

Develeopment of 3D Animation Based

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Development of 3D Animation Based Hydrocarbon Learning Media

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Abstract. The learning process of chemistry on the hydrocarbon compound material taught by the teacher currently uses 2D-based media (blackboard). Actually, there is nothing wrong with using this blackboard for teachers in teaching, but there are some materials that need to be explained more concretely through direct media or IT-based media. In addition, students also do not understand the learning being taught because there are no facilities for practice so that students still use their imagination in practical learning. From the information obtained through interviews with chemistry teachers, the teacher's desire to make IT-based media is very high, but they are constrained by the ability to design it. The research method used is the 4D version of Research and Development (RnD) (Define, Design, Develop, Disseminate). The results showed that the products produced were valid, practical, and effective for use as a medium in learning hydrocarbons with the respective values of validity, practicality and effectiveness were 0.83, 0.92, and 0.94.

Keyword: Learning Media, Hydrocarbon Compounds, 3D Animation.

1. Introduction

Renewal efforts in the use of technological results in the learning process continue to be improved along with the development of science and technology. Teachers as teaching staff always try to be able to use the tools provided by the school, and it is possible that these tools are in accordance with the developments and demands of the times. At least the teacher can use easy and efficient media which, although simple, is a must in an effort to achieve the expected learning objectives.

Raharjo, argues that the media is a container of messages which the source wants to be forwarded to the get or recipient of the message. In particular, the notion of media in the teaching and learning process is as graphic, photographic, or electronic tools used to capture, process, and reconstruct visual or verbal information [1]. Using media in the learning process will enhance the interaction process between teachers and students as well as interactions between students and their surroundings [2].

In the design of electronic learning media itself, it is divided into three general categories, namely; Audio media is a media that presents the material in the form of sound that comes out of the speaker. Both visual media that present material in the form of images displayed on the monitor. The three Audio Visual media, namely media that present material in the form of a combination of audio media with visual media, which is also called interactive multimedia-based learning media.

According to Vaughan, multimedia is a combination of text, art, sound, images, animation, and video that can be delivered via computer or manipulated digitally so that it can be controlled interactively [3].



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One form of multimedia that we know today is multimedia in the form of 3D animation. Even so, manual sketching is indispensable in 3D animation. The advantages of 3D animation are more realistic, many elements that can be reused or (reusable), and the animation process is faster [4].

Given the large role of the media in the teaching and learning process, teachers are expected to be able to design and use instructional media in the teaching process in schools, especially for subjects that are considered difficult, one of which is in chemistry subjects. This arises when the scope of chemistry subjects is related to scientific work which includes investigation, research, scientific communication, creativity development, and problem-solving, as well as scientific attitudes and values that sometimes require visualization in learning.

There are several chemistry sciences that require visualization in learning, one of which is about Hydrocarbon Compounds about the Characteristics of Carbon Atoms, Structure of Hydrocarbons, Properties of Hydrocarbons, Alkanes, Alkenes, and Alkynes. To be able to understand the material properly the teacher must be observant and creative to make learning media that can help students get a visual image so that they have the same understanding in receiving the learning delivered by the teacher.

Based on observations and interviews in this researcher, it is known that the learning process for teacher hydrocarbons is currently still using 2D-based media (blackboard). Actually, there is nothing wrong with using this blackboard for teachers in teaching, but there are some materials that need to be explained more concretely through direct media or IT-based media. It is time for the teacher to improve the learning using 3D multimedia with the aim that the chemical material for hydrocarbon compounds can be displayed from three different and more interesting points of view so that it can improve the results of the teaching and learning process carried out. However, not all teachers can make 3D-based media because of the teacher's limited abilities. In addition, students also do not understand the learning being taught because there are no facilities for practice so that students still use their imagination in practical learning.

Based on the above problems, the researcher tries to offer a solution to overcome this problem by developing a 3D animation based Hydrocarbon chemical learning media using multimedia in the form of 3DS MAX.

Other research related to the development of pursuit media using multimedia has also been carried out by Nanda Juanda Dipura Atmaja in 2018. The research published in the Majalengka university journal developed 3D solar system learning media that displays interesting and interactive solar system objects in 5th-grade elementary school students. In the designed 3D media, there is a visual image of the planets in the solar system. This aims to make it easier for teachers to convey material and students can clearly see the objects of the solar system that exist [5]. In 2015 Anjar Purba Asmara also conducted research in the development of instructional media in chemistry subjects on colloid material. Learning media is designed based on audiovisual. The results of Anjar's research succeeded in providing an overview of the making of colloids visually so that students get a clear picture [6]. In addition, research on media development has also been carried out by Luluk Nur Annisa and Aris Nasuha. In his research, the development of interactive multimedia-based learning media was carried out. The software used is Adobe Flash CS3 and XML which is applied to the Computer Skills and Information Management (KPP) subject. After testing by media expert validators, material expert validators, and field trials by students, it was found that the media was suitable for use as a learning resource [7].

Other media development research has also been carried out by Ilmia Nu Izzah, Dyan Worowirasti Ekowati and Husamah in 2017 on the five senses material for grade IV elementary school. Learning media is designed in the form of touch and play using the Adobe Flash application. The concept of touch and play allows students to interact directly with the media used [8]. Other research results in the development of instructional media are the results of research by Adtman and Umi Baroroh in 2019. The development of learning media uses the video scribe application in Arabic subjects. The learning media produced with the Videoscribe application is in the form of an animated whiteboard. The concept of the video scribe application is animated handwriting and drawing on a whiteboard. The resulting learning media products can make students more motivated in learning Arabic at school so that they get better learning outcomes [9].

2. Methodology

The research methodology used is the 4D version of Research and Development (RnD) (Define, Design, Develop, Disseminate). Research results from the RnD method are in the form of certain products or test the effectiveness of a product [10]. The products produced will first be tested for their validity and effectiveness. The following are 4 stages in RnD research, namely:

a. Define

The first stage in the RnD research method is to define and define the problem through analysis and formulation of objectives. At this stage, it is determined what products will be developed, along with the specifications. Then conducted research needs analysis and literature study.

b. Design

At this stage, the design of the product that has been determined is carried out. The goal at this stage is to prepare a prototype of learning media for chemical hydrocarbon compounds. This stage is the first step that connects between the define stage and the design stage.

c. Develop

Developing Hydrocarbon Compound chemistry learning media using multimedia in the form of 3DS Max. At this stage, product testing was also carried out including validity, effectiveness, and practicality tests.

1) Test validity of the product

The validity test aims to determine the accuracy and accuracy of a measuring instrument (test) in performing its measuring function. The exact measuring function and the appropriate measuring result state that a test has high validity. The formula for measuring the validity in this study refers to the formula proposed by Aiken as follows:

$$V = \sum s / [n(c-1)]$$

Formula description:

$$S = r - l_0$$

l_0 = the lowest number of validity assessments (for example 1)

C = the highest number of validity assessments (eg 5)

R = number given by the assessor

The results of the calculation of the validity value (V) obtained values between 0.00 to 1.00. A product is declared valid if it has a value range between 0.60-1.00. The product will be invalid if it gets Aiken's value smaller than 0.60.

2) Test the practicality of the product

The practicality test of a product obtained from the user or user ratings. The practicality test sheet used is the practicality test sheet according to the students who use the learning media. To find out a product has good practicality with the following formula:

$$N = \frac{BP}{BM} \times 100\%$$

Formula description:

N = value obtained

BP = weight obtained from the questionnaire given

BM = maximum weight for each statement item in the questionnaire

The results obtained are interpreted using the following categories.

Table 1. Percentage of Practicality

Value (%)	Category
$80 < P \leq 100$	Very Practically
$60 < P \leq 80$	Practically
$40 < P \leq 60$	Enough
$20 < P \leq 40$	Less
$P = 20$	Not Practically

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3) Test the effectiveness of the product
To determine the effectiveness of a product that has been produced, it is necessary to test the effectiveness. The calculation of the effectiveness value refers to the Kappa Moment Statistics formula, which is as follows:

$$k = \frac{p - pe}{1 - pe}$$

2
Formula description:

K : Kappa moment that shows the effectiveness of the product

p : The proportion that is realized, calculated by dividing the number of scores given by the examiner.

pe : The unrealized proportion, calculated using the maximum value minus the total value given by the examiner with the maximum number of values.

- d. Disseminate (Spread)
This objective contains activities to disseminate products that have been tested by other people.

3. Result and Discussion

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Based on the developed media, the authors obtained results using the 4-D version of RnD research and the Luther-Sutopo version of the multimedia development model, as follows:

a. Define

This is the first step that must be done before the development of instructional media. By conducting a search of the current situation to make it easier for the author to define the problems faced by students in chemistry subjects in the even semester about hydrocarbon compounds. Problem analysis aims to determine the importance of learning media to be designed and the things needed in the process of developing learning media for hydrocarbon compounds.

Furthermore, the analysis of needs or determination of needs, the writer looks for theories and concepts related to research. The theories and concepts studied relate to the object and research problems, namely reference books, thesis journals, and also the concepts that support this research.

Another thing that must be considered in the operation of the learning media is hardware and software for designing media. Hardware in the form of hardware such as laptops or PCs required for testing learning media and software in the form of Windows operating system software, Autodesk 3DS MAX, and Adobe Flash CS6 as well as other software that supports the learning media development process.

b. Design

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The design is made with the design of learning media in the form of general depictions, designing the design in the form of a blueprint (blue-print). This media is designed using 7 access buttons where there are entry buttons, main menu buttons, profile buttons, basic competency buttons, media instruction buttons, training buttons, hydrocarbon compound learning media material buttons. Users can only access learning media as restricted users, meaning that users are not given access rights to edit the learning media system.

c. Develop

1) Concept

This Hydrocarbon Compound Learning Media was developed for teachers and students to improve student learning outcomes in Chemistry subjects, increasing student interest and attractiveness to be more active in participating in learning. The making of learning media for hydrocarbon compounds is designed using the Windows Operating System software, Autodesk 3DS MAX and Adobe Flash CS6 as well as other software that supports the media development process.

2) Design

At this stage, the design of the navigation structure, storyboard and user interface is carried out.

3) Material Collecting

In the material collecting stage, the materials needed in the development of the media to be designed are collected. In this study, the compartments were obtained from student worksheets (student worksheets, supporting images that correspond to 3D objects, and other materials that support Hydrocarbon Compound Chemistry lessons. In practice, this stage can be done in parallel with the assembly stage).

4) Assembly

After all the materials were in the material collecting stage, the next stage was the stage of making the chasing media. Making media is based on the design stage that has been done before. The following is a view of the process of creating 3D objects, background, main menu display, material, and others

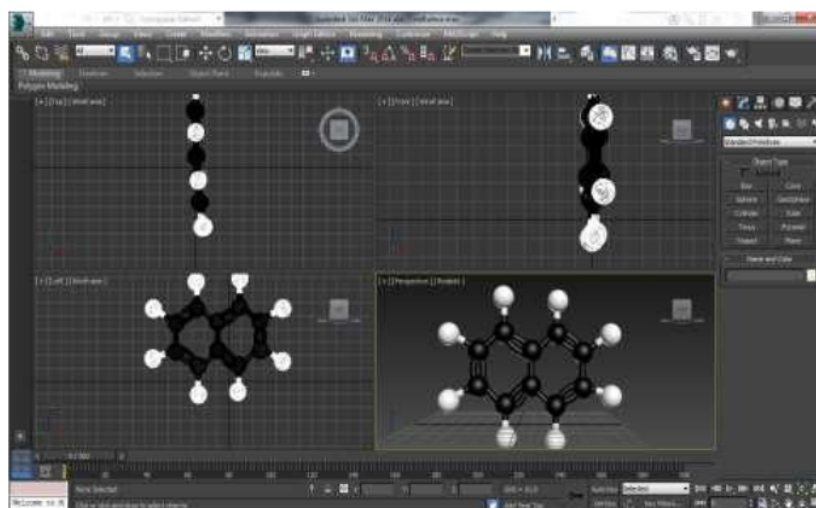


Figure1. View the process of creating 3D objects on 3DS Max

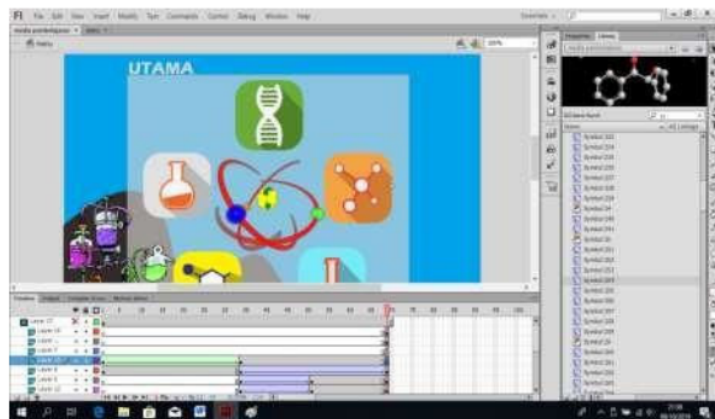


Figure2. Display the main menu creation process

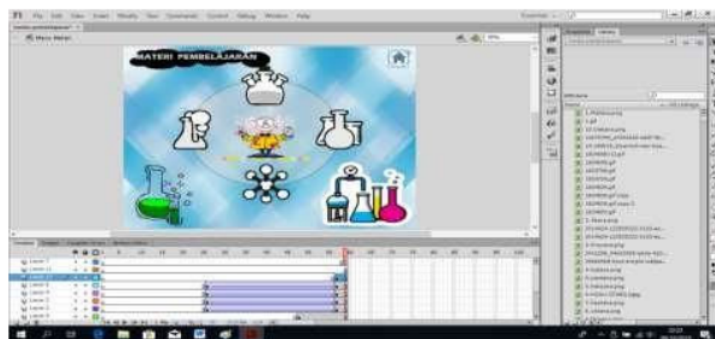


Figure3. Display of the material menu creation process



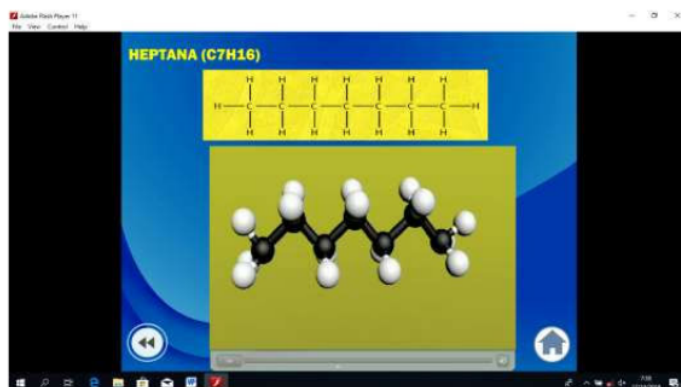


Figure4. Display of hydrocarbon compound material

5) Testing

Testing is the stage of testing the finished media. If an error occurs, the media will be repaired, if it is running well, the process will go to the next stage, namely distribution. The testing phase is carried out after the manufacturing stage and all data is entered. At the testing stage, the media was tested using the blackbox method.

6) Distribution

In this process, the media that has been built into *. EXE can be used directly on a Laptop / PC. The next stage is the media that has been developed and then tested, including 3 product tests.

a) Product Validity Test Results

The validation test of the learning media for hydrocarbon compounds was carried out by five lecturers, where two lecturers were experts in the field of science and computers, and three lecturers were media experts.

After calculating the results of the validation sheet from all the experts, the learning media for hydrocarbon compounds received the final validation value with a percentage of 0.83 declared valid.

b) Product Practicality Test Results

The practicality test of learning media for hydrocarbon compounds was carried out on 3 chemistry subject teachers. The practicality test results from the chemistry teacher showed that the average score was 92 in the very practical category.

c) Product Effectiveness Test Results

The effectiveness test was obtained based on the effectiveness sheet that was filled in by 10 students, and the result was that the average obtained was 0.94 with a very effective category.

d. Disseminate

The last stage after testing the product and there are no more errors is the product distribution stage. The learning media for hydrocarbons in chemistry were distributed to class X students. The resulting media was converted into an installer file and then stored in a compact disc (CD).

4. Conclusion

Based on the results of the research conducted, it can be concluded that the resulting product is valid, practical, and effective for use as a medium in learning hydrocarbon compounds in chemistry subjects. The validity value obtained is 0, 80 which is in the range for valid results. The practicality test results obtained a value of 0.92 which means that this hydrocarbon learning media is very practical. Likewise with the results of the effectiveness test which states that this media has a very effective value for use, which is equal to 0.94.

The learning media for hydrocarbon compounds in chemistry subjects are not [easy](#) to operate but also very interesting. In this learning media, a supporting video has been added from [the material presented](#). [In addition](#), with [the limitations of](#) practical learning, this media can be a solution. Students get a visual of the material presented so that they can improve student memory and gain a good understanding.

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