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Development of Interactive Learning Media Based On Augmented Reality Technology With Discovery Learning Model On Hydrokarbon Materials

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Abstract: The increasingly rapid development of technology requires human resources to build a country's future. Improving the quality of human resources through education is the key to being able to follow the development of the industrial revolution 4.0. The world of education has a responsibility to prepare the young generation who have high knowledge and skills. This research aims to develop interactive learning media based on augmented reality technology with a discovery learning model on hydrocarbon material. This research uses the ADDIE development research model. The population in this study were class XI students at Smart Murni Private High School with the research sample being class The results of media and material validation on LKPD with expert validators obtained an average percentage of media validation of 92.5% which was categorized as very feasible and the average percentage of material validation was 93% with a very feasible category. Based on the results of this research, student response results were also obtained, namely that the display obtained 86%, the material presentation obtained 83%, the media presentation obtained 86%. Therefore, the average student assessment was 86% so that the overall criteria obtained showed that the LKPD developed was in the very interesting category.

Keywords: Interactive Media, Augmented Reality, Discovery Learning Model, Hydrocarbons

Abstrak: *Perkembangan teknologi yang semakin pesat membutuhkan sumber daya manusia dalam membangun masa depan suatu negeri. Peningkatan kualitas sumber daya manusia melalui jalur pendidikan adalah kunci untuk mampu mengikuti perkembangan revolusi industri 4.0. Dunia pendidikan memiliki tanggung jawab untuk menyiapkan generasi muda yang memiliki pengetahuan dan keterampilan tinggi. Penelitian ini bertujuan untuk mengembangkan media pembelajaran interaktif berbasis teknologi augmented reality dengan model pembelajaran discovery learning pada materi hidrokarbon. Penelitian ini menggunakan model penelitian pengembangan ADDIE. Populasi dalam penelitian ini adalah siswa kelas XI SMA Swasta Cerdas Murni dengan sampel penelitian yaitu siswa kelas XI Mipa 2 yang berjumlah 30 siswa. Hasil validasi media dan materi pada LKPD dengan validator ahli memperoleh rata rata persentase pada validasi media sebesar 92,5% yang dikegorikan sangat layak dan rata rata persentase validasi materi sebesar 93% dengan kategori sangat layak. Berdasarkan hasil penelitian, diperoleh juga hasil respon siswa yaitu pada tampilan memperoleh 86%, penyajian materi memperoleh 83%, penyajian media memperoleh 86%. Oleh karena itu, rata-rata penilaian siswa sebanyak 86% sehingga kriteria yang diperoleh secara keseluruhan menunjukkan bahwa LKPD yang dikembangkan masuk kedalam kategori sangat menarik.*

Kata kunci: *Media Interaktif, Augmented Reality, Model Discovery learning, Hidrokarbon.*

- **INTRODUCTION**

The Industrial Revolution 4.0 has changed the way people live, making information technology an important element, especially in the field of education. In this era, education must be able to produce students who are adaptive to change. To meet these needs, teachers need to have competencies that are in line with the latest developments, including the ability to utilize technology (Lase, 2019). Creativity, innovation and analytical skills are the main keys in this era, encouraging students to create new ideas and innovative solutions. Shahroom & Hussin (2018) stated that the application of technology in learning, especially through online learning, provides flexibility for students and expands access to learning resources.

Learning is a change in behavior involving aspects of knowledge, attitudes and skills from initially not knowing to understanding (Widyanto & Wahyuni, 2020). In this process, the success of learning depends on the various learning components that support it. According to Adenolira, et al (2023), these components consist of students, teachers, learning objectives, models, methods, facilities/tools, evaluation and learning environment, all of which have their own roles in the learning process. Learning objectives are basically hopes to be achieved in the educational process. According to Widya et al (2023) learning objectives are a detailed formulation of the abilities that students must master after carrying out learning activities related to success.

Augmented Reality (AR) technology is an innovative solution in the learning context, allowing students to visualize difficult concepts interactively (Lase, 2019). One of the chemical materials that is difficult to understand because it is abstract is hydrocarbons, where to understand it requires more concrete learning. In this material, students must be able to classify hydrocarbon compounds based on bond saturation, give names, explain physical and chemical properties, and determine isomers of hydrocarbon compounds which cannot be done just by rote memorization, but requires a strong understanding of concepts and the use of innovative and interactive learning media. . So, students do not have difficulty understanding the concepts presented (Hastuti, et al., 2021).

The long-term benefit of Augmented Reality is that the use of Augmented Reality in learning has the potential to improve the quality of education in the future (Inanna, 2021). Considering that generation Z is currently more interested in learning media that combines technology in it, compared to conventional learning (Fitria, 2023). Augmented Reality (AR) is a technology that combines 2D or 3D virtual objects into a real environment and projects these virtual objects into reality. Augmented Reality (AR) supports the understanding of complex phenomena by providing unique visual and interactive experiences, integrating information and virtual elements, and presenting abstract concepts to students. The use of Augmented Reality (AR) can improve user perception and interaction in real world contexts (Damayanti & Sulisworo, 2022).

Even though AR has been applied in learning, the development of interactive learning media that combines AR technology is still relevant. Therefore, this research is focused on developing interactive Student Worksheets (LKPD) using the Assemblr Edu application. Student Worksheets (LKPD) are one of the teaching materials that can increase student involvement in the teaching and learning process, facilitate students in experimental activities in each material, help students obtain information, and give students opportunities to explore. The prepared LKPD can be designed and developed according to the conditions and situations of learning activities that will be faced (Lase & Zai, 2022).

Fiska Sahrawati's research (2024) entitled Development of Augmented Reality Chemistry 3D Media for Discovery Learning Models on Chemical Bond Material shows that the augmented reality-based interactive media developed has met the criteria for validity, practicality and effectiveness. The average student test score was 83.3 out of 100, with 86.2% of students completing the course. Student motivation and teacher response to learning media are very high, showing its effectiveness and benefits. After validation, revision, and testing, Chemis 3D media was proven to be reliable, useful, and efficient.

• METHOD

This research is included in the type of research and development with the ADDIE development model. The acronym ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation. This type of R&D research is a process or steps to develop a new product or improve an existing product. Development research is a type of research that can be a link or breaker of the gap between basic research and applied research (Okpatrioka, 2023).

The population of this study were all class XI students at Cerdas Murni Private High School for the 2024/2025 academic year with the number of class Sampling used a purposive sampling technique, namely by selecting one of the three classes in Class XI Cerdas Murni Private High School. In this case, the classes used as samples were determined based on suggestions from teachers who had a deep understanding of student characteristics, so that the teacher recommended class XI-1 because it was deemed appropriate to research needs. The instrument used in this study is a non-test instrument, which is used to determine the validity of LKPD based on Augmented Reality and the practicality of students in using LKPD based on Augmented Reality that was developed. The research instruments used include interview sheets, validation sheets, and student response questionnaire sheets.

The procedure of this research begins with the analysis stage, at this stage it can be done through observation, questionnaire distribution, and curriculum analysis. The second stage is design, at this stage a product design or design is made based on the results of the analysis from the previous stage and will produce a product, namely a learning device in the form of interactive LKPD based on Augmented Reality media. The third stage is development, at this stage an interactive LKPD learning media is made based on Augmented Reality on hydrocarbon material, then a validation test is carried out by material experts and media experts. The fourth stage is implementation, after the LKPD is categorized as suitable for use based on the validator's assessment, it is then implemented in class XI-1. The last stage is evaluation, the evaluation results are used to provide feedback on the development.

• RESULT AND DISCUSSION

This development research aims to develop interactive learning media based on augmented reality technology with a discovery learning model on hydrocarbon material. The learning media is in the form of an e-LKPD based on Augmented Reality which can be accesseed online on hydrorcabon material. Learning media use the ADDIE development model, namely Analysis, Design, Development, Implementation, and Evaluation. The LKPD developed was prepared systematically and adapted to BSNP. The first step taken was to describe the indicators and basic competencies based on lesson plan on hydrocarbon material.

The format used in making LKPD based on Augmented Reality in accordance with discovery learning syntax can be seen in figure 1.

Figure 1. Diplay of Learning Media based on Augmented Reality Technology with Discovery Learning Model

The teaching media developed consist of discussion activity which can be done by students in groups through Augmented Reality technology untuk melihat bentuk 3D senyawa hidrokarbon (alkana, alkena dan alkuna) and have been adapted to the learning indicator on the hydrocarbon material. In this LKPD there are also instruction for using LKPD, concept map and glossary. The teaching media developed where is based on the Discovery Learning model which begins by providing students with problem discource related to everyday life so that students are able to draw conlusions from the material they have studied.

After carrying out a series of research procedures, several data were obtained in the form of media and material validation results by expert validators and the results of student responses which are summarized as follows:

Table 1. Results of Student Worksheet Media Validation

No.	Aspect		Indicator	Validator Score	Persentage	Criteria
1	Material Illustration	a.	The Augmented Reality media used is in accordance with the learning material	5	100%	Very good
		b.	The Augmented Reality media used is in accordance with the learning objectives	5	100%	Very good
2	Media quality and appearance	a.	The Augmented Reality media used can provide illustrations that match the actual situation	5	100%	Very good
		b.	Augmented Reality media can make it easier for students to imagine	4	80%	Good
3	Aspect Material	a.	The appearance of Augmented Reality media	5	100%	Very good

			is able to attract students' attention			
		b.	The Augmented Reality media used is not easily damaged	4	80%	Good
4	Illustration	a.	The use of Augmented Reality media can reduce students' dependence on teachers	4	80%	Good
		b.	The use of Augmented Reality media can minimize misperceptions that occur among students.	5	100%	Very good

Based on Table 1, the media validation results can be explained as follows: In the material aspect, the augmented reality media indicators used in accordance with the material and learning objectives obtained a score of 5 with a percentage of 100%, which is categorized as very good. In the illustration aspect, the augmented reality media indicators used can provide illustrations that match reality, getting a score of 5 with a percentage of 100%, also categorized as very good. Meanwhile, the augmented reality media indicator makes it easier for students to imagine getting a score of 4 with a percentage of 80%, which is categorized as good. In the aspect of media quality and appearance, the augmented reality media appearance indicator which is able to attract students' attention received a score of 5 with a percentage of 100%, which is categorized as very good. On the other hand, the indicator for augmented reality media that is not easily damaged received a score of 4 with a percentage of 80%, which is categorized as good. In the attractiveness aspect, the indicator of the use of augmented reality media which can reduce students' dependence on teachers received a score of 4 with a percentage of 80%, which is categorized as good. Meanwhile, the indicator for the use of augmented reality media which can minimize misperceptions among students received a score of 5 with a percentage of 100%, which is categorized as very good. With an average total percentage value of 92.5%, these results state that the media developed in the LKPD can be categorized as very feasible.

Table 2. Validation of Material on Student Worksheets

No.	Aspect		Observed Aspects	Validator Score	Percentage	Criteria
1	LKPD format	a.	Clarity of material	5	100%	Very good
	Fill in the LKPD	b.	Attractiveness	5	100%	Very good
2	Media quality and appearance spect	a.	Content is in accordance with the curriculum and RPP	5	100%	Very good
		b.	The truth of a concept or material	5	100%	Very good

	LKPD format	c.	Conformity of sequence to material	4	80%	Good
3	Fill in the LKPD	a.	The questions are formulated in simple language and do not give rise to multiple interpretations	4	80%	Good
		b.	Use terms that are easy to understand	5	100%	Very good
		c.	Formulated using standard Indonesian language rules	5	100%	Very good

In the next table, namely Table 2, the results of material validation can be explained as follows: In the LKPD format aspect, there are aspects that are of interest, namely regarding the clarity of the material and its attractiveness, getting a score of 5 with a percentage of 100%, which is categorized as very good. In terms of the content of the LKPD, there are aspects that are of interest, namely regarding the content in accordance with the curriculum and lesson plans and the correctness of the concept or material which received a score of 5 with a percentage of 100%, also categorized as very good. Meanwhile, the suitability of the sequence to the material received a score of 4 with a percentage of 80%, which is categorized as good. In terms of quality and media appearance, the aspect of interest is that the questions are formulated in simple language and do not give rise to multiple interpretations, getting a score of 4 with a percentage of 80%, which is categorized as good. On the other hand, using terms that are easy to understand and formulated using standard Indonesian language rules gets a score of 5 with a percentage of 100%, which is categorized as very good. And the total average percentage value is 93%, where these results state that the material developed in the LKPD can be categorized as very feasible.

Table 3. Student Response Results

Research indicators	**Score per Indicator**	**Percentage per Indicator**	**Criteria**
Appearance	311	86%	Very Interesting
Presentation of material	298	83%	Very Interesting
Media presentation	321	89%	Very Interesting
Total number	930	258%	
Total average		310	
Average percentage		**86%**	

Based on Table 3, the results of student responses can be explained as follows: The research indicators include appearance, material presentation and media presentation. In the display, the score per indicator is 311. In the presentation of the material, the score per indicator is 298. In the presentation of the material, the score per indicator is 321. So

the total score per indicator is 930. Furthermore, the percentage per indicator, in the display, is 86%. , in the material presentation it got 83%, in the media presentation it got 89%, so the total percentage per indicator was 258% with the average percentage of student assessments being 86%. The overall criteria obtained are very interesting criteria.

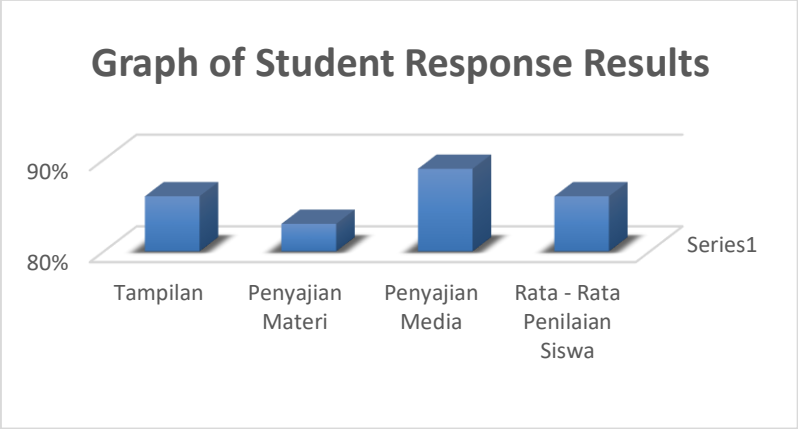

Figure 2. Graph of Student Response Results

Based on the graph, the results of student responses can be explained, namely that the display got 86%, the material presentation got 83%, the media presentation got 86%. So the average student assessment is 86%. The criteria obtained as a whole show that the LKPD being developed falls into the very interesting category.

• CONCLUSION

The research successfully implemented a series of research procedures that have been prepared for class XI IPA 2 students at Cerdas Murni Private High School. Based on the results of media and aterial validation with expert validators, satisfactory results were obtained, where the average percentage of media validation was 92.5%, which was categorized as very feasible, and the average percentage of material validation was 93%, which was categorized as very feasible. Based on this research, the results obtained from student responses were that the display obtained 86%, the material presentation obtained 83%, the media presentation obtained 86%. So the average student assessment is 86%. The criteria obtained as a whole show that the LKPD being developed falls into the very interesting category.

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