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Engaging Chemistry Learning: Combining Uno Flashcards And Assemblr Edu for Nomenclature Of Compound Material

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ABSTRACT

Students nowadays are used to take the advantage of technological advances in their daily lives, especially for education. Thus, students prefer to learn with by the collaboration of the latest electronic media. Therefore, electronic media is a must for the learning process. The purpose of this study is to determine the level of validity and practicality of Uno flashcard learning media on Assemblr Edu-based application on nomenclature of compound materials. The type of the research is DDR (Design and Development Research) development model with the stages of analysis, design, and development. This research was conducted in 2 schools, SMA Cendana Pekanbaru and SMA IT Al-Fityah Pekanbaru. The data was collected by interviews and questionnaires. Then the data analyzed quantitatively and qualitatively. The validity level obtained from this product is 93% (very valid), while the level of practicality obtained by teachers is 95% (very practical), and the response rate from students is 90% (very practical). Based on these results, it can be concluded that the uno flashcard learning media based on Assemblr Edu application on nomenclature of compound material is very feasible and practical to use in the process of learning nomenclature of compound. The implication of this research is that it can provide new and innovative learning experiences to teachers and students.

INTRODUCTION

Learning media is one important components in the learning process. Learning media is a tool to assist teachers in conveying subject matter to students and carrying out the learning process to be more effective and efficient (Alfiah, 2015; Arsyad, 2021). Learning media can be grouped into non-electronic media, electronic media, or educational games. This educational game has the advantage of being able to provide new experiences and challenges to students, thus to stimulate curiosity and develop students' thinking skills. (Hidayat et al., 2019; Mahartika, et al., 2020). Educational games often involve various challenges or problems that students must solve. Completing these educational games requires thinking skills such as analyzing situations, evaluating options, and making decisions. Therefore, by playing games, students can learn how to approach complex problems in an engaging and interactive way (Zaky & Al Mulhim, 2024). One popular type of educational game is the UNO flashcard.

UNO flashcard is an easy-to-play card game by matching colors or numbers. The simplicity and the easy game procedure leads this UNO flashcard become popular among young generation. Apart of being an entertainment, this UNO flashcard game can also be modified and used as an educational game. Based on several previous studies, UNO

flashcards have been modified into games as the students feel interested and able to think faster to complete the games which contain the concept of the subject matter (Harahap et al., 2022; Mahartika, et al., 2020; Putera et al., 2022). However, UNO game is only in the form of 2 dimensions, while students need a more detailed visualization with a 3-dimensional shape. Therefore, a combination of learning media and the latest technology is needed. This aligns with the concept of chemistry material, which is generally abstract. Therefore, students need learning experiences with 3D visualization so they can better understand abstract chemistry concepts, such as molecular structure, complex geometric shapes, or other concepts. Learning by viewing objects in 3D is expected to help students explore these objects from various angles, reinforcing their understanding of structure and spatial relationships (Kurniawan et al., 2024; Rahmawati et al., 2021; Romero et al., 2020).

Technology which rapidly developing nowadays is very influential in various aspects of life, one of which is the education aspect. Technology can be used to expand the range of knowledge and help teachers streamline the process of delivering material to students(Anggraeni et al., 2023; Budiyono, 2020). Usually, teachers also use technology as an electronic learning media. One of the latest technologies that can be used as a learning medium is augmented reality (AR) technology that allows students to interact to the real virtual world (Sulistiani et al., 2023). Augmented reality (AR) technology is a technology that can visualize objects in the form of 3D made by computers to the surrounding environment in real time. This learning media with AR technology aims to explain in detail the 3D form of the subject matter to students (Mahartika et al., 2023; Socrates & Mufit, 2022). Based on previous research, UNO learning media assisted by AR stimulates students to think quickly, actively and independently in the learning process, students can also build good interaction and cooperation with their peers, thus the learning outcomes can also be significantly improved (Istiqomah & Mahabbati, 2019; Yusrul Hana et al., 2023). One of the applications that has AR technology is assemblr edu.

Assemblr edu application is a mobile learning application with AR features that can be easily accessed through various electronic devices online, this helps teachers to be able to provide new and interesting learning experiences for students during the learning process (Majid et al., 2023; Yustisia, 2020). There are a variety of other innovative features that can be used by teachers and students, such as virtual classes, provided learning resources, and improving creativity by editing new desired learning resources (Ridho et al., 2024).

Based on interviews conducted with chemistry teachers in two schools in Pekanbaru, the commonly used learning media are powerpoint, printed books, LKPD, animated videos, kahoot, quizziz, and others. However, teachers find it difficult to create the latest learning media due to time limitation. This is because teachers are often faced with a significant administrative burden, such as preparing lesson plans, assessing student work, managing the classroom, and attending meetings and other school activities. As a result, teachers tend to use existing learning media rather than creating new learning materials. This has an impact on the learning activities, where teachers only utilize available media without introducing new learning tools. Teachers have never tried the educational game learning media in the form of UNO flashcards, while this game is quite popular to play among students. Learning media, such as printed books, generally tend to provide passive learning experiences. In contrast, UNO flashcards offer challenges in learning, which encourage active student involvement in the learning process. UNO flashcards also provide engaging visualizations, which are expected to capture students' interest in learning. Learning with augmented reality-based UNO flashcards is expected to offer a new and more engaging learning experience, enhancing student interactivity. This learning media has the potential to encourage students to be more active in their learning, help them visualize 3D objects of molecular structures that are rarely encountered in textbooks, and assist students in understanding abstract concepts in the

nomenclature of compound materials. In addition, teachers have also never made augmented reality-based learning media, thus teachers have the interest in trying the technology on nomenclature of compound material. Nomenclature of compound material has a theoretical concept that directs students to memorize chemical elements and understand their naming rules, it leads students tend to be less interested in learning concepts and decrease the learning achievement (Hasanah et al., 2023; Manurung & Kristianti, 2023).

Learning the nomenclature of compound materials is typically quite passive and often relies solely on memorization. Therefore, there is a need for learning media that encourages students to actively interact and understand abstract concepts in the study of compound material nomenclature, such as molecular structure, bonds, and the properties of chemical compounds. Meanwhile, textbooks only provide 2D illustrations, which can sometimes fail to clearly depict the detailed shapes of molecules. Based on the background, the researcher interested in conducting research to produce a product in the form of UNO flashcard learning media based on assemblr edu application on nomenclature of compound material.

RESEARCH METHODS

Research Design

This study uses the Design and Development Research (DDR) type 1 which aims to design and develop a products. DDR research method consists of three stages, (1) needs analysis stage; (2) design stage; (3) product development stage (Richey & Klein, 2014). At the needs analysis stage, an analysis of students, educators, materials and curriculum is carried out. Furthermore, at the design stage, storyboard design and initial media design are made. Then at the development stage, the media product is revised in line to the suggestions of media validators, material validators, language validators, chemistry teachers and students, as the final results of the media produced.

Research Target

The sample in this study consisted of 2 lecturers who were the media experts for media validity tests; 2 material expert lecturers for material validity tests; 1 expert lecturer of Language for language validity test; 2 chemistry teachers for practicality tests; 10 students of class XI Science 1 and 10 students of class XI Science 2 at SMA Cendana Pekanbaru, as well as 10 students of class XI SCIENCE SMA IT Al-Fityah for student response tests.

Research Data

The data collection techniques used in this study were interviews to analyze needs, questionnaires to test product feasibility, and documentation during the research process.

Research Instruments

The research instruments used in this study are interview guidelines to analyze the needs of teachers and students, and a product feasibility questionnaire, as shown in Table 1. The questionnaire used in this study is as follows:

Table 1. Practicality Test Questionnaire Conducted by Chemistry Teachers

No.	Aspects	Indicators
1.	Display eligibility	Media size
		Media design
		Typography of media content
2.	Aspects of Content eligibility	Suitability of the material to the curriculum
		Accuracy of material to the actual concepts
3.	Aspects of Presentation eligibility	The presentation technique is arranged systematically

No.	Aspects	Indicators
		and in a systematic manner
		Media presentation and its impact on learning
		Completeness of presentation in the media
4.	Aspects of Language eligibility	Suitability of language with the intellectual development of students
		Conformity with good and correct language rules
		Appropriateness of the use of terms, symbols, and icons
5.	Aspects of using *assemblr edu application*	Media design and display
		A well-usable app
		Marker sensitivity
6.	Usability aspect	Benefits of media for teachers

Data Analysis

The data analysis techniques used in this study were quantitative and qualitative descriptive techniques referred to the Likert scale. In determining the scores, it was limited to 5 options, (1) strongly disagree, (2) disagree, (3) somewhat agree, (4) agree, and (5) strongly agree. The data analysis techniques used in this study are qualitative descriptive analysis and quantitative descriptive analysis. The qualitative descriptive analysis is conducted using content coding from interview transcripts. The quantitative descriptive analysis is conducted to analyze the results of the feasibility questionnaire using a Likert scale limited to 5 points, (1) strongly disagree, (2) disagree, (3) somewhat agree, (4) agree, and (5) strongly agree.

The researcher then calculates the percentage of feasibility testing using the following formula:

$$\text{Validity Percentage} = \frac{\text{obtained score}}{\text{maximum score}} \times 100\%$$

The validity percentage must then be interpreted descriptively according to the following table:

Table 2. Feasibility Test Result Interval

No	Persentase	Kategori
1.	81% - 100%	Very Valid
2.	61% - 81%	Valid
3.	41% - 60%	Sufficiently Valid
4.	21% - 40%	Less Valid
5.	0% - 20%	Invalid

RESULTS AND DISCUSSION

This learning media was developed using design and development research (DDR) type 1, its the research on products and tools. DDR type 1 development model consists of several stages, such as analysis, design, and development (Richey & Klein, 2014). The stages carried out by the researcher in detail are as follows:

Analysis Stage

The purpose of this analysis stage is to analyze the needs by identifying problems that occur in the field and finding solutions to be given (Caesaria et al., 2020). At this stage, field observations, interviews were conducted to the chemistry teachers and several students.

Educator Analysis

Educator analysis is a step in the analysis phase to examine teachers' needs in the learning process. At this stage, the researcher conducted interviews with chemistry teachers. It is known that teachers had used variety of learning media in the classroom. However, teachers

have difficulty in preparing the latest learning media due to preparations in the recent curriculum changes. Curriculum changes keep teachers occupied with various new administrative tasks, leaving them with insufficient time to prepare the latest learning media, such as augmented reality media. In addition, chemistry teachers have never tried to create augmented reality-based learning media, while they have the interest in trying this technology to the chemical materials, such as the nomenclature of compound. In fact, learning with augmented reality greatly helps students visualize abstract chemistry concepts.

Student Analysis

At this stage, the researcher conducted interviews to the students to find out their characteristics. Based on the interview, it was found that several students enjoy chemistry lessons. However, they also encounter difficulties, such as memorization. Most students struggle to remember the names of elements and chemical molecules in learning the nomenclature of chemical compounds. This difficulty is compounded by the fact that the molecular shapes of compounds or elements cannot be directly observed and that the concepts are interrelated across different topics. Based on the interviews conducted, it is known that students prefer various kinds of games, one of which is UNO card, which they play together. Students also hope that there will be new games which easy for them to learn.

Material Analysis

Based on interviews conducted to the chemistry teachers, it is known that there are several materials taught in phase E of the Independent curriculum, namely green chemistry, equalization of reactions and nomenclature of compounds, atomic and nanomaterial theory, periodic systems of elements, and basic laws of chemistry. As for some of these materials, there are materials that need to be given a three-dimensional depiction or visualization so that students can understand the material easily, including compound nomenclature. The process of learning nomenclature of compound material requires accurate and clear concepts, this is because nomenclature of compound material has an understanding of naming rules and how to formulate so that it makes it difficult for students to learn this material. Students also find the nomenclature of compounds challenging because there are too many compound names to memorize. They struggle to grasp abstract concepts that are difficult to visualize in 2D form and have trouble imagining the spatial arrangement of atoms within a molecule. Errors in learning this material can have serious consequences for future chemistry learning, as students are required to understand various chemical reactions. The reason why the researcher chose the nomenclature of compound material in the topic of this research as the nomenclature of compound material is suitable and quite easy to make a 3D visualization of the chemical compound.

Curriculum Analysis

This research was carried out based on the applicable curriculum, the Independent Curriculum. Based on the flow of learning objectives that have been described above, it can be seen that the independent curriculum requires students to be able to understand and demonstrate how to write molecular formulas and name the chemical compounds. Therefore, uno flashcard learning media will be designed so that students can understand the naming of compounds through elemental cards that match each other based on the classification of compounds (ionic, covalent, acidic and alkaline). Then students can deepen more the material using assemblr edu which is able to demonstrate the interaction between two elements that bond to each other and form a chemical compound in three dimensions.

Design Stage

The design stage conducted by the aim to design a product to be developed based on the results of the analysis found. At this stage, researchers need to design the storyboards before start the learning media that adapted from the previous stage. Storyboard is in the form of design or description of the learning media that will be developed.

Then the creation of learning media will be used by several applications, such as Canva, Blender 3D, and Assemblr Edu. First, Canva application is used to create nomenclature of compound uno flashcard design. Secondly, the Blender 3D application is used to design 3D objects from the desired chemical elements and compounds. Third, the assemblr edu application or assemblr studio which use to create AR creations that have to be opened through this application or website, thus will be used to place 3D objects on the AR display and create markers to display the AR.

Development Stage

At the stage of development, storyboards that have previously been designed will be made and developed into learning media that will be tested and used appropriately later (Caesaria et al., 2020). The product is still an initial design which will later be revised based on the advice and input of experts who tested this product. So that later a better product results than before will be produced. The uno flashcard learning media based on the assemblr edu application on the nomenclature of compound material that has been developed and revised is as follows.

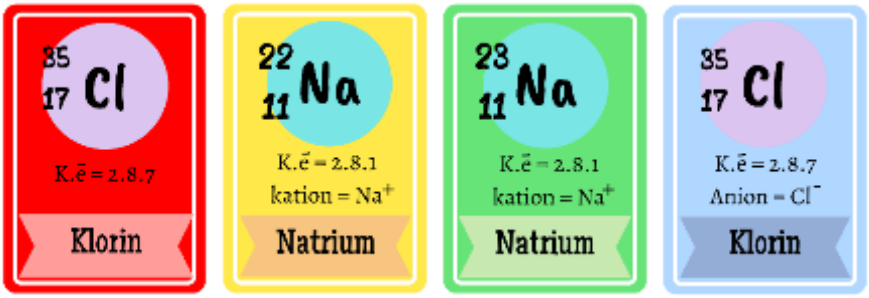

Figure 1. Element Cards

Element cards contain a variety of chemical elements, whether the monoatomic or polyatomic. This element card is divided into 4 colors according to the type of compound that will be formed, namely the red card for covalent compounds, the yellow card for ionic compounds, the green card for alkaline compounds, and the blue card for acid compounds. This card will be used to learn nomenclature of compound material.

Figure 2. Action Cards

Action cards contain challenges that are in line to the rules of the UNO game in general. The skip, reverse, and draw 2 cards each have 4 colors according to the element card. Meanwhile, the wild and wild draw 4 cards are only black.

Figure 3. Marker assemblr edu

The assemblr edu marker is a marker that can only be scanned through the assemblr edu application. Markers can be scanned online using electronic devices such as smartphones, as well as I-pads, and others. Once scanned, the marker will give the object a 3D view of the nomenclature of compound.

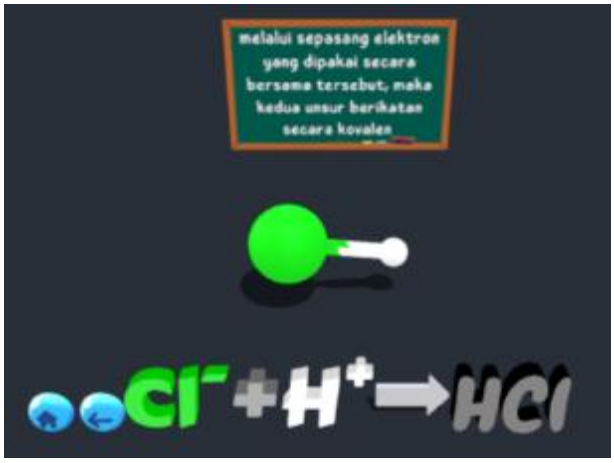

Figure 4. AR display of *the assemblr edu marker*

Here's an example of how a 3D object looks from a marker. There is a brief explanation of the formation of chemical compounds, how the 3-dimensional shape of the chemical compound, and how simple chemical reactions occur as the compound is formed along with the name of the compound.

Validity Test

The products that have been developed were then validated by material experts and media experts. Validity tests are useful in determining the level of validity of the developed products. The validity of learning media products can be done by distributing questionnaires that contain several questions to media experts in their fields. The validation of the learning material is conducted by subject matter experts, specifically two university lecturers in the field of chemistry education. The media validation is carried out by media experts, specifically two university lecturers in the field of chemical technology. The language validation is performed by a language expert, specifically one university lecturer in the field of Indonesian language. The validation results from media experts obtained as a whole can be seen in the following graph.

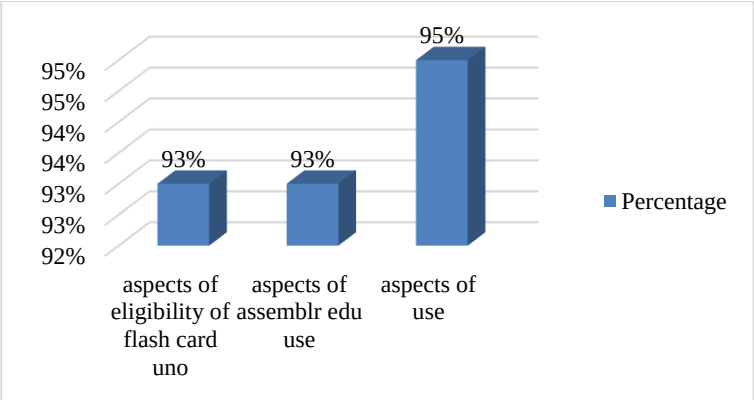

Figure 5. Graph of Validation Results by Media Experts

The percentage results obtained in the aspect of assessing the feasibility of the uno flashcard are 93% with a very valid category, and the percentage results obtained in the aspect of assessing the use of the assemblr edu application is 93% with a very valid category, and the percentage results obtained in the aspect of usability assessment are 95% with a very valid category. Based on the results of the overall assessment, a percentage of 93% was obtained with a very valid category. In accordance with the learning tool guidelines published by the Ministry of National Education (2010), a learning medium allows students to feel interested and learn material concepts in innovative and interactive way (Kementerian Pendidikan Nasional, 2010).

Based on the feasibility results, it shows that the UNO flashcards using the Assemblr Edu application meet high feasibility standards. This is supported by the media's attractive design, which can engage students' interest. This finding aligns with previous research, which indicates that the more appealing the media, the greater students' interest in learning (Ndraha & Harefa, 2023). The feasibility results reflect the ease with which the learning media provides an intuitive and effective learning experience, as well as the media's capability to optimally support the learning process. As it can be concluded that uno flashcard learning media based on the Assemblr Edu application in this nomenclature of compound material is categorized as worthy to follow-up.

Furthermore, the validity test is carried out by material experts. The purpose of this test is to assess the content of the learning media and find out the shortcomings that must be corrected. The results of the validity test conducted by material experts are as follows.

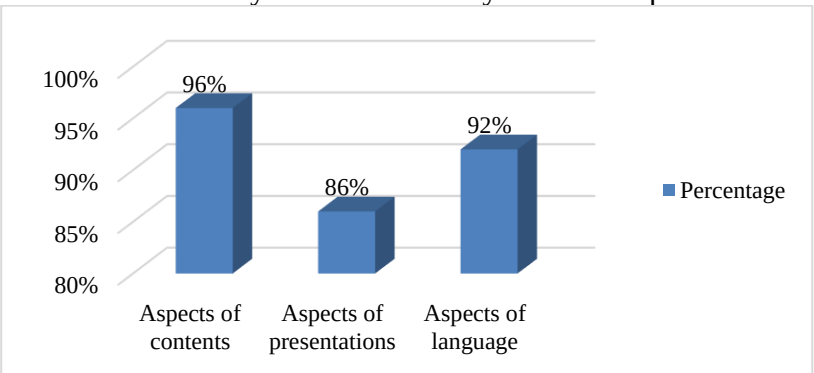

Figure 6. Graph of Validity Test Results by Material Experts

The graph above describes the results of the validity test of uno flashcard learning material based on the assemblr edu application based on an assessment conducted by 2 material experts. The percentage results obtained in the aspect of content feasibility are 96% with a very valid category, and the percentage results obtained in the aspect of presentation feasibility are 86% with a very valid category, and the percentage results obtained in the

language feasibility aspect are 92% with a very valid category. Based on the results of the assessment obtained as a whole, a percentage of 91% was obtained with a very valid category.

Based on these results, it shows that the content feasibility aspect is higher compared to the other results. This indicates that the content within the learning media meets current scientific standards and aligns with the basic competencies and learning objectives. The material presented is also consistent with the curriculum used, including the main topics, scope of coverage, and depth of discussion. Meanwhile, the presentation and language feasibility aspects still require improvement to achieve a more balanced result among these three aspects. So it can be concluded that the uno flashcard learning media based on the Assemblr Edu application in this nomenclature of compound material is categorized as worthy of follow-up. This is in line to the previous research, where good learning media is media that presents good and interesting quality material, so that students can improve insight and understand the material presented well (Pratiwi & Widyaningrum, 2021).

Furthermore, it is necessary to conduct a language validity test. The purpose of the validity test by linguists is to assess the use of language contained in learning media and to find out the shortcomings that must be corrected. The results of the validity test conducted by linguists are as follows.

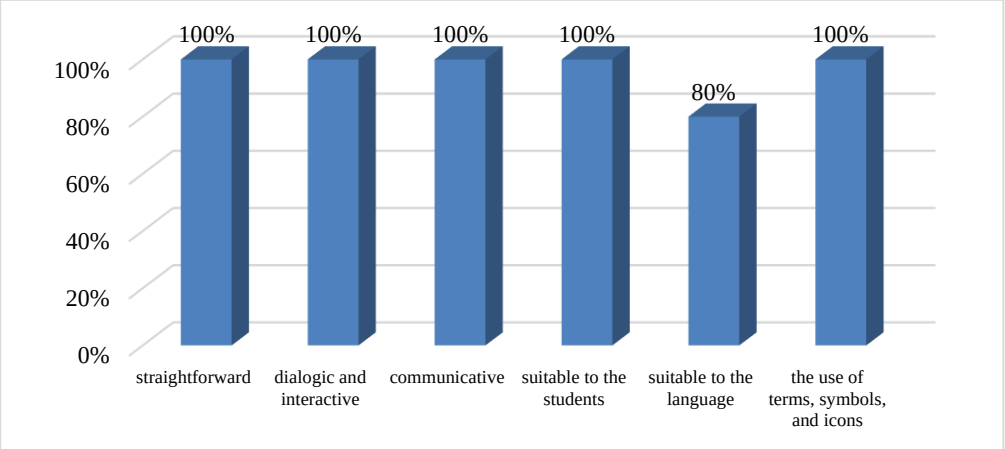

Figure 7. Graph of Validity Test Results by Linguists

The graph above describes the results of the uno flashcard learning language validity test based on *the assemblr edu* application based on an assessment conducted by 1 linguist. Based on the results of the overall assessment, a percentage of 97% was obtained with a very valid category. This is in line with research conducted by Purnanto (2016), in which the feasibility of language in a learning media is assessed from the use of straightforward, dialogical, interactive, communicative language, in line to the development of students, also to the language rules, and good terminology (Purnanto & Mustadi, 2016). As it can be concluded that the uno *flashcard* learning media based on *the Assemblr Edu* application in this nomenclature of compound material is categorized as worthy of follow-up.

Based on the results of the validity test conducted with media experts, material experts, and linguists, the assessment results of the validity test as a whole are as follows.

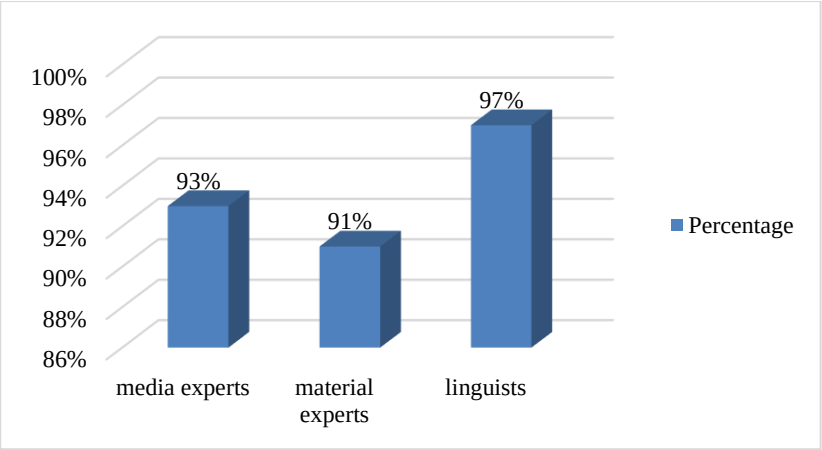

Figure 8. Graph of Overall Validity Test Assessment Results

Based on the results of the overall data calculation above, it can be seen that the overall percentage of Uno flashcard learning media based on the *Assemblr Edu* application in the nomenclature of compound material is 93% with a category that is very valid and suitable for use. This media can be an effective solution to overcome challenges in learning the nomenclature of compounds through an interactive and engaging approach that supports students' in-depth conceptual understanding.

Practicality Test

The uno flashcard learning media product on the assemblr edu application based which has been improved by the advice of the validator, also has been categorized as very valid based on the assessment of the validity test by several experts. Then a practicality test can be carried out with the chemistry subject teacher. The results of the practicality test conducted by teachers are as follows.

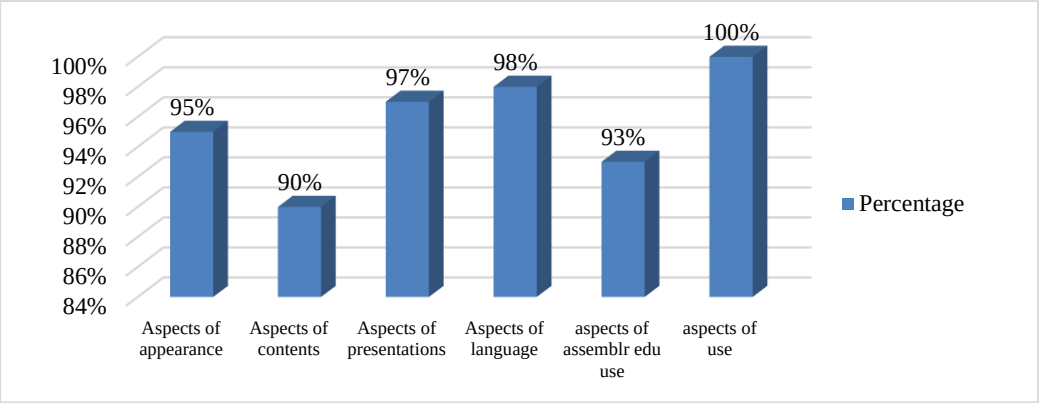

Figure 9. Graph of Practicality Assessment Results by Chemistry Teachers

The graph above describes the results of the uno flashcard learning practicality test based on the assemblr edu application based on assessments conducted by 2 chemistry teachers. This questionnaire contains 12 assessment items with 6 indicators. The feasibility of learning media by teachers is assessed from the feasibility of its appearance, content, language used, practicality of the media, and benefits for teachers who use it, thus the learning process fostered by teachers becomes more effective and efficient (R. Apriani et al., 2021; W. Apriani et al., 2021). Based on the results of the assessment obtained as a whole, a percentage of 95% was obtained with a very practical category. As it can be concluded that the uno flashcard learning media based on the Assemblr Edu application in this nomenclature of compound material is categorized as worthy of continuing.

Response Test

The purpose of conducting a response test by students is to find out the response of students in using the Uno flashcard learning media product based on the Assemblr Edu application. A learning media must be suitable to the conditions of the students who use it, both in terms of appearance and function (Batubara, 2021). The student response test was conducted with 11th-grade students who had studied the nomenclature of compounds in two schools in Pekanbaru. The results of the assessment of responses by students are as follows.

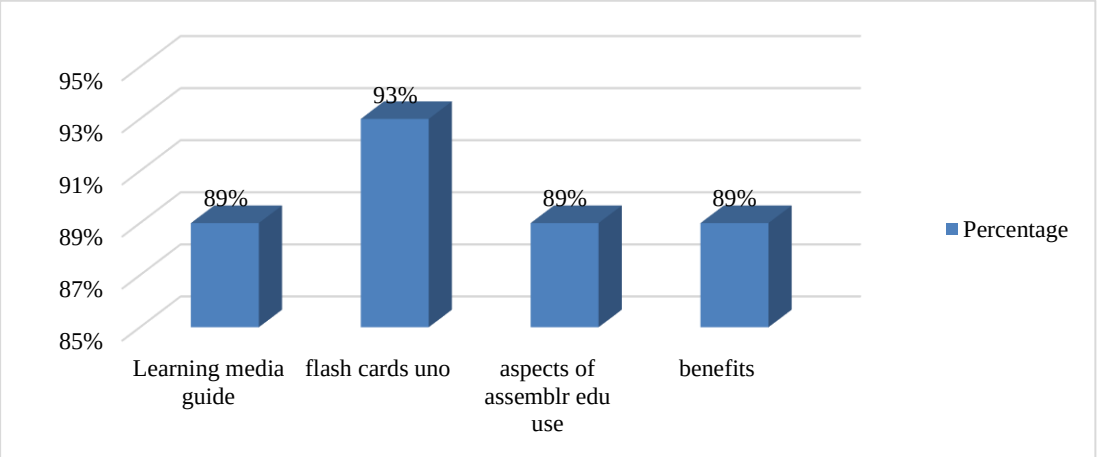

Figure 10. Graph of Response Test Results by Students

Based on the results obtained from the student response test, it was found that the assessment of the learning media usage guide received a score of 89%, categorized as *very good*. The feasibility aspect of the UNO *flashcards* scored 93%, categorized as *very good*. The feasibility aspect of using Assemblr Edu scored 89%, categorized as *very good*. Finally, the feasibility of usage received a score of 89%, also categorized as *very good*. Overall, the average percentage of assessment from the student response test to the Uno flashcard learning media based on the Assemblr Edu application on the nomenclature of compound material is as much as 90% with the category of very good and suitable for students to use.

Based on the feasibility aspect of the learning media usage guide, it shows that the guide is easy to understand and helps students comprehend the learning media, making the study of compound nomenclature easier. The feasibility aspect of UNO flashcards indicates that the cards have an attractive design and color combination, which increases students' interest in learning compound nomenclature. Additionally, the material presented through UNO flashcards is easy for students to understand. The feasibility aspect of using Assemblr Edu demonstrates that the application is easy to use and has an appealing design, which assists students in learning compound nomenclature. Finally, the feasibility of usage shows that this learning media successfully engages students, helping them understand concepts and enabling them to study compound nomenclature independently. This aligns with previous research, which indicates that engaging learning media can help students increase their interest in learning and better understand difficult and abstract material. The addition of 3D visualization using the Assemblr Edu application also aids students in comprehending abstract concepts, allowing them to experience clearer and real-time depictions through augmented reality technology (Estiani et al., 2015; Sari et al., 2022).

CONCLUSION AND RECOMMENDATIONS

The developed media consists of several parts, those are, a guide to the use of learning media of nomenclature of compound material, a nomenclature of compound uno flashcard, and a nomenclature of compound assemblr edu marker card. Based on the assessment of media experts, the material and the level of validity of the Uno flashcard learning media based

on the Assemblr Edu application on the nomenclature of compound material is as much as 93% which can be categorized as very valid. Meanwhile, the results of the practicality test with an assessment of 95% which can be categorized as very practical and the results of the student response test of 90% which can be categorized as very practical. Therefore, it can be concluded that this product is worthy of use in the next learning process. The implication of this study is that teachers and students can get new and enjoyable learning experiences. The researcher hopes that this research can be continued to a larger sample or group.

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