**CE-11**

# THE DEVELOPMENT OF ANDROID MOBILE GAME AS SENIOR HIGH SCHOOL LEARNING MEDIA ON RATE REACTION AND CHEMICAL EQUILIBRIUM

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**Abstract**

The use of Android mobile phone is growing fast, also among senior high school students. Student with Android mobile phone can do many things. They are chatting, browsing, reading books, and also they love playing games with this smart device. It is good to develop an educational game operated in Android mobile phone so the students can learn everywhere and everytime by playing games in their device.

This research was a development research on Android mobile game as senior high school learning media, especially on rate reaction and chemical equilibrium. The Android mobile game was developed by adapted ADDIE (i.e analysis, design, development, implementation, evaluation) method. It was reviewed by expert of chemistry, expert of multimedia, and peer-reviewers. The quality of this Android mobile game was determined based on the aspect of subject matter, language, operating proccess, audio visual, and software design. The assessment data are collected from 5 chemistry teachers and 25 senior high school students by using Likert quistionnaire.

The results shows that the Android mobile game has very good quality. Students said this mobile game is interesting, joyfull, and make chemistry learning more attractive.

**Key words**: android, rate reaction, chemical equilibrium, ADDIE

## INTRODUCTION

A learning process is a process of communication that will not take place optimally in the absence of learning media. Learning media is a tool that can be used to facilitate students' understanding of the competencies which need to be mastered from a subject. One alternative media that can be used is game.

From the literature review conducted by Funk (2002), game applications can improve students' interest in learning, speed of information processing and problem solving, while increasing social sensitivity and academic ability. With game applications, students are encouraged to solve problems in a particular subject by completing training questions contained in the application. This kind of game application commonly referred as the educational application games.

Educational application games can be presented in a variety of devices such as computer, video, and mobile phone. Games that work on the mobile phone have several advantages when compared to the games that run on other devices. Distribution of the mobile phone technology in the society and also the ease of access device, anywhere and anytime, making game applications installed on the device is very popular.

The use of mobile phone in society will always follow trend towards the development of technology used in the mobile phone itself. Mobile phone with Android operating system is now becoming a new trend in the selection of mobile phone devices. According to Dwi Andi Susanto (2012, in www.merdeka.com), Android mobile phone users in the mid-2012 increased four-fold compared to 2011. In 2011, the Android mobile phone users is only about 100 million people while in mid-2012, users had increased to about 400 million people. Mobile phone Android offers an open operating system that allows users to add any application to the mobile phone beyond the basic applications are provided. It also makes Android mobile phones became very popular.

Building educational application games based Android mobile phone can be an alternative learning media. This application game need to be designed to fit the Content Standards of subject. Specifications of subject matter in the media are considered important to enhance the depth and discussion in the media. Therefore, this study focuses on the extent to which Android-based educational application game as a learning media can be developed and utilized in accordance with the existing learning design, to create a fun, effective, and new learning environment, for the achievement of learning goals. To achieve these objectives, this research is devoted to develop Android-based educational application game for high school student. Chemistry learning on reaction rate and chemical equilibrium requires a lot of practice in resolving problems associated with it. Learning in this material will be colored by the new experience of learning by using educational application game on the Android mobile phone.

Android-based mobile game "Brainchemist" offers a new exciting and fun learning because by playing the game, students can improve the understanding of the material presented in the game. The aims of this study is to design and create a an Android-based mobile game on reaction rate and chemical equilibrium. It is expected to be an alternative media learning which is interesting, fun, and can be used by anyone, anytime, and anywhere. Quality assessment of mobile game "Brainchemist" will be given by chemistry teachers and students of high school class XI science to see their assessment and how they response.

**DISCUSSION**

Mobile game "Brainchemist" was developed by using ADDIE (Analisys-Design-Development-Implementation-Evaluation) method. This development model generally includes 5 steps: analysis, design, development, implementation and evaluation, but this study was limited to the implementation step only. The initial product mobile game "Brainchemist" reviewed by 1 subject matter expert, 1 information and technology expert, and 3 peer-reviewers. Mobile game "Brainchemist" assessed by 5 chemistry teachers and 25 high school students using questionnaire with Likert scale. The assessment was based on 5 aspects, they were subject matter, language, operating process, audio visual, and software design. The data were analyzed to determine the quality of mobile games in accordance with the table of ideal criteria assessment. In addition, the results of the assessment were also obtained data on how student responses to the mobile game.

The product of this study is mobile game "Brainchemist" on reaction rate and chemical equilibrium in Android Application Package file format (.apk). This game presents in Indonesia language and can only be operated on the mobile phone with Android operating system. This game was developed using Eclipse Indigo program with Java programming language.

Mobile game "Brainchemist" is a two dimensional game in the form of quiz, containing questions for practicing and for helping the understanding of reaction rate and chemical equilibrium. The material presented in this game was adapted from Chemistry Content Standards by *Badan Standar Nasional Pendidikan* (Indonesian: *National Education* Standards Board). It is all about reaction kinetics, chemical equilibrium, and factors that influence it. Figure 2 showed some game display and available menu button.
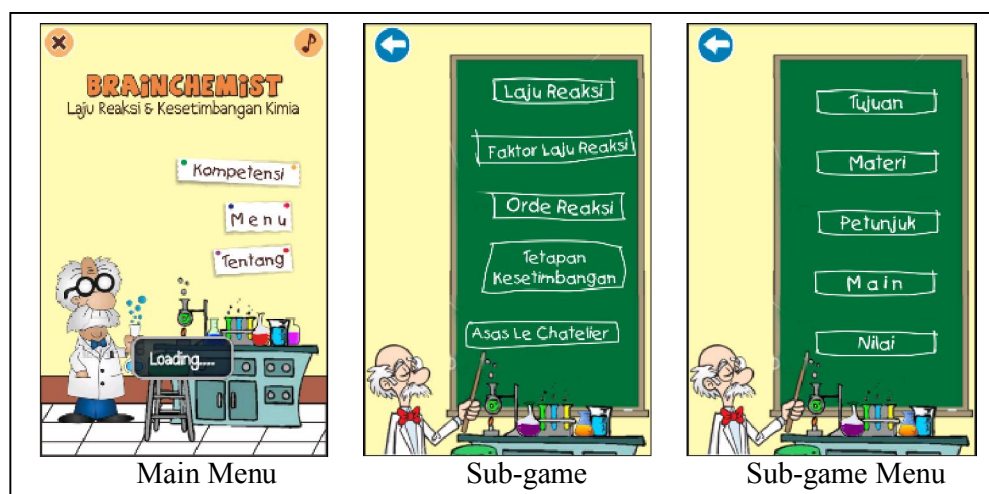
Figure 2. Mobile game "Brainchemist" display

Mobile game "Brainchemist" present in an attractive and colorful layout. The images, sound effects, music, and game rewards also enhance its attractiveness. Mobile game "Brainchemist" consist of 5 sub-games, they are sub-games of reaction rate, factors affecting the reaction rate, reaction order, Le Chatelier's principle, and equilibrium constant. Question type in the sub-game reaction rate is right-wrong questions, while the sub-game reaction order is short field questions. Other 3 sub-games are presented in multiple choices type of question.

Each sub-game provides an option game with a fight against the clock or without against the clock. The time allocated for playing the game was different for each sub-game, depending on the level of difficulty of the questions presented. Each game set consists of 5 questions that come out randomly according to available question bank. Feedback right or wrong answers immediately appear when one question has been answered. After answering five questions, resume game results will appear to show rewards, scores obtained, and a discussion.

The results of the quality assessment of mobile game "Brainchemist" by chemistry teacher shows an average score of 110.6. Based on the assessment ideal criteria table, this score qualifies Very Good because it lies within the range of scores > 105. Maximum score mobile game quality assessment "Brainchemist" by teachers is 125, so the average score of 110.6 indicates the ideal percentage of 88.48%. Details of quality assessment results by chemistry teachers can be seen in Table 1.

Table 1. Quality Assessment of Mobile Game "Brainchemist"
by Chemistry Teacher

| No | Assessment Aspect | Average Score ( | Range of Score | Quality Categories | Maximum Score | Ideal Percentage |
|----|-------------------|--------|------|------|------|------|
| 1. | Subject matter | 27.2 | > 25.2 | Very Good | 30 | 92.33 % |
| 2. | Language | 8.6 | > 8.4 | Very Good | 10 | 86.00 % |
| 3. | Operating Process | 17.8 | > 16.8 | Very Good | 20 | 89.00 % |
| 4. | Audio and Visual | 34.2 | > 33.6 | Very Good | 40 | 85.50 % |
| 5. | Software Design | 22.8 | > 21 | Very Good | 25 | 91.20 % |
| **Overall Score** | | **110.6** | **> 105** | **Very Good** | **125** | **88.48 %** |

Quality mobile game "Brainchemist" is also rated by the students, but without including aspect of subject matter. The result of the quality assessment by the students shows an average score of 80.76. Based on the ideal assessment criteria table, this score qualifies Very Good because it lies within the range of score > 79.8. Maximum score mobile game quality assessment "Brainchemist" by students is 95, so that the average score of 80.76 indicates the ideal percentage of 85%. Details of student assessment results can be seen in Table 2.

Table 2. Quality Assessment of Mobile Game "Brainchemist"
by High School Student

| No | Assessment Aspect | Average Score ( | Range of Score | Quality Categories | Maximum Score | Ideal Percentage |
|----|-------------------|------------------|----------------|--------------------|---------------|------------------|
| 1. | Language | 8.16 | $6.8< \leq 8.4$ | Good | 10 | 81.60 % |
| 2. | Operating Process | 17.16 | > 16.8 | Very Good | 20 | 85.80 % |
| 3. | Audio and Visual | 34.04 | > 33.6 | Very Good | 40 | 85.10 % |
| 4. | Software Design | 21.40 | > 21 | Very Good | 25 | 85.60 % |
| **Overall Score** | | **80.76** | **> 79.8** | **Very Good** | **95** | **85 %** |

The comparison of the ideal percentage of each aspects in quality assessment of mobile game "Brainchemist", both based on the chemistry teachers and high school students is presented in Figure 3.
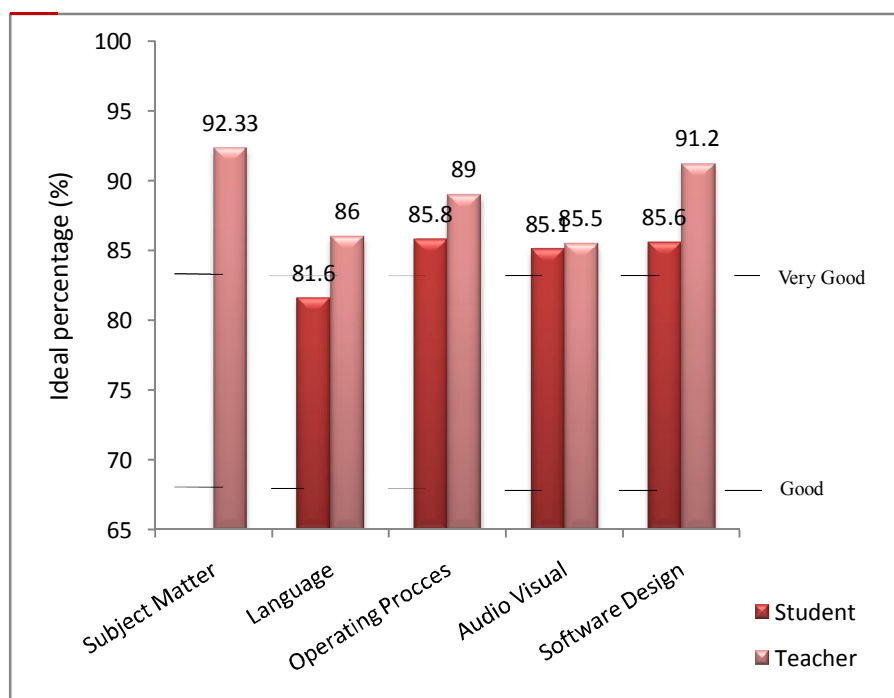


Figure 3. Ideal Percentage of *Mobile Game* "Brainchemist"

Data of student's responses indicate that mobile game "Brainchemist" is interesting, joyfull, and make chemistry learning more attractive. Although the subject matter presented in the mobile game is limited and can not be used to measure mastery learning, generally this game can be

used as a learning media that support the learning process for reaction rate and chemical equilibrium. This game has met the criteria of good learning media according to Mulyanta, they are relevance, convenience, attractiveness, and benefit.

**CONCLUSION**

Mobile game "Brainchemist" as chemistry learning media for senior high school on reaction rate and chemical equilibrium has successfully developed through analysis, design, development, and implementation steps. Quality of mobile game "Brainchemist" as chemistry learning media based on chemistry teacher assessment shows an average score of 110.6 Based on the ideal assessment criteria table, this score qualifies Very Good because it lies within the range of scores $\overline{X} > 105$. Maximum score mobile game quality assessment "Brainchemist" by teachers is 125, so the average score of 110.6 indicates the ideal percentage of 88.48%. Quality of mobile game "Brainchemist" as chemistry learning media based on high school student assessment shows an average score of 80.76. Based on the ideal assessment criteria table, this score qualifies Very Good because it lies within the range of score $\overline{X} > 79.8$. Maximum score mobile game quality assessment "Brainchemist" by students is 95, so that the average score of 80.76 indicates the ideal percentage of 85%. Based on this assessment, the mobile game "Brainchemist" fit for using as chemistry learning media for senior high school on reaction rate and chemical equilibrium. Students assume the media is interesting, joyfull, and make chemistry learning more attractive.

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