LEARNING APPLICATION DEVELOPMENT ELEMENTARY SCHOOL CHILDREN USING TECHNOLOGY AUGMENTED REALITY-BASED ANDROID

Kevin Ajudia

Universitas Komputer Indonesia
Jalan Dipatiukur No. 112-116, Coblong, Lebakgede, Bandung, Kota Bandung, Jawa Barat 40132
E-mail : kevudia@gmail.com

ABSTRACT

SDN Sukapura is a public school located in the city of Bandung which had stood since 1977 this was the level of education the basis for formal education in Indonesia, on this level, students will learn to be creative, and their imagination. The material is taught using thematic books with curriculum 2013, one of the subjects taught are IPA but learning methods used are still a common learning process orally that is still less attractive and interactive.

To overcome these problems, in this writer's thesis research on building a learning-based IPA media applications android Augmented Reality technology which implements using a markerless method, by applying the technology of Augmented Reality learning media on IPA allows users can learn in ways that are more interesting and interactive. In the technology of Augmented Reality library uses library Vuforia, library Vuforia yourself using the method where the target image markerless used no longer uses black and white colored marker, the marker can be are assortment.

Based on the results of testing against this Augmented Reality technology utilization can be drawn the conclusion that, applications that use this interesting Augmented Reality Technology for use.
Keywords: Augmented Reality, The nature of science, Learning, Android, Markerless

1. Introduction

SD Negeri Sukapura 1 and 2 is the Elementary School which is located in the eastern part of Bandung Manglayang 1 Street Neighborhood Palasari Subdistrict Cibiru Bandung SD Negri Sukapura already stood in 1977.
Based on interviews with Mr. Suryana as school principal and Ms Tite as master class 5 SDN Sukapura in learning which is done in the classroom still uses the book as a medium of instruction, students have difficulty with the method of thematic learning due to this thematic learning method in which in one theme, there is some material at once.
This Augmented Reality 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, which is where this technology can display information-information that cannot be displayed by the book, whether it is information in the form of a two-dimensional object and or three dimensions.

In IPA itself there are foreign words are difficult to understand by students, either teachers or students can be inhibited in the ongoing learning process thus students need learning media interest.

Application by applying the technology of Augmented Reality (AR) Android-based since almost the entirety of the students have a smartphone to ease in applying this application, compared denganan desktop based applications that require a computer and a webcam as the supporting media applications, and also for the elderly may also accompany her child in the learning process when using a smartphone.

Of the problems that have been outlined in the learning process required an interactive device so that students can easily understand a subject, as well as have an easy to use wherever and kapapun, then that application-based smartphones to become a medium that is easy to use by students.

Based on the background thus researchers intend to utilization of the technology of Augmented Reality (AR) for elementary school children learning an interactive. As for the title of the research that will be raised is "APPLICATION DEVELOPMENT LEARNING ELEMENTARY SCHOOL CHILDREN by USING the TECHNOLOGY of the AUGMNTED REALITY-BASED ANDROID".

1. CONTENT of the STUDY

Chapter 1

1.1 Goal and purpose

The intent of the research done that is to build an android-based applications by using the technology of Augmented Reality (AR) as a medium of instruction for students ELEMENTARY learning especially in the natural sciences (IPA). To facilitate students in receiving the information difficult to understand by 2D image only.

As for the goal to be achieved from building android-based applications by using the technology of Augmented Reality (AR) as the medium of instruction is as follows.

1. a. assist students in understanding learning IPA.
2. b. Creating an interactive learning.
3. c. Give infromasi a book can't give.

1.1 Research Methodology

Research methodology is the unity of the methods to solve the problem of research systematically and logical need data to support the implementation of the research.

Research methodology the author use in application development learning 5th grade elementary school children by using the technology of Augmented Reality (AR) this android-based research is descriptive research methodology which is one type of methodology that seeks to describe the objects according to what it is, with a descriptive research methodology is also a data collection to test the question researchers associated with circumstances and events now.

1.3 Methods Of Data Collection

Method of data collection is done is interview techniques, observation, and study of literature.

- interview conducted in the form of question and answer session conducted by the author with the place of research as a resource to determine the problems encountered.
- Observation done by looking at where the research is taking place concerning the needs of whatever it takes.
- the literature in this step the author collects related journals regarding the problems occurred, the methods used, as well as handling issues like what.

1.4 Software Development Method

Development of multimedia method is done based on six stages, i.e. concept (mengkonsepkan), design (design), collecting material (material collection), assembly (manufacturing), testing (testing), and distribution (distribution). The sixth stage is not necessarily sequential in practice, these phases can exchange position. However, the concept should be the first thing done:

• the concept

The stage concept (the concept) that determines the goals and who are the users of the program (the identification of the audience), the range of applications (presentations, interactive, and others), the purpose of the application (information, entertainment, training, etc.), and general specifications. The purpose and the end user of the program effect on the feel of multimedia as a reflection of the identity of the organization that wants the information to the end user.

• design

Design (design) at this stage. The specifications made quite detailed so that at a later stage, i.e. collecting materials and assembly of the new decision is not required, but using what is already determined at the stage of design, of which the desaign is easy to understand by all users.

• Collection Materials

at this stage where the author finding and creating materials that will be used in the development of the application of learning the IPA for the students.

• the making of

At the stage of making all multimedia materials or objects

• Testing

This stage of testing (testing) done after the completion of the stage of manufacturing (assembly) and run the application/program and see if there are any errors or not. The first phase at this stage, also known as the alpha testing phase (alpha test) which is done is done by the maker or the maker's own environment. After the escape from the alpha testing, beta testing involving the end user would do.

• Distribution

This stage of the application will be stored in a storage medium. This stage may also be called stage evaluation for the development of products that are already so that it might be better. The results of this evaluation can be used as input to the next stage in the product concept.

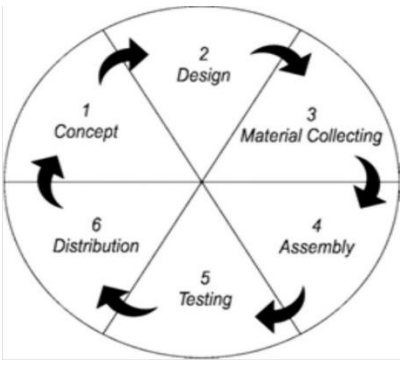


Image 1. Model Multimedia Development life Cycle

Chapter 2

2.1 Primary School

According to the Ministry of education and culture of primary school (elementary school) is the most basic level of formal education in Indoneia. The elementary school is 6 years, starting from grade 1 to grade 6. Basic school graduates can continue their education to junior high school (or the equivalent).
Basic general school students aged 7-12 years. In Indonesia, every citizen aged 7-15 years compulsory basic education, i.e. the following elementary school (or equivalent) 6 years and junior high school (or the equivalent) 3 years.

Elementary School held by the Government and private. Since the enactment of regional autonomy in 2001, the management of the elementary schools of the country (SDN) in Indonesia that had previously been under the Ministry of national education has now become the responsibility of local government district/city. Whereas the Ministry of national education is only acting as a regulator in the field of education standards. Structurally, the elementary school the country is implementing technical education service district/city.
In the legislation of the national education system (Law Number 8 of 2001) article 17 defines basic education as follows:

- basic education is secondary as informing secondary education level.
- basic education shaped primary school (elementary school) and madrasah ibtidaiyah (MI) or other forms of equal as well as middle school (JUNIOR HIGH) and MTS (Mysterious), or any other form of equal.

2.2 Learning

According to Slamento (2003:5) he states that the self-study process suaru is work done to a person to obtain a new behaviour change as a whole, as a result of his own experience in interaction with the environment. According to Darsono (2002:24-25) he states that generally describes the notion of learning as an activity conducted by the teachers in such a way so that the student's behavior changed towards the better, and also according to Arikunto (1993:12) suggests that learning is an activity containing the occurrence process mastery of knowledge, skills and attitudes by the subject that is being studied. Versus statutory national education system number 20 of 2003 States that "learning is the process of interaction with educators and learners learning resources in an environment of learning". Then dilanjut again with Aunurrahman (2010:35) he concluded that learning is a conscious effort made by the individual in good behaviour change through training and experience relating to aspects of cognitive, affective, and pisikomotorik to obtain a particular purpose.

1. Cognitive

The cognitive domain which is mencangkupi in itself is a mental activity (brain). All efforts related to brain activity is included in the cognitive domain. In the cognitive domain, there are six aspects, namely:

- **knowledge**
  Rote knowledge/students to a material
- **Understanding**
  Students ' ability to understand a material, while the learning process
- **the application of the**
  Implement of processes and learning activities have been conducted
- **Analysis**
  Students ' ability in analyzing or draw conclusions from material
- **Synthetic**
  The ability of the students in integrating parts of the separate became a Union.
- **Assessment**
  Students ' ability in conducting its own assessment of whether it is against the material taught in school.

The purpose of this own cognitive aspect-oriented enough to think the ability mencangkupi a simpler intellectual ability, that is given to the ability to solve problems which, according to the students to connect and incorporate some of the ideas or ideas that learned to solve the problem.

2. Affective

The affective domain is associated with attitudes and values. Affective domain includes character behavior such as feelings, interests, attitudes, emotions, and values, the realm of affective becoming more detailed again into five level, namely:

- Pay attention to the
- reaching
- Appraise or appreciate
- Set

3. Pisikomotorik

Pisikomotorik is a domain that is related to the skills (skill) know the ability of acting after someone received a particular learning experience. Psychomotor learning results is actually a continuation of the cognitive learning outcomes (comprehend something) and affective learning outcomes and (the new look in the form of inclinations to behave).

2.3 Natural Sciences

According to Usman Samatowa (2006) posited four reasons including science in the elementary school curriculum are:

- the science that will benefit the people of the nation, need not be questioned at length. Material prosperity of a nation depends greatly on the ability of the nation in the fields of science, because science is the Foundation of technology, often cited as the backbone of sustainable development. Basic knowledge of technology is a science. People do not become a

good electronics engineer, or a doctor, without ample basis on various natural phenomena.

- When science is being taught the right way, then science is a subject which provide opportunities for critical thinking: for example, science was taught by following method "found themselves" with these kids are faced with a problem, for example, can be considered as a matter of "can live without plants leaves?". Children are asked to find and investigate it.
- When the science is taught through experiments carried out by children. Then science is not a subject where the mere memorization
- these subjects have a values education has the potential to help children overall personality.

2.4 learning methods

Computer-assisted learning is taken from the term Computer Aided Instruction (CAI). According to Herman d. Sujono in Idris (2008:1), the term CAI (Computer Aided Instruction) refers to all educational software that is accessed through a computer.

Computer-assisted learning is the application of computers as an integral part of the learning process in the system of learning and teaching which aims to assist students in their learning through a two-way interaction patterns via computer terminals or multidirectional expanded via computer networks (local or global) as well as expanded functionality through interfaces (interfaces) multimedia.

Technological development especially in the field of information technology is increasingly rapidly and increasingly tight competition requires that educators should be more innovative in the optimization process of learning. That's necessary for computer-based learning systems.

Trianto (2011:22) suggested that: the Learning Model is a planning or a pattern that is used as a guide in planning the learning in the classroom or in the tutorials and learning to determine learning tools including books, movies, computers, curriculum and more.

2.5 characteristics of the Learning Model

Trianto (2011:23) suggested the term learning model has a wider meaning than the strategies, methods or procedures. The learning model has four traits that are not owned by the strategy, methods or procedures. These traits are:

- theoretical Rational logical compiled by the creator or developer.
- the cornerstone of thought about what and how students learn (learning objectives to be achieved).
- teaching a behavior required in order that the model can be implemented successfully.
- a learning environment which is needed so that the learning objectives that can be achieved.

2.6 the Learning Model

The approach of classical learning by using method of speaking engagements to date are still very liked by the teacher because it has several advantages compared to other methods. Lecture methods advantages among other things frugal in the use of time and media, in addition it is also practical and economically in delivering learning content. Methods lectures, teachers will be easy to control the speed of teaching so it is easy to determine when the completion of the delivery of the whole content.

But admittedly not always learning by using the method of lecture can last well. Negative symptoms that often complained of teacher is the students become quickly bored and didn't pay attention to the material diceramahkan. Students talk with his friend each other regardless of the teachers who were lecturing the class view is unusual. Given the existence of weaknesses in learning using teachers as main source of learning, then there needs to be an effort to overcome these weaknesses.

Based on some theory and empirical studies, to address the use of information technology (it) in the learning is considered one of the corresponding resolution. Whatever its form, the utilization of IT in learning tradition or culture change brings learning. Utilization of IT in learning learning system can be a standalone (independent Instructor) or also combined in the learning process direct (face-to-face classes) that rely on the presence of the teacher. Computer-based learning is learning to use the computer as a tool. Through this learning materials presented through the medium of the computer so that the activities of teaching and learning become more interesting and challenging for students.

2.7 the importance of Computer-based learning

Learning problems associated with slowness of understanding of students against the concept of the theory if it is left unchecked, the effectiveness and the efficiency of learning. In the end, this will result in a low learning achievement of students. Therefore need to look for a systematic way in order to increase the effectiveness and efficiency of instruction. One of his efforts is to develop computer-based learning model. With computer-based learning, students will more easily understand the subject matter refers to the issue above, the Vedas (2011:208) describes the development of computer-based learning is very important for teachers, students and schools. Here will be described one by one

- **for teachers**
  a) more teachers will act as facilitator for students.
  b) Gives an alternative variation of learning methods.
  c) Help develop learning media, because not all teachers have the creativity and time to do it.
  d) give guidelines for further development.
  e) Minimize the level of misunderstanding the concept/theory that is often experienced by

students so that learning effectiveness and efficiency can be achieved optimally.

• for students

a) students will be easier and quicker to understand the learning material that is abstract, because the concept/theory that is the abstract will be served carefully and concrete, so easily captured by the five senses.

b) was able to increase the motivation of learning students during the learning process.

c) Enhance student learning outcomes.

d) control of learning so that students are at a speed of learning can be tailored to the level of their ability.

e) can accommodate students who are slow in being able to create an effective climate in a way that is more individual.

• for schools

a) with a computer-based learning model is developed, then in schools.

b) will be available materials that have been validated in accordance with the field of study so that each teacher can use with ease

c learning content development) will be in accordance with the fine points of discussion.

d) as a guide to practical implementation of learning in accordance with the conditions and characteristics of the learning.

2.8 Unified Modeling Language

Unified Modeling Language (UML) is a method for visually modeling means of object-oriented design grid, or in other words the UML itself as a language that has become the standard on visualization, designing, and documenting software systems also. In the UML standard provides a system that includes a business concept, writing classes, database schema, and components needed by the software. There are a few diagrams used in the UML modeling:

1. Use Case Diagram

Use Case Diagram is modeling for behavior (Behavior) system, use case diagram, the governing of an interaction between one or more actors. In the graph illustrates the interaction between the user and the system, in this use case is described to anyone who will use the system to be built. In a development application may also have more than one or more use case depends to the needs of the system is required, the system needs or functionality provided by the system will be documented on the creation of a model that will describe the use case needs what is needed in the development of application system.

2. Activity Diagram

Activity diagrams describe an activity in the system that is being designed, or a business process or a menu that will exist in the software that made, in the Activity diagram describes the activities of the system itself is not what is done by the actors.

3. Class Diagram

Class diagrams describe the structure of the system in terms of the definition of the classes that will be created to build the system. The class has attributes and methods (operations). The attribute represents the variables belonging to a class. Methods (operations) functions belonging to a class. The arrangement of the structure of a good grade on a class diagram should have the main class, class view, controller class, as well as the model class.

Chapter 3

3.1 the user needs

Analysis of the users intended to know anyone the user application to be built, then from that analysis of the users need to do analysis, Analysis of user needs on the application meant to know the actors involved in the use of this system. Who are the users of this system of learning media, among others:

Table 1. Analysis of user needs

User	Hak Akses	*User Experience*
Teachers.	Using the learning Media	can use Smartphones.
Student	Using the learning Media	a. can use Smartphone b. the smartphone application can use .

Chapter 4

4.1 Sekenario Beta testing

A detailed questionnaire distributed to 30 respondents. From the results of the questionnaire will do the calculations to be taken towards the conclusion of the assessment of the implementation of the new system. This questionnaire consists of 6 questions (sample questionnaire can be diliihat in the appendix). The question that arises on the beta test is as follows:

• Questions

1. Do you think learning applications using this easy to use AR?
2. What are the application based on this AR technology makes it easy to get the information?
3. is the application of learning using this Interactive AR?
4. is the utilization of this AR technology can help in learning the IPA
5. are applications that use this interesting AR technology for use in learning?
6. do you agree in using the AR technology learning activities?

Tabel 2. Scale Questionnaire Answers

Value	Description
5	Strongly Agree
4	Agree
3	Regular Course
2	Do Not Agree
1	Strongly Disagree

Based on the results of the questionnaire data, look for a percentage of each question. Results of questionnaire data calculation is as follows:

$$Y = \frac{P}{Q} \text{ X } 100\% \quad (1)$$

Description:
Y = Value Percentage
P = total Score obtained
Q = highest value multiplied by the number of respondents (5 x 30 = 150)

Tabel 3. The Results Of The Questionnaire Submission No. 1

Option	Description	Value	Frequency Answer	Score
SS	Strongly Agree	5	25	125
S	Agree	4	5	20
BS	Regular Course	3	0	0
TS	Do Not Agree	2	0	0
STS	Strongly Disagree	1	0	0
Total			30	145

Based on the results of the percentage obtained i.e. amounted to 96.6% of the expected 100%, then it can be concluded that the application of the media learning for elementary school children is easy to use, which is a result of the respondent can be categorized very agree. Criteria for the interpretation of the percentage can be seen in Figure
.

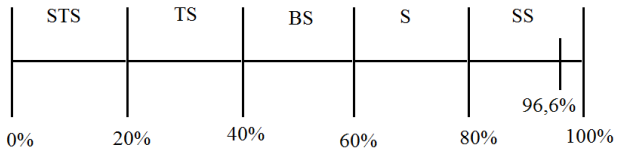


Image 2. Criteria For The Interpretation Of The Answers 1

Tabel 4. The Results Of The Questionnaire Submission No. 2

Option	Description	Value	Frequency Answer	Score
SS	Strongly Agree	5	18	90
S	Agree	4	12	48
BS	Regular Course	3	0	0
TS	Do Not Agree	2	0	0
STS	Strongly Disagree	1	0	0
Total			30	138

Based on the results of the percentage obtained i.e. amounting to 92% of the expected 100%, then it can be concluded that the application of the media learning for elementary school children this ease in getting infromasi, which results from respondents

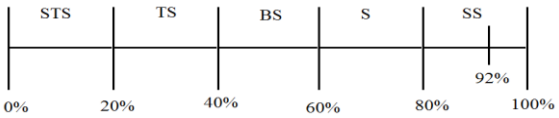


Image 3. Criteria For The Interpretation Of The Answers 2

Tabel 5. The Results Of The Questionnaire Submission No. 3

Option	Description	Value	Frequency Answer	Score
SS	Strongly Agree	5	17	85
S	Agree	4	10	40
BS	Regular Course	3	3	9
TS	Do Not Agree	2	0	0
STS	Strongly Disagree	1	0	0
Total			30	134

Based on the results of the percentage obtained i.e. amounting to 89.3% of the expected 100%, then it can be concluded that the application of the media learning for elementary school children is interactive, which results from respondents are categorized very agree. Criteria for the interpretation of the percentage can be seen on the image.

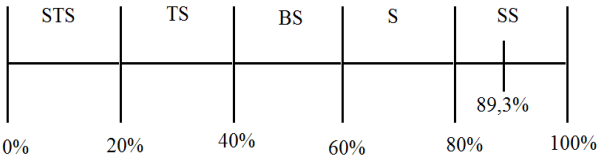


Image 4. Criteria For The Interpretation Of The Answers 3

Tabel 6. The Results Of The Questionnaire Submission No. 4

Option	Description	Value	Frequency Answer	Score
SS	Strongly Agree	5	21	105
S	Agree	4	9	27
BS	Regular Course	3	0	0
TS	Do Not Agree	2	0	0
STS	Strongly Disagree	1	0	0
Total			30	132

Based on the results of the percentage obtained i.e. amounting to 88% of the expected 100%, then it can be concluded that the application of the media learning for elementary school children can help in learning the IPA, which results from respondents are categorized very agree. Criteria for the interpretation of the percentage can be seen on the image.

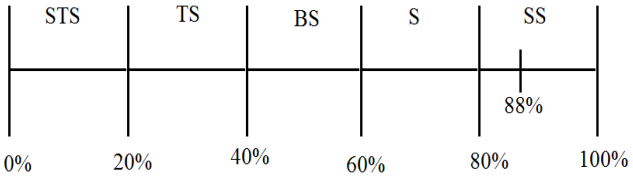


Image 5. Criteria For The Interpretation Of The Answers 4

Tabel 7. The Results Of The Questionnaire Submission No. 5

Option	Description	Value	Frequency Answer	Score
SS	Strongly Agree	5	26	130
S	Agree	4	3	12
BS	Regular Course	3	1	3
TS	Do Not Agree	2	0	0
STS	Strongly Disagree	1	0	0
Total			30	145

Based on the results of the percentage obtained i.e. amounted to 96.6% of the expected 100%, then it can be concluded that the application of the media learning for elementary school children is attractive for use in learning, which is a result of the respondent can be categorized very agree. Criteria for the interpretation of the percentage can be seen on the image.

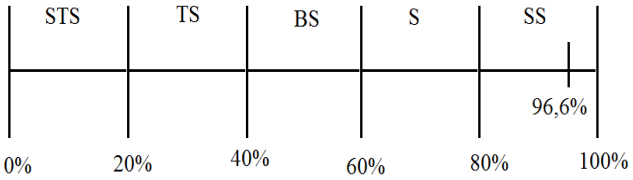


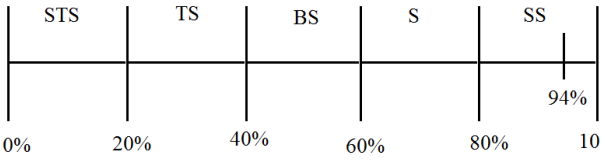
Image 6. Criteria For The Interpretation Of The Answers 5

Tabel 8. The Results Of The Questionnaire Submission No. 6

Option	Description	Value	Frequency Answer	Score
SS	Strongly Agree	5	18	90
S	Agree	4	12	48

BS	Regular Course	3	0	0
TS	Do Not Agree	2	0	0
STS	Strongly Disagree	1	0	0
Total			30	138

Based on the results of the percentage obtained namely by 4% from the expected 100%, then it can be concluded that the application of the media learning for elementary school children is used in learning activities, which results from respondents are categorized very agree. Criteria for the interpretation of the percentage can be seen on the image.



Gambar 9. Criteria For The Interpretation Of The Answers 6

3. COVER

Conclusion

The results obtained from the research done in preparing the thesis refers to research purposes, then it can be inferred.

1. Students can be helped by the existence of the media learning this application.
2. Application used attractive compared
3. to learning that uses the book as a medium of instruction.

3. Using the applications media study can provide the information that the book can not give.

Advice

Here's a suggestion so that this application can run more optimized and more interesting as follows:

1. Application of the AR this is just to use the IPA only subjects, expected kedepanya material that not only taught the IPA only.
2. application this AR can only be used for moblie android-based, later to be developed until satisfactory can also used in IOS.
3. In the menu instructions use only the form text alone is expected to use the video as a media tutorial how to use the application.

A THANK YOU

The preparation of this thesis would not have materialized without the support, assistance and input from various parties. To that end, the author would like to express the deepest gratitude thank you.

1. Allah SWT, who has given grace, and his grace to the author so that it can complete the task.
2. 2. The father and mother who always provide support that never inquiries, by always always anxious prayer, the spirit of giving, moral and material support, as well as the advice sincerely.
3. Mr. Iskandar Ikbal, S.T., m. Kom. as the lecturer guardian IF-4/2011 who have given support to the author and has taught during the study.
4. Ms. Anna Andriana, S. Kom., m. Kom as a supervising lecturer is always always wait give time, direction and guidance to the author to become better.
5. Ms. Sri Hendrawati, S. Pd as principal author does place Sukapura SDN research that has provided the opportunity to do research.
6. Ms. Tite Rustika, S. Pd as a 5th grade teacher has taken the time, as well as referrals to the author.
7. the author And say thanks to the great help of writers in this final task that can not be the author mentioned one by one.

DAFTAR PUSTAKA

[1] Andri Kristanto, 2003, *Perancangan Sistem Informasi dan Aplikasinya*, Gava Media, Jakarta.

[2] Leman, 1998, *Metodologi Pengembangan Sistem Informasi*, Elexmedia Komputindo, Jakarta

[3] Qualcomm, 2011, "*Qualcomm Vuforia Developer Portal*", [online], (https://library.vuforia.com/guide)

[4] Kadir, Abdul .2003. *Pengenalan Sistem Informasi*. Andi.Yogyakarta.

[5] Rentor, M. J. 2013, *Membuat Aplikasi Augmented Reality MenggunakanVuforia SDK dan Unity*.

[6] Sukamto, R. A., dan Shalahudin, M. 2014, *Rekayasa Perangkat Lunak Terstruktur Dan Berorientasi Objek*. Bandung: Informatika Bandung.

[7] Slamento. *2003 Belajar dan faktor-faktor yang mempengaruhinya*. Rineka Cipta. Bandung.

[8] Darsono. 2002, *Theori Pembelajaran*. Erlangga. Jakarta.

[9] Arikunto. 1993, *Prosedure Penelitian, Suatu Pendekatan Praktek*, Rineka, Jakarta.

[10] Sutopo, A. H., 2003, *Multimedia Infteraktif dengan Flash*, Graha Ilmu, Yogyakarta.
[11] Wena. 2011, *Strategi Pembelajaran Inofatif kontemporer: suatu tinjauan Konseptual,* Bumi Aksara, Jakarta.
[12] Mifatkhul Jamawl[1], Ajib Susanto[2] "*PENERAPAN TEKNOLOGI AUGMENTED REALITY SEBAGAI MEDIA PROMOSI BERBASIS ANDROID PADA TOKO JATI TRESNO".* Bandung: [1,2] Teknik Informatika, Fakultas Ilmu Komputer, Universitas Dian Nuswantoro.
[13] Erwin[1],Reza Firandaya Malik[2], R.A.Methia Erviza[3] *"PERPADUAN TEKNIK PEMETAAN PIKIRAN DENGAN APLIKASI AUGMENTED REALITY BERBASIS MARKER TRACKING UNTUK MEDIA PEMBELAJARAN"*.
[14] Slameto. 2003 *Belajar dan Faktor-faktor yang Mempengaruhinya,* Rineka Cipta, Jakarta.
[15] Darsono. 2002 *Theori Pembelajaran*, Erlangga, Jakarta
[16] Arikunto. 1993 *Prosedure Penelitian, Suatu Pendekatan Praktek*, Rineka Cipta, Jakarta.
[17] Aunurrahman. 2010 *Belajar dan Pembelajaran,* Alfabeta, Bandung.
[18] Nana Sudjana. 2005 *Penilaian Hasil Proses Belajar Mengajar*, PT. Remaja Rosdikarya, Bandung.
[19] Usman Samatowa. 2006 *Bagaimana Membelajarkan IPA di Sekolah Dasar*, Depdiknas, Bandung.
[20] Husni Idris. 2008 *Pengembangan Multimedia Pembelajaran Berbantuan Komputer*, [*Online*]. (http://jurnaliqro.files.wordpress.com/2008/08/05-husni-48-57-final.pdf)
[21] Trianto. 2011 *Model Pembelajaran Terpadu Konsep, Strategi Dan Implementasinya Dalam Kurikulum Tingkat Satuan Pendidikan (KTSP),* Bumi Aksara, Jakarta.