

## A Model of an Augmented Reality Book Using Animation for Sustainable Learning based on the AAA Model

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### Abstract

The study used the augmented reality animation and the AAA Model to: (1) analyze and synthesize the frames of a model. (2) design a model of an augmented reality book using animation for sustainable learning and was also based on the AAA Model, and (3) evaluate the entire process with the AAA Model. Samples were taken from seven specialists consisting of two teaching method design specialists, two communication and information technology specialists, and three animation specialists; all of whom were selected by purposive sampling. An evaluation from was used to evaluate the instructional model. Statistics used in the study were the arithmetic mean and standard deviation. The methodology for the prototype augmented reality book consisted of four parts. The first part needed an analysis of six components, including: learner analysis, content analysis, objective setting, context analysis, teacher analysis, and learner motivation. The second part was concerned with teaching methods containing two components: utilizing augmented reality videos and organizing extra materials according to context and student age. The third part, authentic assessment, also contained two components: assigning students to create their own work and an assessment of sustainable learning with an integrated scoring rubric. The fourth part involved analyzing feedback. All seven specialists agreed that the developed model was at the highest appropriate level ( $\bar{x}= 4.53$ , S.D. = 0.15).

**Keywords:** AAA model, Augmented Reality, animation

### บทคัดย่อ

การวิจัยนี้มีวัตถุประสงค์ (1) เพื่อวิเคราะห์และสังเคราะห์กรอบของรูปแบบหนังสือ Augmented Reality โดยใช้ Animation เพื่อการเรียนรู้แบบยั่งยืน ตาม AAA Model (2) เพื่อออกแบบรูปแบบหนังสือ Augmented Reality โดยใช้ Animation เพื่อการเรียนรู้แบบยั่งยืน ตาม AAA Model และ (3) เพื่อประเมินรูปแบบหนังสือ Augmented Reality โดยใช้ Animation เพื่อการเรียนรู้แบบยั่งยืน ตาม AAA Model กลุ่มตัวอย่างคือ ผู้เชี่ยวชาญ 3 ด้านรวม 7 คน ได้แก่ ด้านการออกแบบการเรียนการสอนจำนวน 2 คน ด้านเทคโนโลยีสารสนเทศและการสื่อสารจำนวน 2 คน และด้าน Animation จำนวน 3 คน ได้จากการเลือกแบบเจาะจง เครื่องมือที่ใช้ในการวิจัย คือ แบบประเมินรูปแบบ สถิติที่ใช้ในการวิจัย คือ ค่าเฉลี่ย และส่วนเบี่ยงเบนมาตรฐาน ผลการวิจัยพบว่า (1) ผลการวิเคราะห์และสังเคราะห์กรอบของรูปแบบจากทฤษฎีที่เกี่ยวข้องนำมาสังเคราะห์เป็นกระบวนการเรียนการสอนตาม AAA Model โดยประยุกต์ใช้ Augmented Reality แบบ Animation และสังเคราะห์ได้รูปแบบฯ และได้ผลลัพธ์ทางการเรียนการสอนเป็นการเรียนรู้แบบยั่งยืน (2) ได้รูปแบบหนังสือ Augmented Reality โดยใช้ Animation เพื่อการเรียนรู้แบบยั่งยืน ตาม AAA Model แบ่งเป็น 4 ส่วน ได้แก่ ส่วนที่ 1 วิเคราะห์ความต้องการจำเป็นมี 6 องค์ประกอบ คือ วิเคราะห์ผู้เรียน วิเคราะห์เนื้อหาที่เหมาะสม กำหนดวัตถุประสงค์ วิเคราะห์สภาพแวดล้อม วิเคราะห์ผู้สอน และจัดทำเนื้อหาเป็น Augmented Reality ประเภท Animation เพื่อเป็นแรงจูงใจสำหรับผู้เรียน ส่วนที่ 2 กระบวนการเรียนรู้ข้อ 2 ชนิด คือ สื่อหลัก Augmented Reality ประเภท VDO และสื่อประกอบตามความเหมาะสมส่วนที่ 3 การประเมินอย่างแท้จริง มี 2 องค์ประกอบ คือ มอบหมายให้สร้างสรรผลงานด้วยตนเอง และประเมินการเรียนรู้แบบยั่งยืนอย่างแท้จริงโดยใช้เกณฑ์การประเมินรูบิค แบบของครุรวม ส่วนที่ 4 นำข้อมูลป้อนกลับ และ (3) ผลประเมินโดยผู้เชี่ยวชาญ 7 ท่าน มีความเห็นว่ารูปแบบหนังสือ Augmented Reality โดยใช้ Animation เพื่อการเรียนรู้แบบยั่งยืน ตาม AAA Model ที่พัฒนาขึ้นนั้นมีความเหมาะสมระดับมากที่สุด ( $\bar{x}= 4.53$ , S.D. = 0.15)

**คำสำคัญ:** รูปแบบการเรียนการสอน AAA Model, Augmented Reality, animation

## 1. Introduction

This research sets out to demonstrate ways in which technology can enhance and motivate student learning, and combine the philosophical thinking of two very important concepts. One from deep inside of Thai culture. And another, a derivative work from the first, which focuses on a self-analytic, result driven model for success.

Sufficiency Economy is a philosophy that HM King Bhumibol Adulyadej initiated more than 30 years ago. It is a method of development. Based on the philosophy of the middle path in Buddhism, this idea stresses the importance of prudence, moderation and reasonableness. Sustainability is at the core of this idea. Another supporting concept in this philosophy is that of an internal risk management. As future events are unknown, preparation to cope with various problems in future situations is like an immunity against disease. Internal risk management in this sense refers to the design of a teaching method that would provide the fundamental knowledge necessary for a student's growth; like providing cooking equipment and teaching how to cook. Similarly, students will be able to educate themselves due to constructivism. This attribute is a key to surviving. Surviving economically becomes sufficiency. All-round knowledge in a relevant field helps to plan operations and ensure carefulness. Virtue is stressed as a guideline which promotes the awareness of honesty, patience, perseverance, and intelligence. Integrating these ideals into daily life leads to real happiness (The Chaipattana Foundation, 2007). It means that people will live in a better environment; cleaner and more useful, more convenient and accurate. It creates technology that can be applied to society to create a better environment.

Namon Jeerungsuwan applied the principles of *Sufficiency Economy* into designing a teaching model which is well-balanced and compatible with the globalized environment. This resulted in a teaching model known as the AAA Model. The triple-A model consists of analysis, activity and authentic assessment (Jeerungsuwan, 2015). Analysis related to Moderation, meaning adequate to needs. The teacher must analyze the ability of the students to absorb the lesson. Activity related to reasonableness, meaning activity to learn through learning and instructional design based on the analysis. How the students' projects achieve the desired goals of the subject. Authentic assessment related to an internal risk management, meaning construction knowledge that becomes foundation of life. Success of student work in terms of proficiency, talent or growth. By applying *Sufficiency Economy* to her model, moderation becomes adequacy. Reasonableness means the appropriateness in the design of the teaching model. Effort is put into analyzing related information to make it most suitable and compatible with the students' needs.

Augmented reality (AR) is the technology that combines digital data, text, images, video and sound with the real world by using a web camera. In contrast, virtual reality simply replaces the real world in real time (Miller, 2014; Mesuwan, 2013). In augmented reality, there are three processes: analyzing an image, which defines an image or symbolic database through the webcam; calculating positions in three dimensions to relate, as data, the distance between the camera and the image; a visualization process which displays the compound image. (Mesuwan, 2013)

This research proposes to add animation to AR in a functional and design approach. The term animation is derived from the Latin *animare* which means alive. Animation techniques impress audiences with image sequences in motion, generally either hand drawings or computer graphics. The human eye sees through persistence of vision and the images become animated continuously. This is called image persistence. The part of the human eye that receives images can recognize them in a very short time (measured in microseconds), and once again place them, for mental processes, quite quickly. It relates to data more than aesthetics. It takes a combination of the animated image and the original image, and this process becomes animation (Lieser, 2010; Laowansiri, 1989). One advantage was that animation can relay stories that actors cannot explain, and animation could make a complicated story easier to understand (Laowansiri, 1989).

From what is mentioned above, the researcher was inspired to create an instructional model of augmented reality that utilizes animation based on the AAA model. Which then applies it to the contents of

different subjects to create a teaching model that promotes sustainable learning in students. This instructional model was then evaluated by seven specialists from three specific fields: two teaching method design specialists, two communication and information technology specialists, and three animation specialists.

## **2. Objectives**

2.1 To analyze and synthesize the frames for a model of an augmented reality book that uses animation for sustainable learning and is based on the AAA model (Namon, 2007).

2.2 To design a model.

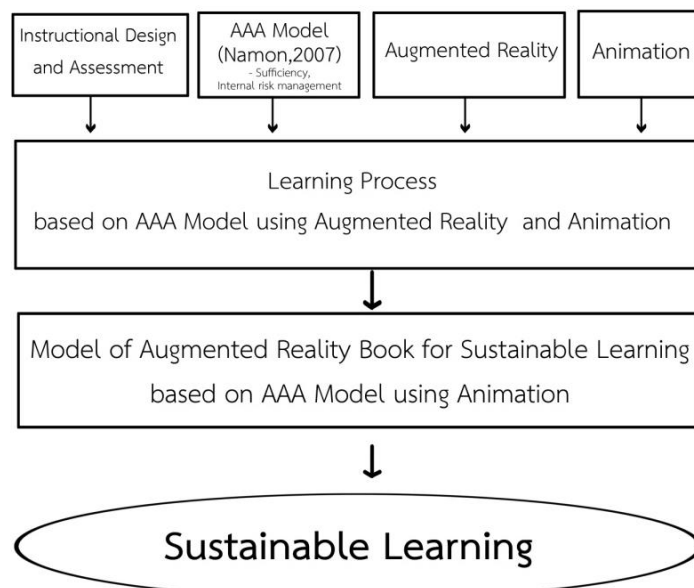
2.3 To evaluate the mentioned model.

## **3. Materials and methods**

(3.1) Literary review of four books by Jeerungsuan (2015), Miller (2014), Mesuwan (2013) and Lieser (2010) was conducted to create a framework for a prototype AR book. The strength of AR is it can attract audiences. Animation can express learning content in an enjoyable way. Then, (3.2) primary analysis was conducted. This process was divided into 3 parts: The first part is context analysis; to analyze what type of context or environment is compatible with the model, such as the availability of tablets and hi-speed internet. The second part is student analysis; to analyze what age of students is most compatible with the model. Students are required to be able to use a tablet to interact with AR animation. Students are also required to have sufficient knowledge of the subject. And the third part is learning analysis; to classify the contents into steps which are suitable for students of different ages while there is conformity from step to step. (3.3) Design a model focused on AR animation to motivate the learners. Key materials for activity were AR videos providing more details of learning content. Some of this content needed speech explanations and extra materials deemed as appropriate. (3.4) The framework was submitted to the AAA Model creator for further advice. (3.5) After that, a model assessment form was created using the Likert scale. The model assessment form was submitted to the advisor and three other experts for evaluation as to the conformity of the questions. Finally, (3.6) a model assessment was conducted by the seven specialists. The results were summarized below (Figure.1).

## **4. Results and Discussion**

The process for synthesizing a framework for this model (Figure.1).



**Figure 1** Frame of Model

The AAA Model was appropriate for creating an approach to make an augmented reality book which uses animation for sustainable learning. The Model contains 3 parts and the researcher added the fourth. Part one of the framework is moderation. This activity regulates the learners, content and teacher. The analysis of the results is used to produce animation which motivates the learner. Part two, reasonableness from the Activity category, used augmented reality videos to further explain the content details. The third part, internal risk management from authentic assessment assigns work to students and sets content standards. The details are as follows:

Part 1: Analysis consisting of six components:

Learner analysis - students have the ability and are at an appropriate age to learn content through the augmented reality animation.

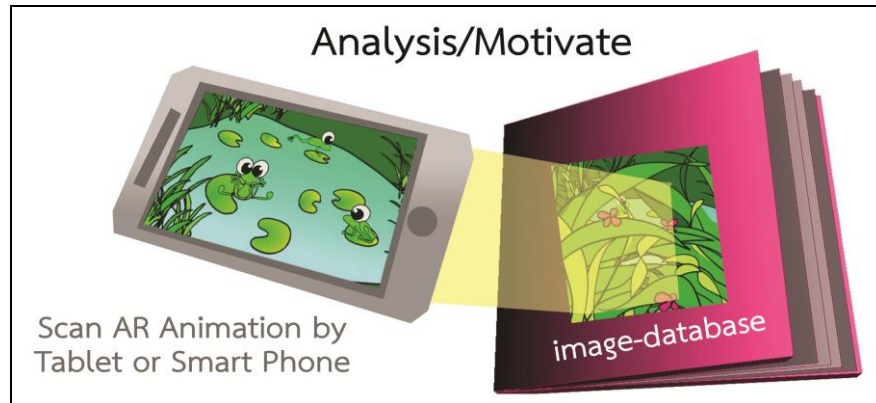
Content analysis - all steps in the process conform to AR animations. Each level is suitable for students.

Objective establishment - each content has its own appropriate objective of learning.

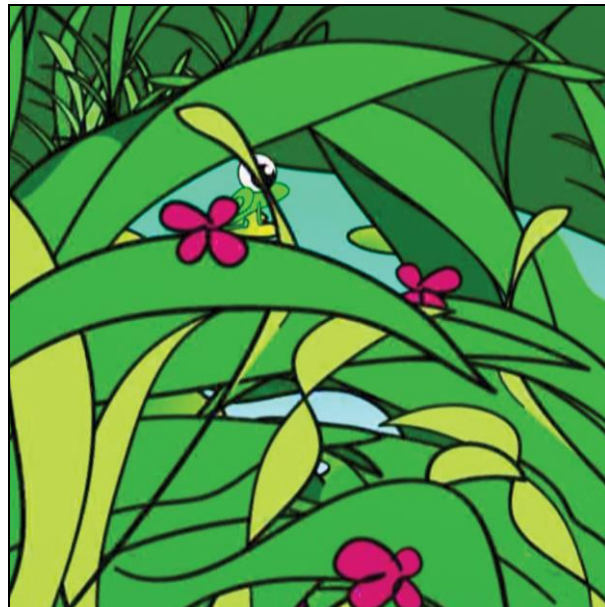
Environment analysis - the environment should be suitable for learning with tablets and hi-speed internet available.

Teacher analysis - teachers should be able to organize the contents to create consistency and conformity which allow effective learning.

Creating AR animated materials to motivate student learning, making the subject easier and more attractive to students (Figure 2, Figure 3).



**Figure 2** Needs Analysis and Motivation



**Figure 3** The example, installs and launches the LAYAR application which scans an image-database causing an augmented reality (AR) animation to appear.

Part 2: Teaching materials consist of two components:

Main materials are augmented reality videos which provide students with the main content. Extra materials are prepared and adjusted according to this content, which is prepared at the appropriate level for a student's age, to reinforce the understanding of content (Figure 4).

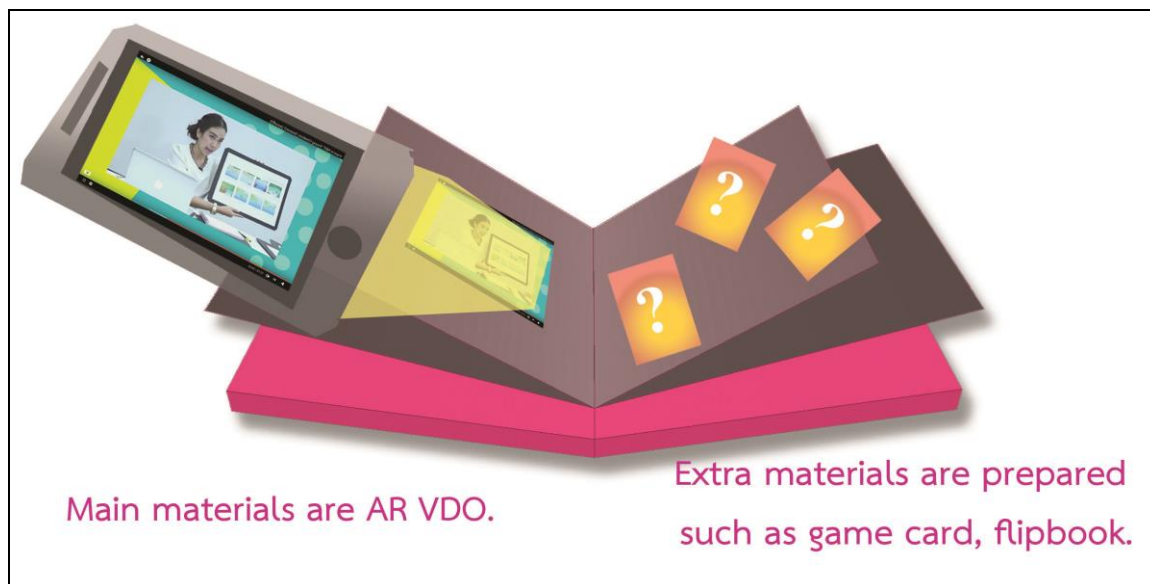


Figure 4 Teaching Materials

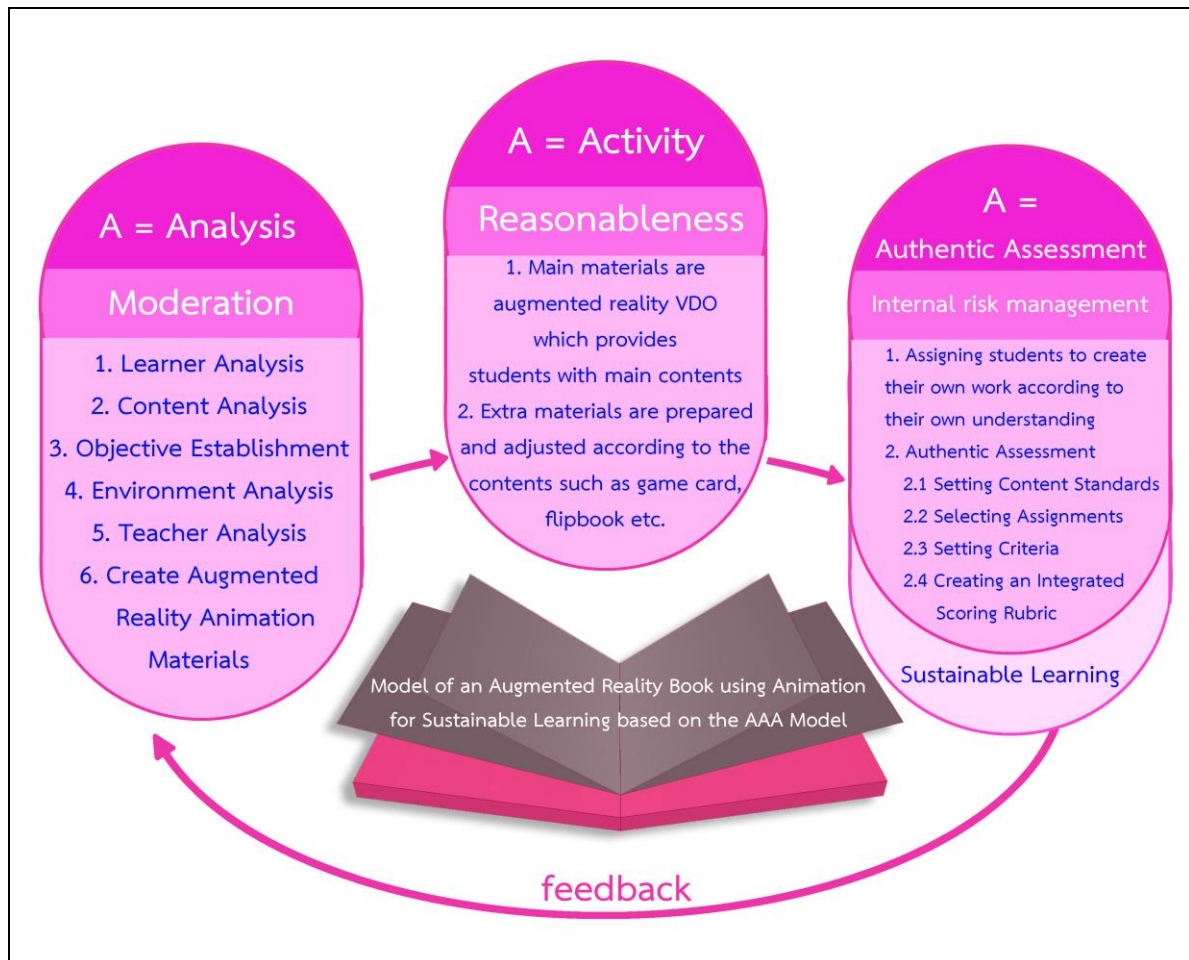
Part 3: Authentic assessment consists of two components:

Assigning students to create their own work according to their own understanding and authentic assessment, which can be divided into four steps as follows: 1) setting content standards by checking whether the students can achieve the objectives. 2) selecting assignments by deciding what kind of assignment is suitable for the students. 3) setting criteria by setting assignment’s questions. And 4), creating an integrated scoring rubric by utilizing the data from teacher’s observation form (Table. 1)

Table 1 Integrated Scoring Rubric

Characteristics	3	2	1	0
Active and Motivated	The student has motivation and inspiration for learning continuously.	The student has motivation and inspiration for learning a lot.	The student has motivation and inspiration for learning sometimes.	The student has no motivation or inspiration for learning.
Construct knowledge	The student can construct knowledge continuously.	The student can construct knowledge a lot.	The student can construct knowledge sometimes.	The student cannot construct knowledge.
Project achievement	The student can achieve an assignment or project continuously.	The student can achieve an assignment or project a lot.	The student can achieve an assignment or project sometimes.	The student cannot achieve an assignment or project.

Part 4: Analyzing feedback from the students and improving the model accordingly (Fig. 5)



**Figure 5** Model of an Augmented Reality Book using Animation for Sustainable Learning based on the AAA Model

The results of research instrument using Likert scale showed that:(3) All seven specialists agreed that the developed Model was: Part 1 needs analysis ( $\bar{x} = 4.57$ , S.D. = 0.65), Part 2 teaching methods ( $\bar{x} = 4.50$ , S.D. = 0.53),Part 3 authentic assessment ( $\bar{x} = 4.55$ , S.D. = 0.51) and Part 4 analyzing feedback ( $\bar{x} = 4.50$ , S.D. = 0.29) is at the highest appropriate level ( $\bar{x} = 4.53$ , S.D. = 0.15).

## 5. Discussion

The model of an augmented reality book that uses animation to create sustainable learning and is based on the AAA model can be separated into 4 parts. The first part is the need for analysis, which includes creating AR animations that motivate the learner. All seven specialists agreed that the developed model was at the highest appropriate level. Results obtained were related to authors such as Dr. Chatchawal Sripakdee (Sripakdee, 2012), who conducted a study entitled 'Improvement of Learning Efficiency of Physics 1 for Engineers by Real-time Simulating Graphical Animations'. He found that the course Physics 1 for Engineers was a difficult subject to access and students had low test scores. But when using animation, students' understanding improved. Students also had a better attitude towards the subject. Also it could be applied to other subjects as well. The results were also related with Somsak Techakosit's work (Techakosit

& Piriyasurawong, 2015) entitled 'Constructionist Learning and Teaching Using Augmented Reality Technology for Science', in this case they also used AR technology to support science literacy.

## 6. Conclusion

After the assessment, the seven specialists agreed that the AAA model could be applied for a book utilizing augmented reality for a sustainable learning outcome. AR animation and AR videos can be used to distribute content for teaching via augmented reality. The framework was at the highest level of suitability and was capable of creating more sustainable learning materials. However, results vary due to the application on each individual subject. For further work, the framework can be applied to various field book and also in the classroom.

## 7. Acknowledgements

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