IC-06

The Development of Basic Arduino Learning Media via the Metaverse Application link to Tinkercad Application

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Abstract

The research aimed to (1) develop basic Arduino learning media via the Metaverse application for teaching management microcontroller courses in accordance with the 2020 Higher Vocational Certificate Program in the field of industrial electronics; (2) determine the effectiveness of the development of basic Arduino learning media via the Metaverse application by using the website Spatial (https://spatial.io/) to create their own avatar and placing the basic Arduino learning lessons in the metaverse classroom, allowing students to click the link from the Metaverse classroom to the website Tinkercad (https://www.tinkercad.com/) to study independently; and (3) investigate student satisfaction after using the learning media. The sample group consisted of twenty Higher Vocational Certificate students from the Electronics Department of Pathum Thani Technical College. The researchers collected data using research instruments consisting of pre-tests, post-tests, worksheets, and student satisfaction surveys. The results of the study were as follows: (1) the efficiency of basic Arduino learning media via the Metaverse application linked to the Tinkercad application was demonstrated by the average pre-test score of 65.50%, which increased to 84.25% in the post-test, resulting in an average post-test score that was higher than the pre-test score by 18.75%; and (2) the students' satisfaction after using the learning media in all five areas had an average score of 4.88, ranked in the highest.
Keywords: Learning media development, Arduino, Metaverse application and Tinkercad Application

1. Introduction

To meet the demands of the current job market. Studies have shown that advances in science and technology have resulted in the world moving towards the so-called “Information Technology” era. The growth of information technology has impacted the advancement of all fields of science, including medicine, business, entertainment, communication, and education. Since technology is increasingly influencing people's way of life, the current system of teaching and learning must be integrated with technology for students to learn effectively and efficiently.

At present, education has a way to promote and develop advanced technology that is more accessible and human-like, leading to innovations and a move away from traditional teaching methods, where teachers stand to impart knowledge and allow technology to serve as a learning center. Students can have access to knowledge without any limitations on time or location and can plan education and lifetime learning activities to quality improve learning in a virtual setting, while also utilizing collaborative learning theory. Students can communicate with teachers or other students in groups to share ideas or work together and digital knowledge presentation via IT technologies. The improvement of education will boost students’ retention and motivation to learn, resulting in the economic and industrial development of the country being promoted and the growth rate increasing greatly. Hence, the workforce in the economy and industry must possess the professional and appropriate technical knowledge and skills necessary to work in such fields. The basic use of Arduino will build basic computer programming skills and microcontrollers, so these students can apply their knowledge to use in a career in the industry in accordance with the field of study, as well as providing opportunities for further study at a higher level for a career path.

According to the Higher Vocational Certificate Program of 2020 in the field of industrial electronics, the Vocational Education Commission focuses on learning from real experiences with practical exercises that are consistent with the content and interests of the learners. For the learners to develop skills and proficiency, they need to often practice until they are proficient and can put them into practice.

In conclusion, due to the importance and problems mentioned above, the researcher has prepared "The Development of Basic Arduino Learning Media via the Metaverse Application Link to the Tinkercad

Application" for teaching management microcontroller courses according to the Higher Vocational Certificate Program of 2020 in the field of industrial electronics. This can be used as an online learning media in the classroom and outside the classroom, and students can also review or learn by themselves.

2. Purposes

1) To develop basic Arduino learning media via the Metaverse application for teaching management microcontroller courses in accordance with the 2020 Higher Vocational Certificate Program in the field of industrial electronics.

2) To determine the effectiveness of the development of basic Arduino learning media via the Metaverse application link to the Tinkercad application.

3) To investigate student satisfaction after using the basic Arduino learning media via the Metaverse application.

3. Research Methodology

1) Participants: The research sample consisted of 20 students from the Electronics Department of Pathum Thani Technical College who were enrolled in the higher vocational certificate program.

2) Training Basic Arduino: Using The development of basic Arduino learning media via the Metaverse application linked to the Tinkercad application.

2.1) *Register on the Website: Spatial Register on the Metaverse application* using the website: Spatial (https://spatial.io/spaces) and create your avatar by opening the camera or uploading a photo. After that, you can choose your skin color, face, hairstyle, and clothing to create your own identity before entering the classroom in the Metaverse.

Figure 1 *Website: Spatial (https://spatial.io/spaces)*

2.2) *Register on the website Tinkercad (https://www.tinkercad.com/)*, a multi-device emulator. You can experiment with a variety of items such as microcontrollers, motors, and sensors. Programming device drivers and, most importantly, programs written in the form of program blocks and printed using the C programming language are all things we can study and practice as we develop our electronic skills.

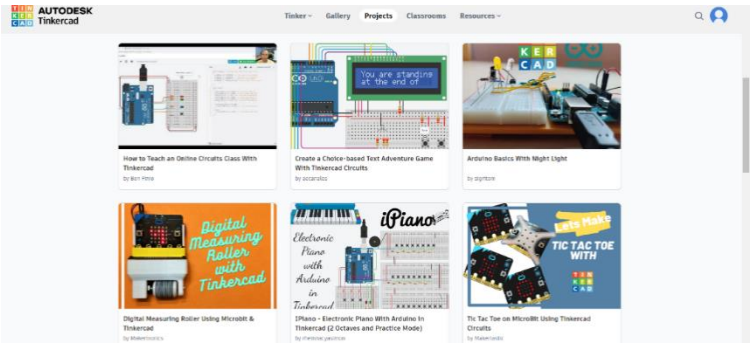

Figure 2 *Website: Tinkercad (https://www.tinkercad.com/)*

2.3) *Teachers create an online classroom on the website Spatial (Metaverse)* by inserting basic Arduino content. Then, they send the link to the students to learn in the Metaverse classroom and to do the experiment on the website Tinkercad.

Figure 3 *Basic Arduino Learning Media via Metaverse Application*

2.4) *Once the students have successfully entered the Metaverse classroom* using Basic Arduino Learning Media via the Metaverse Application, they can use the website Tinkercad to simulate circuit operation and practice programming skills to control and operate devices. By clicking on the "Portal Web" button, they can access the Tinkercad Circuit website page to simulate the circuit and practice.

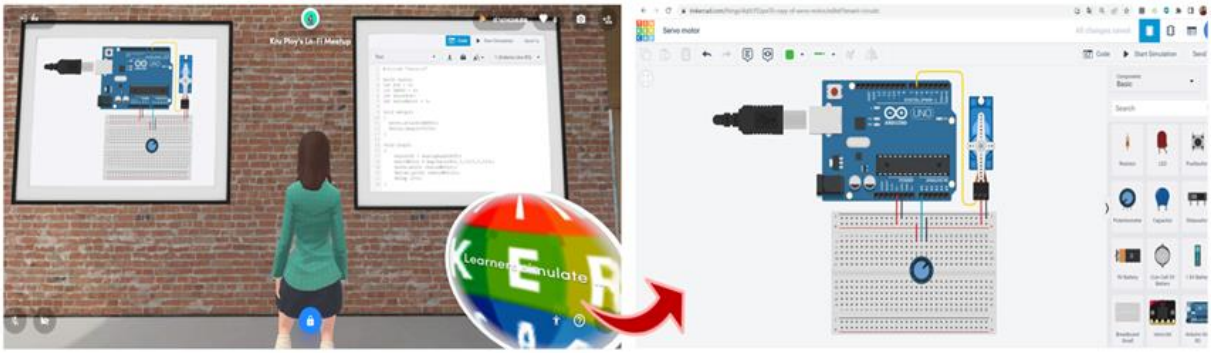

Figure 4 *Click on the "Portal Web" button to enter the Tinkercad Circuit website page.*

3) Collection of data:

3.1) The instructor conducted teaching and learning using learning materials for basic Arduino learning media via the Metaverse application link to the Tinkercad application in the microcontroller course (course code 30105-2007) with the sample group consisted of twenty Higher Vocational Certificate students from the Electronics Department of Pathum Thani Technical College.

3.2) The teacher uses pre-test, post-test, and experimental worksheets from *Unit 6 Programming Servo Motor Control with Arduino* to collect students' scores.

3.3) After completing the teaching and learning process, learners must complete a student satisfaction survey when using online learning materials.

3.4) Data was analyzed to summarize the results of the research and prepare the thesis.

3.5) Finally, the obtained data is analyzed by the researchers to improve the learning materials for higher quality.

4) Analysis of data:

4.1) Academic achievement was analyzed to determine the effectiveness of the online learning materials created by the researcher.

4.2) Analyze the satisfaction assessment questionnaire of the sample.

4. Results

1) The efficiency of basic Arduino learning media via the Metaverse application link to the Tinkercad application.

The collected data was analyzed, and it was found that the results of comparing the difference scores of the pre-test and post-test using learning materials for basic Arduino learning media via the Metaverse application link to the Tinkercad application in "Unit 6 Programming Servo Motor Control with Arduino" in the Microcontroller course with a sample group of twenty Higher Vocational Certificate students from the Electronics Department of Pathum Thani Technical College

Table 1: The results of comparing the difference scores of the pre-test and post-test

scores	Full marks / person	Total score / group	Average ($\bar{X}$) / group	Total percentage / group
Pre-test	20	262	13.10	65.50 %
Post-test	20	337	16.85	84.25 %

From Table 1, it can be seen that the average pre-test score is 65.50%, and the average post-test score is 84.25%. Therefore, the result of the post-test score is greater than the pre-test score by 18.75%.

2) the students' satisfaction after using the basic Arduino learning media via the Metaverse application link to the Tinkercad application.

An analysis of data on average satisfaction after using learning materials for basic Arduino learning materials via the Metaverse application linked to the Tinkercad application from a sample group of twenty people revealed opinions in five aspects:

1. Content
2. Teaching and Learning Management
3. Metaverse Online Learning Materials
4. Educational Media for Simulating Electrical Circuit Connection and Programming with the Website: Tinkercad
5. Expected Benefits.

It can be concluded that the students' satisfaction after using the basic Arduino learning media via the Metaverse application in all five areas had an average score of 4.88, which is the highest level of satisfaction.

5. Discussion

As students learn independently through Basic Arduino Learning Media via the Metaverse Application link to Tinkercad Application, they are able to access and review their knowledge independently. This allows them to experiment with circuits and write a variety of programs that they would not be able to do in the classroom. This increases their practical skills, resulting in them when working on real being able to connect electrical circuits and write control faster programs more accurately and equipment.

6. Conclusions

After creating and developing basic Arduino learning media via the Metaverse application link to the Tinkercad application in *Unit 6 Programming Servo Motor Control with Arduino* in the Microcontroller course, a sample group of twenty Higher Vocational Certificate students from the Electronics Department of Pathum Thani Technical College. The results showed that the average pre-test score was 65.50%, and the average post-test score was 84.25%, resulting in a post-test score that was greater than the pre-test score by 18.75%. The students' satisfaction after using the basic Arduino learning media via the Metaverse application in all five areas had an average score of 4.88, which was the highest level of satisfaction.

7. Recommendations

The teacher adds content to Google Drive or Google Classroom and creates a link or a portal web so that students can easily save the worksheet file.

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