MULTIMEDIA LEARNING AND SIMULATION THE PROCESS OF RESPIRATION IN HUMANS USING AUGMENTED REALITY

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ABSTRAK

In the current learning conducted by primary schools still use the conventional way IE still using regular method of the source material comes from the book the package. There are some subjects that when done conventionally make students become difficult to understand and Digest material presented by the teacher. As with any Natural Science subjects which is one of the lessons is compulsory for students. In the subjects of SCIENCE there are chapters that explain the process of Respiration in humans where the material given to students only see picture dibuku package only, without knowing the details of the process of Respiration in humans.

Keywords: *conventional, respiration, Process Simulation, Augmented reality, the Desktop.*

1. INTRODUCTION

Az-Zakiyah Islamic ELEMENTARY SCHOOL in Bandung, is an elementary school in West Java province which was established in 2003 and is a school that has a vision to form a personal character, to be critical, act in accordance of the Qur'an and As-Sunnah, witty with an insightful intellect. Az-Zakiyah Islamic ELEMENTARY SCHOOL located at Jalan Cijawura Girang IV No. 2 RT 004 RW 014, Kel. Sekejati Kec. Stone Fruit Of Bandung City.

In the current learning conducted by primary schools still use the conventional way IE still using regular method of the source material comes from the book the package. There are some subjects that when done conventionally make students become difficult to understand and Digest material presented by the teacher. As with any Natural Science subjects which is one of the lessons is compulsory for students. In the subjects of SCIENCE there are chapters that explain the process of Respiration in humans where the material given to students only see picture dibuku package only, without knowing the details of the process of Respiration in humans.

The results of research conducted by Sigit Triwibowo [1] explained that an increase in cognitive learning results students analytical study using computer simulations using media media realia (using real objects or props). These results indicate that this simulation using media learning improve understanding of students in learning.

In addition, from the interviews with teachers at the grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah Mother Nurhaningsih, noted that the average grade 5 students are indeed having difficulty in mastering and understanding the material and concepts from human respiration process that begins from the learning process that is hampered in the class, so the teacher must focus on a few students to teach material that has not been terkuasai well. So the process of teaching and learning in the classroom become stunted in the delivery of the material.

The problem of the decline in the quality of understanding students who haven't mastered the material process of respiration in humans, especially on a sub chapter of material that explains about the tools of human respiration, the process of breathing, the respiratory process concept, the difficulty in understanding the symptoms of disorders of the respiratory organs, as well as how to keep breathing tool on the grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah resulted in a decrease in the value under the KKM under 75 of highest grade 100 IPA on lessons.

Observation on the results of the grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah can note that media learning material that is used in the process of Respiration in humans besides the books are simple props to do practice in schools and conventional learning where the teacher is still a central in the learning process. A problem that often arises is the limitation of the number of props make not all students can try or do his experiments alone. According to research conducted by in the journal entitled "the use of the human respiratory system Props on the quality of Learning of JUNIOR HIGH SCHOOL Students of class VIII" explains that the use of props on the learning material of respiration

in humans can optimize the quality of teaching and learning in the classroom. [2]

The use of simulation models in learning by combining augmented reality (AR) is a desktop-based interactive learning media by utilizing facilities owned by Az-Zakiyah Islamic ELEMENTARY SCHOOL. The concept of learning is synonymous with learning realistic, i.e. learning using resources or media close to the lives of students. With the utilization of those concepts, expected teaching and learning in the classroom is becoming more focused, interactive, and students are more motivated in the delivery process of respiration in humans about the introduction of detailed drafting of the organs of the respiratory system using augmented reality so that students can understand the material taught in class. [3]

Based on the above issues, then a single multimedia learning and human respiration process simulation using AR-based desktop for grade 5 students at an Islamic ELEMENTARY SCHOOL Az-Zakiyah. Learning media development is expected to be alternative learning media to help students in learning by means of a more active and interactive.

1.1 *Augmented reality*

Augmented reality or the reality of the Indonesian Language in tertambah, is a technology that combines the two dimensional and virtual objects or three dimensions into a real three-dimensional environment and then projecting the virtual objects in real time, where the technology is going to decimate the line between what is real and what is a computer-generated so that we can see, hear, feel and smell. Ronald t. Azuma defines AR as an amalgamation of real objects and virtual on the real environment, run interactively in real time, and there is the integration of antarbenda in three dimensions, namely integrated virtual objects in the real world. Merging virtual and real objects is possible with the corresponding display technology, interactivity is possible via input devices. [10]

In applying the tools in the research done is use that augmented reality technology that has several components that must exist to support the performance of digital image processing. According to r. Silva, J as for these components is as follows:

a. Scene Generator

Scene Generator is a component of the duty to perform rendering the image captured by the camera. Virtual objects will be captured and then processed so that the object can then be shown. In a study conducted by inserting images of organs are lungs which became a markerless so bring up lung organ on android devices.

b. Tracking System

Tracking system is the most important component in augmented reality. In the process of tracking conducted a virtual object pattern detection with real objects so in sync between the two in terms of virtual projection with the projection of the real must be equal or close to equal so that affects the validity of the results that will be obtained. In a study conducted by selection of objects is a markerless, where the objects are identified by the system which then presented a picture of lung organ on the device.

c. Display

In the development of a system-based augmented reality where the system combines a virtual world and the real world there are some fundamental parameters to note, namely optical and video technology. Both have linkages that depends on resolution, fleksibiltas, point of view, the tracking area. There are limitations in the development of the technology of augmented reality in terms of the process of displaying objects. Are there should be a limitation of lighting, screen resolution, and the difference between the image lighting virtual and real image. In a study conducted of the distance of the camera to detect objects in the template are approximately 10 – 30 cm with the use of a camera that is at least 2 MP to detect objects in the template.

d. Augmented reality Devices

There is some type of media that can be used to display an object-based augmented reality by using optical, virtual retinal system, video Viewer, monitor-based augmented reality and augmented reality-based projector. In a study conducted by displaying the object is either a projector-based augmented reality in which way the work done is to detect objects or object comparison template to display objects from the image of the test or the target image on your android device.1.2 Metode-metode Augmentde Reality

There are several methods that are used in the AR do include the following:

1. The AR Marker (the Marker Based Trancking)

Marker is usually a square black and white illustrations with thick black and white background. The computer will recognize the position and orientation of the marker and created dunisa virtual Unity that is the point (0, 0, 0) and 3 axis (X, Y, Z). 1.2

2. Markeless AR

One method of AR which is developing Markerless AR is a method with this method, users no longer need to use a marker to display elements of digital displays.

3. Face Tracking

By using an algorithm that they develop, the computer can recognize human faces in General by way of recognizing the position of the eyes, nose, and mouth a human will ignore other objects around it such as trees, houses, and other objects. This technique has been used in Indonesia in Pekan Raya

Jakarta in 2010 and Toy Story 3: Event. The following Figure 2.5 is an example of face tracking.

4. Unity Object Tracking

Unlike the face tracking which only recognize a human face in General, Object Tracking techniques can mnegenali Unity all form objects that exist around the car, such as a tv, desk, men, and others.

5. Motion Tracking

In this technique the computer can capture the movement, Motion Tracking has been used extensively to produce films that try to simulate movement.

6. QR Code

According to Wikipedia, the QR code or QR Code is a form of evolution barcode from one dimension into two dimensions. The QR code was already very often used because of its ability to store data larger than the barcode so that it is able to encode information.

2. RESEARCH CONTENTS

2.1 Implementation and System Analysis

2.1.1 Analysis Problem

Analysis of the issue will explain about the problems that existed before the founding of a multimedia learning and aims to assist teachers in delivering the learning process of respiration in humans to elementary school children in particular children who are in grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah. Based on the analysis of a problem that has been done, there are two problems that occur, namely:

1. Grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah slow in mastering and understanding the material process of respiration in humans because of the learning process that is still konversional.
2. Decrease in activity as well as the quality of the students in understanding the material process of respiration in humans, especially in the matter of the introduction of the organs of respiration in humans, the concept of the process of respiration, symptoms and disorders of the respiratory and orga keeping human respiration organ.
3. Increased costs incurred by the school to purchase props needed by students in the delivery process of repirasi in humans.
4. The large number of grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah who don't focus so as to get the value from the exercise under the KKM reserved as well as daily repeats. (1)4. The large number of grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah who don't focus so as to get the value from the exercise under the KKM reserved as well as daily repeats. (1)

2.1.2 Analysis of Material

Analysis of the material will explain about the material-the material to be studied, i.e. material that is associated the introduction of human respiration organs, respiration in humans, symptoms and disorders that occur in respiratory organs in humans as well as how to keep the organs of respiration in humans.

1. The organs of Respiration

The organ is a collection of multiple networks to perform a specific function in the body while the body system is a combination of the organ – the organs of the body that runs the function. Whereas respiration according to Wikipedia is the organ system that is used for gas exchange. Respiration process generally includes the channels used to carry air into the lungs where gas exchange occurs. The diaphragm pulls the air entry and also took it out

a. the nose

The nose is an organ of respiration first traveled outside air, which passed the pit entrance and discharge of air respiration. The incoming air when breathing is called oxygen, while the air is expelled when breathing is called carbon dioxide.

b. Pharynx

The pharynx is the fork of two channels i.e. channel throat which is a respiratory tract and esophagus which is a digestive tract. The pharynx is started from the end of the nostril to the beginning of the larynx (larynx).

c. Larynx

The larynx is the voice box larynx with sound. The vocal cords are located on the wall of the larynx. Membrane vibrate if the noise will be blown away the air out of the lungs. On the larynx lies the base of valve throat (epiglottis) and bone-cartilage that forms the structure of the jakun. The epiglottis is useful to close the larynx during swallowing our food.d.

d. The trachea

Rod throat (trachea) located in front of the esophagus (food). Throat bone composed of rod-shaped rings of cartilage. The inner wall of the throat mucous membrane that their cells have a brunette shakes. The mucous membranes and the vibrating hair serves to hold and pull out the air dirty (dust) in order not to get into the lungs.

e. Bronchus

Branch trunk throat (bronchial) is composed of bone-cartilage ring-shaped. Bronchial branching from the trachea, is branching into 2 IE to the right toward the right lung and the left lung left. In the lung bronchi branches into bronkiolus to each lung lobe.

f. Bronkiolus

Branches stems throat (bronkiolus) takes a branching in accordance with the amount of lung Wattle. Bronkiolus to the right lung branching 3,

while the left lung branching 2. Bronkiolus is a branch of the bronchi, the walls are thinner and thinner its channels. At the end of bronkiolus there are bubbles very small called alveoli. [15]

g. the lungs

Lungs (pulmo) located inside the chest cavity above the diaphragm (the boundary between the thoracic and abdominal cavities). The diaphragm is the boundary limiting body cavity the cavity of the chest with the abdominal cavity. The lungs of a human being there is a pair, the right and left. On the left side consists of 2 Wattle (lobes), while on the right consists of 3 Wattle. Lungs are encased by a membrane of the lung (pleura).

There are two layers of the pleura and between them was filled by a liquid. The liquid is useful to protect the lungs from friction when the inflate and deflate. Inside the lungs there is important that allow the occurrence of air exchange (oxygen and carbon dioxide), namely the alveoli.

2. The process of Respiration in humans

Entry and discharge of air from the lung respiration was the result of work the chest muscles and muscle diagfragma. Diagfragma is the boundary between the thoracic and abdominal cavities. Based on the muscle that set out the influx of air, respiration respiration differentiated into the chest and abdominal respiration.

a. Chest Respiration

Respiration is respiration involving chest muscle antartulang the ribs. The mechanism can be distinguished as follows:

1. Phases of the inspiration.

This phase in the form of berkontraksinya muscles between the ribs so that the enlarged chest cavities, as a result of pressure in the chest cavity become smaller than the pressure outside so that outside air rich in oxygen in. ..

2. Phase ekspirasi.

This phase is the phase of relaxation or the return of the muscle between the ribs to its original position which followed by the descent of a thoracic rib cage so that it becomes small.

b. Abdominal Respiration

Abdominal respiration is respiration involves the muscles of the diaphragm. The mechanism can be distinguished as follows.

1. Phases of the inspiration.

This phase in the form of muscle berkontraksinya the diaphragm so that the enlarged chest cavities, as a result of pressure in the chest cavity become smaller than the pressure outside so that outside air rich in oxygen in. ..

2. Phase ekspirasi

This phase is the phase of relaxation or muscle diaframa return to its original position which followed by the descent of a thoracic rib cage so that it becomes small.

3. Disorders of the Respiratory Organs in humans

Human respiration organ is one of the organs that work with done continuously as long as we live.

a. Emphysema

Emphysema is a disease whose main symptom is narrowing (obstruction) of the airway, due to airbags in excessive bulging and lung damage.

1. Symptoms of this disease include:
   a. At the beginning of the symptoms similar to chronic bronchitis.
   b. Breathless accompanied with a sound like a whistle.
   c. Chest shaped like kegs, neck muscles seem to stand out, the sufferer to bend.
   d. The lip looks bluish.
   e. Weight decreased due to decreased appetite.
   f. Chronical Coughs.
2. The cause include:
   a. Chronic Bronchitis related to smoking.
   b. Suck smoke or dust.
   c. Influence of age.

b. Asthma

Asthma is a disorder in the form of respiration tract obstruction caused by allergies, such as dust, feathers, or hair. These abnormalities can be lowered. This disorder can also be a relapse if the environmental temperature is low enough or cold.

c. Lung cancer

This disease is one of the most dangerous. The cancer cells in the lungs continue to grow uncontrolled. This disease can gradually invade the entire body. One of the triggers of lung cancer is smoking habit. Smoking can trigger the onset of lung cancer and lung damage.

d. Tuberculosis (TBC)

Tuberculosis is a lung disease caused by Mycobacterium tuberculosis. These bacteria cause irregular nodule on the walls of the alveoli. If the disease is attack and left the more broadly, can cause cell lung cells die.

e. Bronchitis

Bronchitis is a disruption on laryngeal branch due to infection. The symptoms are the sufferers experiencing fever and produce mucus to clog the stem of the throat. As a result of sufferers experiencing shortness of breath.

f. Influenza (Flu)

Is the disease caused by the influenza virus. These diseases arise with symptoms of headache, fever, frequent sneezing, coughing, runny nose, and sometimes accompanied by vomiting

g. Pneumonia (whooping cough, cough or a hundred days)

Pneumonia (United Kingdom: pneumonia) is a disease of the lungs in which the alveoli (alveoli) are responsible for absorbing oxygen from

the atmosphere is inflamed and filled by fluid. Pneumonia can be caused by a number of causes, including infection with bacteria, viruses, fungi, or pasilan (parasites).

4. Maintaining healthy organs of Respiration

Given the importance of respiration for our lives, we must always try to preserve the health of the organs of respiration. The efforts that we need to do to avoid disruption on the respiration organs namely:

a. Avoid smoking

Cigarette smoke is not only harmful to the smoker, but also very dangerous for those around the smoker.

b. keep the air circulation in the House

A healthy home is one of the requirement should have enough ventilation so that the air in the House, that we use to breathe in when we are in it can always change with a new, more fresh air.

c. Avoid places that are exposed to air pollution

Places like the trash, the edge of the highway, the area around the factory air is not good for our health because mengendung many harmful gases.

d. Use a mask

When we got to be where the air is polluted, for example when using pesticides, riding a motorcycle, or repainting, we should use a mask to reduce the disorders of the respiratory organs.

2.1.3 Analysis of Method

Markerless Augmented reality, then the use of the marker as a tracking object that had spent a space, will be replaced by images, or any surface that contains with the text, logos or pictures as a tracking

Object in order to directly involve the tracked object so it can be seen live and interactive, also no longer reduces the efficiency of the space with a marker.

Markerless tracking, the camera position and orientation of the camera is calculated between the camera and the real world without any reference, using only dots natural features (edge, corner, line or 3D models). Markerless methods require the model or reference image for initialization. Here are the stages of reading

Markerless on Markerless Augmented reality method in Figure 1:

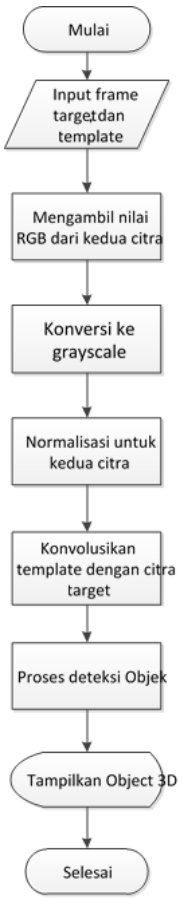


Figure 1 Concept of Detected Object

The following explanation is an overview of the system to be built in Figure 1:

1. The user turning on a camera that will be used as the test image (the target image) and the image will be detected/made a template (as a reference).

2. The image of the form RGB image. Take the value of GRB from both the image.

3. A color image is converted into an image of keabuan (grayscale). To obtain information from intensity images, so you can sort ranging from black for the weakest intensity to white with the intensity of the most intense, and then get the value of the grayscale from the image respectively.

4. The normalization of this second stage, the image later in the normalisasikan using the appropriate normalization stages with Normalized method cross corelation.

5. Konvolusi, at this stage of the konvolusi process is performed where the image was manipulated using external mask/windows to generate a new image. At this stage of the Normalized cross corelation methods do.

6. The process of Matching, after getting the value of the new image of konvolusi matrix of the next stage is the process of matching. That is the process of matching or similarities between the test and the image with the image of the template.

7. Outpunya form of imagery that is already detected the object sought is appropriate.

2.2 Result

The results obtained from the use of Multimedia Learning and Human Respiration process simulation Using Augmented Reality-based Desktop with case studies in Islamic ELEMENTARY SCHOOL Az-Zakiyah is helpful in the process of teaching and learning in the classroom so that students are effective in the learning process.

2.2.1 Result of The Program



Figure 2 Display Main Menu

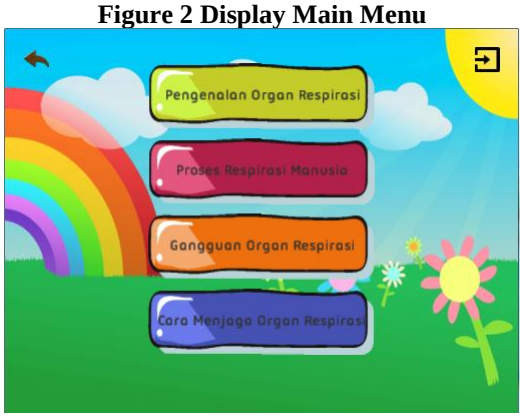


Figure 3 Display Material Menu



Figure 4 Display One of The Material Introduction Respiratory System



Figure 5 Display One of The Exercise Introduction Respiratory Organs



Figure 6 Display Login



Figure 7 Display Login Menu

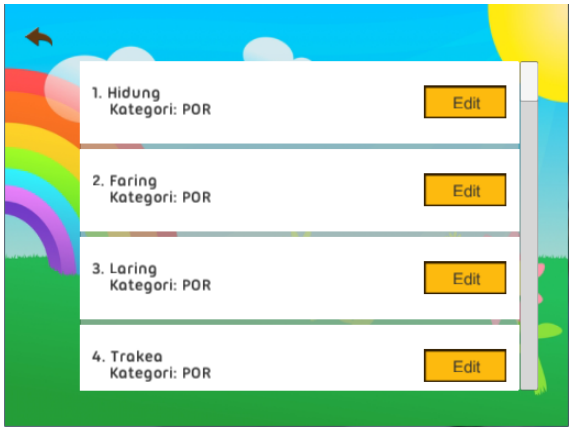


Figure 8 Display Edit Material



Figure 9 Display Edit Exercise

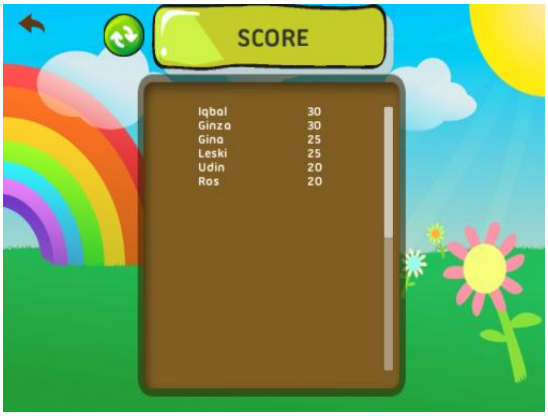


Figure 10 Display View Score



Figure 11 Display Simulation Menu

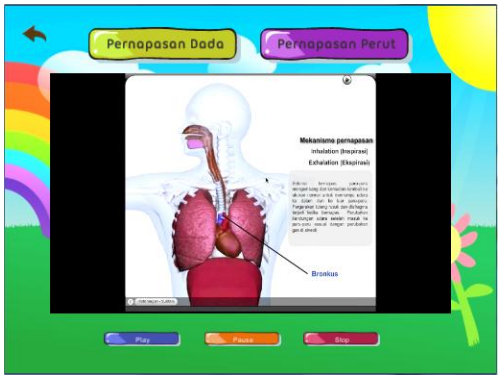


Figure 12 Display One of The Simulation Menu



Figure 13 Display Testing Menu



Figure 14 Display Tampilan Question Testing

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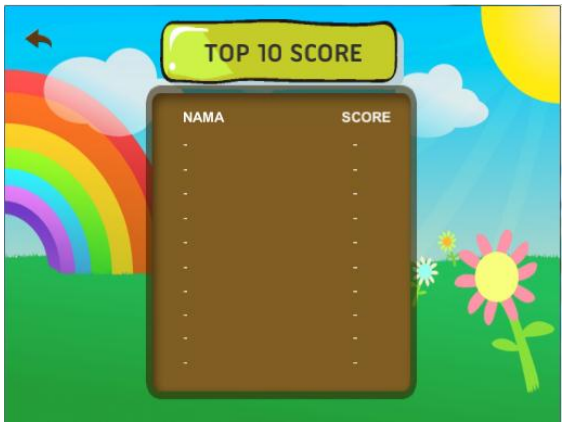


Figure 15 Displau Testing Score

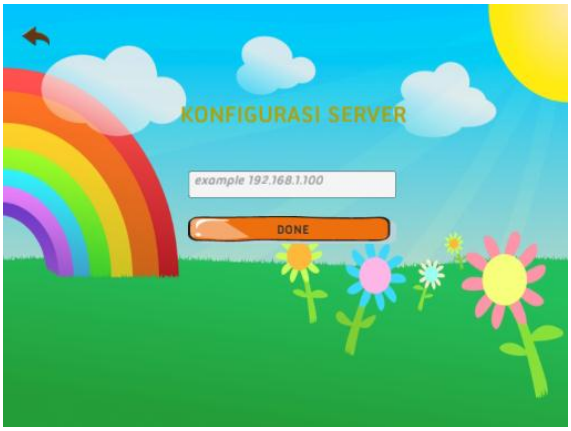


Figure 16 Display Setting IP Address



Figure 17 Display Augmented Reality Menu

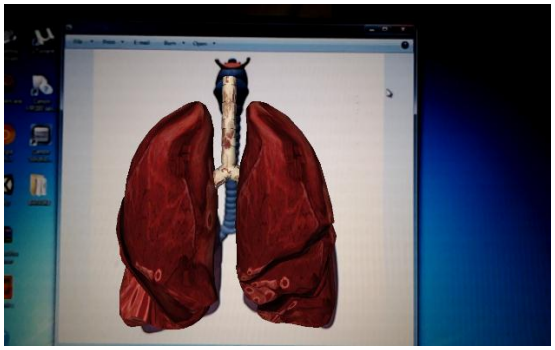


Figure 18 Display Start AR Menu

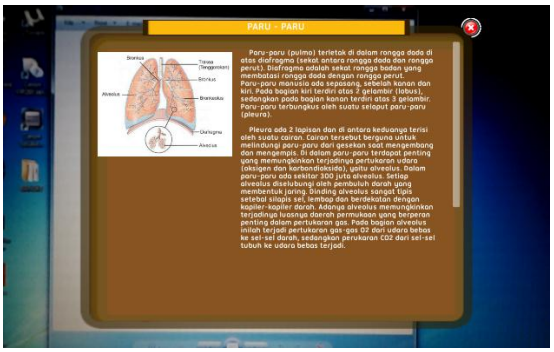


Figure 19 Display Organs Respiration Info



Figure 20 Display How To Use Menu

3. CONCLUDING

3.1 Conclusion

Based on the results of the implementation and the testing that has been done, then the obtained conclusions of the thesis entitled "the development of Multimedia and simulation process of Respiration in humans Using a Desktop-based Augmented reality (a case study of grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah)" that is as follows:

1. Learning multimedia application that has been built up can help students more quickly in mastering and understanding the learning material with a interaktid and how to study effectively.
2. Multimedia Learning and simulation that has been built up can increase the activity and the quality of the student's understanding of the material against the process of respiration in humans at the grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah.
3. The use of the simulation on the application of multimedia learning can help in providing an alternative media viewer in the process of respiration in humans besides the facilities already provided by the school.
4. Development of multimedia learning and simulation can increase the value of the KKM grade 5 ELEMENTARY SCHOOL Islam Az-Zakiyah in matter of human respiration process of the results of the exercise test and problem solved. So that it can increase the overall value of Natural Science subjects are taught in school.

3.2 Saran

In Multimedia Builder learning and human Respiration process simulation Menggunak Desktop-based Augmented reality is still far from perfect and still has drawbacks. Therefore, he had to do the development and further refinement in order to meet the needs of users who are increasingly growing. As for the suggestions towards the development of multimedia learning this for the future are as follows:

1. Using the display of the moving image as well as expand simulation about the process of respiration in humans.
2. Development of augmented reality based android because of limited library contained on the Unity 3D.
3. Development of 3D models in augmented reality menmapilkan objects from the organ's lungs are not yet showing in keselurauhan of the respiratory organ because of the limitations of the 3D model.

BIBLIOGRAPHY

[1] A. A. I. D. P. N. Sigit Triwibowo, "Perbandingan Hasil Belajar Kognitif Siswa Menggunakan Media Komputer dan Media Simulasi Realia," vol. 1, 2013.

[2] N. R. U. P. W. Nurfa Anung Anidityas, "Penggunaan Alat Peraga Sistem Pernapasan Manusia Pada Kualitas Belajar Siswa SMP Kelas VIII," Unnes Science Education Journal, 2012.

[3] R. Hadipratama, "Sistem Pernafasan Manusia, Magic Book, Multimedia Presentasi Pembelajaran Berbasis *Augmented reality* untuk Sistem Pernafasan Manusia dalam Mata Pelajaran Biologi di SMA Angkasa Bandung," 2014.

[4] E. Zuriyani, "Penerapan Model Simulasi Pada Diklat Guru Mata Pelajaran IPA MI," 2012.

[5] B. Warsita, Teknologi Pembelajaran : Landasan dan Aplikasinya, Jakarta: Rineka Cipta, 2008.

[6] I. Sommerville, "Software Engineering 8," in (Rekayasa Perangkat Lunak), Addison-Wesley, 2007.

[7] I. Sommervile, "Software Engineering, 9th ed," Boston, United States of America: Adison-Wesley, 2011.

[8] M. R.Lyu, Digital Interactive Game Interface Table Apps, Hongkong: Chinese University of Hongkong, 2012.

[9] M. Prof. Dr. Azhar Arsyad, Media Pembelajaran, Depok: RajaGrafindo Persada, 2013.

[10] S. Prihatiningtyas, T.Prastowo and B.Jatmiko, "Implementasi Simulasi PhET dan KIT Sederhana Untuk Mengajarkan Keterampilan Psikomotor Siswa Pada Pokok Bahasan Alat Optik," Pendidikan IPA Indonesia, pp. 18-22, 2013.

[11] K. T. Martono, "*Augmented reality* Sebagai Metafora dalam Teknologi Interaksi Manusia dan Komputer".

[12] M. a. S. M. T., "Review article: An Overview of Template Matcing Technique In Image Processing," Research Journal of applied Science Engineering and Technology, 2012.

[13] d. Iwan Setya Nugraha, "Makalah Seminar Tugas Akhir," Pemanfaatan *Augmented reality* Untuk Pembelajaran Pengenalan Alat Musik Piano.

[14] H. Jogiyanto, Analisis dan Desain Sistem Informasi : Pendekatan Terstruktur Teori dan Praktik Aplikasi Bisnis, Yogyakarta: Andi, 2005.

[15] M. Dr. HM. Musfiqon, Pengembangan Media dan Sumber Pembelajaran, Jakarta: Prestasi Pustakaraya, 2012.

[16] B. S. L. Djati, "Simulasi Teori dan Aplikasinya," Yogyakarta, Andi, 2007.

[17] R. T. Azuma, "A Survey of *Augmented reality*," pp. 355-385, 1997.

[18] M. Ali, Guru Dalam Proses Belajar Mengajar, Bandung: Sinar Baru Algesindo, 1996.

[19] Fatansyah, Basis Data, Bandung: Informatika, 1999.

[20] K. Teguh Purwantari, Ilmu Pengetahuan Alam 5, Jakarta: Pusat Perbukuan Kementerian Pendidikan Nasional, 2010.

[21] Sugiyono, Metodologi Penelitian Kuantitatif Kualitatif dan R&D, Bandung: Alfabeta, 2010.

[22] E. W. Heri Sulistyanto, "Ilmu Pengetahuan Alam," Jakarta, Pusat Perbukuan, Departemen Pendidikan Nasional, 2008.