Engaging Learning Content for Digital Learners

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Abstract – **Learning materials are source and means of acquiring knowledge and skills. The rapid development of technologies has an invariable influence on their content and the ways of interacting with learners. Teachers have to develop learning content that provokes learners' activity and engagement and plays the role of a motivator and catalyst of learning. To fulfil all these new functions and roles, the learning content must be developed by the relevant tools. The existing variety of software often makes difficult for teachers to choose the most appropriate one. Recently, H5P is a popular tool used for creating different types of interactive content. The integration capabilities with e-learning environments make H5P a convenient and effective means for experts and educators to develop and share dynamic learning content and learning activities, accessible to learners at any time and place with any available device. The aim of the current paper is to reveal the advantages of H5P for developing, sharing and reusing interactive, rich and attractive learning content and activities based on a specific example – creating and using an Interactive Book in the Computer Graphics course. The possibility of integrating H5P content in various digital learning environments is a prerequisite for engaging, motivating and immersive learning.**

1. Introduction

Digital technologies are developing extremely fast and are implementing in all spheres of life. The modern generation has grown up with technologies and it is no coincidence that they are called the digital generation. Today's learners prefer to learn and communicate through their mobile and smart devices. For this reason, for educational institutions is important to offer training that is as close as possible to the needs and requirements of the digital generation. To respond to this necessity, educational systems are directed towards applying innovative digital technologies in every aspect and stage of the learning process as well as in all supporting administrative activities.

The global pandemic of COVID-19 has changed the perceptions of online learning. During the isolation and restrictions, it became apparent how effective the tools, technologies and pedagogical approaches used up to that point were. Before the pandemic, online learning was considered as complementary to traditional one and its disadvantages were overcome by face-to-face learning. During the pandemic this option did not exist. It became clear that teachers and learners are not quite ready for such a total change. Many of them experienced serious difficulties both due to a lack of sufficient skills and competences to work in a digital environment, and due to a lack of the necessary educational content in digital form. The appropriate digital content can support and facilitate the active participation of learners in the learning process.

Textbooks are the educational technology of the traditional face-to-face learning. They contain and deliver learning content that is selected, structured and organized in a way to carry out the learning process, following the curriculum [1]. The main pedagogical approaches are related to providing the content to learners who are passive consumers of knowledge.

At the present digital era, new and different functions are assigned to the learning content that were previously inherent to the teachers. The new requirements to the digital learning content are to be: rich in multimedia components; adaptive and dynamically changing according to the needs of learners; interactive, with elements of gamification and immediate feedback; accessible at any time with different technical devices. It should engage learners, motivate and guide them in acquiring knowledge, allow collaboration and interaction between all participants in the learning process. There is also a change in the underlying pedagogical theories – constructivism and connectivism are the dominant paradigms [2]. Interactive didactic tools are an important element in modern learning and are available thanks to the development of technologies [3].

Nowadays, teachers and experts need tools to create interactive and multimedia-rich digital learning content that can be reused and integrated into different digital learning environments.

Among the tools gaining popularity and widespread use is H5P. H5P is an innovative solution and platform for developing HTML5 content directly in web browser. Being free to use an open technology, educators can create, share and reuse interactive and mobile-friendly HTML5 content and applications. Educators do not need special technical knowledge to develop H5P content. They can start by creating smaller chunks of learning materials and then combine different H5P activities to build more complex product [4].

The aim of the current paper is to reveal the advantages of H5P for creating, sharing and reusing interactive, rich and attractive learning content and activities based on a specific example – creating and using an Interactive Book in the Computer Graphics course. In Section 2, the essence and benefits of H5P in developing learning content are described. In Section 3, good practices of creating educational H5P content in different disciplines are presented, as well as an example of the use of H5P technology in creating an Interactive Book.

2. H5P Technology

2.1. Essence of H5P

H5P stands for HTML5 Package. H5P is an open technology, licensed with the MIT license [5]. H5P is a tool that users use to create interactive content that can be adapted and reused, and shared with other users [6].

H5P is based on HTML and JavaScript. There is interoperability – the content can be used on different devices (desktops, laptops, tablets and mobile devices) regardless of their operating system. Users can create interactive content directly in a web browser, without the need to have programming skills [7].

H5P content is a collection of HTML, CSS and JavaScript files that are packaged together and can be shared between different websites and platforms [8].

The created H5P content is licensed under a Creative Commons license. It can be downloaded and reused, with options for editing and enrichment [7].

Plugins are available and they allow H5P to be integrated into various content management systems (such as Drupal, WordPress) and e-learning environments (such as Moodle, Blackboard, Brightspace, Canvas, and others). With plugins users can create H5P content directly within these systems.

2.2. Advantages of H5P

The advantages of H5P in creating learning content can be systematized as follows [3],[9],[10],[11],[12]:

Open source and free to use. H5P is an open source and users have access not only to the technology, but also to guides, documentation and support, and best practices created by experts and other users, available on the H5P website. There is a large community of users who develop and share new types of content and the corresponding tools for their creation. Users learn from each other and enrich the technology by expanding its functionality. H5P is free to use, which helps reduce the cost of creating digital learning content.

Diverse types of content rich in multimedia elements. The H5P content is rich in multimedia elements and interactivity and is more attractive and engaging for learners. The availability of diverse types of content enables educators to develop learning materials that are tailored to the needs and preferences of learners and appropriate for achieving the learning goals. The community of users continuously enrich and develop new types of content.

Ease of use. The H5P has a relatively simple interface that makes it easy to use. Users who create content, as well as those who work with the final product, do not need to install any special software or plug-ins on their devices. They need a standard web browser. The technology is compatible with various devices, including mobile, and operating systems, making it convenient to use both in developing and working with the learning content.

Available plugins for Content Management and Learning Management Systems. The H5P content can be integrated into existing Learning Management Systems with minimal efforts. Available plugins allow educators to create interactive HTML5 content

directly in digital learning environments. The integration of all tools and content into one learning environment is a convenience for both teachers and learners. On the other hand, when the tool is integrated into the learning platform, it is easier for teachers to work with. They feel more confident because they work in a familiar environment and the created product becomes directly part of their e-courses.

Share and reuse. The H5P technology makes it possible for any user to create, share and reuse interactive HTML5 content. The created content is publicly available and can be distributed by downloading or by generating embed code.

H5P can be seen as an alternative to Flash and SCORM-based content. Considering the fact that Flash support is no longer available and any web content that includes flash cannot be viewed, there are inconvenience and problems for both educators and learners. Problems of such nature do not exist with H5P technology.

3. Creating Interactive H5P Learning Content

Many universities encourage educators to create interactive learning content with H5P in various disciplines. Interactive content can be used as a didactic tool to create interactive materials and can be applied in the different phases of training – motivation, exposure, fixation, diagnostics and application [3]. H5P content stimulates interaction between learners and learning materials, increases motivation and learning becomes more attractive.

3.1. Related Works

H5P supports the development of self-directed learning skills as learners can complete the interactive activities at their own pace. Learners highly appreciate the interactive H5P learning resources (interactive videos, drag-and-drop activities, chunked learning information, such as Accordian, Image Hotspot and Image Sequencing) which have greatly helped to improve the knowledge in anatomy and physiology disciplines [4].

H5P is used to develop and implement online interactive activities to facilitate blended learning and increase staff digital literacy [13]. They used Course Presentation that allows interactivity by inserting hotspots through which additional information is provided, videos are played, text boxes appear for taking notes, quizzes are available to check the level of understanding of the learning content. They implemented also Branching Scenario that provides authentic learning opportunities resembling real-life situations where learners are required to make decisions based on available information. The decision tree outlines the different activities and paths that the learner can take while executing the scenario.

Annotated videos can be used for teaching and learning activities that increase learners' engagement, accelerate the process of skill acquisition, and increase the level of attention retention compared to the standard videos [14]. They discussed Semantic (learning) annotations as a mean to add a semantic layer that helps describe the content of parts of the video while the level of interaction with learners is low. They emphasized the advantages of Activity (assessment) annotations with very high level of interaction with learners since they are required to input information through text and interactions. The idea of annotated video clips is positively received by the teachers and they expected this type of learning content to maintain the dynamic and engagement of the students.

Similar findings were reported in the study for using interactive educational videos on working in MATLAB environment in a lab course [15]. A significant improvement in learner scores from the first to the last video was observed, which was attributed to the positive impact of the interactive video on learning. Such learner-centered content can stimulate deeper learner engagement.

3.2. Interactive Book – an Example Of Creating and Using Interactive H5P Learning Content

Over 50 types of interactive content and activities can be created with H5P. Teachers can choose among the variety of options those that are suitable for achieving the learning goals and are appropriate for the learners' needs and preferences. Teachers can create simple activities, such as Drag and drop, Interactive images and video, questions of different types, QR codes or develop learning materials that combine several types of interactive content – Course Presentation, Interactive Book, Scenario Branching and more. The latter combine different types of materials, include more content and are a prerequisite for creating a complete interactive multimedia product.

Regardless of the type content, the more important and essential is to create content that is engaging, easy and enjoyable to work with, and encourages active learning. Presenting information in small chunks not only allows learners to engage with the content with minimal distraction from external factors but also increases the possibilities to adapt the content to different subjects. After completing a learning activity, the learner feels rewarded and satisfied and can continue to the next part [16].

Interactive HTML5 content is used in the training of students from the Faculty of Education at Trakia

University in the discipline Computer graphics. As a pilot project, the content type Interactive Book was chosen. The covered topic of the curricula is Color and color systems in Computer graphic.

The Interactive Book combines different types of interactive content. It is suitable both for learning that is part of the formal education and for independent learning, which is inherent for part-time and distance learning students. Using Interactive Books, teachers provide voluminous content as a complete product that includes interactive videos, questions, presentations, assignments, and more,

spread across multiple pages. They can be continuously enriched by adding new pages (chapters) with different types of content and activities. The Interactive Book has a book content and learners can navigate through it freely.

The first type of content that has been used in the Interactive Book is a Course Presentation. It presents part of the learning content in a structured and interactive format [5]. Each slide contains different multimedia interactive elements. Some of them present the learning content in the same way as traditional presentation (Figure 1).
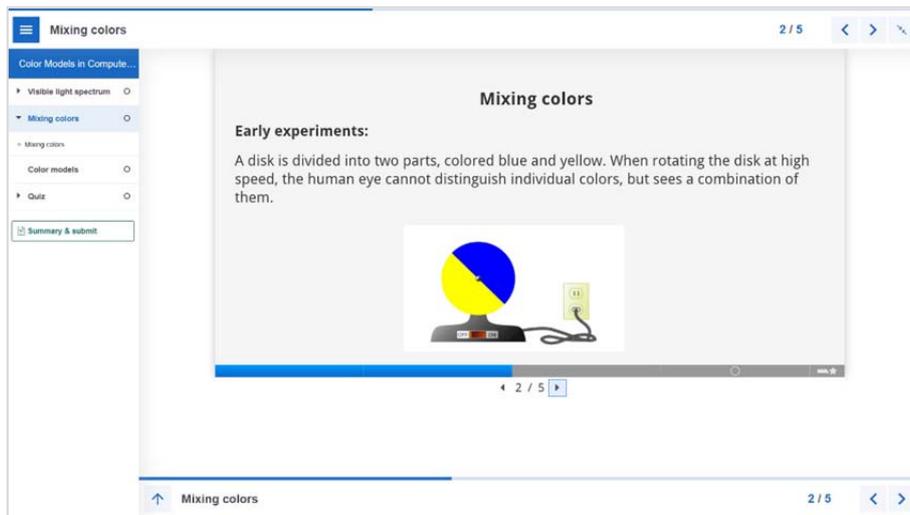

Figure 1. Course presentation slide with multimedia elements

Learners can view the content directly in their web browser. In order to engage and retain the learners' interest, the presentation includes questions about the learning content and provides immediate feedback

(Figure 2). The answers give the necessary information to teachers whether the learners have understood and mastered the content.
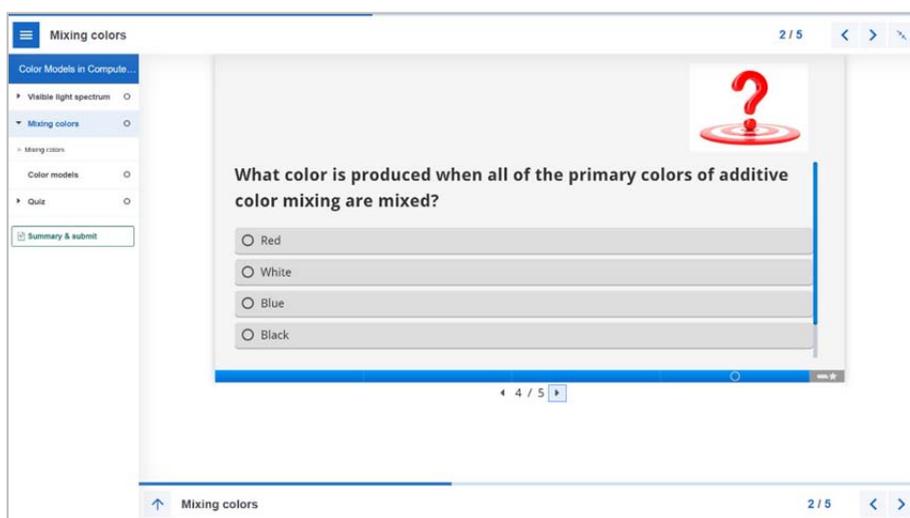

Figure 2. Course presentation slide with questions

Course Presentations are used as a main approach to present and deliver the new learning content. Working with them is easy, because both teachers

and learners have the necessary experience with presentation software. In addition, they include interactive elements for assessment, tips and

feedback that are not inherent for traditional presentation software.

An Interactive Video is the second type of content included in the Interactive Book. Interactive Videos are another convenient way to present new knowledge to learners. Watching a video is considered as passive learning [16]. In case of prolonged videos, a loss of interest and concentration of the majority of learners is noticed. To avoid such a negative result, interactive elements can be added to the video material. They provide additional information or lead to the performance of activities, through which the level of understanding of the video content by the learners can be checked. Thus, watching videos turns from a passive action to an active interaction. In the presented project, a fun video about mixing primary colors to get secondary colors in CMYK model is used. To turn video into interactive video, Quiz interaction (multiple choice questions, fill in the blanks, drag and drop questions) has been added to different parts of the video. They pop-up while the learners are watching the video to check their level of understanding.

A Question Set is another type of content included in the Interactive Book. Creating an interactive activity such as a quiz provides learners with immediate feedback on their performance. Question Set supports different question types – multiple choice, drag the words, fill in the blanks, mark the words and drag and drop. Compared to the traditional online quizzes, H5P activities make quiz more interactive and fun [11]. Figure 3 and Figure 4 show the Question Set content included in the Interactive Book before and after students' answers.

Learners drag the colors and drop them into the correct (according to them) area. They can check their solution and get an immediate feedback about the correct and incorrect answers.
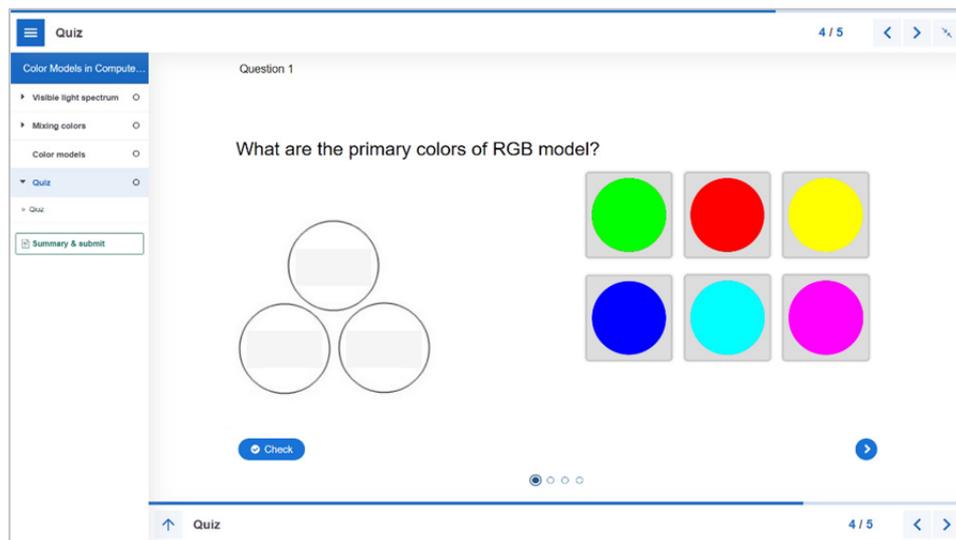

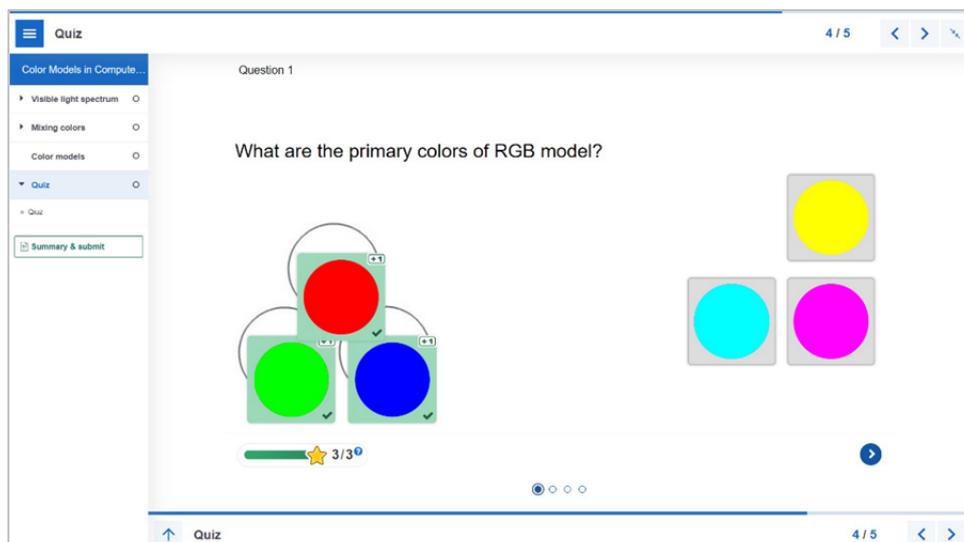*Figure 3. Drag and drop question in Question Set*

Figure 4. Drag and drop question in Question Set after students' answer

The H5P content can be distributed through various channels to reach a wide audience. For each content type, a method of accessing can be chosen. Teachers can allow downloading the content or embedding in other platforms. Some of the content types can be printed, while others have sharing options (for example, in Facebook and Tweeter).

Each content type has behavioral attributes than can be adapted to the learners. Teacher can allow learners to repeat the activity, set penalties for incorrect answers and etc. Regardless of the type of the developed content, a feedback is an important component. As general feedback, teachers can define their own grading scale and personalized and guided comments on correct and incorrect answers. Maintaining and using different feedback mechanisms can improve the quality of learning [3].

Using a variety of interactive content types and activities to present learning content sustains learners' engagement and interest far more than consistently using the same tool or activity [16]. H5P allow teachers to diverse and mix the forms of the learning content. The different types of content that are included in the Interactive Book diversify the learners' activities, ensures interactivity and engagement with the content, guarantee their interest and curiosity.

The interactive H5P content is engaging for learners. They prefer such content to the paper textbooks, traditional text documents or presentations. The ability to integrate different activities and the provided immediate feedback turns the content into an interactive multimedia product that learners can use during the formal or for self-directed learning. The product can be imported in different digital learning environments, modified and reused for achieving different learning goals.

The interactive learning content can be developed on the H5P site or within the e-learning environment. In both cases H5P technology is an opportunity to enrich the digital learning content and create the conditions for active, engaging and motivating learning.

4. Conclusion

The integration of information and communication technologies leads to changes in every aspect of the educational processes. One of the current trends is developing and providing learners with an interactive learning content that provokes their activity and engagement. An interactive content can be developed with various tools and software. Recently, H5P is establishing itself as a technology of choice by educators. Based on the HTML5, interactive multimedia content is a free and effective solution for creating learning materials that can be modified and

reused, as well as shared with other users. The possibilities of integration of H5P content to different e-learning environments, modification in accordance with the changing needs and preferences of the learners and to the learning goals and context, makes H5P a preferred technology by the teachers. The developed content is accessible to learners anytime, anywhere with any available device. The advantages of H5P for developing, sharing and reusing of interactive learning content create conditions for engaging, motivating, immersive and ubiquitous education for today's digital learners.

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