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# Development of Interactive Multimedia Learning Based on Educational Games in Basic Chemistry Learning Media

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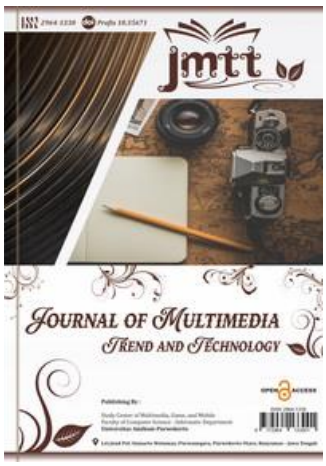


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**ABSTRACT**

The purpose of this study is to investigate the features and efficacy of educational game-based MPI for high school colloid system learning. The stages of problem and potential identification, data collection, product design, design validation, product revision, product testing, design revision, use testing, and product revision were all included in the Research and Development (R&D) research method's design in order to produce a final product. Following the development process, learning media with the following qualities were created as the end product: 1) interactive; 2) engaging and enjoyable; 3) serving as a general and autonomous learning medium on high school curriculum; and 4) practical and compatible. All of the criteria—students who completed KSM 70, which represents no less than 70% of the total student body, students who exhibited very good interests, and students who exhibited very high activity, which represents no less than 70% of the total student body—were found to be effective in the trial use. With a completeness of 92.44%, very good interest of 87.33%, and very high activity of 88.11%, it can be concluded from the research and discussion results that MPI based on education games is effectively implemented in chemistry learning in class XI colloidal systems material at SMA Level.



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## INTRODUCTION

As it is generally understood, the teaching resources available and frequently used in schools nowadays consist of text books, lecture notes, videos, and presentations that are limited to one page[1]. This causes the education that has been provided in the school thus far to be somewhat meek, which makes the students feel jaded and somewhat uninterested in the kimia lessons that eventually get tedious in the classroom. However, there is still room in schools for the use of computers, LCDs, and kimia laboratories, among other laboratories, which have excellent potential for teaching[2].

Learning media was chosen to be the focus of research because media has an important role in achieving student learning success. The choice of media as a learning strategy is also dominant in understanding concepts[3]. Media needs to be used and developed in learning according to the content, explanation of the message to be conveyed and student characteristics. In teaching and learning activities, ambiguity in the material presented can be helped by using media as an intermediary[4]. The complexity of learning material can be simplified with the help of media. Media can represent what teachers are less able to say through certain words or sentences[5]. Apart from that, media can be used as a guide or messenger in learning, as a generator of attention, student motivation and passion for learning through more direct interaction between students and learning resources. Apart from that, limitations of space, time, energy and sensory abilities can also be helped by media[6].

Regarding the influence of flash games on learning, it turns out that it has an effect on learning outcomes. All the potential that games have as a medium is very possible to be used as a motivational learning medium for students. Apart from that, games have a very close relationship and have a positive influence on the learning process[7][8]. Chemo-Edutaiment learning disk drive media has succeeded in making learning disk drive which have received quite good responses and can be used for science learning in junior high schools, both in the classroom and at home[9]. Learning with Interactive Multimedia on the material on osmotic pressure of solutions received positive responses from students, students felt happy learning using Interactive Multimedia software[10][11]. Apart from that, the use of learning using interactive multimedia is a solution to improving the quality of learning in the classroom and provides an alternative to the limited teaching opportunities implemented by educators[12].

The media that will be developed in this research is made in flash format. The advantage of this flash format is that it can be used to visualize simulations and animations, making images more lively and making it possible to create interactive movies where users can use the keyboard and mouse to interact (Interactive)[13][14]. In learning the main material on colloid systems, students study dispersion systems, grouping of colloid systems, the properties of colloids, lyophilic and lyophobic colloids as well as the manufacture and role of colloids in everyday life[15][16]. The choice of colloid system material as the material in the media being developed is because the colloid system material contains basic concepts and is applicable in nature so it requires clearer depictions and real examples in everyday life[17][18]. With the existence of Interactive Learning Multimedia based on education games in flash format, it is hoped that the depiction of colloidal system concepts will be clearer and examples and uses of colloidal systems will become more applicable so that it is hoped that students will become more interested and understand[19].

What qualities of interactive learning multimedia based on educational games as a chemical learning medium are formulated as the research problem? And how successful is Interactive Learning Multimedia, which is built around educational games, as a medium for teaching chemistry? This paper aims to investigate the features of Interactive Learning Multimedia based on educational games as a medium for learning chemistry, as well as

the efficacy of Interactive Learning Multimedia based on education games with insight[20].

## METHOD

The research steps that will be taken in this research are in accordance with the work flow of the modified R&D method. The modification in this research is in the product developed, namely Interactive Learning Multimedia (MPI) based on educational games[21]. In this research there are 2 stages, namely the planning and program development stage which includes problem and potential identification, data collection, product design, design validation, design revision and product trials (small scale) as well as media effectiveness testing stages which include usage trials/effectiveness tests (large scale), final product revisions and final products. In testing the effectiveness of the independent variable in this research is the MPI learning media while the dependent variable is the learning outcomes, interests and activities of students during the learning process.

This research data consists of initial data and main data. The initial data is in the form of learning media, colloid system materials commonly used by teachers, taken through teacher and student interview questionnaires. The main data is an assessment of the feasibility of Education-based Interactive Learning Multimedia (MPI) media by media experts, material experts, language experts taken through a questionnaire in the form of a checklist, student activities through observation sheets in the form of a checklist, learning outcomes through post tests, student interests and responses. students and teachers through a checklist form questionnaire.

The feasibility of Interactive Learning Multimedia (MPI) media based on Education games by media experts, material, language and student response data were analyzed using percentage descriptive techniques using the formula that has been developed, namely as follows:

*Eligibility = Total scores obtained divided by the maximum score multiplied by 100%*

Table 1, Descriptive criteria for MPI eligibility percentage based on Education Game

| Interval | Criteria |
|---|---|
| **81 – 100%** | Very Worth It |
| **61 – 80%** | Worthy |
| **41 – 60%** | Decent Enough |
| **21 – 40%** | Not Worth It |
| **0 – 20%** | Not feasible |

Product effectiveness is determined using data on student learning outcomes, interests and activities. Student learning outcomes in the form of student post test scores are analyzed using the formula:

*Value = Total score obtained divided by the maximum score multiplied by 100%*

To determine the effectiveness of educational game-based Interactive Learning Multimedia (MPI) on student learning outcomes, it is analyzed using the formula:

*Percentage = Number of students who get a score of more than 75 divided by the total students multiplied by 100%*

The trial of using Interactive Learning Multimedia (MPI) based on educational games is said to be effective if students who complete (score≥75) are no less than 75% of the total students. Interest was analyzed using descriptive percentage techniques. The use trial is said to be effective if students who have good interest (score>75%) are no less than 75% of the total students. Student activity was analyzed using a percentage descriptive technique where the use trial was said to be effective if students who had very high activity (score>66%) were no less than 75% of the total students.

Data from student responses in the form of questionnaires were analyzed using descriptive percentage techniques.

Table 2. Descriptive criteria for the percentage of students' responses to the use of Education Game-based MPI

| Interval Score | Criteria |
|---|---|
| **76 – 100%** | Very Good |
| **51 – 75%** | Good |
| **26 – 50%** | Enough |
| **0 – 25%** | Not Good |

A checklist-style questionnaire was used to collect teacher response data (interview results), which would be subjected to a qualitative descriptive approach of analysis. Ten statements with the alternatives "Yes" or "No" are included in the teacher response questionnaire. Researchers can determine whether Multimedia Interactive Learning (MPI), which is based on educational games and has been developed, is appropriate for use in the learning process of Colloid System material by using a questionnaire that teachers respond to.

## RESULT

The media results that have been created are validated by validators, validation of learning media in terms of appearance carried out by media experts, validation of colloid system material by material experts and high school chemistry teachers, language validation by high school Indonesian language teachers and validation in the use of Interactive Learning Multimedia media (MPI ) based on the insightful educational game Chemo-Edutaiment (CET) by teachers. The assessment of the feasibility of educational game-based MPI from experts is presented in Table 3.

Table 3. Feasibility of educational game-based MPI according to media experts, material and language experts

| Aspect | Respondent | Max. Score | Total | Value | Description |
|---|---|---|---|---|---|
| **Media** | Expertise | 64 | 54 | 80,43% | Very Worth It |
| | Teacher | | 60 | 92,32% | Very Worth It |
| **Material** | Expertise | 32 | 26 | 86,21% | Very Worth It |
| | Teacher | | 29 | 88,65% | Very Worth It |
| **Language** | Teacher | 28 | 25 | 92,04% | Very Worth It |

Material experts said that the material content in the media can be used for research. Indicators in the media that are not optimal (value <4) include indicators of depth of material, elaboration of material, and availability of practice questions. The advice given by material experts is to add other visualizations (animations, videos or images) to make it more interesting. Based on the results of the questionnaire and suggestions from

material experts, animations of the soap working process and colloidal images which are closely related to daily life were added to deepen the material and additional practice questions were added to the media.

After being validated by media and material experts, the revised product is validated again by the teacher by looking at the media, material and language aspects. From the media and material aspect, the teacher said that the media was very suitable for use in research without the need for revision.

From linguists, indicators of language use in the media that are not optimal (score <4) include indicators that are easy to understand, in accordance with good spelling and communicative. Experts also provide suggestions to pay more attention to writing affixes and rewords so as not to cause confusion and misconceptions. In accordance with the results of the questionnaire and suggestions given by linguists, corrections were made regarding the writing of words that were ambiguous or caused confusion, the use of words that were not in accordance with the good spelling as well as inappropriate affixes and rewords. After repairs have been carried out, the media is ready to be tested on a small scale.

After the education game-based MPI was completely revised, the valid product was implemented on a limited number of students, namely 9 students in class 3 students each per criteria). The feasibility of educational game-based MPI in product trials (small scale) is presented in Table 4.

Table 4. Feasibility of educational game-based MPI in small-scale tests

| Criteria | The number of students | Value in % |
|---|---|---|
| **Very Worth It** | 7 | 77,78% |
| **Worthy** | 2 | 22,22% |

In accordance with the descriptive criteria for the percentage of eligibility (table 1), 7 out of 9 students gave the assessment criteria as very feasible, while the rest were adequate. However, there are still several errors in writing words/sentences and descriptions of images/animations in the media that need to be corrected so that they can be used in large-scale tests. Apart from providing response questionnaires in small-scale trials, test questions are also carried out which will be used for post-tests in large-scale trials. After analysis, it turns out that students with smart criteria do not always have good results, and conversely, students with less criteria can actually have better results. This could be due to students' interests and activities during the learning process. For some students with smart criteria in small-scale trials, they are less active, tend to be shy and passive during learning so they are less able to receive learning well which results in poor learning outcomes. On the other hand, for some students with poor criteria, they are very active and enthusiastic in learning so they can receive learning well and have good learning results too. This proves that students' interests and activities during learning have a great influence on learning outcomes.

Product revisions are carried out based on the results of student responses to small-scale product trials. The majority of students considered that the MPI based educational game that was tested was very feasible. However, there are still several errors in writing words/sentences and descriptions of images/animations in the media that need to be corrected so that they can be used in large-scale tests.

The resulting product is an MPI-based education game with a Chemo-Edutainment (CET) perspective that has been developed which has the characteristics of 1) Interactive, which is realized through buttons and menus in the media where users are free to choose the way of learning that suits their wishes, 2) Interesting and fun, which is realized

through educational games contained in the media in the form of TTS games, puzzles, word search and quizzes so that it is hoped that students will become more interested in learning using media and can create a pleasant learning atmosphere, 3) As a general and independent learning media which is realized through media packaging in the form of Learning Disk Drive so that users can use the media for general learning at school or as independent learning media at home, 4) Useable and compatible which is realized through media file formats created in the form of Executable (*.exe) and Shockwave Flash Object (* .swf) making it easier to operate and can be run on various hardware and software.

The revised media testing results include learning outcomes, interests, activities, student responses and teacher responses are presented in Table 5, Table 6, Table 7 and Table 8.

Table 5. Student learning outcomes

| Criteria | Total | Value in % |
|---|---|---|
| **Completed** | 34 | 92,44% |
| **Incompleted** | 2 | 5,55% |

Table 6. Student interest in Education Game-based MPI

| Interesting Criteria | Total | Value in % |
|---|---|---|
| **Very Good** | 30 | 83,33% |
| **Good** | 6 | 16,67% |
| **Enough** | 0 | 0% |
| **Not Good** | 0 | 0% |

Table 7. Student activities towards Education Game-based MPI

| Activity Criteria | Total | Value in % |
|---|---|---|
| **High** | 31 | 86,11% |
| **Middle** | 5 | 13,89% |
| **Low** | 0 | 0% |

In the analysis of learning outcomes, student interests and activities in learning using education game-based MPI (tables 5, 6, 7) it can be seen that the learning outcomes of students who achieved completeness were 94.44%, students with very good interest were 83.33% and students with very high activity were 86.11%. This shows that MPI based on education games is effectively applied in learning colloid systems in high school. Learning with visual media influences student interest and learning outcomes. In the analysis of learning outcomes, student interests and activities in learning using education game-based MPI, it turns out that there is a relationship between student interests and activities during learning and student learning outcomes during the post test. Students with high learning outcomes tend to have high interest and activity when learning and conversely students with low learning outcomes tend to have low interest and activity as well. Another opinion states that enjoyable learning is learning with a teaching and learning atmosphere that makes students happy so that students focus their full attention and spend time on task, in other words high interest and activity. This high time on task will improve student learning outcomes. Effective learning can be achieved if: (a) students are motivated and participate more in learning, (b) students are aware of their progress and

strengths, (c) students make progress from the results previously achieved, (d) students are responsible, active in school and the wider community, (e) students are actively involved in learning and improving their abilities. Learning with visual media in the classroom influences students' chemistry interest and learning outcomes on the subject matter of electrolyte solutions.

Table 8. Student responses to Education Game-based MPI

| Responsibility Criteria | Total | Value in % |
|---|---|---|
| **Very Good** | 29 | 80,56% |
| **Good** | 7 | 19,44% |
| **Enough** | 0 | 0% |
| **Not Good** | 0 | 0% |

In calculating student responses to the education game-based MPI (table 8), it is known that students with very good responses reached 80.56% and 19.44% of students gave quite good responses. Students want similar media that can be used in other learning because they have never previously studied with the help of media with games in it. In this research, games are used as educational learning media (educational games). Educational games are designed to simulate existing problems so that essence/knowledge can be obtained that can be used to solve these problems. The use of computer-based learning media turns out to have a positive effect on learning outcomes. Games are a powerful connector for learning. Apart from that, games can also be presented as an addition to strengthen material in mastering abilities.

Teacher responses are used to determine the extent of convenience provided by education game-based MPI in delivering colloid system material. From these data it is known that the teacher gave a positive impression in the teacher response questionnaire. The teacher stated that learning with MPI based on education games is interesting, learning objectives can be formulated clearly, the presentation of the material is also structured systematically with complete material, the instructions for use are clear, the learning activities are varied, the pictures/animations presented can help students' understanding, the practice questions are also varied, thus providing convenience for students, and making students more active and interested in learning. Apart from that, MPI based on education games can be used independently and can help teachers explain material to students in a fun way.

## CONCLUTIONS

fter going through the development process, the final product is produced in the form of learning media with the characteristics: 1) interactive, 2) interesting and fun because there are educational games (fuzzy games, puzzles, word search and quizzes) in it, 3) as a learning medium for high school colloid materials both in school or independently at home, and 4) packaged in the form of a learning disk in (*.exe) and (*.swf) formats. Apart from that, in the test of using MPI based on educational games, it was effectively applied to the learning of chemistry material on colloidal systems in class .

In today's media projections, it is very possible to use learning media that are used simultaneously. If these variables are added, it is possible that the values will become complex and it can be concluded that the online media that have the highest value also have the highest impact. This paper has limitations because not all schools support information technology media that can be run in real time, such as mobile and websites.

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