

**DEVELOPMENT OF AN ANDROID APPLICATION
IN THE FORM OF A SIMULATION LAB TO EXPLAIN PROPERTIES OF AN
IDEAL GAS**

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ABSTRACT

The aim of this research is to create a learning media that can explain the properties of an ideal gas through a simulation lab in the form of an android application. The method used in the study is research and development. A simulation lab android application which has been made subsequently validated by concept and media experts, further empirical testing by teachers and students. Assessments of the product is done by filling in questionnaires and rated by rating scale. Averages for feasibility of the media on all indicators are 83.13% from media experts, 87.5% from concept experts, 83.13% from empirical test of teachers, and 78.51% from student test. It is concluded that the android application in the form of a simulation lab can be used as a learning media to explain the properties of an ideal gas

Keywords: android application, Simulation Lab, Ideal Gas Properties

INTRODUCTION

Conventional learning is an activity occurring at the classroom where teachers present learning material to students. Because of dependence on teachers, students should attend in every learning process and can not get access of learning material anytime and anywhere.

Technological development has created breakthroughs in learning. In the development process, students often contact devices of mobile communication and internet being a new trend that have possibility to organize mobile learning (m-learning). Because of m-learning, students should not always attend in any learning process. Besides that, students can gain access the learning material anytime and anywhere.

According to Wood (2005), a term of m-learning is based on using of a technological and mobile device, such as PDA, mobile phones, laptop, and tablet in learning. Saedah Siraj and Vijay (2009) said "m-learning is using of a mobile device to have possibility which can organize learning anywhere and anytime". According to Mohammed Osman, M. El-Hussein, and Johannes C. Cronje (2010), m-learning is one of models in learning environment considering mobile-technology device, student mobility, learning mobility.

Some research done about m-learning predict that it can give much benefit. M. Tamimudin (2009) said that m-learning is prospective and progressive learning to be implemented because it is supported by communication technologies which are sophisticated, cheap, and reliable. Mahizer (2009) on his research concluded that m-learning has been begun an important role in education. The existence of m-learning and wireless devices is a reality.

Freedom for students to learn and get information makes m-learning be a favourite.

Physics is knowledge learning about nature phenomenon and interaction in the universe. Learning of physics demands teachers to demonstrate the real nature phenomenon through direct observation or experiment so students understand whole concepts comprehensively. Physics learning through experiments can not demonstrate all phenomenon, such as ideal gas phenomenon. Demonstrating ideal gas properties is hard enough. A simulation lab is made to overcome that problem so students can understand ideal gas properties directly.

According to Yudhi Munadhi (2010), a simulation is to demonstrate or immitate condition which can not be presented live in a room or at the classroom. General principle of simulation model can be implemented if a course has these characteristics: (a) learn a work process of a tool and creating of certain products, (b) consist of procedures in certain systems, (c) learn how to use a tool, procedure, and certain method, (d) have an aim to prove something through a process, (e) demonstrate and show a simulation sequently, (f) an analysis, a synthesis, and an application, (g) need an accurate observation, (h) stress on physical and attitude achievement, (i) demand evaluation of experiment and observation.

Computer programs are often used as means to learn through simulation because computer can integrate colors, music, and graphic animation. Beacuse of those reasons, computer can present learning concepts in high level of realism. According to Arsyad (2006), a simulation in computers gives chances to learn interactively and personally. That statement is clarified by Bambang Warsita (2009). He said that a simulation is one of forms of learning media based on computer. The program try to immitate dynamic process occuring in the real world. As the time goes by, computer functions can be used in tablet and smartphone.

Tablet and phone which have been used recently use android as operating system. It is an open source giving developers chances to develop their applications so all android users can download the applications in application store (playsore) with or without payment. There are many applications in the playstore. One of categories in playstore is education. Nowadays, applications for physics learning are a few, especially application in the form of silmulation lab supporting m-learning.

According to the explanation above, research about “Development Of An Android Application In The Form Of A Simulation Lab To Explain Properties Of An Ideal Gas” has to be done. The aim of this research is to create a learning media that can explain the properties of an ideal gas through a simulation lab in the form of an android application.

METHOD

The method used in this research is research and development. According to sugiyono (2008), the method of research and development is a kind of research method used to create and test products. The product of this research is an android application which has been validated by concept and media experts, empirical test of teachers, and student test.

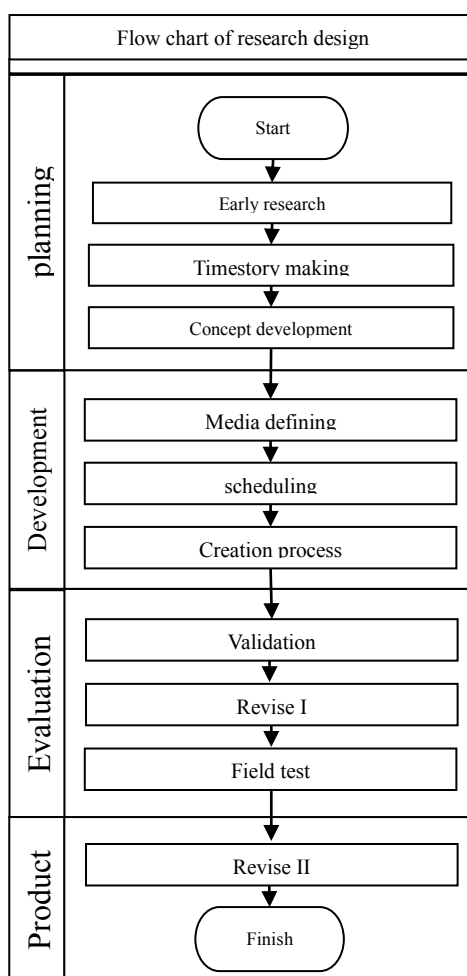


Figure 1. Research Design

Figure 1 shows that research using research and development method has four main steps: 1) planning, 2) development, 3) evaluation (validation by concept experts, media experts, empirical test of teachers, student test), 4) Android application product in the form of simulation lab

In the evaluation step, media is rated through questionnaires. Then, data is processed by rating scale (in the scale of four)

RESULTS AND DISCUSSION

In this part, results of research obtained from data of media development sequence, validation data, and product test is presented.

In the beginning, this research started with planning. In that step, early research is done. It collected data from various source to know physics applications in playstore and software of physics simulation used in learning. Then, timestory which would be used in application is made. Time story contains interface design, layout, and concepts. Next, the concepts are developed. Standard of competence for the concepts is “to apply thermodynamic concept in heat machine”. Meanwhile, basic competence discussed in the application is “to describe

properties of monoatomic gas”. Concepts which can be learnt by the application are Boyle’s law, Charles’s law, Gay Lussac law, boyle-lusaac law.

Creation process of application in thr form of simulation lab uses Adobe Flash Professional CS.5.5 and ActionScript 3.0 for scripting

```

129 import flash.display.Shape;
130 import flash.events.Event;
131 import flash.display.MovieClip;
132
133 var circles:Array = [],speedX:Number = 5,speedY:Number = 5, circle:MovieClip,mc:MovieClip;
134
135 function createCircle(msg):MovieClip
136 {
137     mc = new MovieClip();
138     circle=new MovieClip();
139     circle.graphics.beginFill(msg.warna,1);
140     circle.graphics.drawCircle(0,0,msg.radius);
141     circle.graphics.endFill();
142     mc.speedX = speedX;
143     mc.speedY = speedY;
144     mc.addChild(circle);
145     return mc;
146 }
147
148 function checkCollision(msg):void
149 {
150     var i:int = 0, anotherCircle:MovieClip,deltaX:Number,deltaY:Number,distance:Number, collideDistance:Number;
151
152     for (i; i<circles.length; i++)
153     {
154         anotherCircle = circles[i];
155         if (anotherCircle != msg.bola)
156         {
157             deltaX = anotherCircle.x - msg.bola.x;

```

Figure 2. Script

Figure 2, script is used to control navigation buttons and gas particle motion. Simulation lab created to understand properties of ideal gas can be used by following instruction on simulation page.

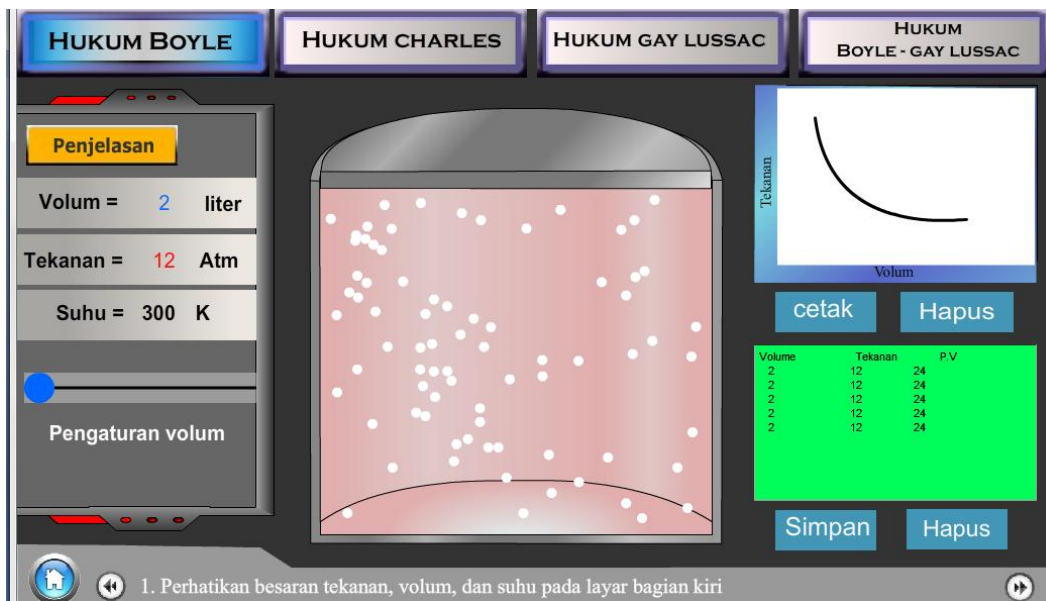



Figure 3. Simulation Page

By following instructions, students are demanded to understand properties of ideal gas or fundamental law of an ideal gas through observing gas motion and change of volume,

pressure, and temperature. Data obtained when students try simulation can be saved in table. Saving data, students can make graph based on the data like figure 3.

Besides doing simulation, students can understand more and more by short explanation like figure 4. Figure 5 shows exercises containing multiple choice questions to test students understanding about the concept discussed in simulation lab.

Hukum Boyle



Robert Boyle adalah ilmuwan pertama yang melakukan percobaan untuk menyelidiki perilaku sejumlah gas tertentu dalam suatu wadah yang bertekanan dan memiliki volum tertentu pada suhu tetap.

Boyle memperoleh hasil bahwa volum gas berbanding terbalik dengan tekanan yang diberikan padanya ketika suhu dijaga konstan. Secara lengkap hukum Boyle berbunyi: Bila massa dan suhu suatu gas dijaga konstan maka volum gas akan berbanding terbalik dengan tekanan.

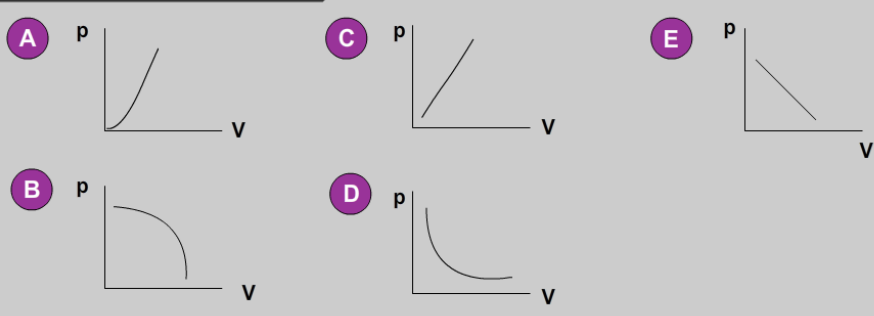
Secara matematis pernyataan ini dapat dituliskan sebagai berikut

$$P_1 \cdot V_1 = P_2 \cdot V_2$$

dengan P_1 = Tekanan gas mula-mula (N/m^2 atau Pa)
 V_1 = Volum gas mula-mula (m^3)
 P_2 = Tekanan gas akhir (N/m^2 atau Pa)
 V_2 = Volum gas akhir (m^3)

Figure 4. Short Explanation

1. Grafik hubungan antara tekanan dan volum pada hukum Boyle adalah...



A

B

C

D

E

Beranda

Figure 5. Exercise

After simulation lab application has been created, it is evaluated. Validation for simulation lab application is done by media and concept experts. The application is validated by two media experts

Questionnaire for media experts consists of 17 questions about interface design, font, interaction, illustration, appropriate language. Scale consists of 1-4 score and is interpreted by rating scale from 0%, rather good, to 100% , very good. The application is tested by Dr. Supriyadi, M.Pd and Razali Rasyid, M.Si, Lectures of State University of Jakarta. Data are shown on figure 6.

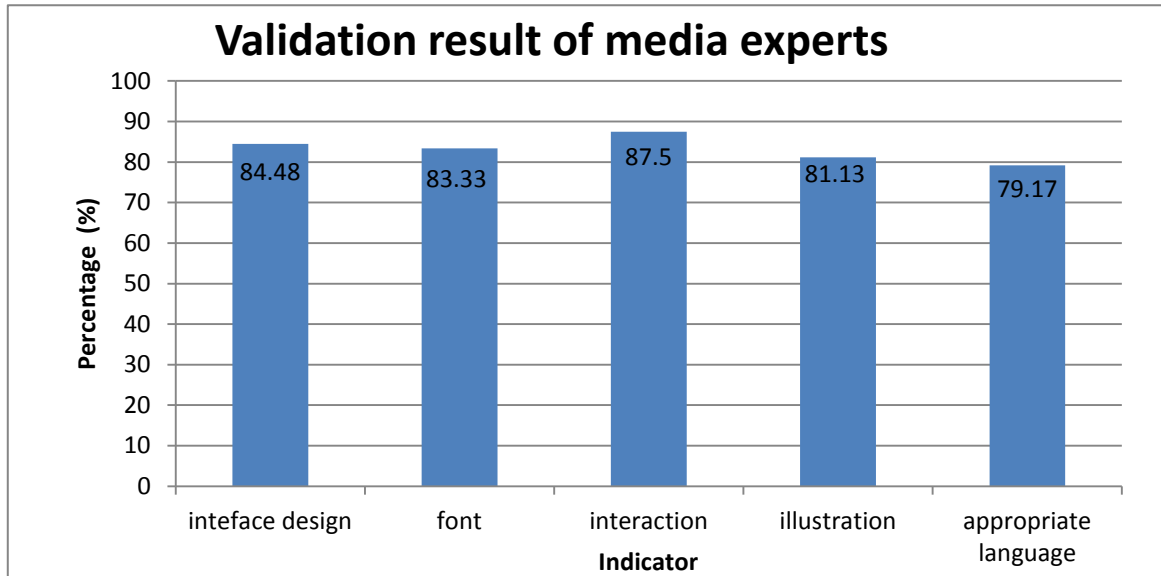


Figure 6. validation result of media experts

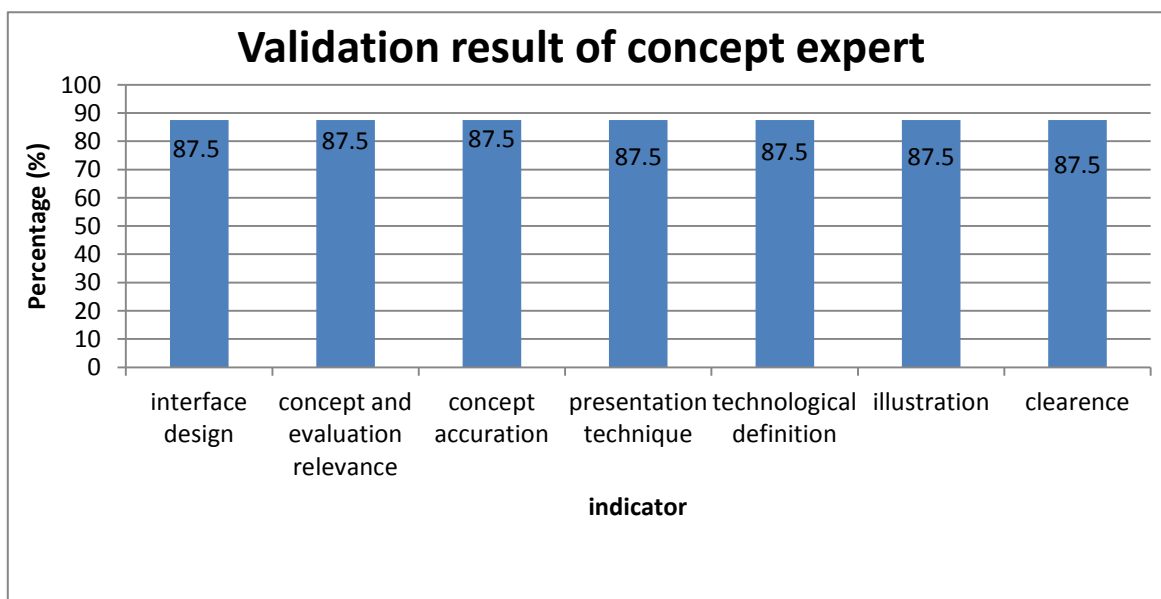


Figure 7. Validation result of concept expert

Shown on figure 6, averages for the application are 84,48 for interface design, 83,33 for font, 87,5% for interaction, 81,13 for illustration, and 79,17% for appropriate language. Total average for the application shows that it is very good. In other words, the application can be used as learning media.

Then, the application is validated by concept experts to test whether concept in the application is right and easy to understand. Validation Instrument of concept expert consists of 13 questions discussing about interface design, concept and evaluation relevance to curriculum, technological definition, illustration, clearance and difficulties to understand. Data obtained from concept experts is shown on figure 7.

According to figure 7, average score for all indicator is 87,5%. It represents that the application is very good and can be used as learning media.

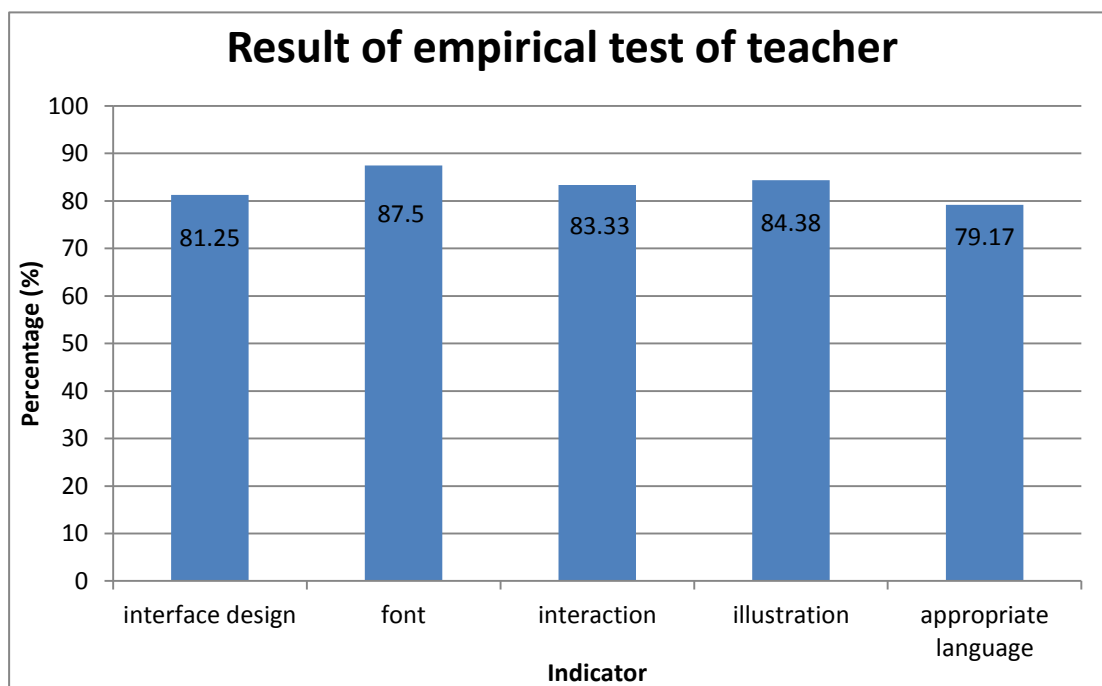


Figure 8. Result of empirical test of teacher

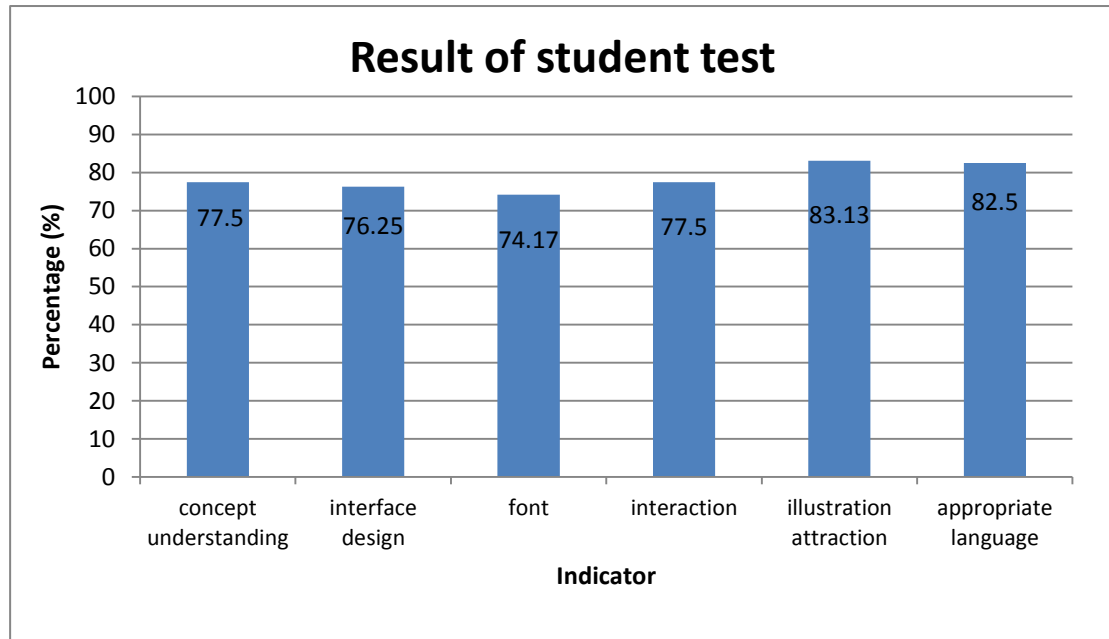


Figure 9. Result of student test

The simulation lab application which has been revised is tested and rated by teachers to know whether the application can be used in learning process. Empirical test of teachers is done by two physics teachers of SMAN 30. Indicator for assessment are interface design, font, interaction, illustration, appropriate language. Data obtained from teachers is shown on figure 8. According to figure 8, average score are 81,25% for interface design, 87,5% for font, 83,33% for interaction, 84,38 for illustration, 79,17% for appropriate language. Average score for all indicators shows that the application is very good and can be used as learning media.

Then, The android application in the form of simulation lab is tested by students of SMAN 30. They assessed the application through questionnaire containing some indicators, such as concept understanding, interface design, font, interaction, attraction of illustration (figure, animation, video), language. Data obtained from student test is shown on figure 9. Average score are 77,5% for concept understanding, 76,25% for interface design, 74,17% for font, 77,5% for interaction, 83,13% for attraction of illustration. Total average represents that the application is very good to be a learning media.

Conclusion

According to the result, conclusion for this research is that the simulation lab application can be used as learning media to explain properties of ideal gas.

Recommendations for other researcher are 1) to explore actionsript 3 in application developing, 2) to give more figure, animation, and video, 3) to use various function in application performing.

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