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The Development of Augmented Reality Book to Promote Analytical Thinking for Grade 7 Students on the Basic of Life Units

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THE DEVELOPMENT OF AUGMENTED REALITY BOOK TO PROMOTE ANALYTICAL THINKING FOR GRADE 7 STUDENTS ON THE BASIC OF LIFE UNITS

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Abstract. This study aims to 1) design and develop augmented reality (AR) book to improve the Analytical thinking skills of students on the topic of the basic of life units 2) study the Analytical thinking skills of students in learning AR book 3) compare the students' learning achievement before and after using AR book and 4) study the students' satisfactions with the AR book. The research subjects were 40 of grade 7 students, Thailand. The technique of collecting data consisting of Analytical thinking tests, pre-test and post-test, and satisfaction evaluation. The results showed that AR book "the basic of life units" was developed using unity 3D and designed using Adobe InDesign for four chapters. (1) the ability to identify elements of something or a particular subject (2) the ability to identify correlated reasons, and (3) the ability to assess the value of things. The result found that the students' Analytical thinking score were higher than the specified criterion as 0% of 37 people, representing 92.50%. The students' achievement scores resulting from the test performance after study with AR book were higher than the specified criterion as 70% of 36 people, representing 90.00%. The post-test scores were significantly higher than those tested prior at the level .01 on the t-test scale. The students' satisfactions toward the AR book to improve the Analytical thinking skills were mostly high ($\bar{x}$ = 4.10, S.D. = 0.78)

Keywords: Development of book, Augmented Reality Technology: AR, Analytical thinking, The basic of life units

1 Introduction

Distance learning has become relatively simple thanks to rapid technological advancements. This type of distance learning is known by a variety of names, including online learning. open education Web-based learning is a type of blended learning that involves the use of computers as a medium. It is the capacity to link computers to a network that allows teachers and students to stay in touch. and may teach at anytime, anywhere, and in any beat using a variety of methods Online learning is a tool that allows for a more student-centered learning experience. Because of technological advancements in connectivity and communication, as well as more flexibility. The term "online learning" refers to a learning experience that takes place in a multi-device context. such as cell phones, computers, and Internet access in order to live in an atmosphere where students can engage with professors and other students through these surroundings. Students can learn without regard to their physical location.

Students can attend live lectures in this learning environment. Teachers and students can connect in real time and can interact with each other right away. Synchronous learning is the term for this. Social interactions arise as a result of this method of learning. From the teaching data of teachers who teach scientific courses in the second semester of the academic year 2021 at Surawittayakarn school; the secondary school at Surin province, Thailand. The teacher found that the grade 7 students who study on the subject of fundamentals of living organisms. They do not understand and Students do not understand and cannot imagine images the composition and shape of cells, cell types, cell structure, and transport of substances into and out of cells. The students currently study using 2D images in textbooks. The diagrams aren't clear. As a result, kids become bored with learning, and teachers lack augmented reality technology-based teaching tools. It is aligned with the National Education Act of 1999, stressing learners from the philosophy of learning that relies on learners to build knowledge from confrontation with problem circumstances. As a result, a constructivist approach to learning should be used, which encourages learners to create self-learning, encourages learners to learn from knowledge-building methods through processes, and focuses on learners building knowledge through actions that follow their own thought process (อ้างอิง). Present, many countries have introduced augmented reality technology to assist in teaching and learning. In a similar many research, they are observed that AR-based application help to show a more positive attitude and enhancing analytical thinking skills of students [1] [2] [3] [4] [5] .

For the reasons stated above as a result, we are considering create an augmented reality book in the topic of “the basic of life units” for enhancing learning and encourage analytical thinking of the grade 7 students. The contents of the book include; how to operate a microscope, cell structure and function of plant and animal cells, transport of substances into and out of cells. In the form of a 3D model, assist learners in seeing clearly. may more readily comprehend the collection of information The use of augmented reality technology in the books to encourage analytical thinking.

2 Research objectives

2.1 To develop an augmented reality book to promote analytical thinking on the topic of the basic of life units.
2.2 To study the analytical thinking skills of students in learning augmented reality book.
2.3 To compare the students' learning achievement before and after using augmented reality book.
2.4 To study the satisfaction of students after learned with augmented reality book.

3 Research scope

This research is development research (Richey and Klein, 2007), which focuses on the design and development process. It aims to design and develop a learning environment on the network which in this design and development process consists of document research, a study of the context of teaching and learning management, synthesis of design conceptual frameworks, designing and creating a learning environment model and improving the quality. Conducting research details are as follows.

4 Research method

Development of AR book in this research study consists of 3 Process, such as 1) Design and development AR book Process 2) Trial process and 3) Evaluation Process.

4.1 Population and Sample

The population of this research was the secondary school seventh grade students studying in Surawittayakarn school, Surin province, Thailand. A total sample of 580 students from 16 rooms. The samples were selected using purposive sampling technique. The samples were 40 students from room No. 5 who took the exam scored less than the criteria for analytical thinking skill.

4.2 Research Procedure

This study was to develop interactive multimedia augmented reality book to promote analytical thinking skill of students in learning on the basic of life units. The steps of research and development in this study followed:

1) The development of the interactive augmented reality book on the topic of the basic of life units using unity 3D and designed using Adobe indesign for four chapters. Then design validation and preliminary AR book testing. The augmented reality book prototype was then validated by experts to get input and suggestions until they got the approval of the expert team. The experts involved were two, consisting of experts on biochemistry and experts in media technology. The revised AR book will be tested with grade 7 students and will be evaluated for its effectiveness.

2) Study the analytical thinking skills of students in learning augmented reality

book “the basic of life units” by designed and developed environmental learning based on the analytical framework according to Chaisomboon and Samat [6]. consist of: 1) the situation problem and learning tasks 2) learning resources 3) promote analytical thinking center 4) base of support (5) coaching and (6) knowledge exchange. The problem situations and learning tasks that are created must follow to a three-step analytical thinking framework, which includes: 1) the ability to identify elements of something or a particular subject 2) the ability to identify correlated reasons, and 3) the ability to assess the value of things. Next step, the students’ analytical thinking skills were measured using a analytical thinking exam. The test results are used to calculate the basic statistical variables, such as mean and standard deviation. The students must achieve a 60% score on the analytical thinking criteria.

3) Compare the students’ learning achievement before and after using AR book. Design the learning achievement quiz. The augmented of quiz was then evaluated by experts. The revised quiz will be tested with grade 7 students. The exam results will be examined to determine the test's confidence level using the equation KR-20 according to Kuder Richardson is equal to 0.8550.

4) Evaluate the satisfaction of students after learned with augmented reality book “the basic of life units”. The questionnaires evaluated using rating scale and five-point Linkert scale.

4.3 Data collection Technique and Instruments.

Data collection research used tests and questionnaires. The students’ analytical thinking skills were measured using an essay test. The students’ answer was then measured using an analytical thinking skill rubric [7]. Before used, the research instruments had been validated using expert validation and empirical validation. The students’ learning achievement were compared the score before and after study with AR book “the basic of life units”. The satisfaction questionnaire aims to evaluate students' satisfactions toward the AR book interactive multimedia in learning the basic of life unit

4.4 Data Analysis

Analyze the effectiveness of AR book according to the 80/80 criteria. Analytical thinking measured by solving 4 situations using basic statistical values, i.e. percentage, mean ($\bar{x}$) and standard deviation (S.D.). Learning achievement of learners who study with augmented reality technology textbooks measure was measured by having students take a pre- and post-test. The results were used to analyze the quantitative data such as percentage, mean score ($\bar{x}$), standard deviation (S.D.) Evaluate the satisfaction of students after learned with augmented reality book “the basic of life units”. The questionnaires evaluated using rating scale and five-point Linkert scale.

5 The result of research

1. Design and development of AR book

1.1 Creating a theoretical conceptual framework, a conceptual framework based on the study and analysis of theoretical principles, research, variables and relationships between theoretical principles. Research and related theories are able to synthesize the conceptual framework as follows.

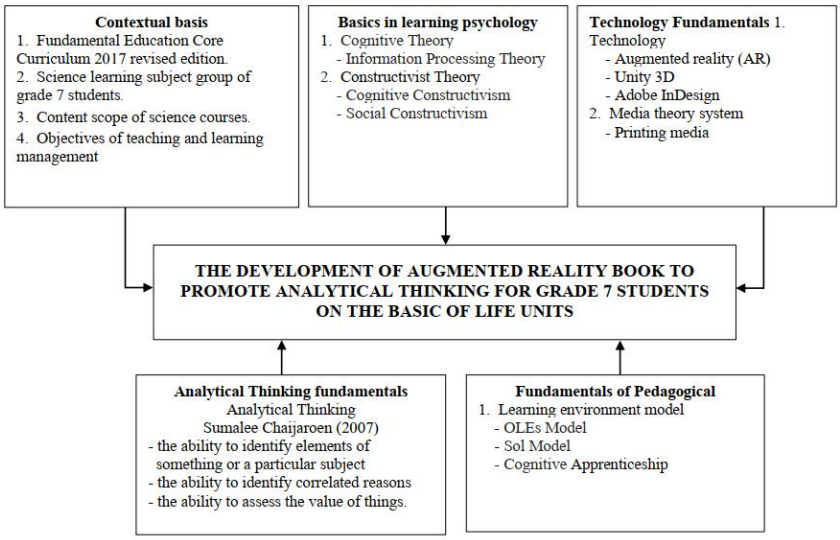

Figure 1. Theoretical framework of learning development on AR book on the basic of life units.

1.2 Synthesize a design conceptual framework.

This step is to synthesize the conceptual framework for development AR book to promote analytical thinking on the basic of life units. The researcher has used the theoretical framework as a guideline in the synthesis of a theoretical design conceptual framework. which shows the details of the design conceptual framework in Figure 2.

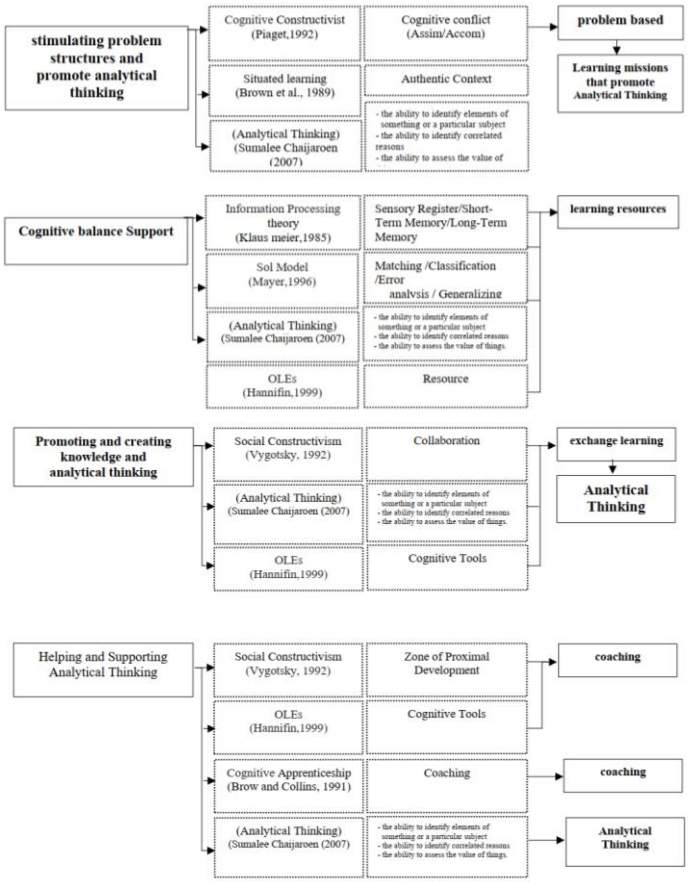

Figure 2. Designing framework of development of AR book on the basic of life units.

1.3 AR book has developed consisting of 4 modules Once it has been revised as recommended by experts, it will be used by teachers to use with their target audience.

Example, AR book “the basic of life units” in Figure 3.

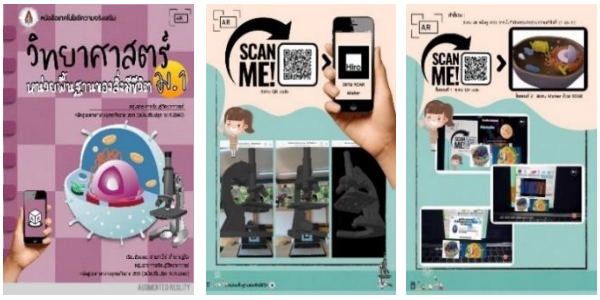

Figure 3. Example of AR book on the basic of life units.

2. The analytical thinking results obtained from the analytical thinking measurement of the learners. AR book to promote analytical thinking on the basic of life units.

2.1 Design a learning environment for use in promoting students' analytical thinking skills. of 4 problem based Figure 4.

Figure 4. Example of learning environment

2.2 The results of analytical thinking obtained from the analytical thinking measure of the learners.

Table 1. The results of analytical thinking obtained from the analytical thinking measure of the learners.

	the ability to identify elements of something or a particular subject	**the ability to identify correlated reasons**	**the ability to assess the value of things.**	**total**
				Show total
$\bar{x}$	5.48	6.88	14.28	26.63
S.D	0.60	1.02	1.54	2.64
Total students (person)				40
Number of students with a passing score of 70 percent (person)				37
Percentage of students with a passing score of 70 percent (21 points)				92.50
Student grade point average ($\bar{x}$)				26.63
Standard Deviation (S.D)				2.64

* means a passing score of 7o percent or more (21 points)

3. The results of the study on the achievement of the learners who studied with AR book AR book to promote analytical thinking on the basic of life units. For grade 7 students.

Table 2. Comparison of Pre-test and post-test achievement t-test

Achievement	n	$\bar{x}$	S.D.	t-test	sig
Pre-test	40	14.88	2.21	46.16**	<.001
Post-test	40	19.00	1.20		

** Statistically significant at the level .01

4. The results of the study of the satisfaction of the learners who studied with AR book AR book to promote analytical thinking on the basic of life units. For grade 7 students.

Table 3. The results of the study of the satisfaction of the learners who studied with AR book AR book to promote analytical thinking on the basic of life units. For grade 7 students.

Assessment item	$\overline{x}$	S.D.	quality
content	4.10	0.55	very satisfied
Instructor side	4.02	0.52	very satisfied
Print media (AR book)	4.07	0.53	very satisfied
Measurement and evaluation	4.19	0.45	very satisfied
Assessment of overall learning management	4.08	0.45	very satisfied

6 Discussion and Conclusion

From the findings in this study show that AR book “the basic of life units” can promotes analytical thinking skill of learners and make learners have knowledge and understanding of the lesson “the basic of life units” Learners can understand the different components of a microscope. and microscopy can be used to study the intracellular composition of plants and animals initially. In addition, learners can distinguish the appearance of organelles and Identify the functions of various organelles. inside the cell After applying the AR book to the learners, it was found that the learners had higher learning achievements. In a similar study by Yeh & Tseng [2] state that the students’achievement and attitudes towards the science course increased significantly with augmented reality based applications. Moreover, AR book “the basic of life units” to be used as a media in teaching and learning to help learners have higher analytical thinking skills. consistent with the research of Tamam et al. [4] found that the implementation of learning models using AR technology in Biology course can increase the contribution of attention towards students’ analytical thinking skills. Moreover, consistent with the research of Syawaludin et al.[1] indicate that the development of augmented reality-based interactive multimedia to improve the analytical thinking skills of elementary school teacher education students.

Environment of learning include classification, identifying, rational relationships classification. The development of learning environment enabling students to study and acquire knowledge as needed unlimited search for information to answer the mission of the problem situation and to support learning management in the 21st century, emphasizing on learning management by using technology to transfer knowledge to learners in order to develop quality learning management and achieve maximum efficiency for all learners.

In conclusion, teaching and learning by bringing technology AR technology will help learners can facilitate interactive learning, meaning there is feedback in the form of ideas, arguments, providing explanations, and increase analytical thinking skills as well as the results of problem-solving in learning on AR book in the topic of the basic of life units.

7 Suggestion

1. Should study augmented reality technology books in other formats by considering that model to be consistent and appropriate to promote the analytical thinking of the learners.
2. Results of a study on development of AR book can be used to guide the development of other relevant learning environments.

8 Acknowledgments

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