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Development of Android-based E-Modules on Molecular Shape Materials of VSEPR Theory

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ABSTRACT

The use of teaching materials in online learning during the Covid-19 pandemic results in a lack of students' understanding of the molecular shape material of the VSEPR theory leading to learning objectives not being achieved. So the researchers make an Android-based e-module as a teaching material as a solution so that students better understand the material of molecular shapes in online learning. This study aims to determine the feasibility of an android-based e-module on the molecular shape material of the VSEPR theory. This research used a research and development (R&D) method which is based on the ADDIE model. The android-based e-module on the molecular shape material of the VSEPR theory was validated by an expert or validator which included the feasibility of the material, language, and graphics. The results show that the android-based e-module developed is categorized as very feasible to use. This Feasibility is reviewed from the results of the validation of the feasibility of the material which obtain a validity score of 92.69% showing that the e-emodule made has fulfilled the Feasibility aspects including the suitability of the material and basic competence, the accuracy of the material, the updating of the material, and encouraging curiosity. Language Feasibility validation with a validity score of 92.69% shows the module made has fulfilled the Feasibility aspects of being straightforward, communicative, conformity with the development of students, and conformity with the correct rules of the Indonesian language. Graphic feasibility validation with a feasibility percentage of 91.66% with very decent criteria shows that the e-module has met the qualifications from the aspect of measurement, cover design, and cover body design. The feasibility research results obtained will be applied as a reference in the manufacturee-mode android based, so the e-modules that are suitable for use can be used in further research.

Keywords: Android-based E-module, ADDIE model, VSEPR theory

INTRODUCTION

The 2013 curriculum requires students to think critically, arouse curiosity, be independent, cooperative and active in implementing learning both inside and outside the classroom. Not only that, the 2013 curriculum is also required to maximize the use of technology in learning. Educators can use technology to become learning media or mediators in conveying knowledge to students through several applications, such as zoom, google classroom, google meeting or WhatsApp group. By using the learning media, educators can make explanations of material that are interesting and not monotonous so that students are interested and remain enthusiastic in participating in these teaching and learning activities (Salsabila, H, U & Agustian, N, 2021).

The use of technology in learning is a factor that plays an important role in the continuity

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of learning. The use of media or teaching materials that rely on technology is one example that is commonly used in learning. The media or teaching materials in question can be in the form of audio visual. This is in accordance with Sapto, H (2009) who states that one of the media used in learning and is believed to be able to further excite the desire to learn in learning is audio visual media. The use of technology can make it easier for teachers to prepare media. Practically learning media has several benefits, including concretizing abstract concepts, so that it can reduce verbalism, generate student learning motivation, help increase learning understanding by presenting material in an interesting way and simplify interpretation of material that is considered difficult (Kiki, 2014).

The use of technology in education also plays an important role in learning during the Covid-19 pandemic and becomes unavoidable. This is because students learn not through face-to-face meetings, so learning is done online. There are obstacles caused by the Covid-19 pandemic, the teaching and learning process can be carried out with various applications that allow teachers and students not to need to meet face to face in carrying out the learning process. Learning outcomes are a process carried out by the teacher at the end of learning activities or the end of the program to determine student learning outcomes (Mamluah, S, K & Maulidi, A, 2021). Learning is carried out remotely using WhatsApp, zoom, google classroom, and google meet. The process of teaching in this way requires suitable media and teaching materials. Teachers can no longer fully use conventional methods in distance learning.

The use of the conventional method usually includes a process with a lecture model and question and answer model. In such a learning process it usually focuses on the teacher and still uses textbooks or Student Work Sheets as the main source of information in learning. This is in line with Irwan's (2007) study that the gap found in chemistry learning is the lack of use of media in the learning process, and materials used in the learning process, namely student worksheets, do not describe material in detail and depth, so that students find it difficult to understand the material being studied.

The situation in distance learning, where teachers still use conventional methods, also occurs in SMA Negeri 1 Selakau. This has an impact on the level of students' understanding of the chemistry material presented, especially the molecular shape material. The same thing also happened at SMA Negeri 2 Selakau. In distance learning, the teacher only gives material in the form of presentation slides, then explains and opens a question-and-answer session. Another problem faced is the lack of use of additional media in learning, which causes students to have difficulty understanding molecular shape material. This is reinforced by Lalu (2018) that at SMA Negeri 1 Pujut on chemical bonding material, the teaching materials used by teachers in teaching still use ordinary textbooks. The model or method used by the teacher in teaching is still monotonous and teacher-centered so that the interaction between the teacher and students is still lacking.

The results of interviews conducted with chemistry teachers at SMA Negeri 1 Selakau and SMA Negeri 2 Selakau regarding the problems students experienced when learning the molecular shapes of VSEPR theory, show that students have problems not understanding how to determine molecular shapes based on VSEPR theory. As a result of these problems, students also have difficulty describing the molecular shape of a compound. This problem causes students' understanding of the molecular shape material of VSEPR theory to be very minimal. During the interview, the chemistry teachers also explained that this problem is caused by the teacher still using conventional methods. The teachers use conventional methods due to the absence of additional teaching materials available, especially about the molecular shape of the VSEPR theory. This resulted in the teacher experiencing difficulties in conveying material on the molecular shape of the VSEPR theory so that students could achieve the existing basic competencies.

The basic competency in molecular shape material is to apply the valence shell electron pair repulsion (VSEPR) theory. This basic competency requires students to be able to determine the molecular shape of a compound using VSEPR theory. Besides that, in its application students must also be able to describe the shape of a molecule either in 2 dimensions or 3 dimensions. To achieve this, teachers are expected to be able to use additional teaching materials which contain material about the steps for determining the shape of a molecule and learning videos, animations, and pictures so that they can facilitate the student learning process online or distance learning. In addition, the animation in the form of audio-visual makes it easier for students to better understand how to describe molecular shapes in 2 dimensions and 3 dimensions.

There is demand for teaching materials that can help online learning, contain material, learning videos, animations, and images, so teaching materials are needed that are packaged in digital form. Digital teaching materials can be in the form of e-modules or e-books. However, the facts on the ground are that digital teaching materials in the form of e-modules or e-books are not available. There are only presentation slides which are not very helpful in the online learning process. Overcoming this problem, the researchers here made an android-based e-module on VSEPR theory material. This refers to research by Herawati, N, S (2020) which states that by using modules, students can learn according to their level of ability and after class lessons are finished students can find out the level of success achieved. The existence of the module gives students the opportunity to remedial or correct weaknesses, mistakes or deficiencies of students, so students can find their own evaluations that are given continuously.

The electronic module is an innovative medium that can increase students' interest in learning. A learning process in order to be able to improve the achievement of learning outcomes needs to be supported by the right learning guide. This is because face-to-face time in front of the class is very limited when compared to the volume of material that must be completed, so it is needed a learning guide which is able to activate students in learning. A learning guide that makes it possible to increase student learning outcomes and prioritize student active independence is the electronic module (Suryadie in Herawati, N, S, 2020).

This aligns with Santoso's, F (2013) research which states that based on the results of initial observations with one of the chemistry teachers at SMA Negeri 1 Sidoarjo it is known that the VSEPR Theory Molecular Shape Material is one of the most difficult chemistry materials in terms of material complexity for students to understand. This is supported by the low student learning completeness, which is 60% before remedial is carried out. Based on this research, the researchers created this e-module containing detailed material content and a description of the shape of a molecule in the form of a 3D animation so that students can more clearly visualize the molecular shape of a compound. Apart from 3D animation, this e-module also contains learning videos and animations as additional helpers to make it easier for students to understand.

With animations and pictures, students are expected to be able to understand the material for determining molecular shapes in detail. E-modules are teaching materials in the form of modules displayed in electronic format which are expected to increase students' interest and motivation in learning (Asrizal et al., 2022). This is because the e-module involves displaying images, audio, video, and animation (Suarsana in Siregar, A, D & Harahap, L, K, 2020). This e-module is made based on consideration in terms of use. This e-module has the apk extension, which can be installed on the android platform. Besides that, this e-module can be carried out offline or without using cellular data. This is due to the large number of students currently using Android and the location where most students live in areas where the network has not reached the maximum. An e-module which is installed on students' android smartphones, is expected to make it easier for students to read either at home or at any time.

Android is an operating system for mobile phones based on Linux. Android provides an open platform for developers to create their own applications so that they can be used by various driving devices. Initially, Google Inc. bought Android Inc. newcomers who made software for mobile phones (Firdan, A, 2011). The existence of android on mobile phone technology or smartphone has been widely used at the present time which is the background of researchers to make an e-module that can be installed on students' devices.

This is supported by the results of the online questionnaire to students of class X natural science in the two schools about smartphones in daily use. Here are the results obtained.

Table 1. Data on Android Use by Students

Question	Answer	
	Yes	No
You are a smartphone/android user	100%	0
You more often use android than computer	100%	0
Smartphone use intensity 8-10 hours per day	59%	41%
Use for social – media	92.1%	7.9%
Use for playing games	69.8%	30.2%
Use to search for books/articles/chemistry learning materials	93.7%	6.7%
Does the use of smartphones in chemistry learning help you understand chemistry material?	73%	27%

In addition, the results of direct interviews with the chemistry teacher state that during the learning process students are also allowed to use their smartphones with the condition that it is only to look for material so that it can help the learning process. Smartphones are also widely used by students at home to do assignments. Based on the data obtained, it can be concluded that students often use their smartphones in daily activities and help students in learning chemistry. Based on the background of the problem, it can be stated that the development of an Android-based e-module is needed to facilitate learning. For this reason, the researchers are interested in developing an android-based e-module in the molecular shape of the VSEPR theory. The purpose of this study is to determine the feasibility of the Android-based E-Module for VSEPR material in the aspects of content validation, language, and graphics.

METHODS

The research used the research and development method which was used to produce certain products and test the effectiveness of these products. (Sugiyono, 2013). This research referred to the ADDIE model which includes the steps: 1) Analysis relates to thinking about what is needed, 2) Design relates to considering or designing an instrument, 3) Development relates to making an instrument based on design, 4) Implementation relates to the application of the instrument, and 5) Evaluation relates to deciding on a feasible instrument to use (Wegener, 2006). However, this research was limited to the development process.

According to Branch, R, M (2009), the steps, processes, or stages in this development each stage had to be sequential starting from analysis, design, development, implementation, and evaluation. However, at each of these steps an evaluation could be carried out. This scheme draft can be seen in Figure 1 below:

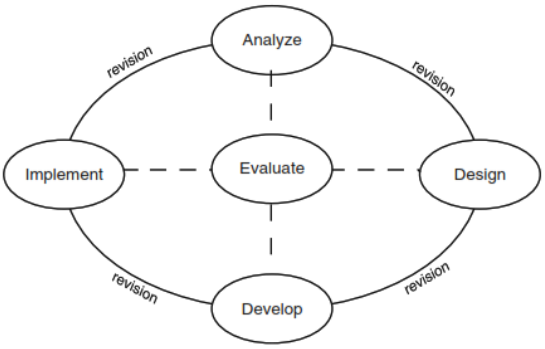

Figure 1. ADDIE Scheme

The research on this Android-based e-module was only done until the third stage, namely the development stage. The subject in this study was an android-based e-module in the molecular shape of VSEPR theory. An expert validator would perform validation on the e-module developed. Validation was carried out including aspects of material feasibility, language feasibility, and graphic feasibility.

The data analysis technique used was using the technique according to Riduwan, which was the first to calculate the percentage of the score:

$$P = \frac{\sum X}{\sum Xi} \text{ x } 100\ \%$$

Description: (P) the percentage of scores obtained, (∑X) the total scores obtained for the total statements, (∑Xi) the highest total scores. Then, to calculate the average percentage of Feasibility of the Android-based e-module as a whole use:

$$V=\frac{\sum P}{n}$$

Description: (V) the average percentage of Feasibility, (∑P) the average number of percentage scores for each statement, (n) is the totality number assessed.

Table 2. Feasibility Level of The Android-based E-module

Range (%)	Category
0 – 40	Very unworthy
41 – 60	Not feasible
61 – 80	Worth
81– 100	Very worth

Source: Riduwan (cited in Chorina, M,2018 2019)

RESULTS AND DISCUSSION

Results

The research on the android-based e-module in the material of molecular shape of VSEPR theory refers to research on the development of the ADDIE model, which is limited to the development stage, which is as follows:

Results of Analysis Stage

The analysis stage focuses on the target audience. At the analysis stage, defining the problems, objectives, and learning objectives is carried out. This step does a problem analysis and analysis of the necessary needs of students. The initial step is to conduct interviews directly with teachers regarding the teaching and learning process which is carried out online.

The results of interviews with teachers which were conducted directly show results,

including, lack of teaching materials or additional media used, conventional learning in the form of delivering material in a lecture and question and answer manner, only using textbooks as the main source of information and student worksheets as an addition, students easily bored, poor network quality for students who live in villages, making it difficult in the learning process, deficiencies on student worksheets such as colorless content design, delivery of information that is not detailed enough, pictures of molecular shapes that are less attractive and not detailed.

The factors above resulted in students not understanding the material presented, so that the impact on students' daily test scores was low. The next step is to give students an online questionnaire. The questionnaire provided contained statements about the use of Android Smartphones with students. The results show that students use Android Smartphones a lot in their daily activities both for playing games, social media, or in learning.

At this stage, an analysis of basic competencies is also carried out. The basic competency used in the molecular shape material is basic competency 3.6, namely determining the shape of a molecule using the valence shell electron pair repulsion (VSEPR) theory or Electron Domain Theory. After the analysis is carried out, the results show that students are required to be able to determine the shape of the molecule based on VSEPR theory and Electron Domain theory. To be able to use this theory, students must understand PEI and PEB, VSEPR theory, Electron Domain theory, how to determine the shape of a molecule and understand how to visualize it both in 3 dimensions and 2 dimensional.

Based on the data that has been obtained, a needs analysis can be carried out. The result shows that to overcome the problems faced by students, teaching materials or learning media are needed that can be used freely, have a variety of complete information, both in the form of material explanations in the form of writing, animation, video, and audio in one package, and can be used without an internet network so students living in villages with poor network access can be helped. Based on these considerations the researchers decided to make an android-based e-module which is packaged in the form of an apk extension application that can be directly installed on students' smartphones.

Results of the Design Stage

At this stage, planning is carried out in the form of designing an e-module which will be made in the form of a story board and making a validation questionnaire. This stage produces an initial plan of e-module in the form of story board (Figures 2, 3, 4).

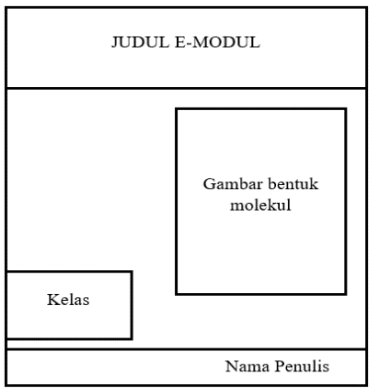

Figure 2. Front Cover of E-Module

Figure 3 shows a story board on e-module contents. The initial plan for writing titles and subtitles was at the top, then continued with the contents of the material, and writing page numbers in the lower right corner.

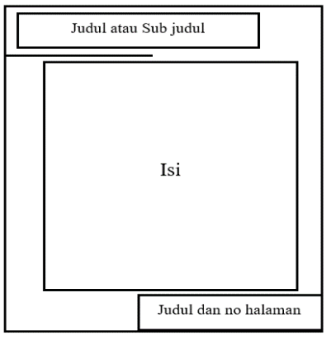

Figure 3. Content of E-Module

Figure 4 shows the initial design of the back cover of the e-module. The title of e-module was written at the top, the author's biodata was written in the middle of the page, then the author's name in the lower right corner.

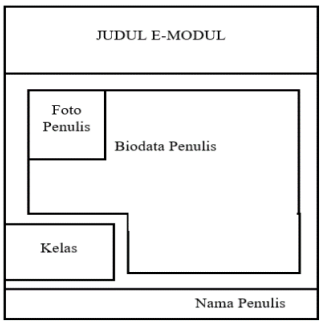

Figure 4. Back Cover of E-Module

The initial plan for the content of the android-based module is using Microsoft word, but after the work was carried out, difficulties were found in arranging the layout of the images, sentences, and additional designs needed. So, to overcome the problem, Microsoft PowerPoint was used. In addition, in the initial stage, the module was designed to only display evaluation questions that cannot be answered directly in the application, so it is necessary to use other media in the form of books to write answers. After carrying out various kinds of experiments, in the end it can contain evaluation questions in the form of multiple choices which can be filled directly in the application. Making front cover, background content, and back cover used the help of the application Adobe Photoshop. Making the module with the extension html using application Flip PDF Corporation, then to change it to the apk extension using the application website 2 Apk Builder.

Results of the Development Stage

At the development stage, the creation and integration of content that has been designed at the design stage is carried out. In this stage, an android-based e-module is made which includes writing content and creating the necessary graphics. Besides that, validation is also carried out at this stage which includes material feasibility validation, language feasibility validation, and graphic feasibility validation. The developed Android-based e-module has an application file specification with the apk extension that can be installed on an Android device. The application file has a size of approximately 42 MegaByte (42 MB) and can be used without internet. The application contains 3-dimensional molecular shape animations, pictures, and learning videos. There are multiple choice evaluation questions that can be filled directly in the application. The following is an example of an e-module image that has been created:

Figure 5. Front Cover, Inside and Back Cover of the e-Module

The e-module which is created in the apk extension and can be installed on the student's android device makes it easier for students to access the information contained in the e-module anywhere and anytime. In addition, the e-module has several interesting features such as 3-dimensional animation of molecular shapes and material explanation videos that can help students understand the material being studied. There are also multiple-choice evaluation questions that can be filled directly on the student's Android after students learn the materials provided. This feature can help students practice doing questions on the VSEPR molecular shape material both at home, at school, and in their spare time. Based on the features provided, students are expected not to get bored in learning and easily understand the material presented in the class, so that it can help students' understanding, both in terms of determining the shape of the molecule or in terms of visualizing the shape of the molecule. In this situation it is expected to increase the student's daily test scores.

The development stage conducted validation on the e-module developed, by giving validation questionnaires for material feasibility tests, language feasibility validation, and graphic feasibility validation to expert validators in each field.

Table 3. Feasibility Test Results

Aspect	Results	Category
Material	92.69%	Very feasible
Language	92.69%	Very feasible
Graphic	91.66%	Very feasible

Based on the data in Table 3, the e-module is categorized as very feasible because in every aspect, namely aspects of material feasibility, language feasibility, and graphic feasibility, the criteria are very feasible.

Following are the validation results for each aspect:

Material Feasibility Validation

Table 4. Material Feasibility Test Results

Aspect	Results	Category
Suitability of the material with basic competence	91.66 %	Very feasible
Material accuracy	95.80%	Very feasible
Material update (presentability)	91.66%	Very feasible
Encouraging curiosity	91.66%	Very feasible
Average	92.69%	Very feasible

Based on the data in Table 4, the material feasibility test is divided into 4 assessment aspects. The aspect of suitability of the material with basic competence obtains a result of 91.66%, which means that the material made on the e-module is relevant to Basic Competency 3.6 that students must achieve, namely applying the theory of valence electron pair repulsion (VSEPR) to determine the molecular shape of a compound. According to Permendikbud Number 24 of 2016, Basic Competence (KD) is the minimum ability and material that must be achieved by students for a subject in each educational unit that refers to core competencies. This suitability is intended so that the learning indicators that have been set can be achieved by students at the end of the lesson. The achievement of each predetermined learning indicator can show the success of students in understanding the molecular shape material of the VSEPR theory in determining the molecular shape of a compound. This aspect is indicated by the written basic competencies and indicators that students must achieve to make it easier for students to focus on what material must be studied so that learning is carried out according to the indicators set.

The aspect of accuracy of the material obtains a score of 95.80%. This shows that the explanation of the material is in accordance with the concept of the experts. The concept of experts who become a reference can help students understand the material presented. In addition, with the existence of the concept of these experts, it is intended that there will be no errors in the basic concepts conveyed to the audience. The accuracy of the material on the e-module is indicated by the existence of an expert concept written in italics. Besides, the material made is also based on references to existing books and journals.

The aspect of material update obtains 91.66%. This aspect includes the coherence of the material and the use of the latest references in creating the e-module. This aspect is shown by the delivery of sub-chapters of material written coherently in determining the shape of a molecule. Conveying information in a coherent manner can make it easier for students to learn the steps to determine the molecular shape of a compound. In addition, the e-module also uses the latest references taken from books, articles, and journals. This can be seen in the bibliography of the e-module which shows references from the most recent year.

In the last aspect, the aspect of encouraging curiosity gets a score of 92.69%. This score indicates this aspect which includes the delivery of material related to everyday life. Delivery of material like this aims to foster students' curiosity about the material of molecular shapes. This is indicated by the use of compounds that can be found in everyday life as an example to explain the material steps for determining the molecular shape of a compound. The final result of validating the feasibility of the material gets an average score of 92.69%. This score indicates that the android-based e-module that has been made has a very feasible category.

Language Feasibility Validation

Language feasibility validation is carried out by a linguist validator and the results are obtained in Table 5 below.

Table 5. Language Feasibility Test Results

Aspect	Results	Category
Straightforward	95.80 %	Very feasible
Communicative	91.66%	Very feasible
Suitability with the development of students	91.66%	Very feasible

Compliance with the correct rules of the Indonesian language	91.66%	Very feasible
Average	92.69 %	Very feasible

Based on the data in Table 5, the material feasibility test is divided into 4 assessment aspects. In the straightforward aspect, it has a score that is categorized as very feasible, namely 95.80%, this shows that the average language conveyed is in accordance with the rules of effective sentences, and the clarity of the sentences conveyed is also good. According to Sugihastuti in Darmanella (2018), effective sentences must be composed according to the applicable rules, at least have elements of a subject and predicate.

The communicative aspect gets a score of 91.66%, this shows that the language used is interactive and dialogic so that it can help students understand the information conveyed. This aspect can be seen from the words used such as the word "*Tahukah anda*" (Did you know). In addition, in the delivery of material, there are also invitation sentences so that students are more interested in learning to use the e-module which has been made. The aspect of suitability with the development of students has an average score of 91.66%, this shows that the language used in delivering information is according to the abilities of students, namely class X high school students. This aims to make it easier for students to absorb and understand the information contained in the e-module. A good module is user friendly (Daryanto in Randa, S, 2017). The use of language that is good and correct and easy to understand is one form of application of user friendly.

The e-module also has a very appropriate category in compliance with language rules, which includes the use of grammar used in conveying information in accordance with Indonesian Spelling (EBI). Besides, the Indonesian language rules used are good and correct. According to the Big Indonesian Dictionary (KBBI), spelling is the rule of how to describe sounds (words, sentences, and so on) in writing (letters) and the use of punctuation marks. (KBBI in Maryani, Y, 2014). This explanation implies that spelling is only related to grammar which includes the use of letters, the writing of words, including the writing of borrowed words or terms, and the use of punctuation marks. In spelling there are no rules for selecting words or constructing sentences (Maryani, Y, 2014). All of these aspects are made with the aim that e-module is easy for readers to read and understand. In this aspect, it has a percentage score of 91.6%. The final results on language feasibility validation show an average of 92.69%. This score shows that the e-module developed is very feasible in the use of language.

Graphic Feasibility Validation

The graphic feasibility validation assessment is carried out for three indicators, namely e-module size, cover design, and e-module content design. The validity value for each graphical feasibility indicator can be seen in Table 6.

Table 6. Graphic Feasibility Test Results

Aspect	Results	Category
E-module size	100 %	Very feasible
Cover design	87.49%	Very feasible
Content Design	87.49%	Very feasible
Average	91.66%	Very feasible

Based on the data in Table 6, the material feasibility test is divided into three assessment aspects. The module size has been adapted to the user's smartphone screen. This results in a percentage score of 100% in this aspect. Adjustment of the size of the module is made so that the module fits all user screen sizes, the size match makes it more comfortable to use in

learning. The cover design gets a very feasible category with a score of 87.49%. The cover design has harmony between the front and back covers both in terms of background color, title, and cover style. This is indicated by the alignment of the background color of the front cover and the green back cover which makes the title text appear clearly. Making a cover like this aims to attract students' interest the first time they open the e-module installed on smartphones. This is in line with Mudjito in Agustina, E (2015) stating that a reading book with an attractive cover and equipped with pictures can arouse someone's interest in reading. Thus, every book publication must be designed in such a way as to attract everyone's interest in reading it.

The content design, which is categorized as very feasible, gets a score of 87.49%. This design aspect includes the type and size of the font that is aligned, the layout of sentences that make it easier for readers, the selection of images and videos that can make it easier for readers, the color of the text, and the color of the background the contrast ones already have a decent design. In education, animation is used as a modern learning media, especially to describe material that is not easily explained verbally. In entertainment, animation is used as a medium of entertainment in the learning process so that students do not get bored when they see the subject matter provided by educators. Moreover, this animation-based learning media plus narrative voice that provides explanations of the material makes students interested in the learning process.

Discussion

Chemistry involves three main levels, namely macroscopic, submicroscopic, and symbolic representations. The macroscopic level relates to phenomena that can be seen with the eye. The microscopic level deals with elementary particles (e.g., atoms, molecules, and electrons). While the symbolic level involves formulas and chemical equations (Aksela, M, in Santoso, F, 2013). Animation-based learning media has the ability to describe something that is complicated or complex or difficult to explain with just pictures or words. (Sumarni in Gustin, V , S, 2020). The existence of interesting content designs that contain pictures, animations, and videos is expected to make students understand the shape of molecules in detail. This aspect is shown in the content of the material which is equipped with learning videos, pictures of molecular shapes, and animations of moving molecular shapes.

The final results on the validation of graphic feasibility show an average of 91.66%. This score shows that the e-module is very feasible to use in all aspects of graphics. Based on the description of the results of the research, the android-based e-module on the molecular shape material of the class X has met the feasibility standards. The feasibility standard is obtained based on validation tests conducted by linguists, material experts, and graphic experts. Choosing the android-based e-module as teaching material in learning during the Covid-19 pandemic carried out remotely can help students understand molecular shape material, visualize concepts, and encourage students in learning. This research is relevant to Hurrahman, M (2022) that e-modules are easy to use, have an attractive appearance, can help visualize the concept of molecular shape, and can give users pleasure.

CONCLUSION

Based on the data from the discussion above, it can be concluded that the android-based e-module on molecular shape of VSEPR theory is very feasible to use for the teaching and learning process in schools. The android-based e-module gets high validation results, namely in the material feasibility validation gets a percentage of 92.69%, indicating that the e-module has fulfilled the feasibility aspects of the suitability of the material and basic competence, the

accuracy of the material, the updating of the material, and encouraging curiosity. Language feasibility validation with a percentage of 92.69% indicates the e-module has fulfilled the feasibility aspects of being straightforward, communicative, suitability with the development of students, and compliance with the correct rules of the Indonesian language. Graphic feasibility validation with a percentage of 91.66% with very feasible category indicates the e-module has met the qualifications from the aspect of e-module size, cover design, and content design. The feasibility research results obtained will be applied as a reference in creating the android-based e-module that is suitable for use in further research. Based on the results, conclusions, implications and limitations, suggestions from this study are for teachers and students to optimize the use of this e-module in learning, while for further researchers to follow up on the limitations of this research so that the results of the research can contribute to efforts to improve quality of education in Indonesia.

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