

Design of Android Interactive Multimedia for the Concept of Aromatic Compound

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Abstract. Some organic chemistry lectures material is abstract. The lack of development of appropriate learning media has become one of the causes of the difficulty of the student in understanding organic chemistry. The purpose of this study is to create interactive multimedia that can facilitate students in studying the material of organic chemistry course especially on the concept of aromatic compound. To support this research, methods of Research and Development used in this study. Stages of research done with the development of design and manufacture of applications on the Android operating system and analyse the results of limited trials. Based on the results of the study, the manufacture of interactive multimedia on this Android system has the potential to be applied to the learning of organic chemistry especially on the aromatic compound subject. It is because the existence of interactive multimedia makes it easier for the student to study organic chemistry especially on the concept of aromatic compound.

1 Introduction

Lecture materials, especially Organic Chemistry is a material that is abstract so that students view difficult and less happy in learning [1]. Some of these difficulties are the students difficult in understanding the mechanism of electrophilic substitution reactions in benzene and electrophile forming process and lack of proper instructional media development, and this has an impact on low student outcomes [2]. Therefore, it is necessary to manufacture and develop instructional media that can help students to study aromatic compounds. Some of the benefits of learning media are to concretize abstract concepts, facilitating difficult material interpretation, minimizing text, and improving learning motivation and understanding [3].

Multimedia is a digital product that presents and combines text, sound, images, animation, audio and video [4], implemented with tools and connection so that users can navigate, interact, work, and communicate [5]. Multimedia is called interactive multimedia when the user can control every element in multimedia at any time [6]. In education process, multimedia is used as a teaching medium, either in classroom or self-learning [7]. In learning process, multimedia has proven to be able to: create a fun learning atmosphere [8], enhance learning motivation [9], increase the effectiveness of learning [10], improve the level of understanding [11], create student-centred learning [12], and make efficient investment of learning means [13].

One of the multimedia that began to be developed in the world of education today is mobile internet or mobile learning (m-learning) [14]. The device or mobile

computing gadget used is a smartphone that has an Android operating system. Based on the research that has been done by Azziz et al. (2013) entitled: "The Effectiveness of Multimedia Organic Chemistry Module: SN₁ and SN₂ reaction mechanism" is about the use of IMCM (Interactive Multimedia Chemistry Module) organic multimedia module on SN₁ and SN₂ mechanisms. The results show that the application of IMCM module can improve understanding and learning result of organic chemistry learning [15]. Research on similar topics was also conducted by Setiawan et al. (2016) on the influence of multimedia teaching materials on students' learning outcomes and perceptions in the organic chemistry course 1. The results showed a positive result that the existence of multimedia teaching materials make students feel happy, motivated and interested in learning organic chemistry 1 [16].

The study aims to manufacture and developed learning media, i.e., Android interactive multimedia for the concept of aromatic compound using the Research and Development method as a research method. The stages of research used in this study are to analyse the concept of aromatic compounds, create the design/ multimedia design and create interactive multimedia. Research results show that interactive multimedia is declared valid and suitable for use as learning media. Besides that, interactive multimedia can also help students to learn organic chemistry, especially on aromatic material compounds.

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2 Method

The method used in this research is Research and Development (R&D) method. R&D is a research method used to produce a particular product [17]. The stages of research used in this study are to analyse the concept of aromatic compounds, create the design/ multimedia design and create interactive multimedia.

2.1 Analysis of the concept of aromatic compounds

The first stage of making interactive multimedia on the concept of aromatic compounds is analyse the concept of aromatic compounds. (organic chemistry I syllabi). The result of concept analysis then made a concept map. After that analyse of aromatic compound material, from the result of the analysis of the material and analyse of learning achievement indicators. Then conducted a literature reviews to collect data needed in multimedia.

2.2 Multimedia design

The next step is to create a multimedia design. Multimedia design is created in the form of working drawings, charts or brief descriptions of which are used to create multimedia [17]. The design is made in the form of the draft concept, content, script and multimedia graphics. The designs are then created in the form of Storyboard, a series of sketches that describe the sequence of multimedia elements [18].

2.3 Making interactive multimedia based on Android

The next stage is the stage of multimedia creation. The first step in making multimedia is to create a picture of the structure of aromatic compounds using ChemDraw Pro 12.0, creating a 3D molecule of aromatic compounds using Chem3D Pro 12.0. Images of structures and molecules of aromatic compounds that have been made and materials that have been determined previously then combined with using Adobe Animate Creative Cloud (CC) 2017. The multimedia project that has been created and then published in the form *.apk. Apk (Application Package File) is a package of Android apps with apk extension which contains applications or programs that will run on Android devices [19].

2.4 Validity test of interactive multimedia based on Android

Interactive multimedia validation is conducted by 4 (four) experts or experts (judgment experts) consisting of material experts and media experts.

2.5 Limited trials of interactive multimedia based on Android

The test of limited trials of interactive multimedia was conducted on a small scale, i.e., performed on 14

(fourteen) Chemistry Education students selected at random.

3 Result and Discussion

The result of this research is in the form of instructional media that is interactive android interactive with the concept of aromatic compound.

3.1 Stages of making Android interactive multimedia

The first stage in making interactive multimedia is to install all the applications or software needed in making multimedia on the computer first. These applications are ChemDraw Pro 12.0, Chem3D Pro 12.0 and Adobe Animate CC. To be able to install this application, an application called Adobe Creative Cloud is required. Once the Adobe Creative Cloud app is installed, then open the app and look for an app called Adobe Animate CC and install it. After all the applications needed to create multimedia installed in the computer, the next step is to run the ChemDraw Pro 12.0 and Chem3D Pro 12.0 applications to create all the structures and molecules of aromatic compounds needed in multimedia. Below is an image of the process of making the structure and molecules of aromatic compounds.

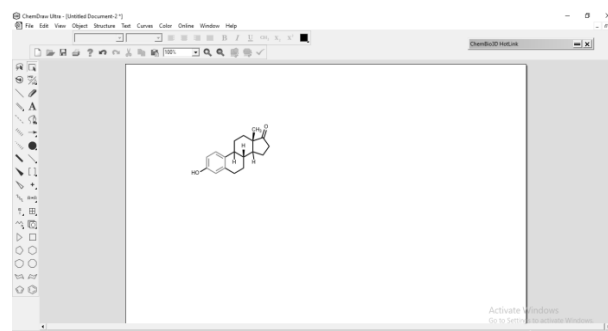


Fig. 1. Manufacture of the chemical structure of aromatic compounds on ChemDraw Pro 12.0.

Figure 1 shows the process of making chemical structures and the equations of the reaction of aromatic compounds using the application of ChemDraw Pro 12.0. Figure 2 shows the process of making molecules of 3D aromatic compounds. The saved file extensions are *.png and *.gif.

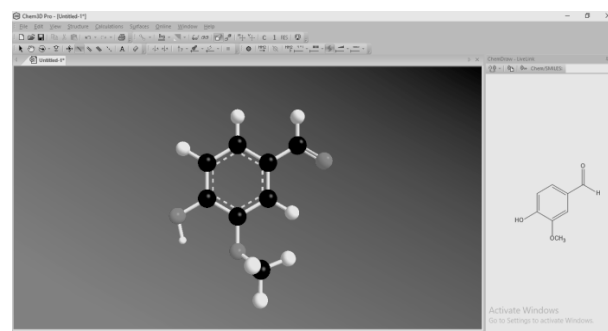


Fig. 2. Manufacture of 3D molecules in Chem3D Pro 12.0.

Once all the structures and molecules of aromatic compounds are made, the next step is to create interactive multimedia using Adobe Animate CC 2017. Figure 3 shows the process of making multimedia using Adobe Animate CC application. Here is created a scene of multimedia, navigation button, input text, picture, video, animation and music into multimedia. The scene contained in multimedia is the main display scene, main menu, learning indicators, materials, reactions, problems, discussion of benzene compounds and derivatives in life, clues, and profiles.

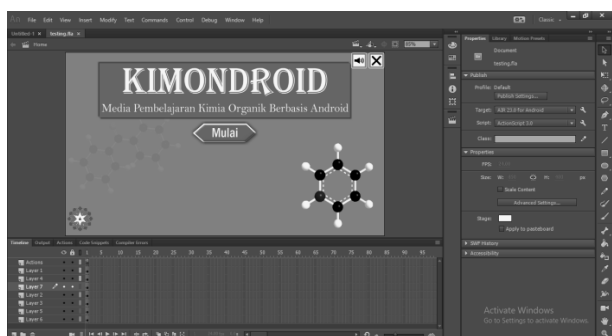


Fig. 3. Creating multimedia using Adobe Animate CC app.

After the multimedia design in Adobe Animate CC application is created, then the next is to publish interactive multimedia project into the *.apk extension. Figure 4 shows the interactive multimedia publishing process.

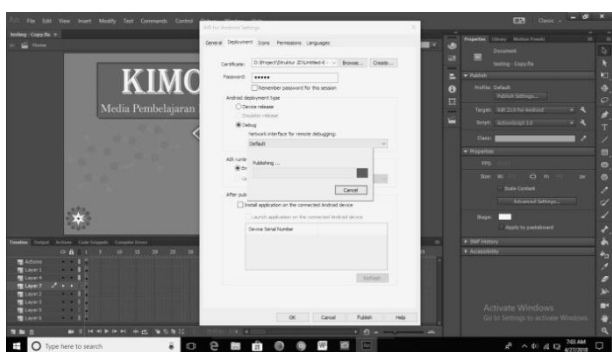


Fig. 4. Interactive multimedia publishing process.

Figure 5 shows the initial view of Android interactive multimedia for the concept of the aromatic compound that currently active on a smartphone with the Android operating system.



Fig. 5. Android interactive multimedia for the concept of aromatic compound.

3.2 Validation test results

The diagram in the Figure 6 reveals that the calculation of the value of r_{count} in each aspect is 0.8 in the aspect of truth (1) and the language structure aspect (4), 0.83 on the aspect breadth and depth of the concept (2) and the media display aspect (5), 0.84 on the material device aspect and the question (3), 0.85 on the aspects of liability (7) and 0.86 on the aspects of software engineering (8). The greatest value of r_{count} is on the aspect of software engineering that is equal to 0.86, and the lowest r_{count} value is on the aspect of truth and linguistic structure aspects that is equal to 0.8. The overall feasibility range (r_{count}) is 0.8-0.9. This value is above the $r_{critical}$ value of 0.3. Thus, the feasibility of interactive multimedia is very high and is declared valid or feasible to be used in the learning process. The Android interactive multimedia validation test result data can be seen in Figure 6.

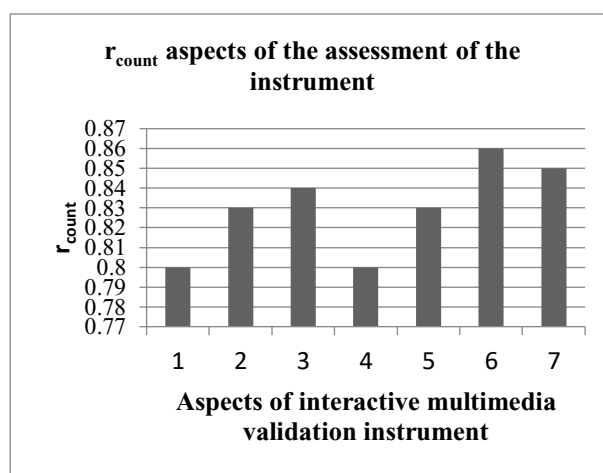


Fig. 6. Data of validation test results.

3.3 Trials results

According to the data percentage of respondents' responses, the percentage of respondents' responses of ease of use and multimedia practicality indicator (1) is equal to 98.22%, multimedia display and graphics indicator (2) is equal to 96.94%, the linguistic structure indicator (3) is equal to 100%, presentation of material indicator (4) is equal to 95.24%, and the engagement indicator (5) is equal to 100%. The average percent of respondents' response of 98.08%, which means that interactive multimedia otherwise very feasible and ready to be used as a medium of learning. The Android interactive multimedia trials test result data shown in Figure 7.

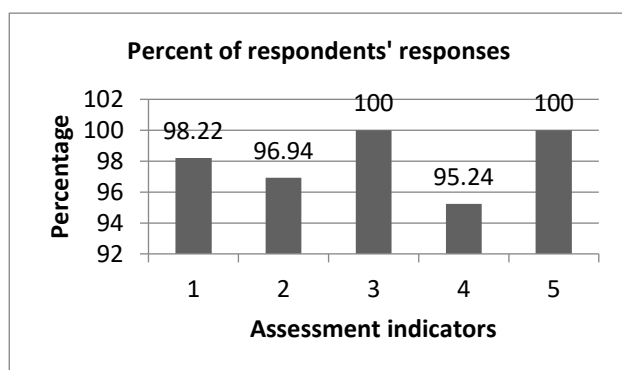


Fig. 7. Trials test results

4 Conclusion

In conclusion, based on the research design that has been described, Android-based interactive multimedia on the concept of aromatic compounds have been successfully created and has the potential to be applied to the learning aromatic compound subject with the average percentage of respondents' response is 98.08%.

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