for example by teacher-student interaction, using rewards, possibly penalties or by arousing their cognitive needs (e.g. [17], [18]). Creating interactive H5P content as a didactic material, can be one of the means to boost students' performance, commitment and motivation. The exposure phase aims to provide students with new knowledge through available means and processes that allow them to learn under the guidance of the teacher. In this phase the foundations and fundamental skills and habits are being developed, which are further amplified in the fixation phase [13]. Furthermore, through fixation the acquired knowledge, attitudes and beliefs are consolidated and deepend. Basic forms of fixation include repetition and exercise. Subsequently, verification, testing or assessment of acquired
knowledge takes place in the diagnostics phase. Emphasis is also placed on feedback. Its significance is undeniable. The last phase, application, assumes the active involvement of the acquired knowledge and skills on a practical level, which is, for example, an independent creative activity of students.

### 4.3 The design of the interactive content H5P based on the phases of instruction

As a part of the initiative to promote the introduction of interactive elements into e-learning courses in LMS Moodle in higher education (for both full-time and combined studies), interactive content H5P has been studied and categorized into segments corresponding with the instruction process (motivation (M), exposure (E), fixation (F), diagnostics (D) and application (A)) into which the content can be effectively placed. Individual categories are divided based on the multimedia element which is the most represented in the selected task type. Due to the large amount of the different types of tasks, the authors of this paper are limited to a number of selected ones which are further defined in the following charts.

#### 4.3.1 H5P - Text tasks

<table>
<thead>
<tr>
<th>Task name</th>
<th>H5P task description</th>
<th>Phase</th>
<th>Example of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accordion</td>
<td>creating accordion items - a key word conceals more detailed content</td>
<td>E</td>
<td>definition of key concepts</td>
</tr>
<tr>
<td>Documentation tool</td>
<td>tool for creating guides for structured writing processes</td>
<td>E</td>
<td>description of the working process or development stage</td>
</tr>
<tr>
<td>Drag the words</td>
<td>adding text to empty fields by selecting from predefined words or phrases based on the correct meaning, a type of close task, a closed interpretation task with the choice of an answer</td>
<td>F, D</td>
<td>language learning support, development of reading literacy, inferring from a text, grammar exercises – adding words in the correct form, foreign language texts – selecting suitable words based on understanding</td>
</tr>
<tr>
<td>Essay</td>
<td>creating an essay assignment with the possibility to define the mandatory number of characters or keywords that must be present in the essay, students get immediate feedback</td>
<td>D, A</td>
<td>tasks supporting critical thinking, memory training by creating a story, supporting reading skills development</td>
</tr>
<tr>
<td>Fill the blanks</td>
<td>creating tasks that contain blank text fields to be filled in (without selecting an option from a predefined menu), type of cloze and open-ended answer task</td>
<td>F, D</td>
<td>a task useful for adding unambiguous terms with the option to display help, for example filling in the names of capitals, mathematical solutions</td>
</tr>
<tr>
<td>Mark the Words</td>
<td>task type: designate a word or phrase that does not belong to others, type of a closed task with multiple choice selection</td>
<td>F, D</td>
<td>denoting expressions that do not belong to a set of objects, e.g. among EU Member States, tasks to practice logical reasoning</td>
</tr>
<tr>
<td>Personality quiz / Questionnaire</td>
<td>creating personal quizzes, survey</td>
<td>D</td>
<td>questionnaire, school project evaluation, finding out personal preferences, psychological personality questionnaires</td>
</tr>
<tr>
<td>Quiz</td>
<td>creating quizzes, supporting a combination of different question types - multiple choice, fill in the blanks, drag the words, mark the words and regular drag and drop</td>
<td>F, D</td>
<td>knowledge quiz, test, competition</td>
</tr>
<tr>
<td>Arithmetic’s Quiz</td>
<td>creating mathematical quizzes with a timer, choosing correct answers from multiple choice, type of a closed task with a brief answer</td>
<td>F, D</td>
<td>practicing numerical operations, mathematical competitions within a specific time</td>
</tr>
<tr>
<td>Advanced fill the blanks</td>
<td>filling in the missing words or selecting the correct answer from the drop-down menu with emphasis on feedback</td>
<td>F, D</td>
<td>Filling words in the correct form</td>
</tr>
</tbody>
</table>
### 4.3.2 H5P - Image tasks

#### Table 2. Image / Photography.

<table>
<thead>
<tr>
<th>Task name</th>
<th>Description</th>
<th>Phase</th>
<th>Example of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agamotto</td>
<td>multiexposition – layering/gradual blending of two or more images by moving the slider, each image level may contain a short label</td>
<td>E</td>
<td>historical development of boundary territory in time, zoom, morphing effect, conversion of an object in time, display of the golden ration in a picture</td>
</tr>
<tr>
<td>Collage</td>
<td>creating picture collages using templates</td>
<td>M, E, F, A</td>
<td>showcases of students’ work, collage on a given topic, collage as a means of illustrating the selected object from different angles and levels of view, collage of prominent representatives</td>
</tr>
<tr>
<td>Find the hotspot / Find multiple hotspots</td>
<td>searching for a single or multiple hidden elements in an image or between images</td>
<td>F, D</td>
<td>mark a literary work that is not a book for children and juveniles, find a mistake, find the differences between pictures</td>
</tr>
<tr>
<td>Image Juxtaposition</td>
<td>comparing two ‘before and after’ images side by side with the option to use the interactive slider</td>
<td>M, E</td>
<td>photos before and after the final editing, displaying the correct or incorrect image solution</td>
</tr>
<tr>
<td>Image pairing</td>
<td>creating image pairs that belong to each other, the images are not the same as in the memory game</td>
<td>F, D</td>
<td>creating fairy-tale pairs, assigning the invention to the inventor, book to the author, linking in the basis of similarity</td>
</tr>
<tr>
<td>Image Sequencing</td>
<td>sorting images into the correct order using timekeeping, type of a closed, sorting task</td>
<td>F, D</td>
<td>sorting planets by their distance from the sun, sorting countries by their territorial area</td>
</tr>
<tr>
<td>Virtual Tour (360)</td>
<td>creating a virtual tour using 360° static or dynamic photography</td>
<td>M, E, A</td>
<td>creation of a virtual tour of the school or a historically interesting location to support the clarity of the curriculum, practice of creation and application of 360° photography</td>
</tr>
</tbody>
</table>

### 4.3.3 H5p - Video tasks

#### Table 3. Video.

<table>
<thead>
<tr>
<th>Task name</th>
<th>Description</th>
<th>Phase</th>
<th>Example of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive video</td>
<td>creating video with interactive inputs, such as comprehension questions, supplementary texts and descriptions</td>
<td>M, E, F, D</td>
<td>working process accompanied with comments or comprehensive questions, video tutorials for creating graphical objects or explaining a sequence of operation</td>
</tr>
</tbody>
</table>
4.3.4 H5P – Audio tasks

<table>
<thead>
<tr>
<th>Task name</th>
<th>Description</th>
<th>Phase</th>
<th>Example of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td>a tool for inserting audio recordings</td>
<td>M, E, F</td>
<td>recordings of radio programs, listening to interviews in foreign language classes, recording a task assignment, recording of animal sounds, musical trailer or individual musical instruments sounds</td>
</tr>
<tr>
<td>Audio recorder</td>
<td>a tool for creating an audio recording</td>
<td>D, A</td>
<td>submitting a recording as a part of homework, foreign language pronunciation practice by students, recording of a student playing a musical instrument</td>
</tr>
<tr>
<td>Dictation</td>
<td>an audio-based transcript task with the option of setting the speed of playback as well as the number of times the audio can be played</td>
<td>F, D, A</td>
<td>transcription in foreign language classes</td>
</tr>
<tr>
<td>Speak the words</td>
<td>a student answers a given question, his answer is uploaded and sent for evaluation, chrome browser support</td>
<td>F, D</td>
<td>pronunciation training, spelling</td>
</tr>
</tbody>
</table>

4.3.5 H5P – Multimedia tasks

<table>
<thead>
<tr>
<th>Task name</th>
<th>Description</th>
<th>Phase</th>
<th>Example of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drag and drop</td>
<td>a task to assign items their proper place, dragging and dropping images and texts into a predefined space</td>
<td>F, D, A</td>
<td>completing schemas – for example internal computer components</td>
</tr>
<tr>
<td>Course Presentation</td>
<td>presentation with interactive slides, multimedia content and selected types of H5P tasks can be inserted</td>
<td>M, E, F, D, A</td>
<td>a comprehensive tool for teaching new curriculum, practicing and verifying acquired knowledge</td>
</tr>
<tr>
<td>Timeline</td>
<td>creating a time series with chronologically arranged data, it is possible to insert images, videos, text and hyperlinks</td>
<td>E</td>
<td>key moments in man’s development, the timeline of the WW II</td>
</tr>
<tr>
<td>Branching Scenario</td>
<td>a type of dilemma-based task, self-paced learning scenarios, etc. (flexible task type, the main content may be based on videos, interactive presentation, image, etc.)</td>
<td>F, A</td>
<td>support for adaptive learning, situational video</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------------------------------------------------------------------</td>
<td>-----</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Flashcards</td>
<td>cards containing textual or image information, which students use to fill in the correct answer</td>
<td>F, D</td>
<td>vocabulary exercises, numerical examples, task type: what do you see in the picture?</td>
</tr>
<tr>
<td>Dialog cards</td>
<td>'two-sided flashcards', the first side contains a keyword, concept or a question, when clicked on, it turns on the other side and displays the required answer, aside from text, images or audio can also be inserted, without evaluation or feedback</td>
<td>E, F</td>
<td>practicing knowledge (foreign languages, nomenclature of animals, plants), subject interpretation – e.g. visual representation and description of traffic signs, symbols ...)</td>
</tr>
<tr>
<td>Image Hotspots</td>
<td>hidden information in an image that convey more detailed multimedia content (images, videos, hyperlinks...)</td>
<td>E, F</td>
<td>descriptions of objects, sub-elements, or learning environments, such as symbol explanations, hidden map information</td>
</tr>
</tbody>
</table>

**Figure 4. Image Hotspots.**

**Figure 5. Flashcards.**
Among other things, the interactive content H5P also includes a group of experimental tasks, which is currently in the development phase. Part of the group are, for example, Interactive book or Impressive Presentation with 3D transitions. The multimedia content used for creating tasks (images, videos or audios) must not exceed the limit of 16MB [8]. To achieve greater file capacity H5P needs to be installed on one’s own website or a link can be inserted that points to the multimedia file remote storage (such as a video placed on a YouTube social network). If a teacher is able to work with multimedia elements in the process of preparing digital materials (e.g. working with images - merging multiple images into one), he can extend the capabilities of interactive tasks. For example, Image Sequencing or Image Pairing, where only images (jpg, png or gif) can be inserted. However, the teacher can prepare text cards, which are then saved in supported formats. Attention must be paid to content readability (choose short phrases, keywords).

H5P is a versatile and adaptive learning content creation tool that can be applied at all stages of the learning process. Even though teachers have to devote time not only to navigate in the development environment for creating H5P tasks, but also in the number of available tasks which is continually growing, it is possible to consider the H5P an innovative didactic tool for creating one’s own didactic materials.

5 CONCLUSIONS

The interactive content H5P is a suitable and affordable solution for creating didactic materials compatible with modern platforms. In particular, its benefit lies in diversity, openness, accessibility, material sharing support, versatility across cross-curricular modules, as well as a unified structure that helps teachers adapt to the environment. Teachers also appreciate the possibility of setting their own means of expression in their mother tongue, making it possible to use teaching materials across all educational levels, and thus in accordance with requirements placed (not only) on digital educational resources supported by public means.

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