

Interactive Animation of Photosynthesis Process as an Educational Means for Elementary School Students

Ramadhani^{a,1,*}, Devi Mulia Sari^{b,2}, Hijrina^{c,3}
a,b,c Politeknik Aceh, Banda Aceh

¹ ramadhani@politeknikaceh.ac.id*; ² devi@politeknikaceh.ac.id ; ³ hijranasuci123@gmail.com

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ABSTRACT

Natural science lessons have been taught to elementary school students. In natural science lessons, there are various kinds of materials, one of which is the photosynthesis system. There are many misconceptions in conveying material using the lecture method and printed book media. Based on these problems, the role of interactive multimedia is expected to help the teaching and learning process of agriculture become easier to understand by presenting it in the form of visuals, sound and moving images. The photosynthesis animation application was designed using Adobe Illustrator to create images, Adobe After Effects and Unity to create animations and visual effects. Based on the average evaluation results on this application, elementary school students more easily understand photosynthesis material by more than 85%.

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I. Introduction

Natural Science subjects are sciences that study the natural environment. Science lessons have started to be taught to elementary school students, because these lessons are basic lessons that students must know to continue their studies to a higher level. In science subjects there are various kinds of material, one of which is the photosynthesis system.

Photosynthesis is the process of making food carried out by plants for their own food sources, as well as making oxygen which is useful for human survival. Photosynthesis is a biological process; this process uses energy and sunlight that can be utilized by chlorophyll contained in chloroplasts. The process of photosynthesis is influenced by several factors including water (H₂O), carbon dioxide (CO₂), temperature, carbohydrates, and light.[1]

The use of technology such as interactive media has begun to develop to assist the process of teaching and learning Natural Sciences, several examples of interactive animations that have been made, namely interactive animations for Learning the Human Digestive System for Elementary School Students [2], Interactive Multimedia Material for the Human Circulatory System for Class V Elementary School [3] and Science interactive learning to increase students' understanding of Middle School Microorganisms material [4]. Although in reality in a learning process there is no one method that is most appropriate, the use of multimedia is highly recommended to increase student understanding.

The role of multimedia is an alternative as a learning medium to increase understanding of learning material that is able to describe a situation in visual form, both process and material. Therefore, with interactive media, children are expected to remember faster and learn easily and increase their desire not to get bored in learning about the process of photosynthesis.

II. The Proposed Method/Algorithm

In making interactive animations using some software assistance such as the following block diagram:



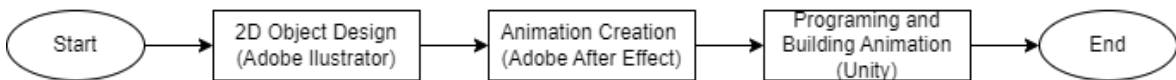


Fig. 1. Block Diagram of the Animation Making Process

The first process in making this application is to design objects for the photosynthesis process using Adobe Illustrator as shown in Figure 2, the next process is to combine objects into one frame as shown in Figure 3. All design results that have been made will be saved in image form with the extension PNG, then imported into Adobe After Effects for making animation with the addition of visual effects, sound and motion on objects as shown in Figures 4 and 5. After the object is animated, then the process of giving action to the buttons on the menu uses Unity as shown. shown in figures 6 and 7.



Fig. 2. Design objects and buttons in Adobe Illustrator

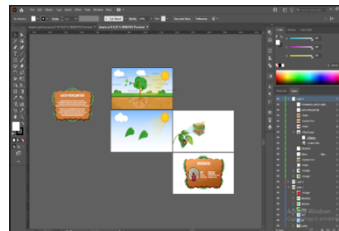


Fig. 3. Frame Making Process in Adobe Illustrator

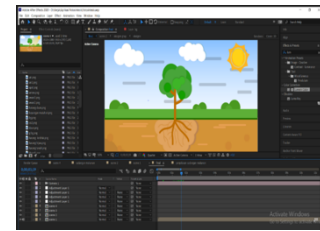


Fig. 4. Moving Image Composition Process

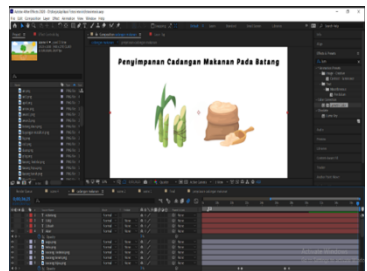


Fig. 5. Process of Adding Effects

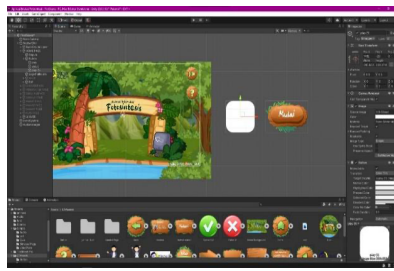


Fig. 6. Creation of the Start button in Unity

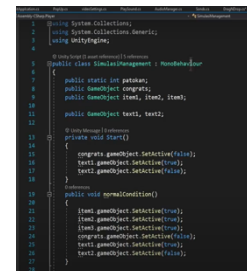


Fig. 7. Animation Action Coding

III. Method

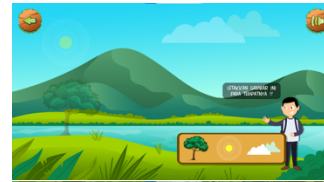
In this research the method is made in the form of storyboards and flowcharts. Storyboards are used to be able to convey story ideas from each photosynthetic animation process to others more easily because they can simulate story ideas using existing pictures. While the Flowchart is used to explain the flow of using the photosynthesis animation application.

- *Storyboard*

No	Scene	Visual
1.	Main Page	
2.	Main View	
3.	Introductory Menu	



4. Simulation Menu



5. Material Menu



6. Quiz Menu



7. Quiz Results Menu



• *Flowchart*

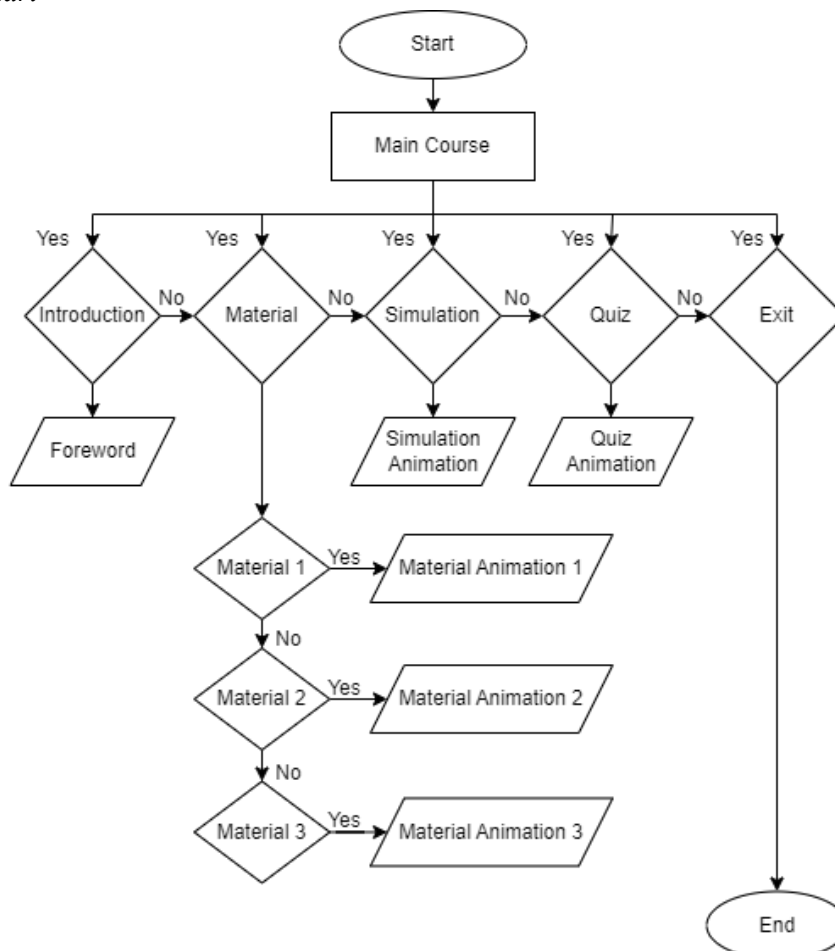


Fig. 8. Photosynthesis Animation Application Flowchart

IV. Results and Discussion

From the design stage to the stage of making animated videos, it can be used to make it easier for teachers to explain the process of photosynthesis to students in elementary schools. on this animation There are 3 menus of material that will be studied by students, namely photosynthesis process material, leaf function material, and food storage material in plants. At the simulation stage each student is invited to interact to move objects based on directions to create the correct photosynthesis process. In addition to learning about the process of photosynthesis, there is also an evaluation menu in the form of a quiz game, making it easier for teachers to find out students who already understand the process of photosynthesis.



Fig. 9. Main Page



Fig. 10. Main View

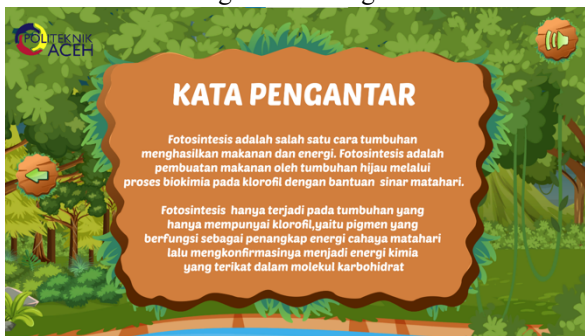


Fig. 11. Foreword



Fig. 12. Material Display

Figure 9. is the initial page when the user opens the photosynthesis animation application. On this page there is one navigation button, namely the "Enter" button. This button serves to go to the next page. While the volume buttons are on all pages that can be turned on and off. Figure 10. Is the main menu page. On this page there are four main menus, namely an introductory menu, a simulation menu, a material menu and a quiz menu. Figure 11. Overview of the introductory words to discuss what photosynthesis is so that students can understand photosynthesis animation in the material.

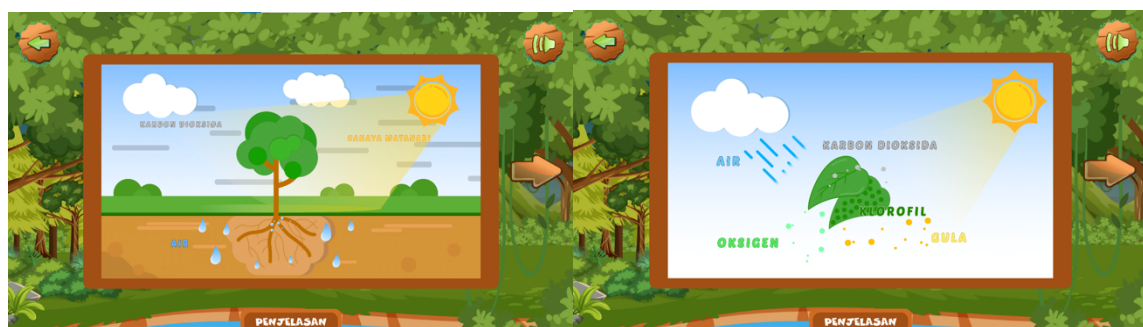


Fig. 13. Photosynthesis System



Fig. 14. Leaf Function



Fig. 15. Storage of Food Reserves in the Roots



Fig. 16. Storage of Food Reserves in Seeds



Fig. 17. Storage of Food Reserves on Stems



Fig. 18. Storage of Food Reserves in Fruit

Figure 12-18. This menu contains a collection of materials that will be explained in the photosynthesis animation. This menu explains the three materials that occur in photosynthesis. In the first material explains the process of photosynthesis in plants where what is needed to make food reserves are water, carbon dioxide, chlorophyll and sunlight. In the second material explains the parts of the leaf and the function of the leaf as a place for the process of photosynthesis. The third material explains the storage of food reserves in plants. Based on where the plant stores food, it is divided into 4 groups, namely the first in tuber plants, roots or stems that bulge as a place to store food reserves, for example, is cassava. Two plants that store food reserves in fruit, for example, are mangoes, apples, oranges and papayas. The three plants that store food reserves in seeds, for example, are green beans, peanuts, and soybeans. Finally, plants that store food reserves in stems, for example, are sago and sugarcane. In this animation students can repeat material if they still don't understand, in this case it greatly lightens the teacher's work where the teacher does not need to repeat explaining this material.

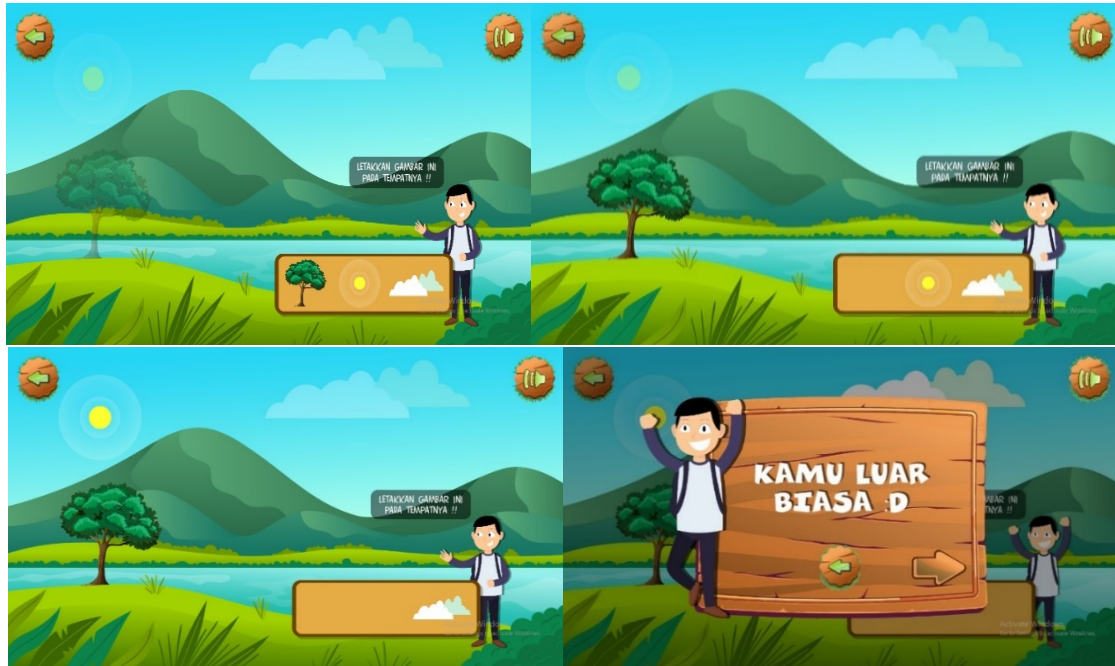


Fig. 19. Photosynthesis Simulation

Figure 19. Is a simulation page for students, in this menu students can try to learn while playing the components needed for photosynthesis. Students are directed to drag and drop images on the box according to the instructions contained in the image. Students are instructed to move the tree items and then place them in the places that have been directed via the red arrows, as well as the sun and cloud components to be put in place. At the end of the menu, information will appear to stimulate students in learning. This simulation can be repeated if something goes wrong or if you still don't understand.



Fig. 20. Quiz Page

Figure 20. Is an evaluation page for students. In this menu the teacher can evaluate the extent of students' knowledge and understanding of photosynthesis material that has been studied in this application. There are 10 questions that students can work on, if students can answer correctly a notification will appear in the form of a check mark, and vice versa if the student answers incorrectly then a notification will immediately come out in the form of a cross so that students can immediately find out the error in answering the question. After students answer all the questions on the quiz page, students can immediately find out the value obtained. This is very helpful for teachers so that they no longer need to check the results of student evaluations.

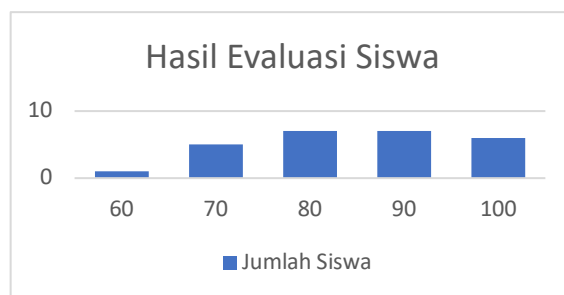


Fig. 21. Student Evaluation Results

Figure 21. Is the result of an evaluation of quiz questions in an application that was tested on 35 elementary school students. Based on the picture, the results of student presentations show that on average 85,2% of students easily understand photosynthesis material using animation.

V. Conclusion

Based on the application that has been made, it can be concluded that this application can help and facilitate teachers in introducing and explaining the process of photosynthesis in plants.

References

- [1] H. Sulistyanto and E. Wiyono, *Ilmu pengetahuan Alam untuk SD dan MI Kelas V*, vol. 5, no. 3. 2020.
- [2] Z. N. Aini, A. B. Kusdinar, and W. Apriandari, "Model Media Animasi Berbasis Multimedia Interaktif Untuk Pembelajaran Sistem Pencernaan pada Manusia Bagi Siswa Sekolah Dasar," *Jutisi J. Ilm. Tek. Inform. dan Sist. Inf.*, vol. 10, no. 3, pp. 515–524, 2021.
- [3] I. Munawaroh, S. Sulthoni, and S. Susilaningsih, "Pengembangan Multimedia Interaktif Materi Sistem Peredaran Darah Manusia Untuk Kelas V Sekolah Dasar," *JKTP J. Kaji. Teknol. Pendidik.*, vol. 5, no. 2, pp. 190–199, 2022.
- [4] H. Hotimah and A. Muhtadi, "Pengembangan multimedia pembelajaran interaktif IPA untuk meningkatkan pemahaman siswa pada materi Mikroorganisme SMP," *J. Inov. Teknol. Pendidik.*, vol. 4, no. 2, pp. 201–213, 2017.