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The Implementation Of 2d Animation Using The Addie Model To Support Science Education

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Abstract− This study presents research findings on the use of animation in a multimedia application for teaching and learning in science. Using the ADDIE instructional model, this research investigates the impact of 2D animation, enhanced with storytelling techniques, on student engagement and comprehension. The animation project Lemo & Carro: The Vitamin Battles was developed to explain the benefits of eating vegetables and fruits. Early results indicate that students exposed to animated storytelling showed improved understanding of scientific theories. Further analysis will assess long-term improvements in science education performance.

Keywords: Animation, Education, Science, Addie Methodology, Storytelling

1. INTRODUCTION

The concept of learning through storytelling with 2D animation makes a topic more fascinating and fun, particularly for children. Animation is an exciting and simple form of visual storytelling that makes use of moving pictures. To get an attractive movement effect, a series of images, frames, or graphics must be created and displayed in sequence. Animation is frequently employed in entertainment, education, gaming, and advertising. In the subject of education, animation is viewed as one of the mediums that can pique students' interest and serve as a teaching aid in addition to books and other digital materials. Animation has characteristics that can be an effective teaching aid in an educational context. Some of these characteristics involve elements of creativity, visualization, and the ability to convey information in an interesting and easy-to-understand manner. Animation serves as an additional reference that is easy to refer to students, parents, and teachers.

Science learning is a process of discovering more about the students and the world around them. It covers a variety of natural phenomena facts and ideas in addition to teaching students how to do research and think like scientists. It can be difficult to teach science to students at a lower level (Syawaludin, Gunarhadi, & Rintayati, 2019). Shaban & Egbert (2018) note that in teaching science, teachers have been expected to become proficient in and make the best use of instructional multimedia applications. Besides, Previous studies by Chan (2015) and Ritonga et al. (2020) emphasized the benefits of using animation to enhance student understanding and critical thinking in various subjects, including science. Meanwhile, Hanif (2020) found that motion animation improves learning outcomes, particularly in primary education. However, most studies focused on general multimedia tools or advanced subjects, leaving a gap in the application of 2D animation for lower-level science education using storytelling techniques. This research fills that gap by developing a science-focused animation aimed at young learners, using the ADDIE model. Based on several problems above, this research tries to discuss the design and development of 2D animation video called Lemo & Carro: The Vitamin Battles. This animation can be one of the tools for learning science using storytelling methods.

2. RESEARCH METHOD

2.1 Literature Review

Modern learners are surrounded by multimedia technology, including 2D and 3D animations, video games, online videos, and colorful graphics. Animation can provide new and improved learning possibilities, as well as improve the engagement and performance of all students in the classroom (Tyagi, 2018). According to a study conducted by Chan (2015), 95% of teachers agreed that students gained a better understanding of the assessment rubric after watching the animation. Research by Ritonga et al. (2020) found that animated videos can improve critical thinking skills, especially in science courses. This statement is supported by Hanif (2020) who argues that motion animation will improve students' learning sciences. 2D animation can be an effective tool in education, improving the learning experience in a variety of ways. The researchers discovered that 2D animation is a cost-effective technology that might be used in online education.

Wickramasinghe (2021) in their research observed that animation videos are an effective way to engage students in lessons and will impact students' sense of morality and their social development. One of the main characteristics of animation is its ability to generate the illusion of motion and change by quickly presenting a series of static images. The animation approach in learning allows objects and characters in the animation to come to life while attracting the audience's interest with their storytelling ability (Chiu & Chang, 2018). Furthermore, animation is an effective tool for visual design to create captivating special effects and immersive environments (Ying, 2021). Animation is more than just an enjoyable medium, it is also an important type of visual art with a huge impact on

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society. It affects our perceptions, beliefs, and values (Wang, 2014). Using virtuality, animation in film and television demonstrates its artistic values.

2D animation helps to attempt and improve science education by efficiently illustrating complicated topics and principles (Dalacosta et al., 2009). The animation uses the concepts of visual storytelling to create an engaging viewing experience for the audience. This multimedia tool, which includes animated cartoons, has been demonstrated to help science teaching and learning (Hu, 2021). The use of animation in science education can improve students' math and science achievement. This is because the use of computer animation to teach science has been proven to improve students' understanding of difficult science topics (Chen, 2020).

2.2 Methodology

This study uses the ADDIE methodology to complete the animation development. It consists of five phases based on research design Analysis, Design, Development, Implementation, and Evaluation. This kind of method was developed by Dick and Cary in 1978 and used to manage and improve the flow of the animation development process (Kurt, 2019). The Addie method is relevant to animation design, which often includes creating graphics, characters, and storylines for entertaining or educational purposes. Figure 1 illustrates the ADDIE instructional model, detailing the five phases (Analysis, Design, Development, Implementation, and Evaluation) applied in the animation development process.

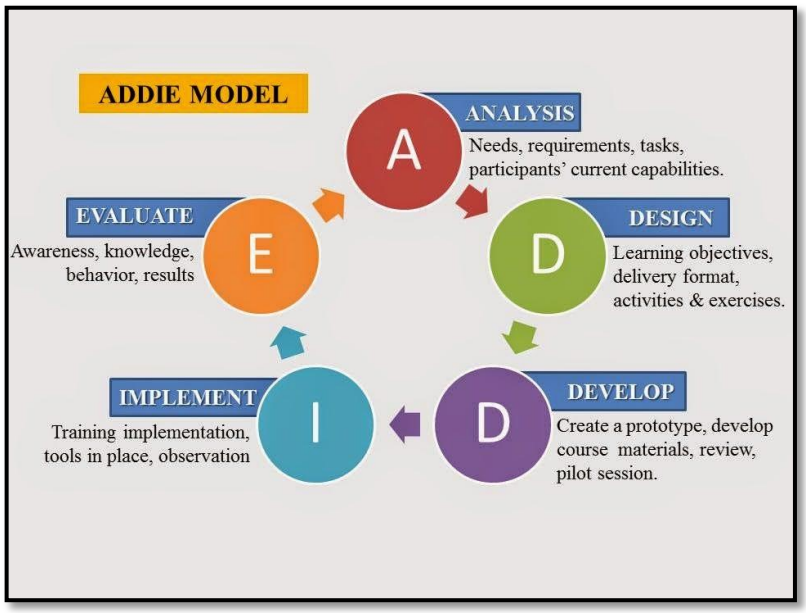

Figure 1. ADDIE Methodology

The ADDIE model is implemented in five key phases (Analysis, Design, Development, Implementation, and Evaluation). Each phase follows a structured process:

1. Analysis: Identify content (nutritional benefits of fruits and vegetables) and target audience.
2. Design: Develop child-friendly characters and storylines, using colorful and simple animations.
3. Development: Create animation assets and storyboard to convey the content.
4. Implementation: Introduce the animation in a classroom setting and collect initial feedback.
5. Evaluation: Measure engagement and comprehension improvements, making necessary adjustments.

2.3 Phase of ADDIE Methodology

In the analysis phase, the requirements for the design will be implemented. The benefits of each fruit and vegetable that will be included in the animation have been analyzed and the storyline of the animation has been drawn up. In addition, the storyboard will be designed to see the outline of the animated journey based on the designed storyline. The design phase continues by determining how the animation will work. During this phase, the character's initial concept will be implemented, with all designs being child-friendly and using attractive colors and shapes that are easy to recall and appealing to children. While in the development phase, a suitable animation-based concept will be produced. The development process starts with making decisions about 2D animation and planning the storyline to show the whole storyline. All required assets, including character designs, background artwork, and any other visual elements required for the animation will be designed. During the implementation phase, the character and background designs are created before being put into 2D-style animation. In this phase, the process of installing the project in a real-world context was implemented. The final phase involves the verification process where it involves goal-based and will focus on achieving an appeal to children on the project subject. Process evaluation determines

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the adequacy of instructions and reviews activities in case of any changes and improvements to the developed animation.

3. RESULTS AND DISCUSSION

The development of animation-based learning media is developed based on 2D animation that combines moving objects and an interesting background image. Lemo & Carro: The Vitamin Battles is a 2D animation that explains the scientific theory related to vitamins in vegetables and fruits in the form of storytelling. in the development of 2D animation, there are steps implemented to produce animation in conveying science using the concept of storytelling.

3.1 Concept and Storyboarding

In the production of Concept and Storyboarding, studies related to the content, characters, and themes of the story are drawn up and planned in the form of sketches and several drafts until the result is a thumbnail. Thumbnails are used to show the entire story outline of an animation. Figure 2 shows a thumbnail sketch of the entire animation storyline, offering a visual representation of the flow and key scenes in the project.

Figure 2. Animation Thumbnail

3.2 Create a Storyboard

After the theme and concept of the story are reviewed and finalized, the production of the storyboard is carried out based on the sketched thumbnails. The entire animated storyline such as dialogue, shot types, video and voice, involved scenes, and character positions are depicted in the storyboard. A collection of drawings or early visuals that outline the important sequences and activities of an animation shown in a storyboard. It helps in viewing the animation's flow and determining action timing and Figure 3 shows the sample of storyboard sketched in this animation design. Figure 3 displays the storyboard for the animation, outlining the sequence of scenes, dialogue, and character positioning. It provides a structured view of the narrative flow and visual elements.

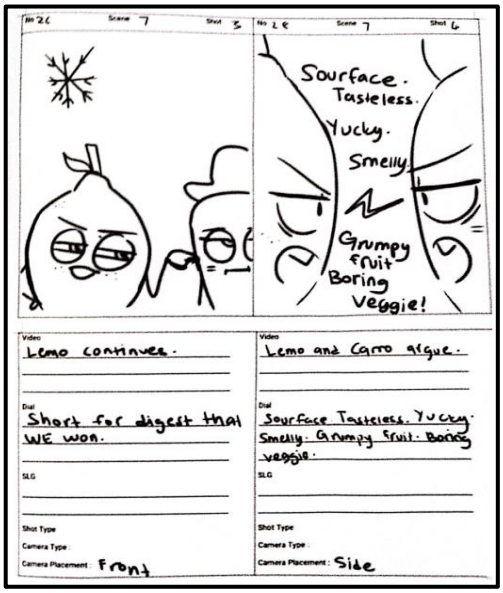

Figure 3. Animation Storyboard

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3.3 Design the Character for the Animation

The character design in this animation is sketched based on the concept of fruits and vegetables. This animation also uses a child character to attract the audience's interest to remember each character in this animation. In character design, the characteristics of each character such as graphic representation, character appearance, personality, and any unique features or characteristics will be determined for each character that exists in this animation. Figures 4 presents early sketches of the animation characters, demonstrating the initial concept design for each character based on fruits and vegetables. Meanwhile, in Figures 5 showcases the final design of the main characters, Lemo and Carro, highlighting progression from sketches to the polished, child-friendly animation style.

Figure 4. Character Sketches

Figure 5. Final Character Designs for Lemo and Carro Animation

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3.4 Design Animation Background

Background design and animation environment are important to show the mood and environment of an animation. These environments provide character context as well as assist with animation and environmental sounds. In this designed animation, the environment that is the basis of the design is the environment in the kitchen and in the refrigerator. The base colors turquoise and purple are used as the background colors to bring out the character's hue, which is the natural color of veggies and fruits.

3.5 Animatic Design

The final step in the design and development phase is making the animation. A rough draft of the animation based on the storyboard will be developed and each plan in the storyboard will be transformed into an animated form. Figure 6 introduces the human character in the animation, showing their role and interaction with the animated fruits and vegetables to convey the educational message. Whereas, Figures 7 highlights the main scientific terms presented in the animation, emphasizing their role in strengthening the educational content for the audience and Figures 8 explains the nutritional benefits of various vegetables, as conveyed through animation. The combination of visuals and text is designed to enhance comprehension for young learners. The animation is brought to life using Adobe Animate and Ibis Paint for illustration, with the drawings created on an iPad using a stylus pen.

Figure 6. Introduction of the Human Character

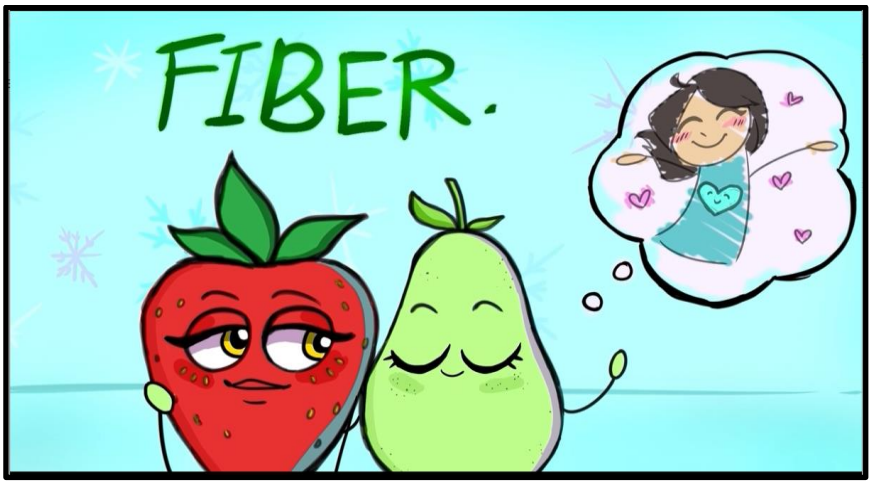

Figure 7. Key Terms Highlighted in Animation

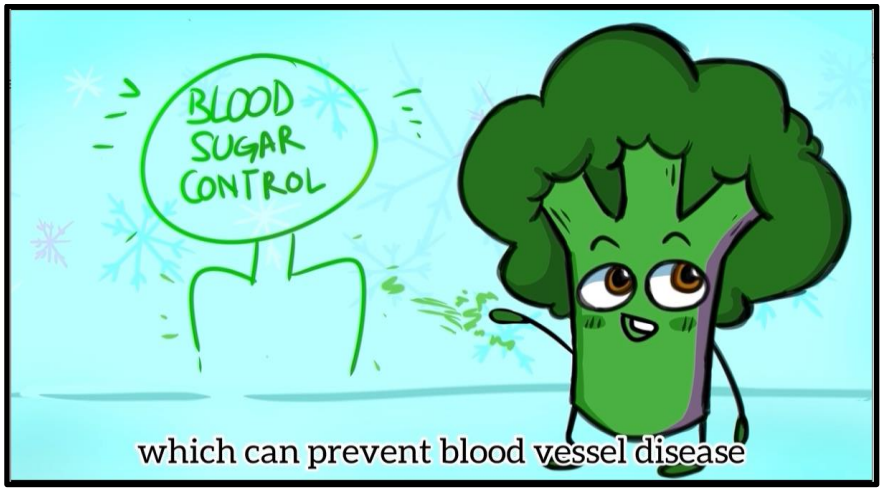

Figure 8. Explanation of the Benefits of Each Vegetable

4. CONCLUSION

This research will help young children better understand the importance of fruits and vegetables for growth. In addition, the users will improve their eating habits and include healthier options such as different types of fruits and veggies. Furthermore, this project can be beneficial for kindergartens and schools for teaching young children the nutritional values of various fruits and vegetables which will be displayed in the animation. 2D animation is seen to be able to deal with concepts that are difficult to explain in learning science. The representation of characters that are interesting and easy to remember is also able to provide an appealing effect in animated storytelling. This study shows that 2D animation, when integrated into science education, can simplify complex topics and engage young learners. The initial feedback suggests that animated storytelling improves student interest and knowledge retention. Future research will analyze the long-term effects of this multimedia tool on students' understanding and academic performance in science subjects, potentially leading to a wider application in educational settings.

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