

**THE DEVELOPMENT OF ANDROID-BASED MOBILE LEARNING MEDIA  
AS CHEMISTRY LEARNING FOR SENIOR HIGH SCHOOL ON ACID BASE,  
BUFFER SOLUTION, AND SALT HYDROLYSIS**

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**ABSTRACT**

This research is a development research in chemistry education. The aims of this research were (1) to develop android-based mobile learning media for chemistry learning in senior high school on acid base, buffer solution, and salt hydrolysis, (2) to determine the quality of mobile learning media based on evaluating by five chemistry teachers, and (3) to evaluate the quality and to measure the response of senior high school students to the media.

The model of development was adapted from ADDIE (Analyze, Design, Development, Implementation, dan Evaluation) model. The early product was reviewed and commented by research supervisors subject matter expert, technology and information expert and, peer reviewers, and then revised. The revised product was evaluated and reviewed by chemistry teachers and was field tested by Senior High School students. The results of the evaluation was analyzed to determine the quality of product.

The result of this development research were android-based mobile learning media for chemistry learning in Senior High School on acid base, buffer solution, and salt hydrolysis. This mobile learning media can be applied on Android mobile phone. Analysis data showed that the quality of the media was very good with ideal percentage of 89.40% based on chemistry teachers evaluations and was good with ideal percentage of 76.30% based on students review. Students response that the media was interesting, joyfull, and attractive. In conclusion, the media can be applied very well for chemistry mobile learning media on acid base, buffer solution, and salt hydrolysis.

Keywords: mobile learning media; android; and acid base

**INTRODUCTION**

Developments in science and technology drive the process of learning to be more applicable and attractive as an effort to improve the quality of education. In general, the learning process that takes place at this time is between the students face to face with students and teachers in the classroom (conventional learning). According to Burrowes (2003), the conventional learning emphasis on the completion of the subject matter without giving sufficient time for students to reflect on the material presented, linking with prior knowledge, or apply in real life. Further stated that the conventional learning have characteristics, namely: teacher-centered learning, there is passive learning, interaction among students is less, there is no cooperative groups, and assessment sporadic. Lessons are conducted in conventional lead to student learning is not effective and do not feel motivated students, causing students less or no understanding of material provided by the teacher (Daryanto, 2010: 2). Success of learning is not only determined by the teacher and the student, but also is influenced by learning media and

teaching materials used. Liliek Setiono (2009), said that the use of learning media in teaching and learning can generate interest and a new desire, motivating and stimulating learning activities, and even carry psychological effects on students.

Information and communication technologies change the location of learning from the classroom to place anywhere and anytime students can learn. Thus, the evolution of communications technology push on the evolution of the location and time of study. Learning is no longer just a place in the school and in the classroom, learning can happen anywhere as long as there are teaching materials and students feel comfortable with the situation (Mandy Akhirul A, 2009).

According to I Made Agus Wirawan (2011: 316), the use of mobile phone technology has not only focused as a media of communication, or entertainment, but also has been used as a learning media. One media that based mobile phone that can be used by teachers in the learning and application has not been developed is a mobile game based learning (mGBL). mGBL is an application form of the game that contains subject matter and constructed in accordance with the level of education and also adapted to the prevailing curriculum and running on mobile phone devices.

According to Muhamed Ally Pieri Micelle (2009: 193), learning by using mobile learning make student learning becomes interesting and fun. The learning process will be effective when the students are in a state of happy and unhappy. The students will feel fear, worry, anxiety, feeling uncomfortable that can lead not optimal results when student learning is too forced (Eko Susanto, 2009: 19-20). Accordingly, the application of mobile gaming as a learning media can be developed and utilized in accordance with the existing learning design, to create a new learning environment, effective, and enjoyable to facilitate the achievement of learning goals.

Mobile Game "Brainchemist", the learning media of chemistry can be used as an alternative to chemical learning media fun and accessible. Mobile Game "Brainchemist" is adapted from the game Brainjiggle and the game BrainJuice that has been modified so that display just the relevant with chemical materials.

Chemistry learning can not be separated from definition of the learning and chemistry itself. Chemistry is the science of searching for answers to what, why, and how natural phenomena related to the composition, structure and properties, changes, dynamics, and energetics of substances. There are two point related, the chemical can not be separated, chemistry as the products (chemical knowledge in the form of facts, concepts, principles, laws, and theories) and chemistry as the process of scientific work (Mulyasa E., 2006: 132-133). Success in achieving the chemistry learning objectives is influenced by several factors. For example, teaching and learning strategies, methods and approaches to teaching and learning resources or learning media.

The development of learning media, both for formal and non-formal education, a curriculum that applies is the primary reference that must be considered. In addition, ease of use, attractive and also usefulness must be considered. Criteria of good learning media ideally includes 4 main things (Mulyanta, 2009: 3-4), namely: the suitability or relevance, convenience, attractive, and usefulness.

Products of learning media are developed to run on Android-based mobile phone. Android is the operating system platform for mobile devices that is open source. Android has various advantages as software that uses computer code base that can be distributed openly (open source) so that the user can create a new application in it.

Develop of mobile game "Brainchemist" using Eclipse Indigo. Eclipse is an IDE (Integrated Development Environment) to develop software and can run on any platform. The advantages of Eclipse that makes it popular is its ability to be developed by the user with a component called a plug-in ([www.eclipse.org](http://www.eclipse.org)).

According to Dwi Cahya Wahyudi (2010: 30), Amelia Handayani Burhan (2012: 61), Nur Rachma Kartika and Achmad Lutfi (2012: 178), chemistry learning media can be used as a interesting media for independent learning and motivate students in the learning activities.

Based on the above four studies, the researcher developed a mobile game "Brainchemist" as a chemistry learning media SMA/MA in acid-base material, buffers and salts hydrolysis.

## **RESEARCH METHOD**

Development of media should be done using the right development model. One model that is often used in the research is the development model ADDIE. Several phase in the ADDIE Model is as follows (Mulyanta and M Marlong Leong, 2009: 5):

1. Analysis phase
2. Design phase
3. Development phase
4. Implementation phase
5. Evaluation phase

The development research follows of the ADDIE model. The phase in this research are phase analysis (analysis of curriculum, analysis of media creation benefit), the design phase (mobile game design and preparation of assessment instruments), stage of development (manufacture of mobile games and review by supervisors, material experts, IT experts, and peer reviewers), the implementation phase (mobile game used by teachers and students) and the evaluation phase (evaluate the quality of learning media). The form of research instrument is a questionnaire to assess the quality of media produced, adaptation of existing assessment instruments (Romi Satria Wahono, 2006 in aspect and learning media assessment criteria). Assessment criteria include five aspects of the assessment are to matter and task, linguistic, materialize, audio visual display, and software engineering (without matter and task aspects for students). The results are converted from qualitative data to quantitative data, tabulated and analyzed using the ideal criteria for determining the quality of the media (Eko Putro Widoyoko, 2011:238).

## **RESULT AND DISCUSSION**

The result of this development is a product of the mobile game "Brainchemist" as a chemistry learning media for Senior High School in acid-base, a buffer solution, and salt hydrolysis matter. The products of mobile game "Brainchemist" as a learning media is apk application form that can be run with android based mobile phone. Mobile game "Brainchemist" contain materials or matters, and the discussion of acid-base, buffer solution, and salt hydrolysis.

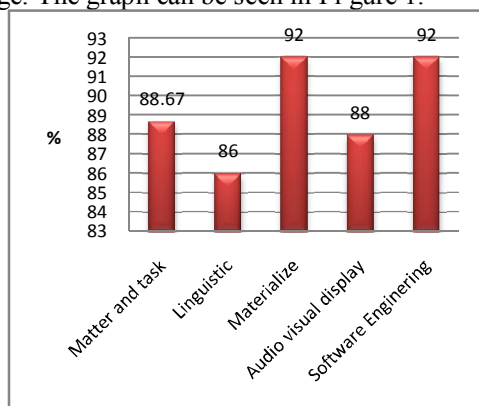
### **1. Data Quality Product from Reviewers**

Quality mobile games "Brainchemist" are assessed by the reviewers first (5 senior high school chemistry teachers in Yogyakarta). The results of the assessment show that the quality of mobile games "Brainchemist" are included in the category of Very Good (SB) with an overall average score of 111.8 and ideals percentage of 89.4%. Assessment of every aspect can be seen in table 1.

**Table 1.** The quality of every aspect assessment by reviewer

Criteria	Number Indicator	Average Score ( )	Maximal Score	Ideals percentage(%)	Category
Matter and task	6	26,6	30	88,67	SB ( >25,2)
Linguistic	2	8,6	10	86	SB ( >8,4)
Materialize	4	18,4	20	92	SB ( >16,8)
Audio visual display	8	35,2	40	88	SB ( >33,6)
Software Engineering	5	23	25	92	SB ( >21,0)
<b>Overall</b>	<b>25</b>	<b>111,8</b>	<b>125</b>	<b>89,4</b>	<b>SB</b> ( >105,1)

Based on the assessment of every aspect can be made by the graph of quality of every aspect versus the ideals percentage. The graph can be seen in Figure 1.

**Figure 1.** The graph of quality of every aspect versus the ideals percentage

The assessment by reviewer show that aspects of matter and task is included in the *very good* category (SB). Ideals percentage of matter and task aspect is 88.67%. When it is compared to the ideals percentage of the other aspects, ideals percentage of the matter and task aspect is the second largest. Percentage of 88.67% in the aspects of matter and task can not be separated from matter and task presented in the mobile game "Brainchemist" which has been adapted to the content standards of curriculum. The material presented is also adapted to the knowledge of high school students. Answer questions and discussion contained in the game are also one that are proper to the students' knowledge.

Linguistic aspects get the lowest ideals percentage than any other aspect, 86%. This is because it is less raw linguistic aspects by a reviewer. This is because the use of language in the game is still too much when compared to the games that circulate in the society. However, the language used is not rigid but the language used is the communicative language and does not cause double interpretation so that students can more easily understand. Overall aspects of language are included in the very good category (SB) and proper for use in a mobile game "Brainchemist" as a learning media for students of Senior High School.

Based on the assesment by reviewer, materialize aspects are included in the very good category (SB). Ideals percentage of materialize aspects get the highest aspect compared to other aspects, 92%. This is because of the reward each end games make students motivated to try again to obtain a desired reward by students. The interesting thing about the presentation of the material is to make the students do not feel bored easily in learning with mobile game "Brainchemist". In addition, the ability to use the media in frequent times and advantages of the media can attract the students to use this media as a supplement facility in the study.

Based on the assesment by reviewer, audio visual display aspects are included in the very good category (SB) by the ideals percentage which are also quite prominent, 88%. In all aspects of audio visual display mobile game "Brainchemist" as a chemistry learning media on Senior High School in acid-base material, a buffer solution, and salt hydrolysis can be concluded that the size of the text and pictures are very good so that there are illustrations to facilitate understanding of students in learning material presented text. The clarity of the colors used in the illustrations is very good so that students can focus on the presentation of the material which is completed by the pictures. In addition, the contrasting background color, font size is large enough, and the font type is also adapted to the user, that is the students.

Aspects assessment of software engineering also get very good (SB) of the reviewer with the highest ideals percentage than other aspect, 92%. This is because mobile games "Brainchemist" contain elements of creativity and innovation in the manufacture of new learning media. Formerly, there are still very few mobile developers who implement their ability to create learning media based mobile phone. Ease of use and ease of operation of the mobile game "Brainchemist" make the students have no difficulty in learning the material. Students who are are not familiar to the game can read the instructions for using the mobile game "Brainchemist" so that it is not difficult to use of mobile game "Brainchemist".

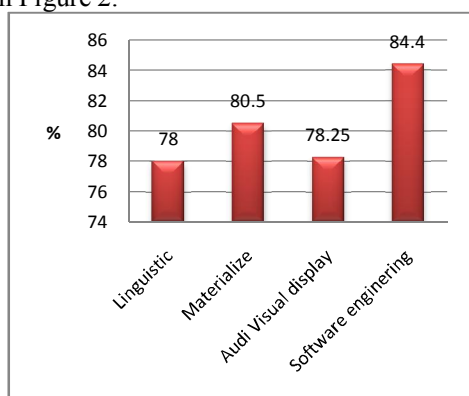
## 2. Data quality by Students

Quality mobile game "Brainchemist" also assessed from the perspective of the students. The data quality assessment is generated from the 24 students of class XI semester II SMA N 9 Yogyakarta. Assessment from students is slightly different to the reviewer, the students did not assess aspects of matter and task. Based on the assessment of the quality by students, quality mobile games "Brainchemist" included in the category of good (B) and has an average score of 76.3 with 80.3% percentage of ideals. Assessment of every aspect of the students can be seen in Table 2.

**Table 2.** The quality of every aspect " based on the assessment by students

Criteria	Number Indicator	Average Scor ( $\bar{X}$ )	Maxi-mal Score	Idelas Percentage (%)	Category
Linguistic	2	7,8	10	78	B ( $6,8 < \bar{X} \leq 8,4$ )
Materialize	4	16,1	20	80,5	B ( $13,6 < \bar{X} \leq 16,8$ )
Audio Visual display	8	31,3	40	78,25	B ( $27,2 < \bar{X} \leq 33,6$ )
Software Engineering	5	21,1	25	84,4	SB ( $\bar{X} > 21,0$ )
<b>Overall</b>	<b>19</b>	<b>76,3</b>	<b>95</b>	<b>80,3</b>	<b>B</b> ( $64,6 < \bar{X} \leq 79,8$ )

Ideals percentage quality assessment mobile game "Brainchemist" by every aspect of the assessment are presented in Figure 2.



**Figure 2.** Quality Graphics of Every aspect of ideal percentage mobile gaming "Brain-chemist" on the assessment by students

Ideals percentage of linguistic aspects obtain the lowest, with ideals percentage 78%. Language used is a correction for researchers to pay attention to the preferred language by students. Because the age of the young students will prefer the communicative language for teenagers and not cause double interpretation. However, the assessment of language by students are included in good category (B), so that the aspects of linguistic fit for use in a mobile game "Brainchemist" to help students in learning / study.

Based on the assessment by students, materialize aspects included in good category (B) with ideals percentage of 80.5%. Ideals percentage of materialize aspect quite prominent than other aspects. This is because the implementation of mobile game "Brainchemist" is presented to the students in an interesting way. In addition, any student who uses a mobile game "Brainchemist" appropriately reward will be given the results of his work. Reward will stimulate students to try again to play, and the play went unnoticed by students and learning materials chemistry. Mobile game "Brainchemist" has the ability to be used continuously but not the same task/matter and out randomly. Mobile game "Brainchemist" has advantages over other learning media that can keep students interested in using it. The advantages of mobile game "Brainchemist" such as: simple, easy to use anywhere, anytime, and without requiring the use of the boot process.

Aspects of audio visual display included in good category (B) according assesment by students. Ideals percentage of audio visual display aspects is also quite prominent than other aspects. Aspects of audio visual appearance ideals percentage 78.25% gain. This percentage indicates that students like the look of the mobile game "Brainchemist" as a learning media that can help students to perform learning activities with an attractive illustration that accompanied the picture to make it easier to understand the material.

Based on the assessment by learners, software engineering aspects is include in the very good category (SB) with ideals percentage is the highest, 84.4%. This is because the mobile game "Brainchemist" is made with the latest learning innovations that can be used simply by using mobile phones making it easier for students to learn. Ease of touch and drag function in the mobile game "Brainchemist" is considered as to support ease of use. Mobile game "Brainchemist" also comes with use instructions that explain how to use the software game, so that students who do not know how to use can be guided by the instructions for use. In addition, for the development of learning media for science and technology development of mobile game "Brainchemist" This is very promising, because the use of mobile phone as a learning media is still little use.



Students were asked to rate other than product quality are also given open-ended questions that are packed in assessment instruments to determine student response. The response of students who are interested and excited to learn by using mobile gaming as many as 23 people or 95.8% and who are interested in learning more after playing the mobile game "Brainchemist" as many as 23 people or 95.8%.

The product of this research is mobile game "Brainchemist" which has a minimum specification devices to run on android based mobile phone, operating system Android Froyo 2.2, 256 Mb RAM, and 600MHz processor. File size of mobile game "Brainchemist" of 15 MB can be installed on an external mobile phone memory. Example of display in a mobile game "Brainchemist" can be seen in Figure 3.



Figure 3. Screenshoot matter of media

## CONCLUSION AND SUGGESTIONS

### Conclusion

Mobile game "Brainchemist" as a chemistry learning media for Senior High School in acid-base material, a buffer solution, and salt hydrolysis qualified in accordance with the categories specified quality media has been successfully developed. Quality of mobile game

"Brainchemist" as a chemistry learning media for Senior High School in acid-base material, a buffer solution, and salt hydrolysis based assessment by reviewer scored an average of  $\bar{X} = 111,8$  ( $\bar{X} > 105,1$ ), thus including the categories of very good (SB) with ideals percentage of 89.4%. Quality of mobile game "Brainchemist" based on assessment by students scored an average of  $\bar{X} = 76,3$  ( $64,6 < \bar{X} \leq 79,8$ ), so it is included in the category Good (B) with the ideals percentage of 80.3%. Based on this assessment, the mobile game "Brainchemist" fit for use as a learning media or as reference students in learning.

A total of 95.8% of students believe learning by use the mobile game "Brainchemist" more interesting and fun, and as much as 95.8% of students are also interested in further study chemistry after playing Mobile Game "Brainchemist". These results indicate Mobile Game "Brainchemist" can make students become interested in studying chemistry with a nice atmosphere.

### Suggestion

Suggestions can be submitted by researchers associated with the development of this research is a kind of learning media needs to be developed to be operated by using another OS, such as iOS, Blackberry, or Windows phone. Learning media similar to other chemical materials need to be developed in order to be used as a complementary reference for students. Mobile Game "Brainchemist" needs to be tested in teaching of chemistry in senior high school to determine the extent of benefits and drawbacks.

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