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Application of H5p in Teaching the Basic Programming Course in the Information Technology Department at Hung Vuong University

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Abstract: In the current context, digital transformation is developing rapidly, especially in higher education. This transformation involves changes in teaching methods and improvements in supportive infrastructure to meet the needs of administration, teaching, and learning for students, instructors, and the campus environment. The Digital Education model enables students to access a wealth of diverse learning resources through electronic devices such as computers, tablets, and smartphones. Additionally, the application of information technology and digital transformation in education and training enhances interactivity and practical experience for students and learners. This digital shift in teaching allows instructors to prepare lessons quickly using available templates while leveraging various resources like videos, images, and digital materials. Consequently, it attracts learners and improves teaching effectiveness. In this paper, we discuss the application of information technology, specifically the use of H5P, to create electronic learning materials for the Basic Programming course at Hung Vuong University.

Keywords: H5P, C/C++ Programming, Basic Programming, E-Learning, Etc.

Review Paper

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1. INTRODUCTION

Hung Vuong University clearly defines its mission and is announced on the school's website (hvu.edu.vn): "Hung Vuong University is a multidisciplinary public university, training high-quality human resources in an applied orientation; is a center for modern scientific research and advanced technology transfer, serving the cause of economic - social - cultural development of Phu Tho province and the whole country". To achieve its goals in the 4.0 era, the school has been innovating teaching methods, improving training quality, implementing policies, and committing to output for students after graduation. Therefore, students studying at the school are cared for, creating the best conditions for research and creativity. The "Regulations on regular university and college training according to the credit system" of the Ministry of Education and Training clearly stipulates: "For theoretical or practical and experimental courses, to acquire one credit, students must spend at least 30 hours of personal preparation".

The Information Technology Department of Hung Vuong University has the advantage of applying Information Technology in teaching, so it quickly approached online training and achieved many positive results. In which, the application of H5P to build electronic lecture content plays a particularly important role and determines the success of online courses. The following part of the article will present more details on this issue.

2. Research Content

2.1. E-Learning in Higher Education Institutions

Higher education institutions are also implementing online learning methods more frequently with the increased use of electronic devices with Internet connections in and out of the classroom, as well as the implementation of online classes [5-7]. A 2017 report estimated that 91% of enrolled students and 87% of institutions rely on learning management systems (LMS), specific software applications or web-based technologies used for online learning. Today's online learning platforms provide this increased adaptability for both learners and teachers. Web-based training and E-Learning allow for greater flexibility in how learners use information and greater adaptability to new information that becomes available. With the development trend of E-Learning in recent years and the impact of the Covid-19 epidemic at Hung Vuong University, online teaching and learning has been promoted. The LMS system at the school meets the needs of online teaching and learning and assessment (LMS) has the function of online teaching and learning and assessment, meeting the needs of online teaching and learning of teachers and students of the school [1]. Website address to access the online

learning system of Hung Vuong University: https://elearning.hvu.edu.vn/

2.2. H5P and the Basic Programming course

As mentioned above, the key to the success of online teaching is the construction of lecture content, in which H5P is a particularly useful tool in the process of building online lecture content. H5P [9], is an acronym for HTML5 Package. H5P is a plugin that allows publishing systems to create more interactive content. H5P makes it easy for people to create and share interactive content with an experience for both content creators and content viewers. More and more websites around the world are using H5P exponentially to provide users with more interesting content. H5P can be connected to software such as Canvas, Brightspace or WordPress and empower users of these software to create better content faster. H5P allows people to create, share and reuse interactive content. Users can create interactive content such as lectures, insert questions into videos without having to write code. Therefore, this content can be stored and shared on many websites such as WordPress, Moodle or Drupal or integrated via LTI with Canvas, Brightspace, Blackboard and many other VLEs that support LTI integration. H5P allows users to create small interactive activities such as inserting questions into videos taken from YouTube or writing a few multiple choice questions. This content can be arranged into a suitable course or learning path. If the user changes the management platform, this content can be dismantled and rearranged easily. Therefore, H5P is not dependent on the platform or device, it operates independently but is compatible with most available platforms.

In the training program, the Basic Programming course [4], is a compulsory course for first-year students in the Information Technology major. It helps students understand the basic knowledge of how to represent data on computers, basic arithmetic and logic operations, how to program with control structures, functional programming and some skills in processing array-type data and structured data and programming computer programs to solve practical problems.

The Basic Programming course provides content on algorithms and methods of representing algorithms; steps to build a computer program,... Understand the structure and how to write a C program.

Through the knowledge learned, students can get acquainted with programming and practice basic C/C++ programming thinking.

The content of the course is divided into Modules, each Module students will learn about different lesson content including:

- Module 1: Overview of programming
- Module 2: Some basic concepts and command structures
- Module 3: Pointers, arrays, character strings
- Module 4: Functions
- Module 5: Data structures and files

The total number of lessons conducted in class is 70, of which 20 are theory lessons, 50 are practice lessons and students are required to study on their own for 80 lessons.

2.2. H5P Application to Build the Content of the Basic Programming Course

2.2.1. H5P Application to Build the Content of Module 1: "Overview of Programming"

Overview of programming includes 3 main contents: Algorithms, Methods of describing algorithms, Introduction to programming languages. Overview of programming will help students remember the concept of programming, the development process, basic components, methods of describing algorithms, algorithm concepts, programming languages. From the 3 main contents above, the author has built a total of 14 exercise contents and interactive videos. Especially with interactive videos, viewers can interact with the video, for example: Pause the video, answer the questions that appear in the video itself, and then continue watching the video content after answering.

2.2.2. H5P Application Builds Exercises on Module 2: "Some Basic Concepts and Command Structures"

Module 2:

Some basic concepts and command structures includes 5 main contents: Basic concepts, Program structure and simple data types, Input and output commands, Conditional command structures, Loop command structures.

The lesson content of the Module will help students understand the concepts of basic command structures, simple program structures, input and output commands, control command structures and loop commands. From the lesson content of Module 2, the author has built a total of 11 interactive contents.

2.2.3. H5P Application to Build Content Module 3: Pointers, Arrays, Character Strings

Module 3:

Some basic concepts and command structures include 3 main contents: Introduction to Pointers, Introduction to Arrays - Character Strings. The lesson content of Module 3 will help students approach the basic concepts and structures of pointers, arrays and character strings. Understand the role of pointers of arrays and character strings. From the lesson content in Module 3, the author has built 11 interactive exercise contents.

2.2.4. Applying H5P to Build the Content of Module 4: Some Concepts, Basic Command Structures Including 4 Main Contents:

Functions and how to build functions, Global variables and local variables, Parameters and parameter passing, Recursive functions. The lesson will help students approach the basic concepts and command structures of functions, how to build functions, global variables and local variables, parameters and parameter passing and recursive functions. From the lesson content and objectives, students will learn. From the lesson content, the author has built 9 contents and 2 interactive videos introducing functions and recursive functions.

2.2.5. Structure and Data Files

Includes some basic concepts and command structures including 2 main contents: Structure and data files. The lesson helps students understand how to declare and use structured data types and files. Students apply operations to structured data types, operations on files to program problems. Students have a positive learning attitude, apply the knowledge learned in the chapter to perform tasks as required, and have professional ethics. From the lesson content, the author has built 8 interactive exercise contents.

2.2.6. Summary Table of the Number of Interactive Exercises by Module

The total number of exercises in the set of exercises and interactive videos of the Basic Programming course is 55 exercises and interactive videos.

Interactive exercise content	Number of exercises per module					Total number of exercises
	Module 1: Programming Overview	Module 2: Some concepts and command structures basic	Module 3: Pointers, arrays, strings	Module 4: Functions	Module 5: Data Structure and Files	
Drag the world	5	0	0	0	2	7
Interactive Video	1	0	2	2	0	5
Fill in the blanks	3	3	2	2	3	13
True/ False Question	2	0	6	3	1	12
Single Choice Set	0	5(25 sentences)	0	2(10 sentences)	2(10)	9
Multiple choice	3 (45 sentences)	3(45 sentences)	1 (15 sentences)	2(30 sentences)	0	9

2.3. Testing and Evaluation

2.3.1. Testing Purpose

Testing the interactive exercises of the Basic Programming course aims to test the correctness of the scientific hypothesis of the topic, initially evaluate the feasibility and effectiveness of the interactive exercises that have been researched, designed and built. At the same time, test students' interest in learning, helping to improve their knowledge of the course through research content.

2.3.2. Testing Subjects

The interactive exercises of the Basic Programming course were tested on the Basic Programming classes including students of classes K20-Information Technology A, K20- Information

Technology B and K17- Information Technology. In addition to the experimental study for students, the product was also tested on all teachers teaching information technology majors in the Faculty of Engineering - Technology of Hung Vuong University. The results of the experimental study will be through the evaluation form and evaluation table.

2.3.3. Test Results

- Access address of the interactive exercise set for the Basic Programming course: https://elearning.hvu.edu.vn/course/view.php?id=1132.
- The total number of exercises in the interactive exercise set for the Basic Programming course is 55 interactive exercises. After the trial learning process, it received the attention and interaction of students. The number of students accessing the interactive exercises was recorded on the E-Learning system as follows: Testing on a total of 151 students, the number of Clicks received on the entire course was 5355.
- The exercises that received the most interactions include: Drag the words exercises on Basic concepts, multiple choice questions on Basic concepts, Multiple choice exercises and Fill in the blanks exercises on Basic concepts. The number of exercises with the most interactions out of the total number of exercises is in the exercises in module 1.

2.3.4. Survey Evaluation of Interactive Exercise Evaluation Form:

After conducting a trial study with a number of students in the classes in the experimental group, the evaluation results for each question content were obtained as follows:

+ Questions according to the curriculum: 2 questions
+ Questions about interactive exercise content: 4 questions.
+ Video image quality: 1 question.
+ Questions about lesson display format: 2 questions
+ Questions about knowledge gained after studying the course: 2 questions.

After the testing process, there were feedbacks from students who received evaluation forms from 50 participants, including 70.8% of first-year students; 6.3% of second-year students and 22.9% of fourth-year students.

2.3.4.1. Curriculum-Based Questions

The curriculum-based assessment questions include 2 assessment questions with the following content and results:

- Question "Do you think the content is suitable for the lesson?"

Through the assessment form on the appropriateness of the interactive exercise content, we see that the appropriate assessment rate is over 54%, the very appropriate assessment is nearly 42%, and the very good assessment is 4%. So the interactive exercise content is suitable for the lesson content that students have learned in class.

- Question: Is the interactive exercise closely following your curriculum?"

Through the assessment form on the level of complete agreement with the interactive exercise content, we see that the complete agreement rate is over 34%, the agreement rate is over 62%, and the very good assessment is 4%. So the interactive exercise content is suitable for the lesson content that students have learned in class.

2.3.4.2. Questions about Interactive Exercise Content

For the group of questions about interactive exercise content, the author surveyed students with 4 questions and received a total of 50 responses from students. The questions and evaluations have the following results:

- **Question**: "Do you find the questions, lesson content, and interactive exercises easier to absorb knowledge?"

Through the evaluation questions, the following evaluations were obtained from students: 30% rated the questions as easy, 16% rated as very easy, 44% rated as normal, and 10% as other levels. So we can see that the absorption of knowledge from interactive exercise content for learners is at a fair level.

- **Question**: "Is the content of the exercises easy to understand?"

The above question received the following evaluation results: The answer to the question at the easy-to-understand level accounted for 66%, the answer to the very easy-to-understand level accounted for 26%, and the difficult-to-understand level and other levels accounted for 8%. From the above evaluation results, it can be seen that the content of the interactive exercises is very easy to understand and clear

- **Question**: "Are the types of exercises rich?"

With the above question, the author received the following evaluation form: The percentage of students who think the types of exercises are suitable accounted for 68.8%, the percentage of students who rate the exercises as very suitable accounted for 31.3%. From the results obtained from the evaluation of the interactive exercises suitable for students.

- **Question**: "Is the content of the exercises engaging?"

With the question of whether the exercise content is attractive, the evaluation results from students are as follows: The percentage of people who agree is about 66.7%, the percentage of people who completely

agree is 20.8%, the percentage of people who are undecided is 10.4%, and the rest are disagreeing. From the above evaluation results, it shows that the content of the question is attractive to learners.

2.3.4.3. Video and Image Quality

With the content of the question assessing the quality of videos and images, the following student assessments were given: 27.1% rated it as very good; 52.1% rated it as good; 8.3% rated it as fair; 12.5% rated it as average. From the above student assessments according to the percentages, the author found that the quality of videos and images was fair.

2.3.4.4. Lesson Display Format

Regarding the content of the question "Do you find this content easy to watch?", the following student assessments were received: 79.2% of students agreed, 29.8% of students strongly agreed. The above results show that. The content of the Basic Programming course built with H5P is very easy for learners to watch.

2.3.4.5. Knowledge Acquired After Studying the Course

The author has 2 evaluation questions about the knowledge that students have learned after completing the course:

- **Question**: "Do the exercises reinforce the lesson knowledge for students?"

The results of the evaluation form show that 21.1% of students completely agree with the evaluation question, 68.8% of students agree. From the above evaluation results, we can see that the interactive exercises reinforce the lesson knowledge of students.

- **Question**: "After studying the trial course, do you feel that you have absorbed the knowledge of the course?"

With the above question, the evaluation of students is as follows: 75% of students rated yes, 25% of students rated normal. With the above evaluation results, it shows that students after studying the course acquired a lot of knowledge.

2.3.4.6. Evaluation of Effectiveness

The results obtained from the student evaluation form after the trial learning process show that: The set of interactive exercises is suitable for the students' lesson content and closely follows the detailed lecture content of the course. The way the exercises are displayed on the school's E-Learning system is easy to understand and easy to see. The quality of the videos and images is quite good, although there are certain difficulties in creating the videos. The lesson content is rich, easy to understand, easy to absorb, attractive, and not boring. The set of interactive exercises for the Basic Programming course brings good learning results to students, helping them grasp knowledge from theory to application and practice. Students will gain a large amount of knowledge after completing the course.

3. CONCLUSION

The application of the E-learning model in university training, especially application-oriented training, is inevitable to suit the 4.0 education era and respond to the 4.0 industrial revolution. The flexible use of models in E-learning combined with the use of effective teaching methods will help learners develop professional capacity and promote their creativity. To effectively implement this innovation, training institutions need specific strategies, develop facilities, especially information technology infrastructure, and high-quality human resources. Each teacher applies the E-learning model in a way to build lectures to bring high efficiency in teaching and learning, developing students' self-study capacity. Each training institution relies on its own resources to be able to effectively combine and apply the E-learning model. In which, the construction of Elearning lecture content plays a particularly important role. The application of H5P in the construction of Elearning lecture content with the Basic Programming course has brought positive results, creating attraction and interest for students while still ensuring the provision of knowledge in a complete and accurate manner.

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