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Designing a Mobile Application to Promote Vocational Students' Learning in Basic Technical Drawings Course

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Abstract: Traditional teaching methods taught in classrooms are becoming a thing of the past. When innovation and technology play a role in daily life, the whole world is currently facing the Covid-19 epidemic, resulting in students having to study online, teachers cannot teach in the classroom. The basic technical drawings course problems found that teaching in this course is that most students still lack the skills to read the first and third angle projection drawings. The skills are essential and are the basis for applying them in the following unit of study. Thus, this study proposes a mobile application for smartphone learning on projection drawings in basic technical drawings for vocational certificate students. The introduction of various technologies to help learn can promote students' reading skills in the first and third angle projection in the additional introductory technical drawing course. Moreover, the students can develop their knowledge and abilities according to the course competencies. Without limitations of time and place, the learning process is more interesting, fun, and motivating.

Keywords: M-learning, engineering education, vocational education, STEM

1. Introduction

The Thailand Vocational Education Act (2018) focused on producing a workforce with technical skills to be suitable and meet the needs of the industrial labor market essential for economic development. An excellent technical skills workforce should bring knowledge and skills gained from learning in the institute to be used effectively in real work in the industrial field. Therefore, technician work is a branch of Vocational Education and Training (TVET) that provides teaching and learning to enable the student to apply knowledge and theories toward practical than memorizing. Therefore, practice activities must cover various cognitive, attitudes, and practices (Rujirawee, Thanin & Phadungchai, 2015).

Especially in the work of technicians work drawing is an important factor in communication. This is the transfer of the designer's ideas and imagination to shape them on paper, called a production drawing, to be used to produce various products that succeed the work and reduce errors or misunderstandings with people involved in that work (Saitong, 2018). Therefore, education in industrial technicians from operator level, technician to engineer level. All of them must have knowledge and understanding of reading and writing drawings correctly. Otherwise, they will not be able to communicate their understanding of the work to each other. Moreover, now, the work model is used internationally. Therefore, there must be rules, regulations, and symbols. The standard is perceived and understood the same all over the world (Somchai, 2016). For this reason, those who will study to become industrial technicians. Must have the ability to write and read the drawings according to international standards correctly as well.

Therefore, we have designed a mobile application for learning on smartphones about projection images for first-year students in vocational college learned in the basic technical drawing course to be used as a learning material for motivating the students and increased technical drawings, especially the projection view topic.

2. Literature Review

2.1 Mobile Application for Learning

Currently, traditional classrooms such as learning on the blackboard or a PowerPoint presentation will become a way of the past. Most of the students have to focus their mobile screens in the classroom, and they will be all viewing holographic 3D objects surfacing from a table and the teacher explaining the visuals. Technological innovation will transform the teaching and learning process with new types to enhance students' development and contextual understanding (Hadgraft, & Kolmos, 2020). The modern engineering educational environment ensures an extensive application of Augmented Reality (AR) on mobile device technology to successfully memorize graphic material (Zhylenko, 2021).

Many studies presented AR technology on mobile devices as part of their learning in education provides a new educational paradigm; it offers many opportunities for students to work on their creativity while at the same time it becomes an element of motivation and collaboration (Arulanand, Babu & Rajesh, 2020; Jesionkowska, Wild & Deval, 2020). Budijono et al. (2019) proposed a module for teaching the drawing technique of projection with application software on a mobile device that promotes learning outcomes with a positive response to the module developed. Criollo et al. (2021) proposed an augmented reality mobile application for engineering students to study the impact of learning effectiveness and motivation. The results show that users are satisfied and optimistic affects learning. Thus, AR and mobile devices are integrated technologies that have produced the most learning innovations in many educational fields.

3. Design a Mobile Application

3.1 A Mobile Application Framework

This application aims to design vocational education students to develop knowledge and abilities with no restrictions on time and place that focus on providing students' skills in reading and writing about the projection in the introductory technical drawing course. The application has consisted of content, samples of various types of workpieces, and quizzes, which will have images and sounds for learning. Moreover, we developed a mobile application that can be downloaded at the App Store in the IOS system and the Play Store in the android system.

The students must log in and then study various topics with images and audio accompanying the lecture and samples of various works. After that, the students have studied the characteristics of the projection. For example, view the first and third angles on each side of the workpiece. When study content on various topics is finished, the students can test their conceptual understanding. Lastly, when learning in a mobile application is complete, students can log out of the system. The design of a mobile application framework is depicted in Figure 1 below.

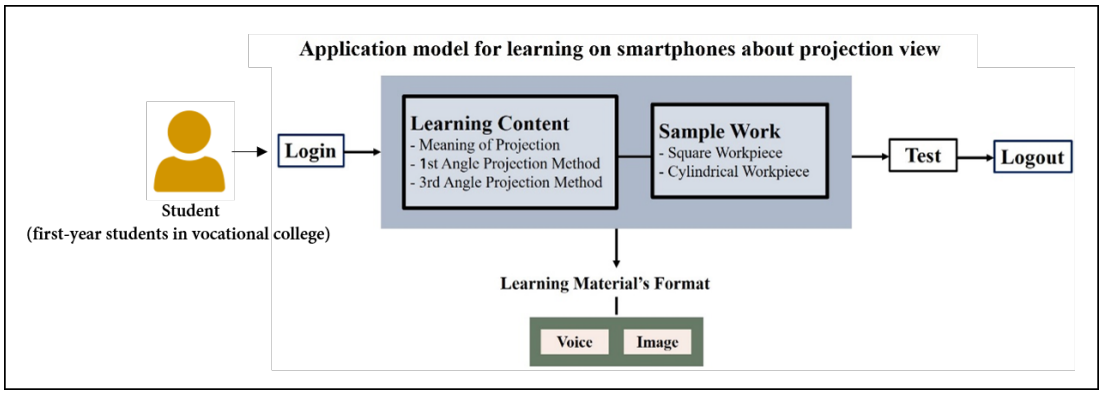


Figure 1. A mobile application framework

3.2 Development a Mobile Application

In this development process, we have 6 steps as follow:

- *Step 1*: we have analyzed the content and conceptual of basic technical drawing course of Vocational Certificate Program, TVET (B.E. 2019)
- *Step 2*: we have defined the learning objectives and content on the projected image as a guideline for presenting the lesson as a learning hierarchy. The content details are the meaning of the projection image, first angle projection method, and third angle projection method.
- *Step 3:* we have developed the storyboard of the mobile application. In this step, the design of the application screen is to match the content and be appropriate to the student, such as background color, font color, presentation style, as shown in Figure 2.

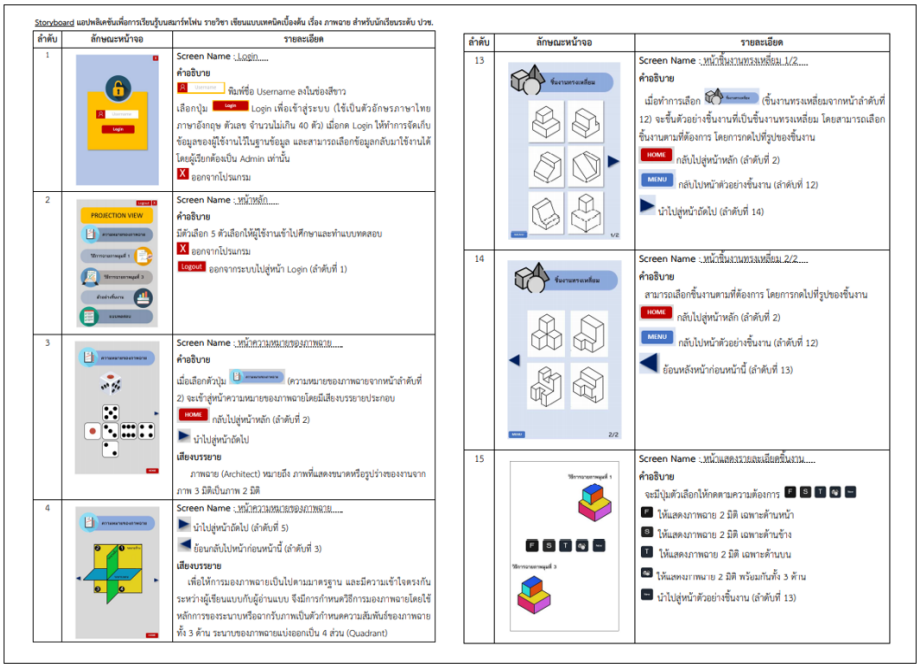
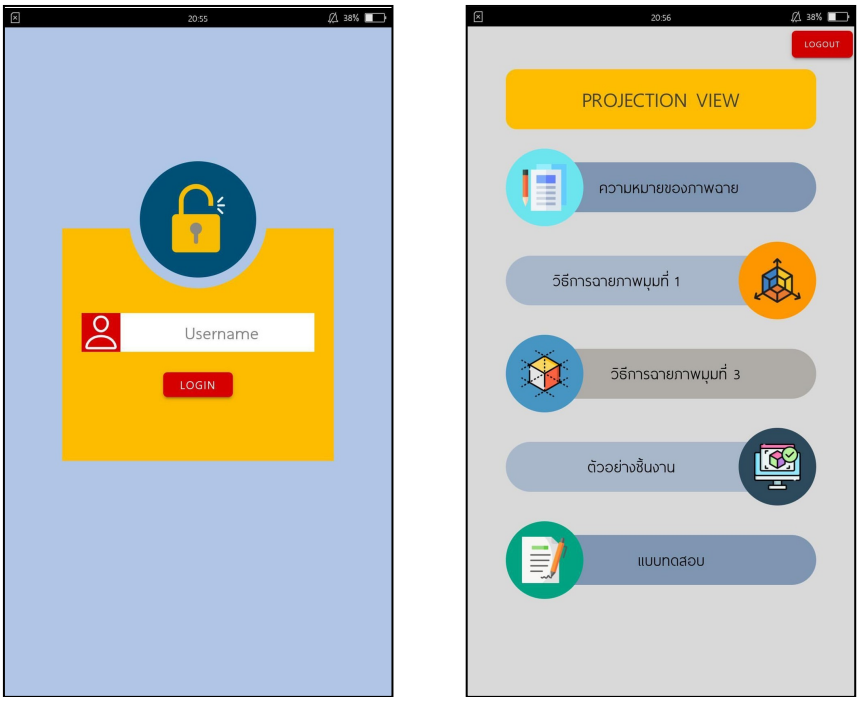


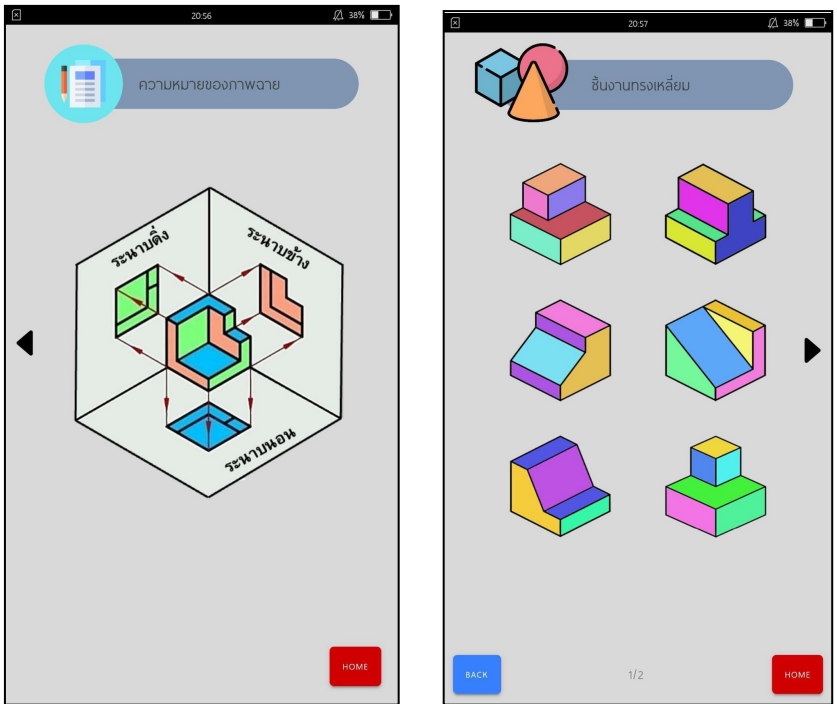
Figure 2. The storyboard of projection topic in a mobile application.

- *Step 4:* we have binged the storyboard to the experts to verify the correctness of the content, use of language, use illustrations, and link other components, then bring it to improve for the next step.
- *Step 5:* We have prepared the required resources such as text, still images, animations, and various sound effects that must be used in the lesson to be ready to be used by the program application.
- *Step 6:* We have created a mobile application on the projection topic of introductory technical drawing course including four sections as follow:
  1) Entrance to instruction is login page and main menu, as shown in Figure 3 (a) and (b).
  2) Introduction of mobile application is content pages and sample pages, as shown in Figure 4 (a) and (b).
  3) Orthographic Views are the top of the rectangular workpiece and the top of the cylindrical specimen, as shown in Figure 5 (a) and (b).
  4) Progression of learning is the quiz pages and the score pages, as shown in Figure 6 (a) and (b).



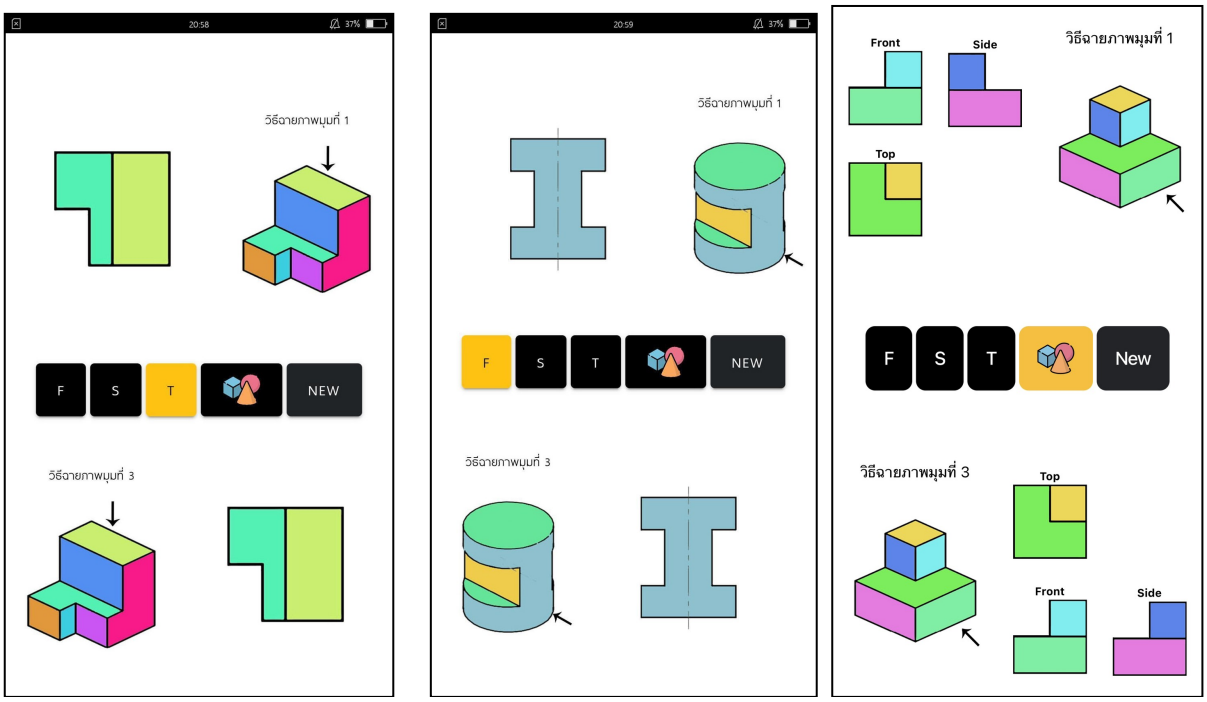
(a) login page (b) Main menu

Figure 3. Entrance to instruction.



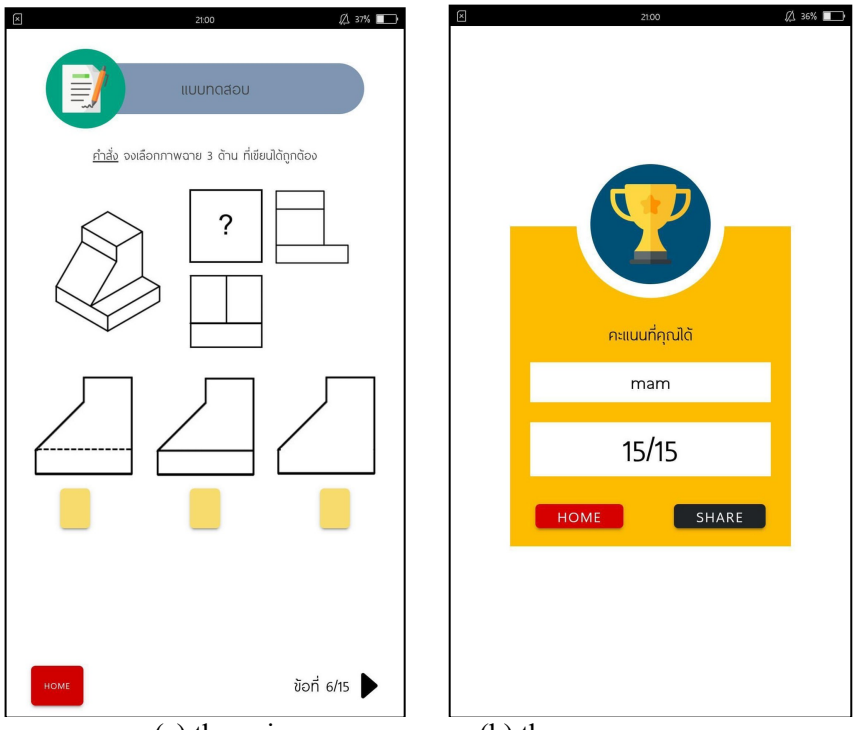
(a) content pages (b) a sample pages

Figure 4. Introduction of mobile application.



(a) the rectangular workpiece (b) the cylindrical specimen (c) 1st and 3rd angle projection

Figure 5. Orthographic views.



(a) the quiz pages (b) the score pages

Figure 6. Progression of learning.

After that, we will take the mobile application that has been successfully created to be evaluated by experts for recommendations to improve before implementation with students at the 1st year vocational education next time.

4. Conclusions

Teaching on a blackboard or studying in the classroom is a traditional teaching method to become the past when innovation and technology play a role in daily life. Moreover, the whole world faces the Covid-19 epidemic situation, causing teaching and learning to be in the online format. Therefore, learning with a smartphone application is an essential part of online teaching in the current situation. It is using technology that will change the teaching and learning process without the time and place constraints. Learning with a smartphone application allows students to apply the knowledge gained from the study to analyze and synthesize information for problem-solving. This paper has shown the design learning material to encourage students to have reading skills in the basic technical drawing course's first and third angle projections. In addition, it makes the learning process more interesting, fun and motivating.

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