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Development of Application Supports Learning on Smartphone by Augmented Reality Technology Using KWL Activity for Higher Education Institution in Thailand

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Abstract

Recently, there has been a proliferation of education technology practices, based on the application of active teaching and learning processes using Augmented Reality technology. The purposes of this research are: 1) to development the application supports learning on smartphone by augmented reality technology using KWL (Know-Want-Learn) activity; 2) to evaluate the effectiveness of the application supports learning AR with KWL activity; and 3) to compare students' learning achievement between pretest and posttest of the students learning through this application. This type of research is experimental research with one group pretest - posttest design. The samples used in the experiment is 46 students at Bachelor of Arts in Information Studies, Faculty of Humanities, Srinakharinwirot University, Thailand, selected by using purposive sampling method. The instruments used in this study were using application supports learning on computer programming in information work class, efficiency analytic of an application, learning achievement test and satisfaction questionnaires. The satisfaction used in the analysis were percentage, mean, standard deviation and t-test assisted by SPSS and descriptive statistics. The results of the study showed that the Application in design side was in the highest level of the quality with mean ($\bar{x}$) of 4.68 and standard deviation (S.D.) of 0.15. The student has the posttest score significantly higher than the pretest score ($p < .001$). This study investigates the effectiveness of AR application learning materials and using KWL in terms of learning performance, motivation, attitude, and behavior towards different methods of learning. Our activity results favor AR application learning techniques where students' learning motivation and performance are enhanced compared to the non- AR application learning methods. Majority of the students reported higher satisfaction on learning though application. Suggestions and comments from students revealed that using Application, students will be able to independently learn and self-test their learning at their own convenience. Instructors can use the application to provide additional study aids for the students. The Application, which is being developed as a pilot project, will be expanded, and applied as a learning tool for education.

Keywords: Application Supports Learning, Augmented Reality Technology, KWL activity

1. Introduction

With the emerging technologies of Augmented Reality (AR) the learning process in today's classroom is much more effective and motivational. Nowadays, we live in a society in which the use of information and characterized by new virtual and digital ways to access and treat information (1). With regard to the latter, the importance of AR as a resource to encourage student participation and to motivate and activate interest in their learning process should be highlighted, the new learning scenarios require the planification of new instructional spaces, physical and virtual, and implementation of new digital resources to promote a more dynamic teaching-learning process. (2)

Augmented Reality (AR) technology are used extensively in various real-world applications for education are technologies that are very attractive to the learners since they offer new experiences when learning about the real world (13). Those technologies can be easily incorporated in the classroom when used with mobile devices that learners already possess. Augmented reality describes the application of technologies to enhance a physical space or object with relevant information that is presented in a digital medium (3). In this paper, explore advantages and

disadvantages of using virtual and augmented reality applications in educational settings. And analyze pedagogical approaches that underpin the development of AR applications used in education. Especially in the education field, AR application techniques have completely changed the design and method of learning (14). The application supports learning on smartphone by augmented reality technology using KWL activity are one of the most popular and optimized ways to learn factual knowledge. Students of modern age, who use smart technology and mobile devices in their daily lives, often lack the time and motivation to study. We aim to use the inseparable relationship between university students and their smartphones to create new options for higher education, converting their cellphones into study. We have used this new technology to develop a simple application to convert the smart mobile devices of students into study.

Now's learners are exposed to various digital technologies, most of which are suitable for active learning when accompanied by appropriate pedagogical approaches. In recent years AR technologies draw attention of educators since they offer new experiences to learners when they learn about the real world. These technologies are quite similar, but there is one major difference between them. In augmented reality, the user sees elements that are added from the virtual world to the real world and are blended, while in virtual reality, the user is completely immersed in the virtual world without seeing the real world (4). This work is focused on mobile Augmented Reality (AR) technology and multimedia applications developed using the Android platform for educational purposes show in figure 1.

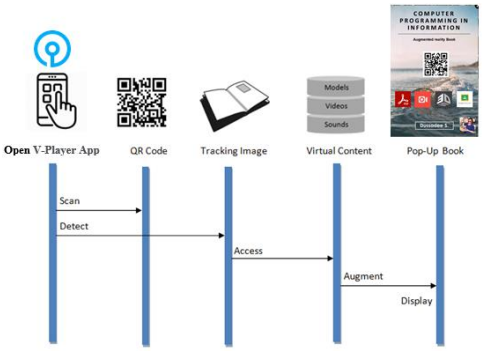

Figure 1 Application supports learning on Smartphone by Augmented Reality system

AR application is possible due to recent technological advances, but as a learning experience, represents more than just the merging of hardware, software, and contextually relevant information (5). Defining AR as a concept allows for the use of a broad array of hardware, software, and design strategies (6), which can encourage the development of education, contextually relevant AR learning experiences. Those virtual elements can be triggered by real-world image recognition or by the user's location. And has potential to increase learning performance, as it can make boring content more enjoyable and can be used to provide immediate feedback and support autonomous learning (9).

In this era of technology, most of the teaching community and researchers are interested in modifying the education system to enhance both the learning and teaching understandings (15). AR application techniques several positive impressions on the students in comparison with traditional methods of learning and increase students' motivation for learning, teamwork in group tasks, and understanding of the learning content for an extended period (16). To makes the learning process fun, attractive, and interesting, for learning purposes of these topics with mobile applications. In this way, can make the usage of smartphones positive and effective for students.

Consequently, in this study are employed the AR on KWL activities to motivate pre-service teachers to develop instructional materials. In this regard, an attempt was made to answer a research question: Do the pre-service students who learn with AR application using KWL activity. KWL activities is a strategy usually applied in study where students are geared to construct their knowledge, first, by activating their prior knowledge or what they Know, questioning what they Want to know, and concluding what they study. This study aims at describing how KWL activities can be used to study for the students of on computer programming in information work class and be used to motivate them to study and have positive exception toward learning activities respectively. Besides, it may lead to the improvement on their learning skills (7) show in figure 2.

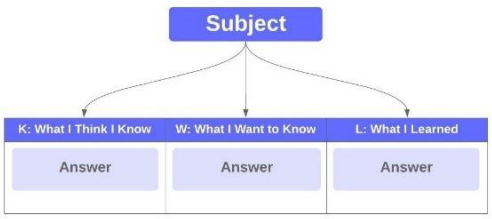

Figure 2 KWL Chart activities

2. Methodology

In this section, discuss the development of the proposed AR-based learning approach in detail. To build an application for educational purposes for supports learning on the subject computer programming in information work, we must consider all the student's academic and emotional aspects. In the technological aspect, we select AR techniques for developing learning and teaching content. AR technology fulfills all the educational needs required by students for learning effectively. With the help of AR techniques, the students see the virtual learning content in the real world, and they can interact with them in real-time. This study to use the Vidinoti and

Zappar applications, due to its extensive usage in the development of AR learning applications. Vidinoti and Zappar applications are an AR application that can track target images, objects, and ground surfaces with computer vision techniques. Using it, a 3D virtual environment can be augmented into the real-world surface. The target's position and direction are tracked with the help of an AR camera (mobile, webcam), and then the virtual 3D objects are rendered on the surface of the target. The virtual content is user interactive in real-time, and it seems the same as the part of real-world physical life. Figure 3 shows the complete architecture of the Vidinoti and Zappar applications.

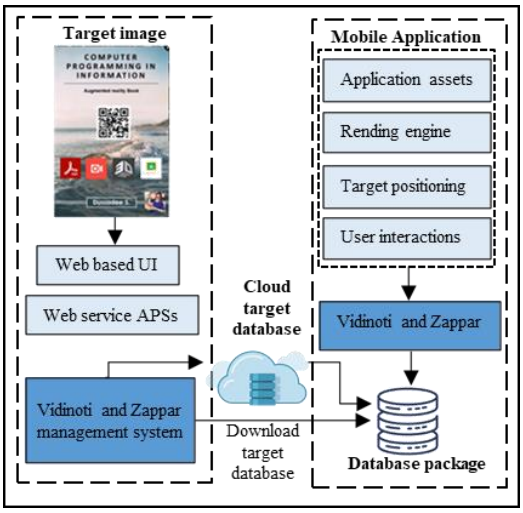

Figure 3 The architecture of the Vidinoti and Zappar management application

2. Materials and Experiment

The main objective of this research were to evaluate the effectiveness of the application supports learning AR application with KWL activity and compare students' learning achievement between pretest and posttest of the students learning through application supports learning using KWL activity. This research is experimental research with one group pretest - posttest design (8), as in Table 1. In this research, there is one group pretest - posttest design.

Table 1 Research design

Pre-test	Treatment	Post-test
T_1	X	T_2

Note:
T_1: Pretest
T_2: Posttest
X: Given to the students using Application supports learning on Smartphone by Augmented Reality

This research is a type of experimental research with one group pretest - posttest design. The location of this research is in Faculty of Humanities, Srinakharinwirot University, Thailand, conduct in the 1st Semester 2020. The samples of 46 students. This research conducts in on class: on computer programming in information work as the control class. The instruments used was valid by expert judgment. The questions used to learn achievement test and satisfaction questionnaires of the Application supports learning on Smartphone by Augmented Reality. Data were analyzed using the Application supports learning on Smartphone by Augmented Reality achievement test, satisfaction test and independent t-test assisted by SPSS and descriptive statistics are shown in Table 2 Explanatory sequential design was used to direct different methods and mixed collection data tools were employed with the objective to triangulate and validate research and prove evidence.

Initially, in both pretest and posttest, the students were to be given 30 questions multiple choices tests. However, after some considerations and thorough the validation process. The questions for the students' conceptual mastery are based on Bloom's taxonomy (4).

The application supports learning on smartphone by augmented reality technology using KWL used in teaching and learning management using application supports learning AR with Google Suit by using problem-based learning to enhance the students' ability to solve problems in computer programming in information work. The study format for the KWL activity has been defined as shown in figure 4.

Table 2 Illustrates the research design.

Research pursued	Research objective	Sample/ Participants	Data collection method
Explain	Development the application supports learning on smartphone by augmented reality technology using KWL activity	N= 46 studies N= 200 Factors identified	Literature review
Explain	Evaluate the effectiveness of the application supports learning AR with KWL activity	N= 46 studies	Systematic review
Explain	Compare students' learning achievement between pretest and posttest of the students learning through application supports learning using KWL activity	N= 46 studies	Systematic review

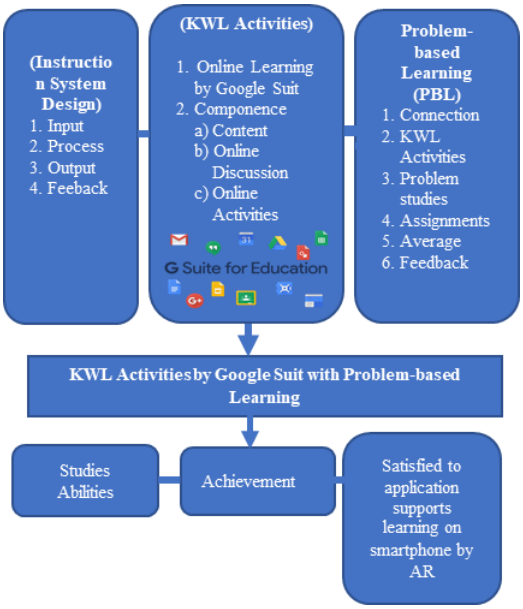

Figure 4 the application supports learning on smartphone by augmented reality technology using KWL (Know-Want-Learn) activity

3. Results and Discussion

The objective of this study approach are the effect of learning content developed with application supports learning on smartphone by augmented reality technology using KWL and compared to traditional learning approaches on students at Bachelor of Arts in Information Studies, Faculty of Humanities, Srinakharinwirot University on the computer programming in information work class, using such technology for learning in education fields motivates students to learn more than traditional learning methods. AR application learning techniques make it possible to educate students in an

This study aims to development the application supports learning on smartphone by augmented reality technology using KWL activity for Higher Education Institution in Thailand. This research was carried out during the COVID-19 Pandemic so that learning carries out online / remotely. Learning carries out using the Google Classroom platform, learning using Google App Education Edition Suite shown in figure 5 and figure 6.

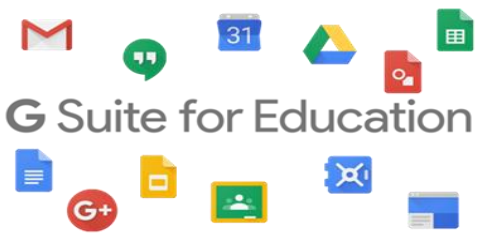

Figure 5 Google Apps Education Edition Suite.

Figure 6 Google Classroom platform

3.1 The result of development the application supports learning on smartphone by augmented reality technology using KWL activity on computer programming in information work class. AR application mobile application that designs for learning on the subject of computer programming in information work to understanding is the first challenge for students when they are starts learning. In this application, images of structures from the subject are used as image targets for visualizing virtual content. The students can simply download the image target from the QR code given in the application and use them for the application as AR camera target images. The user can simply download the image target from the link given in the application, print them, and use them for the application as AR camera target images. Students can interact with the learning content of the application and can learn computer programming in information work by application supports learning Application AR with KWL activity in the experimental class, as in Figure 5. Making application supports learning provides using. Then students use smartphones for scanning using the Vidinoti application show in figure 7, figure 8, figure 9 and figure 10 Students using application supports learning on smartphone by AR application technology using KWL activity on computer programming in information work class. The AR application's interactive design helps to entertain students, while using this application and motivates them to learn. This application is designed for both learning and testing purposes.

Figure 7 shows the QR code reader application is such a nice tool to apply to different activities in class. In this AR application technology using KWL activity. Motivation is plan for classes to provide fun, interactive and innovative lessons in order to create a joyful learning environment, where students feel comfortable, confident, engaged and motivated to learn and practice.

Figure 8 shows the students get their devices and scan a code with directions. Scanning a code gets students to turn on their devices and get ready for learning. A popular use for QR codes in education is to add multimedia content to hard copy pages. It is kind of like a step on their way to fully digitized textbooks show in figure 9. Not only is this a novel way for students to study, it once again lets teachers

use multimedia content to present in a more thorough and engaging manner.

Figure 10 shows the application supports learning uses a device, usually a smartphone, to augment the real world. Think of it as adding an extra layer onto your physical surroundings. That layer could be an animation, or any combination of images, sound, and video that create an experience.

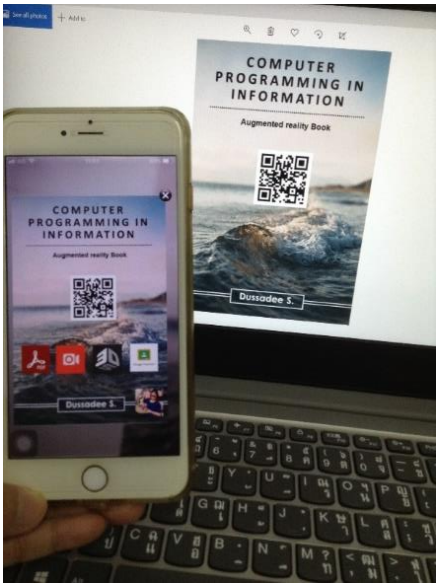

Figure 7 QR code scanning application. It's available for iOS, Android.

Figure 8 Multimedia content and get ready to begin student's learning.

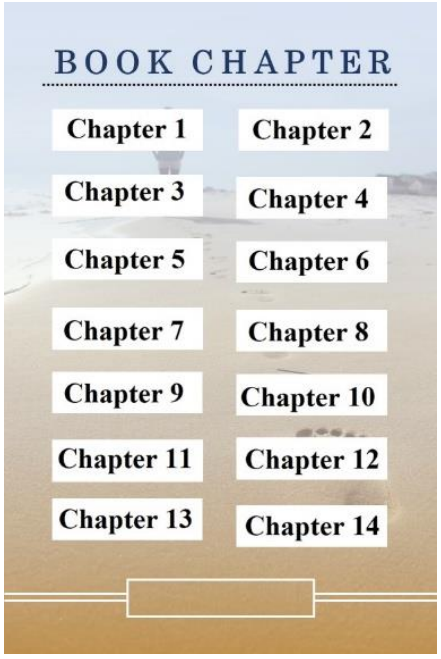

Figure 9 Digitized Textbooks.

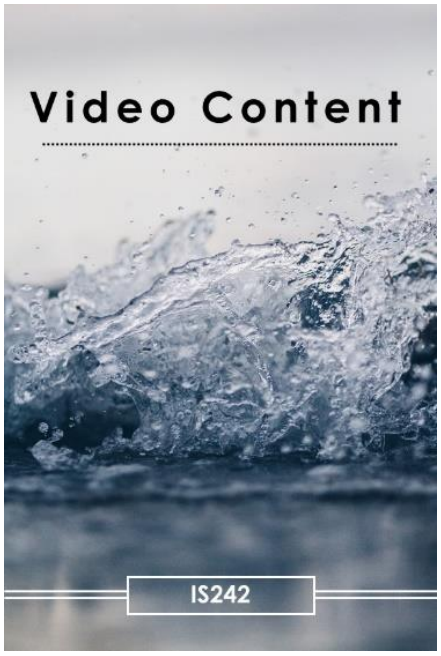

Figure 10 Video content.

3.2 Evaluate the effectiveness of the application supports learning AR with KWL activity show in table 3.

Table 3 The efficiency analytic result of Application supports learning on Smartphone by Augmented Reality

Efficiency Application	$\bar{x}$	S.D.	Interpretation
1. Functional Test	4.50	0.37	higher
2. Output Validation Test	4.54	0.37	higher
3. Output Validation Test	4.54	0.45	higher
3. Usability Test	4.36	0.36	highs
4. Security Test	4.35	0.31	highs
Total	**4.46**	**0.47**	**higher**

3.3 Compare students' learning achievement between pretest and posttest of the students learning through application supports learning AR application with KWL activity. Based on research, out of 50 score rating. Using the average scores obtained in the pretest and posttest by t-test show in table 4.

Table 4 The result of compare students' learning achievement between pretest and posttest of the students learning through application supports learning AR with KWL activity.

Test	Score	N	Score Average	t-test
Pre-test	30	46	13.81	23.21
Post-test	30	46	25.27	

In the table 4, is an enhancement in the pre-test compared to the post-test. The initial score obtained by the students measured by the pretest is shown to be 13.81 out of 30 score rating. The students were already informed about holding the pretest before and were not taught by the teacher about the concept before to test their prior knowledge. After the implementation of application supports learning AR application with KWL activity, the posttest was held to measure students' conceptual mastery about the concept. The result of score 25.27 out of 30 score rating was obtained from the posttest. The experimental class used an application. It shows that learning using application supports learning AR with KWL activity provides a better chance than everyday learning. It is consistent with research (11, 12) that the use of AR application supports learning with KWL activity affects students' conceptual mastery and creative thinking ability.

3.4 The results of the student satisfaction assessment were determined to determine the level of satisfaction. and summarize the results as shown in Table 5.

Table 5 shows the results of the sum of the analysis of the satisfaction assessment.

the student satisfaction assessment	$\bar{x}$	S.D.	Interpretation
1. Content presentation satisfaction	4.68	0.57	Most satisfied
2. Lesson design satisfaction	4.82	0.47	Most satisfied
3. Benefit of lessons learned satisfaction	4.79	0.52	Most satisfied
Total	**4.78**	**0.49**	**Most satisfied**

Table 5 shows the results of the sum of the analysis of the 46 students satisfaction assessment from the mean 4.78 and a standard deviation of 0.49 at the most satisfactory level.

4. Conclusions

In this study, the Augmented Reality technology (AR) was applied as an effective learning method to improve the learning process of the students' using smartphones through KWL activity approach. Developed a set of application for learning of computer programming in information work class and performed different types of learning KWL activities with various learning methods, evaluated the students' learning performances, comparative analysis of these activities revealed a positive impact of application learning methods on students and supportive effect was noted on the student's motivation towards the learning process during application learning sessions.

The students also showed a positive attitude and behavior towards the application learning method. As compared to the traditional learning methods, application AR application supports learning make the learning process easy, fast, and enjoyable. In traditional learning, students could not interact with the educational content, resulting in a lack of focused learning. Interaction in real-time enhances the student's excitement to explore the learning materials more. Students were pleased in the application learning session and did not show any signs of boredom while learning.

The success of Augmented Reality technology it brings to education. This research has shown that it significantly increases student motivation, since it allows the content of study subjects to be presented in an attractive and novel way, awakening interest and curiosity in the teaching process (16, 17), which is a fundamental to achieving significant learning (18). The success of Augmented Reality technology it brings to education.

Based on the results on the analysis in the research, it can be concluded that: (1) The Application supports learning on Smartphone by Augmented Reality is efficiency (2) as for students' studies ability

by Know-Want-Learn activity in the experimental class using application supports learning application is better after using application. There is a significant difference in students' studies abilities by using application supports learning.

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Declaration of conflicting interests
The authors declared that they have no conflicts of interest in the research, authorship, and this article's publication.

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