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The Development of Character-Based Mobile Game "Robochem" on the Reaction Rate Topic and the Response of Grade 11ᵗʰ Students to the Game

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Abstract

This research developed chemistry learning media of mobile game called Robochem. The media is on Reaction Rate, learning materials for 11ᵗʰ grade of Senior High School. Character education was integrated into the media by integrating it into learning materials through playing manual, and via inserted wise quotes. The character based mobile game "Robochem" is a Java game, which can be played using Android mobile phone. The objectives of this research were to determine the quality of the game based on the assessment and to study the responses of students toward the game. The development of the game was in line with Borg and Gall Educational Research and Development, including four main steps, which are preliminary research, planning, development, and test. The mobile game product was played and responded by 24 students at grade 11 of SMA N 1 Yogyakarta to collect two different sets of data; data on quality of the game and students' response to the integration of character education value. Data analysis showed that the quality of the game "Robochem" was good (B) whose average score was ... whereas students' responses to the integration of character education value was ... which mean the character education was well integrated into "Robochem". According to the results, this game is a well qualified media which is eligible for enrichment material and may enhance learning independence and flexibility.

Keywords: mobile game; learning media; character education, reaction rate

Introduction

The development of technology improves rapidly. Communication and information technology affects significantly lifestyle of Indonesian. About 20% of Indonesian uses mobile phone [1]. Therefore, game-based mobile learning becomes increasingly popular. Most mobile devices provide supports for multimedia content, location awareness, augmented reality and connectivity [2]. The features of most mobile phones support its use as a medium of learning. Learning media that is compatible with most mobile devices such as Smartphone, feature phones, pocket PCs, personal digital assistants (PDA), tablet PCs and portable media players are mobile games. The mobile game can be used as potential enrichment materials for students.

Based on Ref. [3] the use of mobile games can help additionally to integrate outside informal learning with more formal classroom activities. Moreover, the use of mobile game can provide the nature of students' learning practices using games. So many games were developed to support learning process which is often called educational game.

Character is the most important aspect to be developed through education. Gray [4] said that teaching character should be as important as teaching academics. Society will continue to be in a state of chaos until character is taught in schools. In this way, education can be used as a way to significantly decrease moral decay from overtaking society. Even Education Law of 2003 instructs to establish education not only to produce smart people, but also to educate the next generation to be a good personality or character person. Therefore, integrating character education into a mobile game can be acceptable and useful for flexible and independent learning media.

The topic discussed in this game was reaction rate combining concepts and calculation. Illustration or animation is often needed to understand the concepts of reaction rate. The calculation on reaction rate often becomes materials on final assessment, and therefore students should have more practices. The practices can be easier and more enjoyable by use of attractive media.

This research aims to develop a chemistry learning media and also to know the responses of students towards the integration of character education value in the mobile game. So the media do not only contain chemistry learning materials but also character education value. The mobile game is an educational game played on Android mobile phone and called *Robochem*. *Robochem* was taken from the word robot and chemistry.

Research Methodology

The development method was in line with Borg and Gall Educational Development model, including four main steps, which are preliminary research development, and field test. Preliminary research consists of determination looking for references like book, journal, article that encourage documentation, and application. Planning was conducted by designing designing the game using Corel Draw, Photoshop and other programs that background, button and other pictures, preparation and validation material the game, and collecting some needed apparatus. Development step was of media which was reviewed by experts of multimedia and Chemistry peers. The product dummy was then reviewed and evaluated by Chemistry product is made by using *Eclipse Indigo* program. After all revisions due to evaluation of the dummy, the product was finally field-tested to students a set Lykert scale questionnaire for the quality of the product [5]. From the score obtained then converted into score conversion table. Table of score seen in 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

Whereas data of students' responses were collected using a question integration of character education value. The integration of character education

trough three ways that are learning material, game playing rule and wise quotes. The character education value were religious, honesty, discipline, independent, hard work, creative, curiosity, achievement, caring, and patriotism. The sample was 24 students at grade 11th of SMA N 1 Yogyakarta. Collected data were analyzed using descriptive statistic.

Result and Discussion

The result of this research is a mobile game product and data of students' response to the integration of character education value. Mobile game "Robochem" product has six main navigations that are rules, competences, materials, enrichments, start, and profile. Mobile game "Robochem" has two types of game. The first game is to test "how good is your chemistry?" and the second is to test "how good is your character?" The first game is on Enrichments Menu and the second game is on Start Menu. The display of Navigation, Start Menu, and Enrichments Menu can be seen in Figure 1, Figure 2, and the Figure 3 respectively.
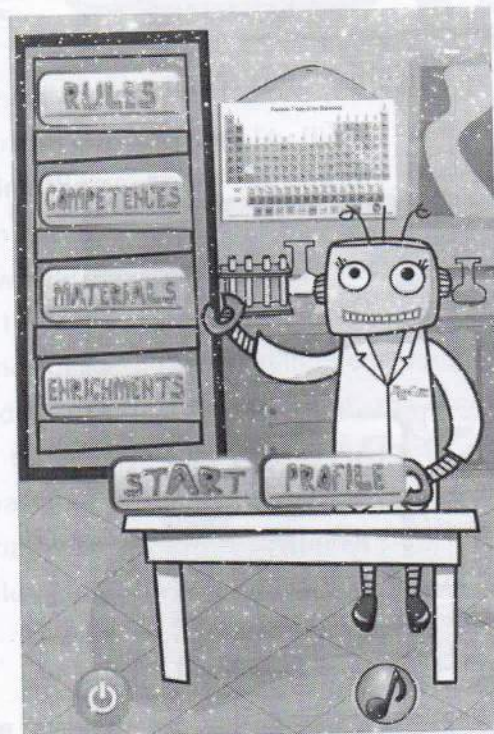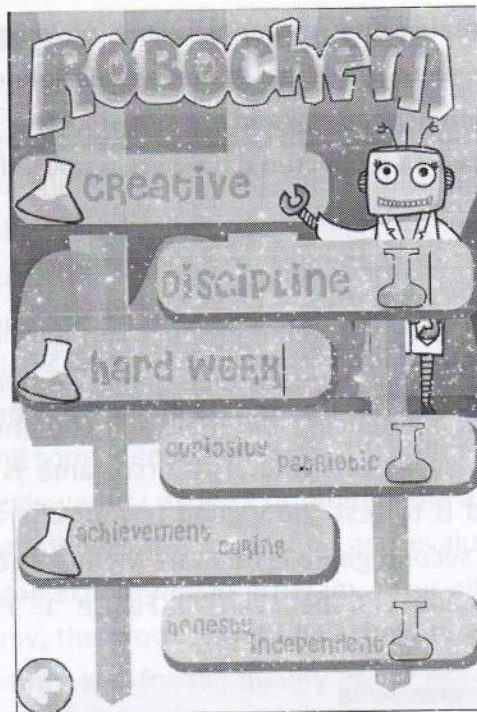
Figure 1. First Navigation

Figure 2. Start Menu

Figure 3. Enrichment Menu

a. Assessment of product quality mobile games "*Robochem*" by students

Mobile game "*Robochem*" was reviewed by 24 students at grade 11th of SMA N 1 Yogyakarta. Students were given a set of questionnaire about the indicators and criteria of quality that has to be chosen. The indicators in the questionnaire were 19 from 4 aspects of assessments; Linguistics, Usage, Display, Audio-Visual, and Software Engineering. Data analysis shows the quality of "*Robochem*" had an average score of 74.1 or ideal percentage of 78%. From the calculation, the average score converted into score conversion to five grade scale. The result of conversion can be seen in the table 2:

	Range of score	Quality category
1	$79.8 < X$	Very Good (A)
2	$64.6 < X \le 79.8$	Good (B)
3	$49.4 < X \le 64.6$	Average (C)
4	$34.2 < X \le 49.4$	Poor (D)
5	$X \le 34.2$	Very Poor (E)

The average score X is in the range of score ($64.6 < X \le 79.8$), meaning that the quality of *Robochem* was categorized into good quality (B).

Besides assessing the quality of the product, the students were also given questions about their interest in the mobile game. The questions used to determine the opinion of students towards new learning media. Percentage interest in the students towards the mobile game is equal to 91.7%. From these results it can be said that students interested in new learning media and suggested such media be developed.

Based on the data of quality assessment, the mobile game "*Robochem*" is good on quality and valuable to be used as chemistry learning media. The interest of students towards this media was high. It told us that *Robochem* is qualified media which are eligible for enrichment materials which may enhance learning independence and flexibility. In some extent, similar mobile game on Language and other important disciplines should be developed [6].

b. Students' response to the integration of character education values

The mobile game "*Robochem*" contains character education values, which are integrated via three ways; those are in learning material, in game playing rule, and by wise quotes.

Students' responses include 38 indicators of ten values of character education. The character values are religious, honesty, discipline, independence, hard work, creative, curiosity, achievement, care, and patriotism. Character education has been demonstrated to

be associated with academic motivation and aspirations, academic achievement, prosocial behavior, bonding to school, prosocial and democratic values, conflict-resolution skills, moral reasoning maturity, responsibility, respect, self-efficacy, self-control, self-esteem, social skills, and trust in and respect for teachers [7]. Instrument used only provide two answer that is 'Yes' or 'No'. When in the game includes the integration of character education value so students can select an answer 'Yes' but if there is no integration of character education value then the student can choose the answers 'No'. Each student answer of 'Yes' positive statement worth 1 and 'No' worth 0. While on negative statement, the option was 0 and the choice of No was 1.If the results of the research show the percentage above 50%, so the integration of character education value can be categorized good.

Data analysis shows that the integration of character education value was 73.7%.This mean that character education values was well integrated into the mobile game "Robochem". In more detail, the percentage of students' responses toward each value of character education is shown by Figure 4.
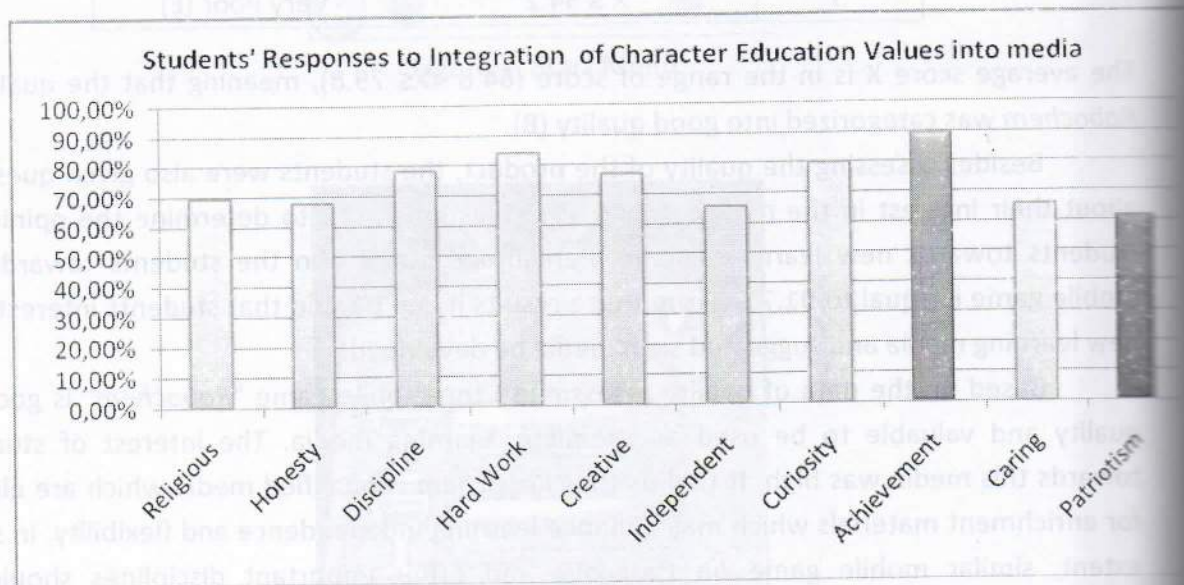

Figure4. Integration Character Education Value Graph

From the graph it can be seen that the highest percentage for the integration of education character value is Achievement with a value of 89.5%. That's because the mobile game "Robochem" give high appreciation to the achievements of students. Students who are able to complete the mission well will get not only achievement score, but also wise quote that can motivate students to continue to the next level game. Then when the student working on the mission, but not good, mobile game also provides appreciation by giving motivational quotes that encourage student not to despair to solve the mission of game. The

lowest percentage of responses was on Patriotism with a value of 61.5%. One of the reasons positioning Patriotism on lowest percentage was about language used in this game which was bilingual. According to some students, the overall game should be in Indonesian since it is the product of Indonesia. Students also stated that the mobile game did not improve students' sense of patriotism because of the lack of wise quotes included in the game. Besides that, the example of pride chemical industry in Indonesia which was included in the media was very limited. Based on the comment from some students, the patriotism was not be able to created only by such kind of media because the patriotism was built in very long comprehensive process. According to Aynur [8] Good character is not formed automatically; it is developed over time through a sustained process of teaching, example, learning and practice. It is developed through character education. The intentional teaching of good character is particularly important in today's society since our youth face many opportunities and dangers unknown to earlier generations.

Conclusion

This research was a development research measuring the quality of the product and students' responses to the integration of character education values into the mobile game "Robochem". The mobile game was good in quality based on students review, and was eligible to be used as a source of independent and flexible learning on the topic of Reaction Rate. The responses of students were very positive, meaning that the character education values were well-integrated in the mobile game "Robochem".

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