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Certificate of Participation Awarded to

JASLIN IKHSAN

For the Attendance of

THE INTERNATIONAL POST GRADUATE CONFERENCE ON

SCIENCE AND MATHEMATICS 2013

On

5-6th OCTOBER 2013

Venue

CONVENTION HALL, E-LEARNING BUILDING

UNIVERSITI PENDIDIKAN SULTAN IDRIS

Professor Dr. Mustaffa Ahmad
Dean
Faculty of Science and Mathematics
Universiti Pendidikan Sultan Idris

Room 3 (Chemistry, Chemistry Education and Mathematic)

Session 1	
Chairperson: Dr. Adila Mohamad Jaafar	
Time	Presenter
10.15-10.30	OR-033: The Optimization Of Nicotine Capture By Using *Sansevieria* Leaf Active Carbon With The Variation Of Mass And Type Of Activator As An Effort To Reduce The Danger Level Of Smoke
10.30-10.45	OR-034: Isolation and characterization of protein from natural rubber latex concentrate factory effluent.
10.45-11.00	OR-035: Synthesis Of Carbon Nanotubes From Different Preparation Method Of Waste Chicken Fats
11.00-11.15	OR-036: Performance Of Unconfined Compressive Strength Of Stabilized/Solidified Sample Containing Heavy Metals From Incinerated Rubber Sludge Waste
11.15-11.30	OR-077: Waste management, practices and awareness in Vocational College welding workshop
11.30-11.45	OR-078: The Study Of Web-Based Collaborative Assistance Through Edmodo As A Hybrid Learning Model On Chemical Kinetic
11.45-12.00	OR-079: Development Of Five Phase Needham Constructivism Module For Electrochemistry Concept
12.00-12.15	OR-080: The Effect Of Using Jigsaw Puzzles In Writing The Formula Of Chemical Compound Among The Secondary School Students
12.15-12.30	OR-081: The Development Of Java 2 Micro Edition Based Mobile Chemistry Encyclopedia "*Chemistclopedia*" As Independent Learning Media For Senior High School Students
12.30-12.45	OR-082: The Development Of Mobile Game "*Scientist Academy*" As Chemistry Learning Media For Independent Experiments
Lunch	
Session 2	
Chairperson: Ms Nor Dalila Abd Rahman	
14.00-14.15	OR-083: The Development Of Java 2 Micro Edition Based *Chemistclopedia* Application On Chemical Elements For Senior High School Students
14.15-14.30	OR-084: The Development Of Java 2 Micro Edition Based Mobile Application *Chemistclopedia* On Hydrocarbon And Petroleum As Learning Media For Senior High School Students
14.30-14.45	OR-085: The Development And Response Of Teachers Toward Character-Based Mobile Game "Robochem" On The Reaction Rate Topic
14.45-15.00	OR-075: Strong Convergence Of An Algorithm About Quasi-Nonexpansive Mappings For The Split Common Fixed-Point Problem In Hilbert Space
15.00-15.15	OR-076: Modeling the Churning Tendency among Mortgage Customers using Data Mining Approach
15.15-15.30	OR-111: Synthesis And Characterization Of Ldh-Latex Stimulant Nanocomposite-Chitosan

OR-085

THE DEVELOPMENT AND RESPONSE OF TEACHERS TOWARD CHARACTER-BASED MOBILE GAME "ROBOCHEM" ON THE REACTION RATE TOPIC

Septi Riyanningsih and Jaslin Ikhsan

Department of Chemistry Education, Faculty of Mathematics and Science, Yogyakarta State University, Yogyakarta 55281 Indonesia.
E-mail: septiriyan@gmail.com, jaslinikhsan@gmail.com

The aims of this research were to develop character-based mobile game "Robochem" on the reaction rate topic and to know the response of chemistry teachers to the integration of character education values into the game. The development of the game was in line with Borg and Gall Educational Research and Development model that was adapted become four main steps, which are preliminary research, planning, development, and field test. The development step was to produce dummy of media. The dummy product was reviewed by experts of multimedia and Chemistry contents, as well as peers. After all revisions, the product was finally reviewed by chemistry teachers. Instruments for reviews and responses were questionnaires. The result of this research was character-based mobile game "Robochem" on the reaction rate topic that can be applied on android mobile phone whose quality based on teachers' review was very good. The response of teachers to integration of character education values into the game was very positive, on which the ideal percentage of integration was 96.3%.

THE DEVELOPMENT AND RESPONSE OF TEACHERS TOWARD CHARACTER-BASED MOBILE GAME "ROBOCHEM" ON THE REACTION RATE TOPIC

Septi Riyanningsih[1] and Jaslin Ikhsan[2]

[1,2]The Department of Chemistry Education, the Faculty of Mathematics and Science
Yogyakarta State University
Karangmalang, Depok, Sleman, Yogyakarta 55281 INDONESIA
[1] septiriyan@gmail.com and [2] jaslinikhsan@gmail.com

Abstract

The aims of this research were to develop character-based mobile game "Robochem" on the reaction rate topic and to know the response of chemistry teachers to the integration of character education values into the game. The development of the game was in line with Borg and Gall Educational Research and Development model that was adapted become four main steps, which are preliminary research, planning, development, and field test. The development step was to produce dummy of media. The dummy product was reviewed by experts of multimedia and Chemistry contents, as well as peers. After all revisions, the product was finally reviewed by chemistry teachers. Instruments for reviews and responses were questionnaires. The result of this research was character-based mobile game "Robochem" on the reaction rate topic that can be applied on android mobile phone whose quality based on teachers' review was very good. The response of teachers to integration of character education values into the game was very positive, on which the ideal percentage of integration was 96.3%.

Keywords: mobile game *Robochem*; reaction rate; character value education.

Introduction

Nowadays, not only technology that improve rapidly but educations also grow rapidly. The educational progress cannot be separated from the use of instructional media that increasingly varieties. So the students can get knowledge from variety of source. Learning media that have characteristic fun and attractive will make the students motivated to continue learning. The key is mobility and flexibility. Douglas Rushkoff (2006) says that the younger generation called "screenagers" because they so frequently interact with technology screens. Nowadays, people have wanted life in hand, everything can be done with one touch using mobile device in his hand.

One of application that always exists on the mobile device is game. Games will always be there in any kind of mobile devices as entertainment or necessity for the user. Games can be as entertainment if the game is to make people feel entertained, but the game can also be a necessity if the game is to make people addicted. The significant role of the games can be adapted to be a learning media. Besides that for now mobile device is not a luxury anymore and almost every student has this gadget. P. Lavín-Mera, J. Torrente, P. Moreno-Ger, and B. Fernández-Manjón (2009) say that in the past three years, mobile technologies have dramatically evolved, promoting the interest in m-Learning systems. This technological evolution comes along with a great reduction in the prices of the devices the cost of the connection services, making the purchase of a last generation cell-phone or PDA (Personal Digital Assistants) no longer an unaffordable luxury.

According Muh Tammim (2007) some 45-50 million people in Indonesia have been identified using mobile phone. The combination between mobile phones and games is often called as mobile game. Learning media that was compatible with most mobile devices such as Smartphone, feature phones, pocket PCs, personal digital assistants (PDA), tablet PCs and portable media players were mobile games (Cory Janssen, 2012). Priyanto H, Aldi D & Sulistyo P (2011: 8) Sulistyo said that humans has characteristic faster to learning everything by visually verbal so game was also good to get involved in the learning process like educational games.

But sometimes a game just loads science contents without giving character education value Even Education Law of 2003 of Indonsian Ministry of National Education instructed to establish

education not only to produce smart people, but also to educate the next generation to be a good personality or character person. Based on the phenomena, integrating character education into a mobile game can be acceptable and useful for independent learning media.

There are 18 character education values in the implementation guide, but according Zubaedi (2002) schools and teachers could add or reduce the value according to the needs of the community, the standard of competence/basic competence and subject matter. However, there are five values that were expected to be developed at each school; they are the comfortable, honest, caring, intelligent, and hard work.

Accordance with Nurtac Conpolat and Tacettin Pinarbasi (2003: 1328-1331) that some of chemistry materials were considered as intangible knowledge, so learning chemistry might be by simplification of existing objects in this world and the discussion not just about the solution which consisted of numbers (about numeric) but also included an explanation of chemical phenomena.

The scope of chemistry is so wide both descriptive and theoretical; the case often makes students feel difficult to study chemistry. These difficulties have an impact on their learning outcomes are less satisfactory. Paradigm that chemistry is a difficult science should not appear, if the students were introduced to chemistry through fun way since the beginning.

One of material that combines between concepts with calculation is reaction rate. To study this material needed a lot of exercises. Exercises that provided in text books sometimes do not make the students challenged and interested. Therefore exercises need to be packaged in a game that is flexible and can be studied anywhere at any time. With an easy medium, the difficulties to learn the reaction rate material can be resolved.

"Robochem" came from Robot and Chemistry. The concept of this game was a character-based adventure game in which it did not only contain of chemistry learning, but also character education values. Through visualization in the game, the character education values were delivered. Moreover, Robochem was a game that had a series of adventures. Each series had to be completed by user in order to continue to the next series. This mobile game used Android operating system which was one of the most popular operating system applied to almost all mobile devices nowadays. This was consistent with data from Growth from Knowledge (GfK) as of August 2011, that Android successfully dominates 84.3% of the market in Indonesia (Hari, 2012).

Research Methodology

The development model was Borg and Gall that have been adapted by Wiji S (2007: 258-267), which included four main steps. Those were preliminary research, planning, development, and field test. This development model was chosen because the development research steps were systematic and easy to follow.

Preliminary step included determining benefit and aims of game development, determining the review of the standards of competence and basic competences of chemistry subject in XI class (second year of senior high school), collecting references include books, journals, and articles related to research. Planning step included the preparation of a research method, preparation and validation the material that be loaded in the game, making flow chart game and the concept of game design. Development step was to produce a dummy product. Mobile game "Robochem" was developed using Eclipse Indigo RCP 3.7 and Corel Draw, Photoshop, and other programs related to design. The dummy product was reviewed by supervisor acted as chemistry expert and multimedia expert, and by peer reviewers. Evaluation results provided important input to edit and improve the product. The last step was review the product by chemistry teachers.

Research instrument that was used to assess the quality of mobile games included 5 aspects of criteria, which consisted of 25 points of indicators. While the research instrument to determine students' response toward the integration of character values into the mobile game was a set of questionnaire about integration the values through learning materials, through games operations which included order, instructions, rules and attitudes, and through wise quotes. This instrument contained 38 points of statements.

The quality of product was determined by chemistry teachers through the assessment in a range of Lykert scale of very good, good, average, poor, and very poor. The category of response quality was done by converting each response into quantitative data. The data were then tabulated and analyzed by using the ideal criteria (Eko P.W., 2009:238). The feedback given by chemistry teacher was used to revise the product. The score conversion table was given in the Table 1.

Table 1: Score Conversion

No.	Range of score	Quality category
1.	$\bar{X}_i + 1,8\,DS_i < X$	Very Good (A)
2.	$\bar{X}_i + 0,6\,DS_i < X \leq \bar{X}_i + 1,8\,DS_i$	Good (B)
3.	$\bar{X}_i - 0,6\,DS_i < X \leq \bar{X}_i + 0,6\,DS_i$	Average (C)
4.	$\bar{X}_i - 1,8\,DS_i < X \leq \bar{X}_i - 0,6\,DS_i$	Poor (D)
5.	$X \leq \bar{X}_i - 1,8\,DS_i$	Very Poor (E)

$\bar{X}_i$ = ideal mean score
DS_i = ideal deviation standard
X = actual score

Data on the integration of character education values into the game were nominal data that collected from teachers. The instrument to collect these data had two answers; 'Yes' or 'No'. If teachers thought that the game included the integration of respective character education value, they could select the answer 'Yes', and vice versa. Answer 'Yes' on positive statement worth 1 and 'No' worth 0. While on negative statement, 'Yes' was 0 and 'No' was 1. Teacher's answer was tabulated and analyzed using this equation:

$$\frac{\text{the number of respondent score}}{\text{the number of total score x the number of indicator}} \times 100\%$$

If the results of the research show the percentage above 50%, so the integration of character education value can be categorized good.

Result and Discussion

Teachers' Review on the Quality of Mobile Game "*Robochem*"

The result of this development research was a character-based mobile game "Robochem" on the reaction rate. Robochem comes from Robot and Chemistry, so the meaning of Robochem is Robot that performs two important missions; chemical adventure and character education. Both missions were then packaged in the form of educational mobile game. This "Robochem" is an application in the format file ".apk" which can be run with android based mobile device with certain specification. Minimum specifications for the Android mobile phone to run were at least Android 2.2 (frozen yogurt), with minimum texture screen 2x2048, RAM of 512 MB, and a processor of at

least 800 MHz. Procedure to run mobile game "Robochem" as a learning media is by installing mobile game file into the android device and can be used immediately after it is installed.

Mobile game "Robochem" had seven main navigations; Rules, Competences, Materials, Enrichments, Start, Profile, and Quit. Not only navigations, mobile game "Robochem" also had many button like back, next, home, switch off, discuss, continue, answer and controller to move the Robot. The main game was located in Start navigation consisting of six levels of games called adventures series. The adventures series themselves consisted of Creativity, Discipline, Hard work, Curiosity and Patriotism, Achievement and Caring, Honesty and Independence. Each level contained a mission that should be solved by player. The mission was about chemistry learning material, especially on reaction rate. The mission could be in the form of multiple choice questions or fill-in-blank questions. Before playing this game, players could try exercises that are available in Enrichments navigation in which there are three kinds of training. The examples of the game can be seen in Figure 1.
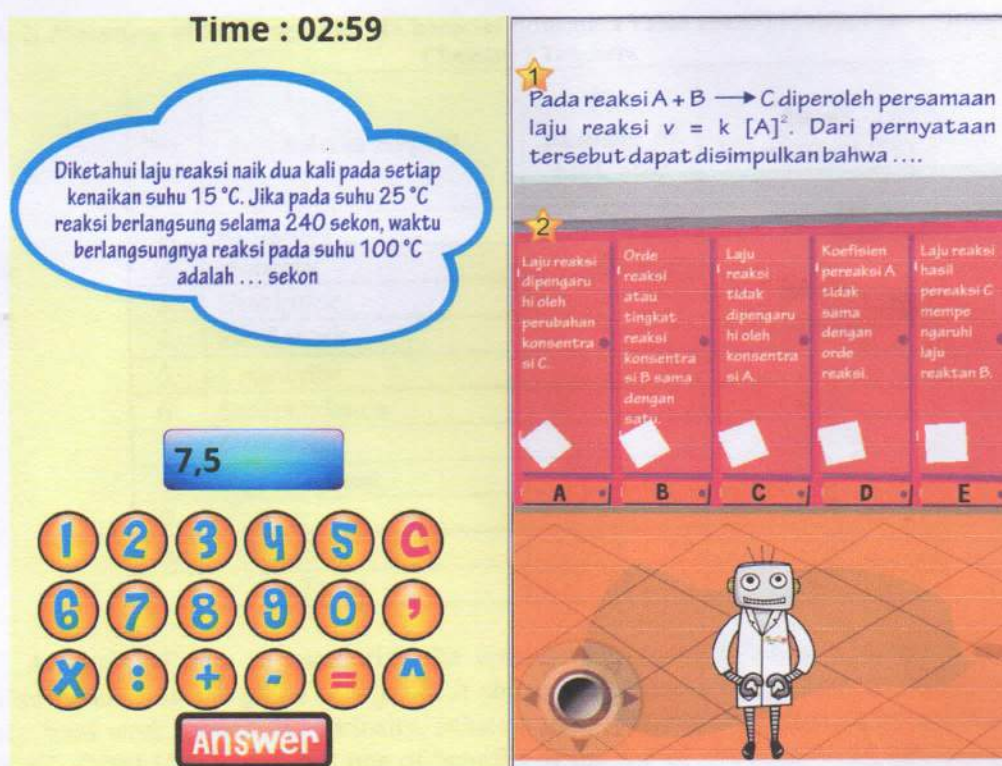

Figure 1: Examples of the game

After being made, the product was reviewed by multimedia expert and chemistry expert as well as peer. Revision was then conducted based on the reviews, and the product was then ready to be reviewed by chemistry teachers who were chosen by random sampling, and they were five chemistry teachers from different schools in Yogyakarta. The teachers responded that the quality of the mobile game "Robochem" was very good with the score of ideality of 87.4%. This result suggested that mobile game "Robochem" might be eligible to be used as independent learning and flexible media. As recommended by Holden and Sykes (2011:22) that mobile game media ought to be developed not only in linguistics but also in other disciplines. Mobile game could be important learning materials in game-based learning and m-learning. The combination of m-Learning and game-based learning can not only improve the attractiveness of the educational activities, but also

add new values and offer new opportunities and scenarios for learnin (Lavín-Mera *et al.*, 2009). It was reasonable because students in this era were digital native students that could not be separated from digital activities (Prensky, 2001). They spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all other toys and tools of the digital age. This phenomenon suggests that learning media with digital platform should be developed to facilitate m-learning. The mobile game such as "Robochem" became very important to be developed as educational media or resources in this global era and for the future, not only in Indonesia but also in the world.

Teacher's Response to the Integration of Character Education Values

The response from teachers on the integration of character values into the game was collected by Yes-No checklist. Overall responses toward the integration were equal to 96.3%, with overall data as in Table 2.

Table 2: Percentage of the Integration of Character Education Value toward Mobile Game "Robochem" by Chemistry Teachers

No.	Criteria Aspect	The number of indicator	Ideal Percentage (%)
1.	Religious	3	93,3%
2.	Honesty	3	100%
3.	Discipline	4	85,0%
4.	Hard work	4	100%
5.	Creativity	4	100%
6.	Independence	4	90%
7.	Curiosity	4	100%
8.	Achievement	4	100%
9.	Caring	4	95%
10.	Patriotism	4	100%
Total		**38**	**96,3%**

Analysis of data to categorize the responses suggested that the integration of character education value into the game was good. It showed from the ideal percentage of each aspect. The honesty, hard work, creativity, curiosity, achievement, and patriotism had high percentage of 100%. Eko P. W. (2009:107) stated that one of benefits of the use of checklist was to measure the process or product that could be detailed into smaller components, operationally defined and very specific. Using checklist, all components that may be observed, whether important components or components that were considered not very significant (nontrivial), need to be included. Moreover, if the observer was observing an object more than one so that observational data can complement each other. Precision of observers to obtain good result for all aspects of both small and large was required.

Aspect that had the second highest percentage was caring with 95%. In this game, caring means concerned about the environment. This character education value put in the game because it was important to teach the character of care for environmental cases, for example. Unfortunately, not all teachers noticed the aspect of care for the environment that included in the game because the example of the character of care in the mobile game "Robochem" was short, just like breaking news

for players. The aspect of religious and independence had the percentage of responses 93.3% and 90% respectively. In the mobile game "Robochem", the integration of both values was relatively few because they were integrated only through orders, rules and quote wise.

The aspect that had the lowest percentage of response was the discipline that was 85%. This aspect was integrated through gaming operations. However, some teachers did not notice it well. One chemistry teacher suggested that the value of discipline should be related to the playing time duration, for example beginner was given longer time than advance.

Teacher's response to the integration of character education values in mobile games was very positive. Although the integration was in the form of words or sentences but that was an innovation and very appropriate which challenged the Indonesian government's to develop mobile games for learning because students in digital era need them. Risanti (2013) stated that educational games should be developed soon because today games that were widespread in youngster and student environments were most likely war games, fights, and murders. This could eventually lead to mental impairments for them. Such violent games tend to teach young people to fight and brutality. Therefore the need of the development of educational games that are based on mobile, animations and any other formats are necessary to replace violent games for students. Educational games do not mean ignore the characteristics of games, such as fun and interesting. It has to load more educational contents and messages.

Overall teachers' responses toward the integration of character education value in the mobile game were good, although the media were not perfect yet. One of the weaknesses of the media was the form of integration. The character education values were integrated through sentences, such as wise quotes that did not require students to practice. As the consequences, the change of students' characters could not be observed. According to Pala (2011: 23-32) Good character was not formed automatically; it had to be developed and trained over time through a sustainable process of teaching, learning and practice, for example through education called character education. The intensive teaching-learning of good characters were particularly important in today society since youth generations can face many good moral decline problems. Therefore, the implementation of character education as early as possible should be carried out. One of the ways on implementing the character education is by integrating the character values into learning media including mobile games.

Conclusion

Character-based mobile game "Robochem" on the reaction rate was successfully developed. The quality of the game "Robochem" based on teachers assessment were very good (A) with ideal percentage of 87.4%. The mobile game was eligible to be used as a source of independent and flexible learning on the topic of Reaction Rate. While teachers' response to the integration of character education values into the game was equal to 96.3%. The responses were very positive, meaning that the character education values were well-integrated in the mobile game "Robochem".

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KARTINI BINTI AHMAD (PhD)
LECTURER
DEPARTMENT OF CHEMISTRY
FAKULTY OF SCIENCE AND MATHEMATICS
UNIVERSITI PENDIDIKAN SULTAN IDRIS
35900 TANJONG MALIM, PERAK