UNESA Journal of Chemical Education *ISSN: 2252-9454*
Vol. 3, No.02, pp 239-245, May 2014

DEVELOPMENT OF EDUCATIONAL GAME-BASED COMPUTER AS LEARNING MEDIA ON CHEMICAL HOUSEHOLD MATTER

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Abstract

The aim of this research was to test the feasibility of educational game-based computer as learning media for students in class VIII Public Junior High School. The method used Research and Development (R&D) which consist of (1) preliminary research, (2) product design, (3) revision of product, (4) expert-judgement product, and (5) limited trial of product. The instrumens used were survey sheet, review sheet, assessment sheet, student's response sheet, and observational sheet. This research used instructors, teachers, and 15 students as respondent. Data collection method used quostionnaire, observation, and test. The data analyzed as qualitative and quantitative description. The result showed that educational game-based computer has been feasible to use as learning media. The feasibility from the expert showed that game was very feasible in three aspect; 81,6% in content aspect, 82,6% in design aspect, and 82,5% in educative game aspect. Whereas from students response showed that game was very good/ very feasible in three aspect; 88,4% in content aspect, 88,4% in design aspect, and 89,6% in educational game aspect. While the classical mastery learning was increased from 33,3% become 93,3% which showed great significance. It could be concluded that the game has been feasible for use as learning media.
Key words: *Educational game, chemical household, learning media*

Abstrak

Penelitian ini bertujuan untuk menguji kelayakan *game* edukasi sebagai media pembelajaran Bahan Kimia Rumah Tangga. Metode Penelitian yang digunakan adalah *Research and Development* dengan tahapan penelitian (1) studi pendahuluan, (2) desain produk, (3) telaah produk, (4) validasi produk, dan (5) uji coba terbatas. Instrumen penelitian yang digunakan adalah angket survei, lembar telaah, lembar validasi, angket respon siswa, lembar observasi, dan lembar tes hasil belajar siswa. Pengujian penelitian ini menggunakan dosen, guru, dan 15 siswa SMP Kelas VIII SMP sebagai responden. Teknik pengumpulan data mengunakan angket, observasi, dan tes. Perolehan data diolah dengan analisis deskriptif kualitatif dan kuantitatif. Hasil penelitian ini menunjukkan bahwa *game* edukasi layak digunakan sebagai media pembelajaran. Penilaian guru dan dosen terhadap *game* termasuk kategori sangat layak dengan tingkat kelayakan pada aspek isi sebesar 81,6% (sangat layak), aspek penyajian sebesar 82,6% (sangat layak), dan aspek *game* edukasi sebesar 82,5% (sangat layak). Respon siswa terhadap *game* termasuk kategori sangat baik atau sangat layak dengan dengan tingkat kelayakan pada aspek isi sebesar 88,4% (sangat layak), aspek penyajian sebesar 88,8% (sangat layak), dan aspek *game* edukasi sebesar 89,6% (sangat layak). Hasil belajar siswa setelah menggunakan *game* mengalami kenaikan ketuntasan klasikal dari 33,8% menjadi 93,3%. Dengan demikian dapat disimpulkan bahwa *game* yang dikembangkan telah layak digunakan sebagai media pembelajaran pada materi pokok Bahan Kimia Rumah Tangga.
Kata kunci: *Game, Bahan Kimia Rumah Tangga, Media Pembelajaran*

 ISSN: 2252-9454

INTRODUCTION

The learning in 21 century leads to a multimedia-based learning as the ability of computer to combine audio, visual, and text components simultaneously. One of the emerging multimedia products are computer games. Positively, the game was well received by children and adolescents [1]. Games are not only made for entertainment, but also has the potential to improve learning success. Games used as learning are called educational games.

Basically, learning process is a communication between learning resource, medium/channel, and receiver [3]. Game can be used as learning media if through gaming the students can receive instructional message so that the objective is fulfiled [4].

Educational game has the potential to regrow learning motivation of children [5]. Another advantage of the use of games in learning are: (1) Students become active producers, creative, and motivated, (2) provide a means of inquiry-based learning, (3) provide experience for recalling information, and (4) present satisfaction,pleasure, motivation, emotion, and creativity which leads to increase of learning result of students [6]. The game potential in improving the learning success can be applied at science learning.

Science learning is expected to be a vehicle for students to learn about themselves, the natural surroundings, and to apply in everyday life. However, the results of the survey in the Public Junior High School of 22 Surabaya showed that students consider science is the matter of memorizing, difficult, and boring subject to learn. Further analysis showed that students have some trouble in learning Chemicals in Everyday Life. This fact is demonstrated by the results of the survey in figure 1.

Based on the questionnaire, it was found that students have difficulties in learning the Household Chemicals matter. This happens for several reasons, which are described in figure 2.

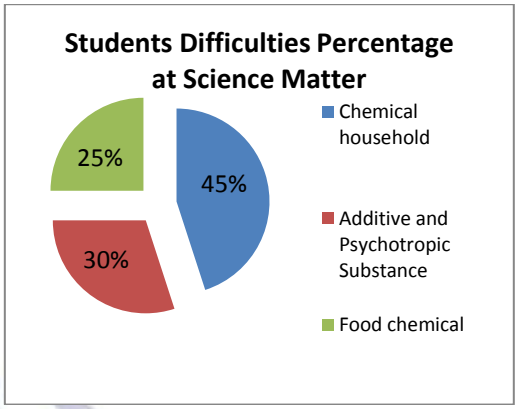

Figure 1. Students Difficulties Percentage

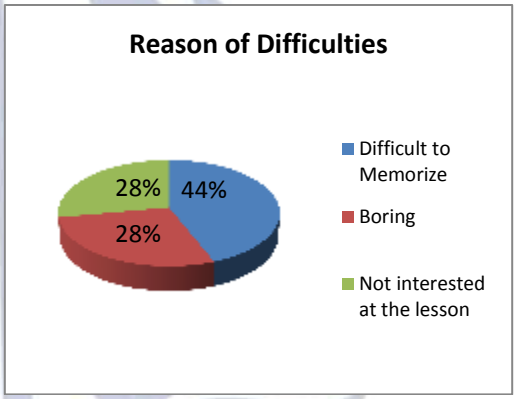

Figure 2. Reasons of Students Difficulties

This learning difficulties decrease the students learning outcomes, that 67% students in Public Junior High School of 22 Surabaya were still not complete in Household Chemicals material with a value below 75. Results of discussions with teacher in Public Junior High School of 22 Surabaya gave information that students have difficulties in identifying the active ingredients of household chemical products that includes cleaning, deodorizer, bleach, and pesticides. In such conditions, need to be developed an educational game as a learning media on Household Chemicals matter that is able to arouse interest, active participation, and increase student comprehension.

Principles and characteristics that must be considered in developing educational games include: (1) active learning, (2) challenges, (3) the purpose, (4) motivation, and (5) feedback [7]. Also,

the key characteristics of game as learning media are challenge, curiosity, control, and fantasy [8]. These elements when combined in the design of a game could lead to a passion and enthusiasm for learning that impact on improving children's learning outcomes.

In terms of learning theory, game can teach cognitive strategy relevant to Piaget's equilibration. Games are also very effective in setting up the motivation to learn, and can be used as constructivist learning. Educational game can make students happy and enjoy so that students are more motivated and have a desire to continue learning [9].

Based on the exposure above, the purpose of this research is to know the feasibility of educational game-based computer as learning media in Household Chemicals matter.

METHOD

The method used in this research is *Research and Development* (R&D) which was adapted from Sugiyono (2010), include (1) a preliminary research, (2) product design, (3) revision of the product, (4) validation of the product, and (5) limited trial [10].

Phase of preliminary research is a step that aims to gather relevant information regarding the need for the development of the game. At this stage the data collected on some aspects; factors that support learning, learning media, and the condition of the students, such as ability, attitude, motivation, and interest in learning. In this stage also collected some relevant literature include theory of educational games, learning media, learning theory, and curriculum analysis to determine the instructional objectives

The design product stage is the stage that includes the determination of the elements that need to be loaded in the software including the basic components of the game, interface design, and support materials. At this stage produced flowcharts, storyboards, and user interface design. The design is then developed using Adobe Flash Player and RPG Maker to produce softfile in .swf extention. This stage finally produce product I.

The revision of product, is a stage of gathering input and advice from the experts on product I. The results form the basis of suggestions to make improvements to the product. This will produce product II.

Expert judgement/validation, is a stage of assessment conducted by lectures and science teachers. If the assessment has met the criteria of worth, then performed limited trial of product.

Limited trial of product, is the test of using product in limited field. In this case, 15 students used as respondent. This stage is meant to obtain students' response to the game that was developed and data on students learning outcomes before and after using game.

The focus of this study is educational game that will serve as a learning media in Household Chemicals matter. Sources of data were obtained from the lecturer, science teacher, and 15 students of Public Junior High School of 22 Surabaya.

The research instrument used were survey field sheet, revision sheet, learning result sheet, student's response sheet, and observational sheet. The data analysis technique used is the technique of qualitative description and quantitative description. Qualitative description is used to present the result of comment from the expert about the game, while quantitative description is the technique used to analyze the results of the validation, student responses, observations, and tests of student learning.

Data validation results of the questionnaire by teachers and lecturers are processed using rating scale measurement and compared with the ideal score to obtain the average percentage rate of the resulting game feasibility. Data results of student questionnaire responses is also processed with rating scale, and is

supported by observations using Guttman scale.

The test learning results will be analyzed quantitatively by comparing the classical completeness before and after using the game. Students are belong to mastery level if the value reaches equal to or more than 75.

RESULTS AND DISCUSSION

1. Validation of Product

Review of educational game is done by lectures and science teachers. After revising product I, there are some aspect that need to be changed to make a better game as learning media. This revision produce product II and can be evaluated by experts include lectures and science teachers. Based on the evaluation by experts, the game developed got a very feasible category with the average percentage of 80.6%.

The assessment aspect include the content aspect, the presentation/layout aspects, and educational game aspect that can be described as follows:

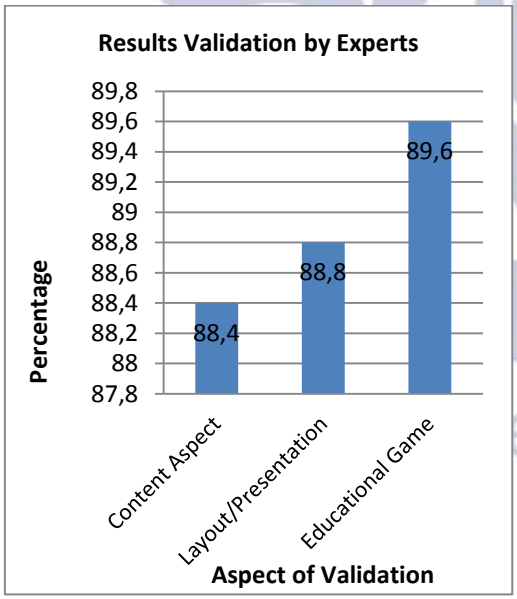

Figure 3. Results Validation by Experts

In the aspect of content, assessment indicators are: the suitability of the material with the purpose of learning and clarity of language. In the aspect of presentation/layout, assessment indicators are: presenting the concept and display media. While the educational aspect of the game is to understand the content through gaming and instructional quality. Based on this assessment, educational game has been feasible and does poses to the next stage. The game can be tested at limited trial of product on small group.

2. Limited Trial of Product

At this stage, there were 15 students as respondent to use the game. Limited trial of product is used to get the data of students response about the game and data of learning result. Their achievement before and after using the game are recorded to see the differences.

Based on student responses, the game developed got a very feasible category with an average percentage of 80.6%. These results include an assessment on the content aspect, the presentation/layout aspects, and educational game aspect that can be described as follows:

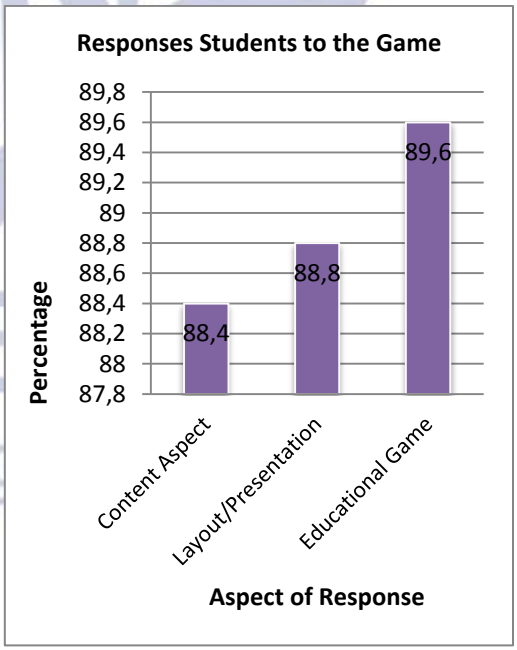

Figure 4. Responses Students

Content aspects describe the ease of the students in understanding the material contained in the game. The game developed has fulfill the ease of

understand the material in 88.4% or very feasible category. Students can understand the material of Household Chemicals with games because the preparation of the material has been adapted to the curriculum, set the indicator, adjusted for age and junior high school students. Materials were selected, ranging from text, images, videos, types of exercises, also adapted to the learning objectives. The support for a very good understanding of the material can be seen from the given exercises, puzzles to solve, pictures and videos, and use of language.

While the layout/presentation aspect refers to the display media such as video, audio, and usability. Ease of using the game got response of 85.3% or very good, supported by the results of the observation that 100% of students did not ask questions, 100% of students did not ask about the functions of the navigation game, and 86.7% of students played the game smoothly. The educational game use the keyboard to run the character, and left click on the mouse which is the basic operation of the computer. With the fulfillment of the criteria for assessment of this aspect indicates that the criteria have been met ease of navigation as one of the assessment criteria for interactive media that should be made easy to use so that students do not need to learn the computer first [11]. In addition, the adoption of music also got a very good response (86.7%), which is the background music is relevant with adventure theme (86.7%) and background music can concentrate the learning (86.7%).This is supported by the observation that 100% of students was not distracted by music

Aspect of educational game involving challenge, interest, and control. To support aspects of challenge, the material presented varies, there are written forms, and conversation form using simple language yet still convey the content of the material. To help players memorize some chemical compounds in household products, puzzle games provide a specific time can be repeated. This repeated excercise would make more embedded memory or increase of retention [12].

In the aspect of control, student response categorized as excellent or very good (89.6%). Students can operate the game itself easily gets ratings (89.3%) or very good, but the valuation range between 3-5 of the maximum value of 5, this can happen because the players are not accustomed to using the kind of adventure games with the direction of movement using the keyboard, and since this game is flash based, some areas of the touch are less firm so the player must touch a certain area with the right direction to be able to bring up the display.

In the aspect of media presentation/layout, students interested in using games (88%) in the excellent category. This is because the game is made with a story to make students able to play their role as the user running the game. So this game has been able to cultivate students' positive attitudes toward learning materials. These results are consistent with research Park [13] who found that there were significant differences on intrinsic motivation in students who use high-level games, such as those involving various types tantagan and training than students who use low-level games that use only one way to play the simple and monotonous.

To determine the effect of the use of games on cognitive abilities of students, it is conducted the pretest and posttest results to be compared. Students are mastery if the value reach of learning outcomes equal to or above 75. Completeness of students can be described in figure 5.

From the analysis found that there is a significant increase in the classical completeness of 33.3% to 93.3%. This suggests that the game developed has a positive influence on student learning outcomes. This is consistent with the results of studies by Chuang and Chen [14] that the computer-based games to

 ISSN: 2252-9454

improve student achievement student's cognitive learning process.

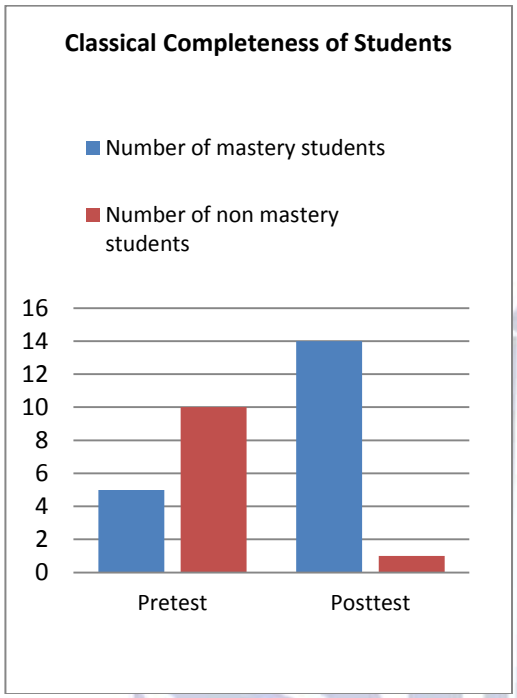

Figure 5. Improved completeness classical Students

CONCLUSION

The educational game developed has been feasible to use as learning media in terms of expert judgments based on the content aspect, the presentation/layout aspects, and educational game aspects that gets an average rating of 82.4% on very good category. In addition, the students' response to that developed game in terms content aspect, presentation aspects, and educational game aspects got 88.8% of the assessment or very good category. Game effect on the increase in student learning outcomes can be seen from the mastery of learning outcomes classical on the pretest results by 33% to 93% on the posttest results.

SUGGESTION

From the research that has been conducted, the recommended advice is that the preparation of the characters and figures on the interface can be made more explicit by using a better program, for example Doc.net program. Besides, in the process of game design, need to consider the allocation of time to play the game since every player has different abilities, depending on the willingness and ability of the player to finish the game

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