# The Development of Android-Based Learning Media for Organic Chemistry I

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**Abstract.** Industrial revolution 4.0 has a distinct feature which is utilization of technology in learning process, and electronic media (android based) usage is being one of them. The aim of this research is to analyzing android-based learning media feasibility which was developed using Microsoft Office PowerPoint, in combination with iSpring Suite 10 and Website 2 Apk Builder. The research was conducted in University of Bengkulu with the subjects were chemistry education students that are enrolled in Organic Chemistry I, 2021/2022 academic year. The research used three out of 4-D type of development model which were Define, Design, Develop and Disseminate. The Disseminate part of the model was left out due to time constriction. The research instrumentation were validation questionnaires for both organic chemistry content and the media itself. The questionnaires were given to 4 experts, which 2 being the experts of organic chemistry subject matter and the other two were learning media practitioners. The results of questionnaire analysis shown that the android-based media on Organic Chemistry I subject is a feasible learning media with the scores of 89,2% and 87,5% for content and media category respectively. The scores fall into very good category which suggested that the media can be used in a larger scale.

**Keywords:** Development · android-based · learning media · organic chemistry1

## 1 Introduction

Learning process in 21st century is a technology-based process in which information technology is the core value of it. Indicators of technology-based process involves robotics, digital communications, internet for all, and creative and innovative education. In industrial revolution 4.0, education is using information technology (IT) in learning process [1]. Technology assists a learning process with no time and space boundaries. Educators are required in designing and developing digital learning and digital learning materials based on IT for an effective, innovative, and efficient learning.

Covid-19 pandemic forced almost all sectors, education included, to adapt and transform to the "new normal". Educators need to adopt science and technology not only for the subject matters but also for delivering the subject matters to their students. Classrooms are forced to be virtual that limited student-teacher interactions. This limitation


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needs to be addressed by utilizing electronic media, IT platforms, and teacher (and student) creativity in using all available resources for effective, efficient learning process without sacrificing the learning quality.

Internet, being one of basic need nowadays, is used as a tool for connecting teachers and students in learning process. A good internet connection (in terms of access and speed) is useful for collecting information in an easier way for students (and teachers). Internet gives information at hands, meaning that we can have the information that we are looking for data collecting, information searching, or for class assignments in an instant [2]. This can change student's lifestyle [3] so that a proper control needs to be maintained. Teachers have roles as facilitator, controller and supervised their students in using the internet.

Learning process in University of Bengkulu has already utilize network/internet based process and can be accessed in the website: http://elearning.unib.ac.id. Besides e-learning platform, subject matters are also taught by using internet platform communications such as Zoom or Google Meet, Google Classrom, Whatsapp application, Edmodo, and other platforms/applications that can be used for virtual meeting/classroom. However, the usage of these platforms is still far from sufficient. Many aspects affect the optimalization of using them, namely teachers' competence in technology, and infrastructure.

Those obstacles are also affecting learning process in University of Bengkulu, and Organic Chemistry I is being the focus on this research. Organic Chemistry I is a compulsory subject for chemistry education undergrads. Most of the challenge that the students facing are that the subject is too abstract, for example the topic of stereochemistry, hydrocarbon, and functional groups. The difficulty in advancing the topics is related to many representations needed to understand the abstract concepts resulted in low perception of the students on the topics. Conceptual understanding is a cognitive domain needed in every student so that they have the ability in problem solving in learning process [4].

During the Covid-19 pandemic, students were "forced" to do an independent study without a proper guidance from the teachers. Observation using questionnaire to the students reveals that most of the time, students need a good learning medium that is interactive, interesting, and easy to understand based on advanced information technology so that the subject matters can be accessed anywhere [5]. Almost all the students nowadays have access to a smartphone for their communication. Smartphone is a communication tool that can access information through internet, communicate through email, or as a Global Positioning System (GPS) depend on the feature installed on the gadget [6]. Operating system used in smartphones varies from BlackBerry, IOS, Android, and windows [7]. The development of learning media can use this type of operating system as is it is a computer. Most of the time Android is used as the platform as 92% of students have Android-based smartphones.

In this research, the learning medium was developed based on android platform application namely Microsoft PowerPoint with iSpring Suite 10 add-ins and Website 2 APK Builder. iSpring helps PPT file into an interactive media with embedded sound and narration from the developer. Web 2 APK Bulider builds the file infot an HTML5 format or EXE format. Beside that, interactive macromedia flash or interactive quiz/test can also be attached to the file to create a multimedia. Learning media development using

these applications are simple without any coding or programming basic competences. The product is also accessible to students by installing it to their smartphone, and by doing so, the media can be used anytime anywhere and hopefully able to assist student independent study and increasing the learning quality [8]. The media development using Microsoft PowerPoint in collaboration with iSpring Suite and Web 2 APK Builder is the focus of the research and the subject matter developed into the media is Organic Chemistry I.

## 2 Method

This research was conducted using a research and development (R&D) method. This is a method where a product (in this case a learning media) is developed and tested for its effectiveness [9]. The development model used was 4D model which consist of Define, Design, Development and Disseminate according to Thiagarajan [10], and on this research, the model was limited to three stages (up to development stage). The subjects of this research were 46 (9 male, 37 female) undergrad students of Chemistry Education, University of Bengkulu, who were enrolled in Organic Chemistry I class, 2021/2022 academic year. Instrumentations of this research were validation questionnaires for the purpose of assessing the feasibility of the learning media by experts (two of whom have expertise in learning media, and the other two have expertise in the subject matter i.e., organic chemistry).

The scoring on the validation sheet categorised following Likert scale describes in Table 1.

The feasibility of the product was calculated using this following formula:

$$P = \frac{S}{N} \times 100\% \tag{1}$$

where,

P: Percentage
S: The number of respond in one aspect
N: the ideal number on an item

**Table 1.** Validation Category

| Category | Score |
|---|---|
| Very Low | 1 |
| Low | 2 |
| Sufficient | 3 |
| Good | 4 |
| Very Good | 5 |

**Table 2.** Feasibility Criteria [11]

| Interval | Criteria |
|---|---|
| 0–20% | Very low feasibility |
| 21%–40% | Low feasibility |
| 41%–60% | Sufficient feasibility |
| 61%–80% | Feasible |
| 81%–100% | Very feasible |

And the average percentage was calculated by this following formula:

$$P = \frac{\sum Ps}{n} \tag{2}$$

where,

P: Average percentage
$\sum$Ps: The number of percentage (Table 2)
N: the number of items on the questionnaire

The product (learning media) is categorized feasible if all aspects are on criteria of ≥60%. The learning media can be used further in learning process if the criteria is met.

## 3 Results and Discussion

The development of learning media is conducted by using Microsoft Office PowerPoint in accordance with iSpring Suite 10 and Website 2 Apk Builder. The first step of the development process was defining step where researcher has conducted analysis on students needs and interest as well as analysis on lesson plan on organic chemistry class. Observation was conducted to students enrolled in organic chemistry class and organic chemistry teacher using questionnaires. The results shows that 97,2% of students need a learning media that can be accessed on their smartphone (mostly with Android operating system) that contain a complete material on the subject matter. A complete content means that it contains learning material (description and/or narration), and learning video contains explanation. Analysis on the lesson plan conclude that the necessary subjects need to be covered in the media is hydrocarbon subject (alkane, alkene, alkyne). These subject need to be provided in subject points (in description or narration), explanation of concepts in video format, and exercise as supplement in the media. As a full cycle of learning process, the media was also completed with evaluation instrument for students' assessment.

The second step of the research was designing the media, including designing the media interface, the content (subject matter), and designing the questionnaires for feasibility assessment. The preliminary prototype consists of display designs, ikons, materials


**Fig. 1.** Android based learning media display example

chosen as contents, and learning video related to the subject matter. For the questionnaires, the rubrics were prepare to accommodate the feasibility assessment based on media and content expertise.

The media display on the designing stage can be seen in Fig. 1.

On the product developed, there are menus namely, (1) learning competence, (2) learning material, (3) exercise, and (4) evaluation (posttest) given in a google form link. The practise/exercise problems were given to students to develop their ability in understanding the subject matters, also can be used to assess students' achievements during the learning process. Problems were given with explanations so that students can review their answers.

Few advantages of using android based learning media are that in can be embedded with learning videos and can be designed to be interactives. These advantages help motivate students in learning process. Learning video visualized abstract concepts that are difficult to explain through narrative reading [12]. Interactive videos also help in

**Table 3.** Subject matter validation

| Aspect | Percentage |
|---|---|
| Language | 95% |
| Content | 87,5% |
| Learning aspect | 85% |
| Average | 89,16% |

**Table 4.** Media validation

| Aspect | Percentage |
|---|---|
| Presentation | 80% |
| Language | 95% |
| Visual display | 82,5% |
| Video and Audio display | 90% |
| Navigation | 90% |
| Average | 87,5% |

maintaining students' attention and focus on the subject given especially when the videos are designed interestingly and fun to watch [13].

**Android Based Learning Media Feasibility**

The product of this research (based on R&D method) is a learning media for Android operating system with subject matter of hydrocarbons. Feasibility assessments of the media were done on media feasibility aspect and content (subject matter) feasibility aspect. Validators are experts on their respective field (namely media and subject matters), and the result of their assessments are given in Table 3.

The average number of subject matter validation was calculated from the assessment of two different experts. The language aspect was scored based on language and sentence structures, symbol usage appropriateness, reaction mechanism order and proper presentation, proper equation, and effectivity, efficacy, and accuracy in using words and sentences to avoid misperceptions in students. The score of language aspect is 95% which is a high score. Language aspect is important in learning media as to wrong sentences can lead to misperception and further can lead to misconception [14]. The indicators of the content aspect are the accuracy of the content, the scope of the learning materials, coherent, and the average score for these indicators is 87,5%. Learning aspect was assessed by its cohesiveness with the lesson plan indicators and the effect of the media to students. The score given for this aspect is 85%. All the scores for all aspects indicate that the product is very feasible as learning media. Media validation score is given in Table 4.

The result presented in Table 4 was concluded from two media experts' assessment through validation questionnaires. Presentation aspect was assessed through several indicators namely media display, menu and navigation page clarity, and font and readability of words. This aspect scored 80%, categorized as feasible. Language aspect was valued form its clarity, communicative, effective, and efficient words and sentences as good sentences give students better ways of understanding the subjects [15]. Visual aspect was design to give meaning to students [16] and it was assessed by font (type and size), background colour, and layout. Video and audio were assessed by their quality and clarity, and their relevancy to the subject matter. For the video, the content and the resolution are important aspect as a good video. The file size needs to be reasonable so that it easier for students to open them in their smartphone [17] as well as the good narration of the video [18]. The average score for visual, video, and audio is 90% which is very feasible in category. Navigation aspect was assessed by its "user friendly" aspect, which means that the APK size or the HTML5 size is reasonable for Andorid based users, accessible, easy to install, and running smoothly during the learning process. The score for this aspect is 90% (very feasible). Besides assessments, inputs from validators were also considered in developing and refining the learning media before it was used to students.

## 4 Conclusion

Learning media in Organic Chemistry for android users as a product of this research was developed based on experts input and assessments. The product is redeemed feasible and can be used as a learning media for Organic Chemistry I class, on the subject of hydrocarbons. It is suggested that the product is disseminated so that it can be used for students on a larger scale.

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