# DESIGN OF SCIENCE MOBILE LEARNING OF ECLIPSE PHENOMENA WITH CONSERVATION INSIGHT ANDROID-BASED APP INVENTOR 2

## M. Taufiq*, A. V. Amalia, Parmin, A. Leviana

Department of Integrated Science, Faculty of Mathematics and Natural Sciences
Universitas Negeri Semarang, Indonesia

## ABSTRACT

Learning application is a medium that can be used to convey the content of the material involving mobile devices such as mobile phones based on Android. Learning Phenomens of Eclipse is android-based multimedia application that is created as a supplementof science instructional material in concepts of eclipses that can be accessed using a mobile device such as mobile phone. The methodology used to make this application is waterfall methodology. The purpose of making the application is the conception of conservation and science mobile learning is expected to help the students in particular and scientific community in general to get the ease of learning the concept of solar and lunar eclipses using a smartphone device without having to print using paper (paperless). The application also comes with interactive features of images, videos and quizzes. The conclusion is that mobile learning science applications of eclipse phenomenon in conception of conservation is developed and feasible to be used to study the concept of eclipse and support theefforts to reduce the use of paper (paperless).

© 2016 Science Education Study Program FMIPA UNNES Semarang

Keywords: science mobile learning, conservation insight, android

## INTRODUCTION

The development of multimedia technology has great potential to change the way to learn by obtaining, customizing and using the information. Multimedia opens opportunity for education to develop science learning techniques. The source of information is no longer focused on conventional learning such as the text of the book, but more than that. According to Bustomi (2010), the lack of tools and aids at school raises problems for teachers to to make students concentrate and understand teachers' explanation of material.

Learning is a process that occurs because of the interaction between people and their environment intentionally or unintentionally. They are considered to learn if there is a change in their behavior to be better, and increasing their knowledge. Rapid technological development makes the need of a concept and mechanism of ICT-based education is not inevitable. This concept was then known as e-learning. The latest branch of e-learning is mobile based learning, or commonly referred to as mobile learning. Mobile learning is improved due to the demands of the use of sophisticated mobile devices (smart phones, Tab, note-book) is increasing and has not been used in the field of education. In addition, the number of mobile devices is produced compared to laptop or PC.

In general, mobile learning is media of learning by utilizing mobile devices. According to Majid (2012) and Ashari & Istiyanto (2009), mobile learning is a learning approach that involves mobile devices such as mobile phones, laptops, and tablet PCs, where students can access

*Alamat korespondensi:
E-mail: muhamadtaufiq@mail.unnes.ac.id

materials, instructions and applications related to subjects without being limited by space and time, wherever and whenever they are. Besides mobile learning is also flexible because it can be changed or updated at any time if there are some changes in material. In addition it can be used for self-learning, mobile learning can also be used as a learning medium that can be accessed anytime and anywhere (Tamhane et al., 2015; Nurhayati, 2013; Sarrab et al., 2012; Douglas et al., 2008).

Mobile learning is the latest ICT advances in the education world where the mobile device is used as media containing a variety of material or teaching aid and can be used at school and home and also it is easier and lighter to bring (Hanafi & Samsudin, 2012). The increasing of the use of mobile phone leads the opportunities using mobile technology in education, and more importantly as a function related to environmentally friendly approach of paperless media.

Taufiq et al. (2016) states that to support and realize the vision of the conservation university that is not only infrastructure needed, but also the preparation of the mental attitude of all academic faculty staff and students through the implementation of learning quality and character. To instill conservation insight to the academic faculty, the innovation of learning process oriented to future particularly in development of the instructional media, mobile learning can be the priority to support science learning-friendly environment through paperless program. Increasing the number of academic community who use mobile devices especially utilizing the OS (Operating System) Android that provides many applications including App Inventor 2 programming. MIT App Inventor 2 is a programming tool block-based that allows everyone, even beginners to begin programming and build a full functional application for Android devices.

The presence of Science Mobile Learning as instructional media is intended as a learning supplement and also supports conservation vision through the use of contemporary media and paperless habit. This certainly can provide a different experience in the learning process of science. Zheng et al. (2015) states that the development of today's smartphones is growing rapidly and quickly, the technology is not only done by the user as a communication medium, but can be used also as a learning medium that is reliable and user friendly.

Learning media according to Bakri (2011) is everything related to software and hardware that can be used as an intermediary to convey the contents of teaching materials from learning sources to learners using learning methods that can give a feed back to the user of what has been put to the media. The development of multimedia technology has great potential to change the way to learn, obtain, and customize information. Multimedia is also an opportunity for education to develop learning techniques. The source of information is no longer focused on conventional learning such as the text of the book, but more than that. Limitations of the existence and function of laboratory instruments and aids makes difficulties for classroom teachers to make students do not pay attention and understand what is being explained by the lecturer. Bustami research result (2010) shows that the android-based learning applications can be used as the interactive learning media.

Android is the arrangement of some softwares (software stack). This stack generally includes the operating system, middleware, and key applications (Eueung, 2012). Android has several versions, starting from android version 1.1, Android version 1.5 (Cupcake), Android version 1.6 (Donut), the Android version 2.0 2.1 (Enclair), Android version 2.2 (Froyo), Android version 2.3 (Gingerbread), Android version 3.0/3.2 (Honeycomb), Android version 4.0 (Ice Cream Sandwich), Android version 4.2 (Jelly Bean) and most recently is the Android version 4.4 (KitKat).

Android provides an open platform for developers to create new applications. Android is a new generation of mobile platform that gives developers to develop based on their needs. The underlying operating system Android is licensed under the GNU General Public License Version 2 (GPLv2), that is often known as "copyleft" license where any third party repairs must continue to fall under the terms. Android is distributed under the Apache Software License (ASL / Apache2), that allows to distribute both derivations of open source and closed source code. The developers (especially handset manufacturers) can choose to raise the platform without having to provide their improvements to the open source community. Instead, developers can benefit from enhancements such as repair and redistribute their work under any license they want (Putra, 2012).

App Inventor is a tool to create interesting android application through visual based programming block, so we can create applications without using any codes. It is called visual programming block, because we will see, use, compile and drag-drops "block" that are symbols of commands and functions specific event handler to create applications, and simply we can without writing code (coding less).

Below is the example of block program in App Inventor to a color list:



**Figure 1**. Block program display in App Inventor

To use App Inventor does not have to have a basic knowledge programmer, understand codes or dabbling in the world of information technology. The most important to make application using App Inventor paramount is on how the programmers use the logic, just as well as putting together a puzzle. For the programmer there are options to make it advance in accordance with the required standards.
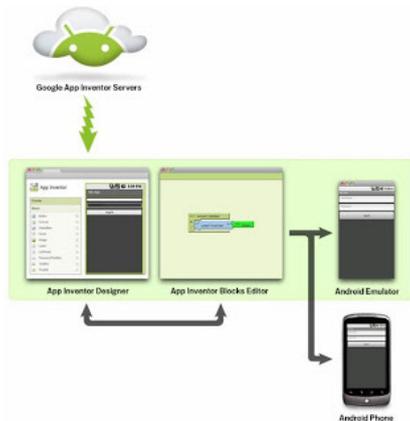


**Figure 2**. Operating System of App Inventor in OS Android

App Inventor can be accessed via *http://beta.appinventor.mit.edu/* beta version of MIT. App Inventor has 2features of:

Through this feature if we have the Android handset, or installing a new virtual Android handset on the computer, or even none at all, App Inventor could be used to create some interesting activity for example editing images, playing puzzle, sharpening your brain by doing crossword puzzles, or learning to strengthen logic skills.

These features provide convenience to students, teachers, professors or hobbist, they will be able to make the App Inventor as a learning tool. Teachers or lecturers can make a great teaching

tool through App Inventor, since visualization will facilitate students to understand and master what will be taught.

Starting from the prototyping, application for personal and organizational needs, or a serious application that can be sold, App Inventor visual -based drag drops gives many conveniences for: 1) It does not need to memorize and remember instructions or program codes; 2) Component and Block event are available, like an object we just put them together with the appropriate components and block its function, then put it down like a puzzle and change the properties, for example, give the numeric values to set the timer etc; 3) Event handler makes it easier to deal with any "events" that want to be handled, for example when making an application to handle SMS, in App Inventor by taking -Drag drops block that handle SMS event.

## METHOD

In developing this application, the methodology used was the waterfall model. The waterfall model is a classic model of systematic and sequential (Sudarmawan, 2007; Martono & Nurhayati, 2014).
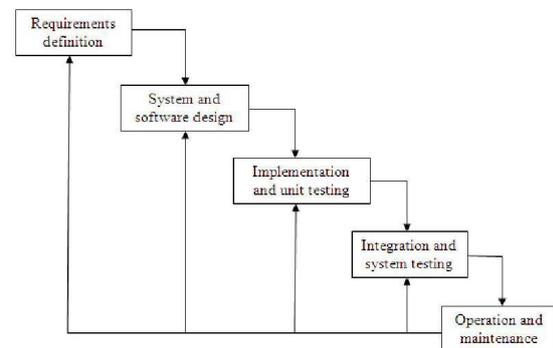


**Figure 3**. Development waterfall method

a. Requirements definition
   Collect what was needed completely then it was analyzed in order to define the requirements that must be solved by the program. This phase should be done comprehensively to produce a complete design. A necessary condition in this phase is elaboration of material phenomena of eclipses, workflow software program and App Inventor, in this phase the researchers did not do the installation program but access the program online through the page: ai2.appinventor. mit.edu/.
b. System and software design
   The design was done after the material needed was collected and completed.

c. Implementation and unit testing

Program design is translated into codes using App Inventor programming language that has been determined. The developed program was directly tested in each unit, whether it was working properly.

d. Integration and system testing

Unification of the program units was then tested as a whole (system testing).

e. Operation and maintenance

The program was operated in its environment and performed maintenance, such as adjustments or changes to adapt to the actual situation.

### RESULT AND DISCUSSION

Use case diagram is a representation of some interactions between the components contained in the application Science Mobile Learning introduced by the developed system. Actor/ user can access the main menu that consists of five menu choices of material, picture, video, quiz, and exit menu.
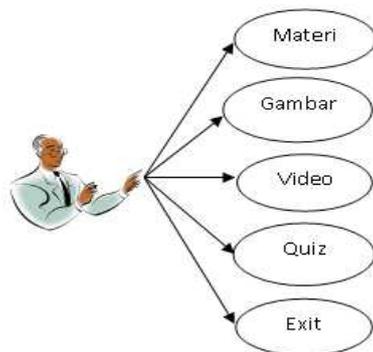
**Figure 4.** Use Case Diagram in Science Mobile Learning Apllication

The class diagram is the core of the object modeling process. It is a collection of object classes and provides an explanation of the classes contained in the application system of Science Mobile Learning. Through the diagram author designed the application system by describing some of the classes that will be used in the application as illustrated in Figure 5.

Activity diagram focuses more on execution and workflow systems rather than how the application systems assembling. Activity diagram shows the activity of the system as a series of actions.

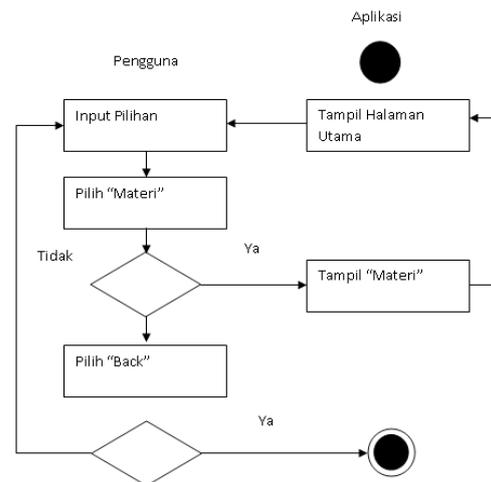Activity diagram to access material presents the user accesses menu of eclipse material.

**Figure 5.** Activity Diagram to Access Material

Activity Diagram to Access Picture presents the user accessesing the image menu of solar and lunar eclipses.
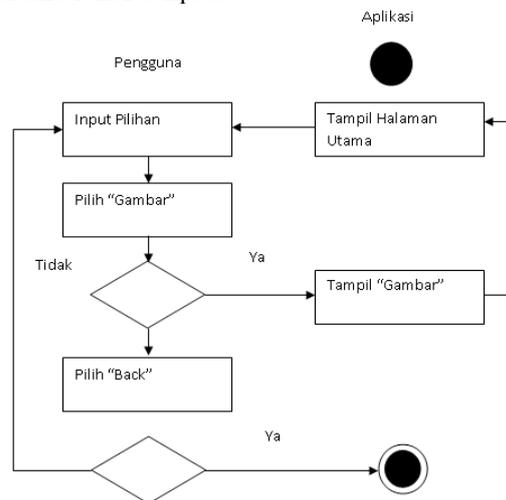
**Figure 6.** Activity Diagram to Access Picture

Activity Diagram to Access Video presents the user accessesing the video menu of solar and lunar eclipses.
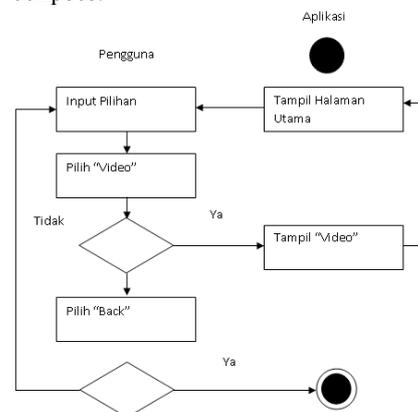
**Figure 7.** Activity Diagram to Access Video

Activity Diagram to Access Quiz presents the user access practice and achievement test of solar and lunar eclipse phenomena
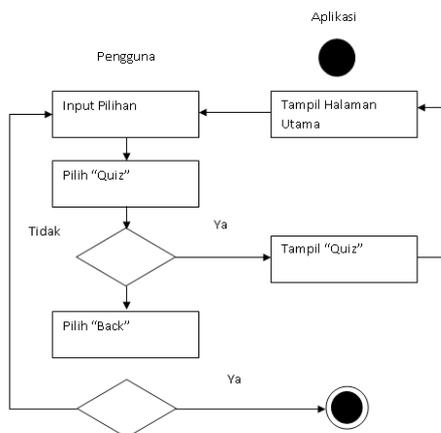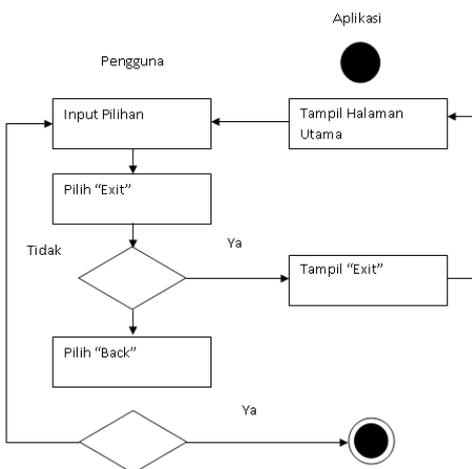


**Figure 8.** Activity Diagram to Access Quiz

Activity Diagram to Access Exit presents the user accessing exit menu in application.



**Gambar 9.** Activity Diagram to Access Exit
**Interface Design of Science Mobile Learning of Eclipse phenomena with Conservation Insight**

This display is the opening on the application. The system will display a splash screen. The splash screen is a condition that is used to describe the image or images that appear when an application or program is in the process of loading. The splash screen is used in applications as feedback that the application is in the process of loading. Images in the splash screen will be lost when the main application window appears. In this application, two splash screens will appear as in Figure 10 and 11. Figure 10 displays splash screen of the logo of UNNES as the first display and Figure 11 is the second splash screen before

entering the main display.



**Gambar 10.** Interface of Splash Screen

After displaying the splash screen, the system will display the main menu as can be seen in Figure 11. In the main menu there are five menus of material, picture, video, quiz and exit.



**Gambar 11.** Main Menu Display

In material display, the user can see information about the concept material of lunar and solar eclipses. The summary of the material eclipse consisting of five slides is presented and users can freely access the next button to see the next material and back button if you want to get back on the slide summary of the previous material.



**Figure 12.** Material Menu Display

In the picture menu the user can see the position of the sun, earth and moon during an eclipse. The material is presented in a slide that contains an image of the sun and the lunar eclipse, so users can easily distinguish the position of the sun, earth and moon when the eclipse phenomenon.
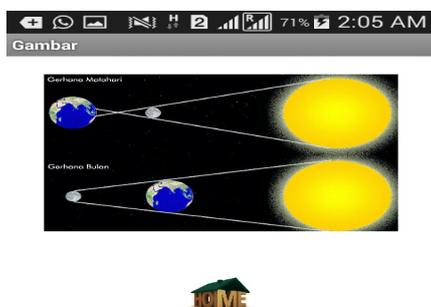


**Figure 13.** Picture Menu Display

Video menu displays interactive video simulation of the lunar and solar eclipses. The users will be more interested and able to understand the material presented through a interactive display designed. This menu allows the user to freely play, pause, repeat, and stop the video. The menu is also supported by explanation audio of the process of the solar and lunar eclipses so that users understand the concept well and conphehensively. It is supported by the results of research that has been done by Widiatmoko (2012), Sholikhakh et al. (2012), and Arda et al. (2015) that state learning science with interactive media is better than using conventional learning strategy, and able to enhance understanding of the concept and making the learning process more interesting.
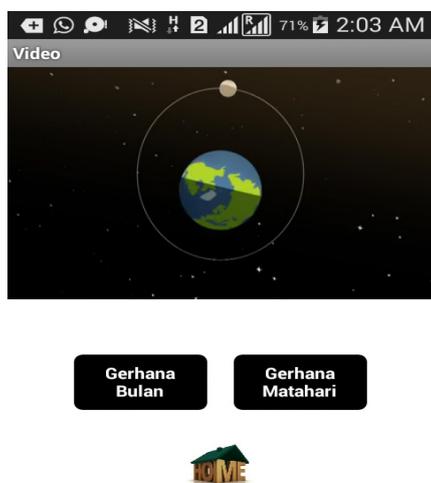


**Figure 14.** Video Menu Display

The consequence of the idea that critical thinking skills is essential in science learning and needs for stimulating element to create an evaluation system that could open the mindset of considering the facts towards critical thinking. On the quiz menu, it displays questions that will test the user's understanding of the concept of the eclipse phenomena. Users can test the understanding of the concept of the phenomenon of solar eclipse and lunar eclipse. There are 10 questions presented randomly from a total of twenty questions that are presented in the application. According Kartimi & Liliasari (2012), the critical thinking needs exercises of doing evaluation questions to develop critical thinking skills.



**Figure 15.** Quiz Menu Display

Exit menu display gives users the option to be really sure to exit or quit the program or continue it. Once the user opens the exit menu if you select "Yes" it will exit the application, whereas if you select "No" it will return to the main menu.

The feasibility validation of Science Mobile Learning application was performed by experts of media and science material. The results are some suggestions and that can be used as a reference to improve the application. Furthermore, the validation was repeatly done and analyzed in order to obtain the maximum score obtained from the validation instrument by dividing the score obtained by the maximum score multiplied by 100%. The result is presented inTable 1.

**Table 1.** Percentage Criteria of Product Feasibility

| Percentage Score Interval | Criteria |
|---|---|
| 81% - 100% | Very good |
| 61% - 80% | good |
| 41% - 60% | Moderate |
| 21% - 40% | Poor |
| <20% | Very poor |

The validation process consists of design and product performed by each field expert resulting score presented below. The result of design expert is presented in Table 2.

**Table 2.** Validation Data of Product by Design Expert

| Validator | Average | Criteria |
|---|---|---|
| Media expert | 3,88 | feasible |
| Material expert | 3,96 | feasible |

Based on the results of expert validation, it is obtained percentage of 98.44% in the criteria very good, so the design can be continued with some improvements.

Based on the display, media experts generally state that the product is good but it needs the right navigation key to enable users to access the application. In addition, the text color should be contrast and font type and size and arrangement of the link to the application interfaces need to be adjusted to make it more harmonious and orderly. In the aspect of programming, media expert claim that it is a good media.

Based on the material expert validation, the application is assessed to be good and the suggestion is to put pictures that match with the concepts and giving the caption. In general, the expert claims that the material is good enough. Researcher improved the product by considering the suggestion of experts, then conducted a series of discussions and evaluations to get a good design of products. In the aspect of learning, material experts stated that there are some materials that are still less interactive presentation and is generally stated that the application / media is already good.

Material expert states that there are some materials that are still less interactive in presentation but overall the media is already good.

The feasibility of products was collected by using squestionnaire developed by the researchers. The results of expert validation to the product is presented in Table 3.

**Table 3.** Rekapitulasi Hasil Validasi Ahli terhadap Produk *Science Mobile Learning* Fenomena Gerhana Berwawasan Konservasi

| Validator | Average | Criteria |
|---|---|---|
| Media Expert | 3.92 | Feasible |
| Material Expert | 3.96 | Feasible |

Advantages of developed product consist of important features of materials, pictures, videos and quizzes that support the learning process. Material is presented more attractively and easily understood because it is presented is not only in the form of writing. All of the features of the application can be downloaded through the Google Store or PlayStore, and then installed on the smart phone and used without having to print it out. This indicates that the application of Science Mobile Learning of Eclipse Phenomena affects on reducing the use of paper (paperless), so that the learning process of science can implement the conservation insight.

**CONCLUSION**

Based on the validation results from media and material experts, it can be concluded that the application of Science Mobile Learning of Eclipse Phenomena with Conservation Insight is feasible to be used and affects on reducing the use of paper (paperless) in the learning process.

**REFERENCES**

Arda, S. S. & Darsikin. (2015). Pengembangan Media Pembelajaran Interaktif Berbasis Komputer untuk Siswa SMP kelas VIII. *Jurnal Mitra Sains*, 3 (1), 69-77.

Ashari, S. & Istiyanto, J. E. (2009). Perspektif & Tantangan Pengembangan MLearning. *Jurnal Ilmiah Informatika*, *5* (1), 46-55.

Bakri, H. 2011. Desain Media Pembelajaran Animasi Berbasis Adobe Flash CS3 Pada Mata Kuliah Instalasi Listrik 2. *Jurnal Medtek*, *3* (2), 3 – 4.

Bustomi, A.Y. (2010). Aplikasi Pembelajaran Panca Indra Pada Manusia Berbasis Android. *Jurnal Telematika*, 3(1), 25-30.

Douglas, M., Matt, P. & Lynch, M. J. (2008). Mobile Learning in Higher Education: An Empirical Assessment of a New Educational Tool. *Turkish Online Journal of Educational Technology*. 7 (3), 223-244.

Eueung, M. (2012). *App Inventor: Ciptakan Sendiri Aplikasi Androidmu*. Yogyakarta: Penerbit Andi.

Hanafi, H. F., & Samsudin, K. 2012. Mobile Learning Environment System (MLES): The Case of Android-based Learning Application on Undergraduates' Learning. *International Journal of Advanced Computer Science and Applications, 3 (3),* 1-5.

Kartimi & Liliasari. (2012). Pengembangan Alat Ukur Berpikir Kritis Pada Konsep Termokimia Untuk SMA Peringkat Atas Dan Menengah. *Jurnal Pendidikan IPA Indonesia*, 1(2) 21-26.

Majid, A. (2012). *Mobile Learning (Isu-isu dalam Penerapan Teknologi Informasi dalam Pendidikan)*. Bandung: Universitas Pendidikan Indonesia.

Martono, K.T., Nurhayati, O. D. 2014. Implementation of android based mobile Learning applica-

tion as a flexible learning Media. *International Journal of Computer Science*, *11* (1), 168-174.

Nurhayati., O. D. 2013. Design of Information Technology in Enhancing the Quality of Mlearning -Based Learning at Diponegoro University. *International Journal of Computer Science*, *10* (6), 190–195.

Putra, P.F., Sari, J.N., dan Suhatman, R. (2012). Aplikasi Pembelajaran Metamorfosis Berbasis Android Augmented Reality. *Jurnal Teknik Informatika*, *1* (1), 1-8.

Sarrab, M, Elgamel, L.,  & Aldabbas, H. (2012). Mobile Learning (M-Learning) and Educational Environments. *International Journal of Distributed and Parallel Systems (IJDPS)*, *3* (4), 31-38.

Sholikhakh, R. A., Rismono dan Waluya, S. B. (2012). Pengembangan Perangkat Pembelajaran Beracuan Konstruktivisme dalam Kemasan CD Interaktif Kelas VIII Materi Geometri dan Pengukuran. *Unnes Journal of  Research Mathematics Education*, 1 (1): 13-19.

Tamhane, K.D., Khan, W.T., Tribhuwan, S.R., Burke, A.P., and Take, S.B. (2015). Mobile Learning Application. *International Journal of Scientific and Research Publications*, *5* (3),  1-4.

Taufiq, M., Sudarmin, Savitri, E. N., & Amalia, A. V. 2016. Media *Electronic Portofolio* Untuk Meningkatkan *Trend* Prestasi Belajar Mahasiswa. Unnes Science Education Journal, *5* (1), 1057-1064.

Widiyatmoko, A. (2012). "Pengembangan Perangkat Pembelajaran IPA Fisika dengan pendekatan *Physics Edutainment* Berbantuan CD Pembelajaran Interaktif". *Journal of Primary Education*, *1* (1): 38-44.

Zheng, Z., Cheng, J. & Peng, J. (2015). Design and Implementation of Teaching System for Mobile Cross-platform. *International Journal of Multimedia and Ubiquitous Engineering*, *10* (2), 287-296.