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Media Design for Learning of 3D Animation Based Hydrocarbon Compounds in Vocational Schools

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ABSTRACT
The results of this study resulted in the development of hydrocarbon-based 3D learning media products in chemistry subjects that have been validated and explained by validators, teacher practicality, and also effectiveness to students. This study uses the Research and Development method with five stages (ADDIE): analysis, design, development, implementation, and evaluation. The development model used for the Luther-Sutopo version of the multimedia development model consists of six stages, namely preparation, design, material development, manufacture, testing, and distribution. The results showed that (1) the validity test of media experts 4 got a score of 81% with the correct category; (2) the practicality test of 3 material experts got a score of 92%, (3) the 10th grade students' effectiveness test got a score of 94% for the instrumental category. Test the validity, practice, and effectiveness of this instructional media product has an appropriate value and can be used in learning hydrocarbons in chemistry subjects. So it can be suggested by researchers that teachers and students can use it as an alternative learning media.

Keywords: *3D Animation, ADDIE, Blended learning, Vocational School.*

1. INTRODUCTION

The development of technology and science (science and technology) describes how high human enthusiasm is to simplify all accesses in doing something, both in transportation communication, education, and others. The development of science and technology increasingly encourages renewal efforts in technological outcomes in the learning process. This requires teachers to be able and accustomed to using the tools and media provided by the school. It is also possible that the platforms and tools provided increase according to the demands of the times. Teachers should utilize and operate in using media that is easy and efficient even though it is simple. However, it is still necessary to achieve better learning objectives as expected. According to Raharjo, media is a container of messages whose sources can be sequenced and conveyed to the message's target or recipient. Understanding the media is a learning process in teaching commonly used as a graphic, photographic or electronic tool to capture, process, and compile visual or verbal information. [1]

Learning media is an effort to improve the learning process formed in the interaction between teacher and students and student interaction with the environment. [2][17][18]

The use of media in learning can help educators convey information and limit class hours. The media serves as a source of information on learning materials and as a source of practice questions. Learning media are designed by the latest technological developments, including collaborating using a PC/Laptop. The learning media that will be

made is about understanding the chemistry of hydrocarbon compounds. Hydrocarbon compounds are learning materials in chemistry subjects aimed at class X SMKN 2 Padang Panjang. Hydrocarbons are carbon (C) and hydrogen (H), which are chemical compounds. Examples of chemical compounds are methane (CH4), ethane (C2H4), and acetylene or carbide gas (C2H2). Hydrocarbons are found in oil and natural gas. [3] Several elements can be animated in 3D regarding the study of hydrocarbons.

A 3D animation is a form of animation in the form of three-dimensional but not in 3D real or physical form in real-time but in the form of three-dimensional color such as hardware (screen forms of media). Unlike the 2D animation that has only two dimensions, length (X) and width (Y), 3D animation add size in the form of a depth (Z). [4] Based on the observations that have been made on the learning of hydrocarbon compounds for class X students of SMK Negeri 2 Padang Panjang, it is known that the learning process for hydrocarbon teachers currently uses 2D-based learning media (blackboard). Researchers make learning media on the subject of chemical compounds but are still limited by their ability. By knowing these conditions, the researcher is pleased to create a form of learning media that is expected to be useful for the continuity of the teaching and learning process regarding learning hydrocarbon compounds. This learning media is designed using software or software that the researcher chooses according to making learning media.

Software (application) is used to design a learning media that has many offline and online variations. 3DS Max and Adobe Flash CS6 applications are some examples of applications used to develop learning media. The software can create animations based on 3D learning media that can be used at no cost and help complete learning media development. The pursuit media created a product, namely 3DS Max. 3D Max can perform processes in the form of animations and images that can be moved and changed easily and can produce animations in 3D. Simultaneously, the Adobe Flash CS6 application is a graphics-based animation software that can create graphic objects and animated displays that have been made so that users can immediately start and design something without having to use more graphic support software such as Adobe Illustrator or Photoshop. Users can access the software, then carry out the steps for making learning media as instructed by the teacher carefully. Then the user waits for a while until the development is complete and the learning media has finished being launched and used.

Based on the explanation, the researcher made a 3D animation based learning media, which presents more engaging learning of hydrocarbon chemistry. The primary author's interest in researching developing to produce a 3D-based animated hydrocarbon learning media at SMKN 2 Padang Panjang describes the validity, practicality, and effectiveness.

2. MATERIAL AND METHODS

In this study, the authors used the Research and Development (Research and Development) method or R & D with the ADDIE model method. ADDIE stands for Analysis-Design-Implement-Evaluation and Development. [5] The development model used is the Luther-Sutopo version of the Multimedia Development model. According to Luther, the multimedia development model consists of six stages, namely Concept (drafting), Design (designing), Material Collection (material collection), Assembly (Making), testing, distribution. [6]

In this research, the subject is learning media related to understanding the chemistry of hydrocarbon compounds. The data used in this study are primary data by conducting observations and secondary data, namely data obtained from documentation such as journals, books, documentation, and the internet. The product validity test was carried out using an instrument in the form of a questionnaire. This validation questionnaire instrument was filled in by 4 examiners who were experts in their fields. The practicality test of instructional media products also uses a questionnaire instrument filled in by 3 examiners who are experts in the material field, namely 2 teachers in chemistry and 1 teacher in the multimedia field. While the questionnaire instrument used to test the effectiveness of learning media products was filled by 10 students who studied hydrocarbon compounds as many as 10 students.

Analysis of the validity, practicality, and effectiveness of instructional media in assessing display aspects, instructional design aspects, content validation aspects, and language was carried out using the following stages: (a). Give the answer score on each indicator with the criteria scale that is often used, namely Likert: 1 = very poor; 2 = less, 3 = enough, 4 = good, 5 = very good. (B). Determine the total score of each respondent by adding up all the scores obtained from each indicator.

Table 1. Criteria for validity, practicality, and effectiveness

Percentage	Criteria c Valid	Criteria c Practical	Criteria Effective
0-20	Invalid	Not Practical	Ineffective
21-40	Less Valid	Less Practical	Less Effective
41-60	Sufficiently Valid	Pretty Practical	Sufficiently Effective
61-80	Valid	Practical	Effective
81-100	Very Valid	Very Practical	Very Effective

In the research procedure, the stages carried out include; (1). The concept stage identifies users and the form of the media in determining the purpose of the press. (2). The design stage is the stage used in the architectural framework to make specifications for instructional media, material requirements for media, and media display styles. Testing the form of implementation and knowing the test method by the research. In this stage, the researcher carried out several designs, namely: (a). The navigation structure is a flow of learning media for hydrocarbon compounds that help design; (b). User interface (User Interface) is part of the media that can interact with users (user). The user interface provides information to users and receives news from users to make it easier for researchers to demonstrate how to find a problem until solutions and solutions are found. Things that must be considered in building a user interface ease using or operating communicative and interactive media. (3). The material collection stage is a stage that aims to collect various kinds of materials needed and made according to images, videos, backgrounds, writings, and other materials related to the process of making learning media based on designs that previous researchers have designed. (4). The manufacturing stage (Assembly). It is a stage in making all objects or media materials by research needs. This learning media uses several software (software) such as 3DS MAX and Adobe Flash CS6. (5). Testing stage or testing phase. That is when the researcher conducts testing of the media created and carried out when the learning media has been completed by running the media and seeing an error in the product that has ensured the product runs as desired. (6) The Distribution stage is the application storage stage. to storage media and applied to social media and the community.

2.1. Analysis

The analysis is the first stage carried out before the researcher conducts the media product design. Researchers conducted observations and interviews with teachers and students. Teachers and students expect to use and utilize technology and information in the chemistry learning process using 3D animation based hydrocarbon compound learning media products.

2.2. Design

Based on this researcher's design stages, designing learning media for hydrocarbon compounds with adjusted material is based on hydrocarbon compound chemistry subjects. Also, researchers developed the media's initial appearance in the form of the main menu displayed in the application later, such as Intro, Profile, Basic Competencies, Media Guidelines, training/quizzes, and materials. The design stages are system design in general and system design, including application output design and technology design.

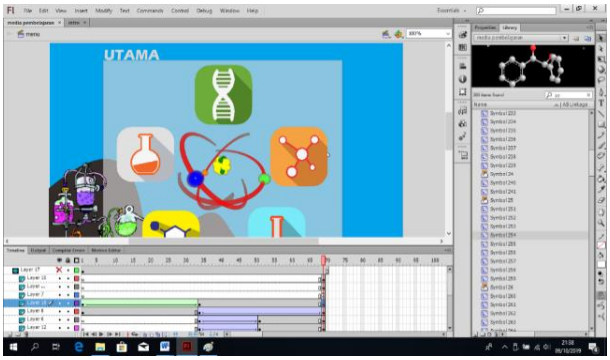

Figure 1 The process of making an intro on learning media.

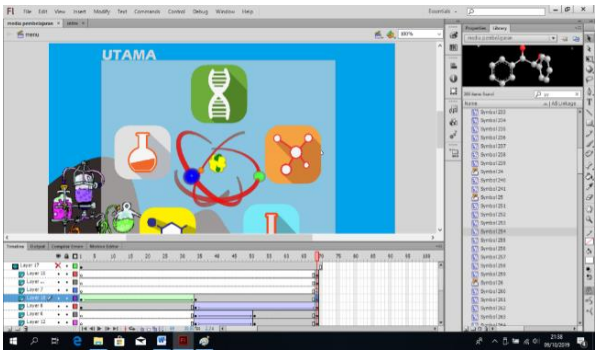

Figure 2 The process of making, especially on learning media.

2.3. Development

Development adopted by the ADDIE models contains the activities of the implementation of media product design. In developing 3D-based learning media, researchers used a development stage model by Luther Sutopo learning media, which has several stages: (a). Concept; Learning media for hydrocarbon compounds that have been designed are then packaged into a file format. This learning media need to install on the device of your PC / Laptop user. Presentation of learning material to students using text, images, 3D animated videos, and right practice questions. (b). System Design (Design).

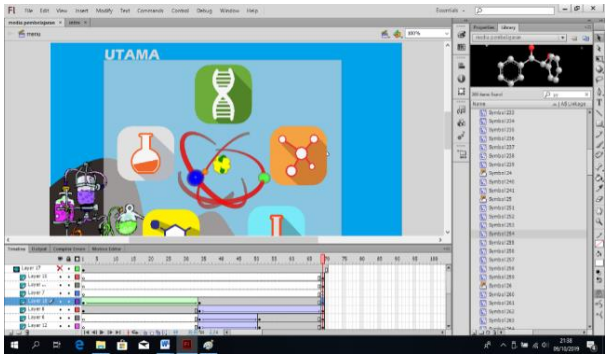

Figure 3 Material display with 3D animation.

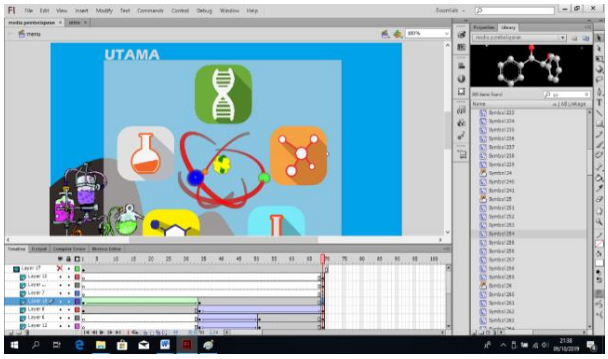

Figure 4 Display practice questions.

2.4. Material Collecting

At the stage of collecting materials in making learning media, such as learning devices, images supporting material, icon or image determinants for buttons, learning media backgrounds, and videos in the form of 3D animation (1). Making Assembly, which is a learning media based on 3DS MAX, begins with designing and creating an animation of the movement of several atomic elements contained in hydrocarbon compounds in 3D. (2) Testing. Testing the author uses the BlackBox testing method. Blackbox testing is a method used to perform software testing centered on useful content, especially on the input of learning media, to determine whether the media is needed in the learning process of hydrocarbon compound chemistry. (3) The distribution of learning media has gone through the testing phase and is in the form of a .exe file. It can be copied to the user's PC/laptop and then proceed to the installation process (install) learning media.

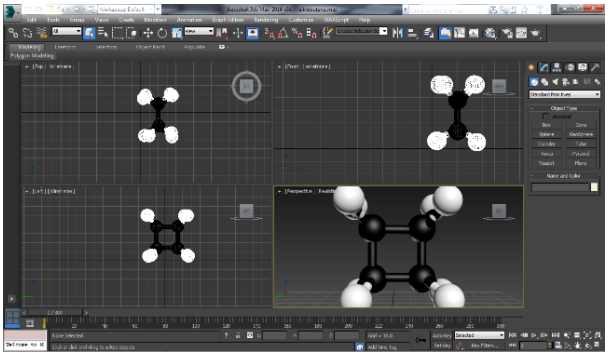

Figure 5 Making 3D objects of atomic elements on hydrocarbon compounds.

Table 2. Media testing scenarios using BlackBox

No	Test Class	Test Item	Type Of Test
1	Learning media for hydrocarbon compounds	Displays learning media for hydrocarbon compounds	Black Box
2	Opening Menu	Displays Opening Menu	Black Box
3	Main Menu	Displays Main Menu	Black Box
4	Profile Menu	Displays Profil Menu	Black Box
5	Basic Competencies Menu	Display Basic Competencies Menu	Black Box
6	Hint Menu	Display Hint Menu	Black Box
7	Theory Menu	Display Theory Menu	Black Box

2.5. Implementation

Implementation is done by installing (install) file exe on a PC / Laptop device, then applied by product testing, including validity testing, practicality testing, and effectiveness testing. The product validity test was carried out using a needs analysis instrument in the form of a questionnaire. The filling out of the validation questionnaire was carried out by 4 design experts competent in their fields. The validity test questionnaire assessed by media experts consists of 12 items divided into three aspects of the assessment.

The formula used in the validity test uses Aiken'scV. Aiken explained that Aiken's V formula is used to calculate the content-validity coefficient based on the results of assessments by n people who refer to several items seen from the extent to which the item represents the extract to be measured. [7]. The formula described by Aiken is as follows:

$$Vc = \sum s / c\,[n\,(c-1)] \quad (1)$$
$$Sc = r - lo$$

Lo = the lowest number of validity assessments (for example 1)
C = the highest number of validity assessments (e.g., 5)
R = number given by the assessor. [9]

The results of the assessment scores of 1 science expert and 3 media experts can be seen in Table 3 below:

Table 3. The results of the validity test of the experts

No	Validator	Average content validity aspects	The instructional aspects of design	Visual communication
1	Liza Efriyanti, S.Si, M.Kom	0,84	0,78	0,80
2	Riri Okra, M.Kom			
3	Gusnita Darmawati, S.Pd, M.Kom			
4	Rina Novita, S.Pd, M.Kom			
Overall average			0,81	
Criteria			Valid	

Based on table 3 above, media experts' validity testing results show that the average score obtained is = 0.81; The learning design aspect got an average = 0.78, and the visual communication aspect = 0.80. Overall, the average score received from media experts 4 shows a score of 0.81 in the Valid category.

The product practicality test also uses an instrument in the form of a questionnaire assessed by 3 learning material experts, namely 2 chemistry teachers and 1 multimedia teacher. The practicality test questionnaire sheet given to material experts in learning consisted of 12 items divided into 3 aspects of assessment. According to the students who use learning media, the practicality test sheet that the writer uses is the practicality test sheet. Practicality test result data with commitment percentage with the formula:

$$N = \frac{BP}{BM} \times 100\% \quad (1)$$

Based on the formula above, N is the value obtained. BP is the weight obtained from the questionnaire given, BM is the maximum weight for each question item on the questionnaire instrument. [8] The final result of the sum of each indicator's values is measured using the Likert scale criteria. The results of the material expert's assessment can be seen in Table 4 below:

Table 4. Test results from practicality by material experts

NO	Statemen	Tester		
		Meri Susanti, S.Pd	Ayu Kulup Hafdi, S.Kom	Ikrar Fardila, S.Pd
A	View			
1	Media can be seen well	100	100	80
2	Suitability of color proportions	100	100	60
3	Text reads well	100	80	80
4	Color and font suitability	80	80	60
5	Using some obvious effects	100	100	100
6	Easy to Use	100	100	100
7	Media has an attractive appearance	100	100	100
B	Content			
1	The suitability of the material with the supporting video	80	100	100
2	Clarity of the structure of the material presented	80	80	100
3	Language use skills	80	100	100
C	Media benefits			

1	Facilitate students' understanding of the material presented	100	100	100
2	Increase student interest in learning	100	100	100
Total Value		1120/12	1120/12	1060/12
Average		93	95	88
Practicality results	92			
Category	Very Practical			

Based on the table above, the practicality test results for material experts in terms of the media's appearance obtained an average score of 93; The conceptual aspect of the material received an average score of 95, parts of utilizing learning media were 88. The average score of the assessment obtained from 3 material experts gave a score of 92 with a category on the Likert scale, which is Very Practical. The effectiveness test was also obtained by using an instrument in the form of a questionnaire assessed by students on the learning media for hydrocarbon chemical compounds class X Multimedia A. Students who filled out a questionnaire loaded randomly were 10 students. Effectiveness testing is used with the data formula obtained and then performs analysis using the Boslaugh kappa moment. [9] k = Information: k = Kappa moment, which shows the validity of a product. ρ = The embodied proportion can be calculated by adding up the effectiveness and dividing the score by the total number of maximum scores. ρe = The unrealized ratio can be calculated by adding the full score and subtracting the total score given by the validator then divided by the total maximum score. The student assessment score of 10 c can be seen in Table 5 below.

Table 5. The results of the student effectiveness test

No	Effective name	k	Effectiveness category
1	Rahmi Yulsita	0,81	Very Effective
2	Nada Turatul Aini	0,81	Very Effective
3	Aurelia SM	0,96	Very Effective
4	Renal Hidayat	1,00	Very Effective
5	Nadine Saputra	1,00	Very Effective
6	Hamila Niati	0,88	Very Effective
7	Yulia Oktaviona	1,00	Very Effective
8	Annisa Suandi	0,91	Very Effective
9	Gilang Ramadhan	1,00	Very Effective
10	Nindi	1,00	Very Effective
Total		9,35	
Average		0,94	Very Effective

According to the table above, testing students' effectiveness in grade 10 can be seen from the score display aspects of learning media, the element content of the product integration, and usability aspects of the application by an average of 0.94. A value of 0.94 out of 10 students indicated the Very Effective category on the overall value obtained.

2.6. Evaluation

After the author's test products that include test validity, test the test's practicality and effectiveness. This variety needs to be evaluated based on expert advice and comments from experts in the assessment form, namely: (a). Media expert. 1). The main menu display is highly recommended to be improved to use an interactive and more comfortable understanding menu model; (b). Material Expert; (1). The letters used vary (c). Media expert; (1). Customize the text with the background color (2). Pay attention to the size of the points/writing. (d). Media Expert; (1). Adjust again in the color and material have written menu.

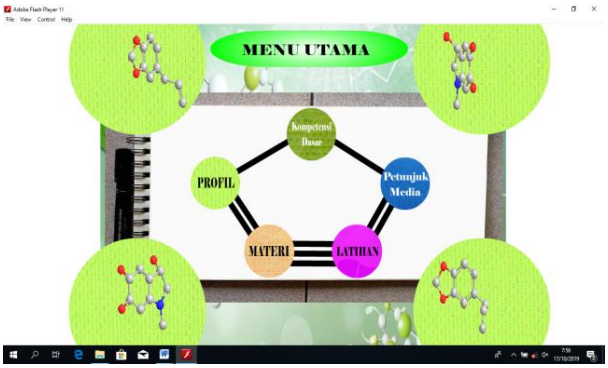

Figure 9 Display c main menu before evaluation.

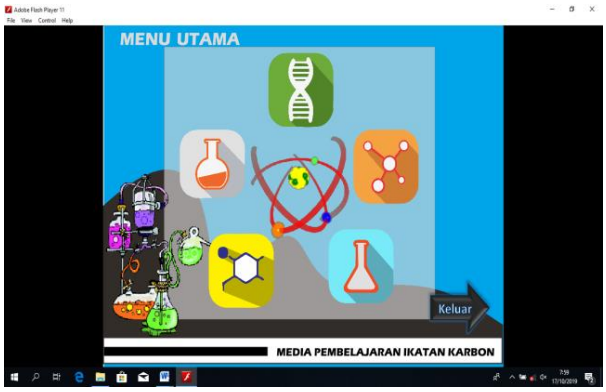

Figure 10 Display of main c menu after evaluation.

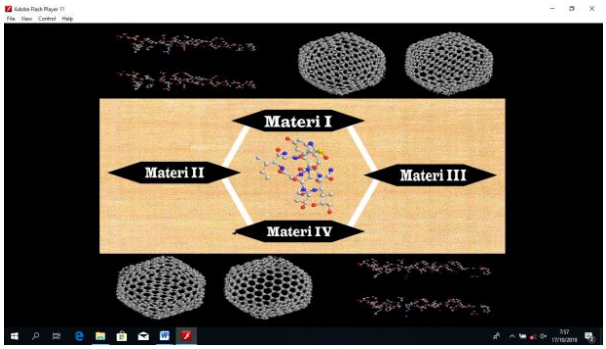

Figure 11 Display before evaluation of the material menu.

Figure 12 Display After Material Menu Evaluation.

3. CONCLUSION

Based on research that has been done on the development of instructional media hydrocarbon-based 3D animation in SMKN 2 Padang Panjang on the subjects of chemistry, it could be concluded as follows: (1). The resulting learning media are hydrocarbon compound products based on 3D animation in chemistry subjects; (2). The validity test results of 4 media experts showed a score of 0.81 with an excellent Likert scale category. Product practice test results matter experts 3 scored 92 classes on a Likert scale that is very practical, then the effectiveness of the test results of 10 students showed a score of 94 in the category Likert scale, which is very useful; (3). Based on the results of the test of validity, practicality, and effectiveness as described in point 2, the product of learning media hydrocarbons feasible and can be applied to the learning of hydrocarbons in chemical subjects.

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