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INTEGRATING MOBILE AUGMENTED REALITY APPLICATIONS THROUGH INQUIRY LEARNING TO IMPROVE STUDENTS' SCIENCE PROCESS SKILLS AND CONCEPT MASTERY

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ABSTRACT

Augmented reality (AR) is a transformational learning experience that can be used and integrated into science classes to overcome the shortcomings of conventional teaching. AR-enabled mobile apps have the potential to be used in blended/hybrid and face-to-face teaching, which is especially important during recovery from learning loss. This study aims to determine augmented reality as an educational medium in chemistry learning, which includes student acceptance of AR content in commercial mobile applications, improvement of learning outcomes, science process skills and mastery of student science concepts. AR media is developed through a 4-D procedure. Product test design is done by applying AR using quasi-experimental methods and receiving AR media through the TAM model. Data on N-gain scores for science process skills and mastery of chemistry concepts were collected through learning pretests and posttests, teacher and student learning observation activities, and teacher and student questionnaires to determine responses to the learning carried out. The results showed that most students found AR valuable and easy to use, had positive attitudes, and expressed an intention to use this educational technology if given the opportunity. Educational performance is highlighted because technical quality positively impacts perceived usefulness and ease of use. The use of AR in inquiry learning significantly influences improving students' science process skills. Even though there are positive results, the use of AR in science still needs development because of the need for more helpful content and the different conditions of students.

Keywords: augmented reality; mastery of science concept; science process skills; students' acceptance

INTRODUCTION

Digital transformation in education is fundamental, especially since we are entering the 21st century. We are now in the era of education 4.0, which is tailored to the needs of industry 4.0. Here, formative assessment, personalized learning paths, inclusive collaboration, teacher mentorship, and a student-centered approach to learning are the cornerstones of the educational process. The educational process can be implemented through learning activities. Learning is an activity that aims to educate students to achieve the desired increase in competency (Setiawaty et al., 2018). Teaching experimental science, such as chemistry subjects, generally has a level of microscopic, macroscopic, and symbolic representation, so abstract concepts need to be taught contextually (Sukmawati, 2019). Therefore, 3D

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visualization in learning can present objects, places or phenomena in a realistic visual form. It allows students to understand the characteristics and complexity of the objects studied, hence the need to develop virtual media such as augmented reality (AR) technology in chemistry learning to create more interesting, interactive, representative and effective learning. Furthermore, Widyatmoko et al. (2023) explain that the world of education needs to implement virtual and digital media in virtual reality.

The need for virtual media in schools aligns with the Ministry of Education and Culture's program (Kemendikbud). At Lhokseumawe State High School, Augmented Reality (AR) in the classroom takes place to support instructors in understanding how to apply the Merdeka Curriculum. The curriculum combines problem-based learning, project-based learning, and scientific approaches with a communicative approach to cooperative learning made possible by Augmented Reality technology. This learning is student-centered, with active learning to acquire knowledge, skills, and attitudes because AR contextualizes learning content.

Teaching has also become an increasingly difficult and demanding undertaking as educational standards have grown, in part because of advancements in science and technology. ICT, or information and communication technology, is now the mainstay of organized education. In order to improve teacher effectiveness and student learning outcomes, the education system must make use of efficient teaching technologies (Tho et al., 2019; Shurygin et al., 2022; Merta et al., 2023). The usage of Android-based games on Chemistry Nomenclature has a favorable effect on students' production and enhances their creativity and cognitive accomplishment (Sugiyarto et al., 2018). It also improves students' learning achievements, motivations in natural science inquiry activities (Chiang et al., 2014) and STEM learning (Hsu et al., 2017; Ibáñez & Delgado, 2018).

Online, blended/hybrid, and connected co-creation could benefit from the use of mobile applications with an Augmented Reality (AR) experience mode. This is where AR as a teaching tool can assist, offering the educational sector a number of advantages. AR, in addition, is a form of interactive technology that creates 3D things on a screen by fusing actual and virtual items. Virtual representations of real-world things are exhibited in the digital realm, enabling direct user interaction (Sin & Zaman, 2010; Altinpulluk, 2019; Tezer et al., 2019; Papakostas et al., 2023).

As per a study, Augmented Reality is characterized by the dynamic overlay of coherent location-based or context-sensitive virtual information on top of a real-world context (Klopfer & Squire, 2008), an extensively adopted at all levels of education (Akçayır et al., 2016; Wong et al., 2021). Because AR is useful for teaching, it has also been studied in a variety of fields, such as physics (Thees et al., 2020) and chemistry (Wong et al., 2021). Since then, the depiction of unclear materials has been made simpler and clearer by using AR to create connections between virtual objects and the natural surroundings (Dunleavy et al., 2009; Sirakaya & Alsancak, 2018). Therefore, AR is suitable for integrating hydrocarbon chemical materials: alkanes, alkenes, and alkynes.

Nonetheless, from the dawn of technology advancement, educators have been intrigued by its potential and advancement in the classroom. With the use of this technology, mobile phone cameras can now identify particular signs and access information online. The stakeholders in education must be aware and concerned about integrating technology into the teaching and learning process to minimize the problems or challenges, so integrating technology will give students meaningful and practical learning. According to Fernández-Enríquez and Delgado-Martín (2020), del Cerro Velázquez and Morales (2021), and Santos et al. (2016), AR has been effectively used to teach a variety of science and math educational subjects, making it one of the alternative tools used in teaching and learning for enjoyment. AR describes computer-generated images that produce things that are added to situations that are found in real life.

Indonesia's Ministry of Education and Culture's policy strongly support learning innovation programs through the implementation of technology that can be applied in the form of mobile applications and can be accessed via gadgets, PCs, laptops, tablets, or smartphones. In this research, the AR developed can be applied using mobile devices by integrating AR content in face-to-face or distance education environments, making it more accessible and cheaper than other AR hardware types (such as smart glasses or AR projection systems). Furthermore, Sharoff (2019) agrees that teachers must be creative and innovative in educating students in the information and communication technology era. Sometimes, teachers hesitate to incorporate digital tools or technology into teaching and learning due to their lack of technological knowledge, skills, and experience. Therefore, teachers must adapt aspects of pedagogy and technology in the teaching and learning process. However, to make learning successful, there needs to be technology, such as creating active and contextual learning activities, so teachers need to have digital literacy skills when using digital devices (Kaimara et al., 2021; Daniela, 2021; Setiawaty et al., 2022). The application of AR provides a new perspective on learning activities, or science experiments carried out in laboratories, which has an essential place in science education (Yilmaz, 2021).

In line with the Merdeka Curriculum program, there is a need to increase the capability and quality of ICT-integrated Learning Resource Centers. So, the fulfillment of ICT-based learning facilities, including the need for learning facilities in the form of dry lab/simulator/augmented reality/virtual reality, must be balanced with the availability of virtual learning media where students and teachers need to be given facilities and support to use and develop learning media according to their needs. Another problem is that schools need to make more use of technology in learning. New technologies are fundamental tools for studying the curriculum content of various subjects. Teachers only use worksheets created by certain publishers, which often do not match the module. Generally, students learn chemistry only by doing exercises and memorizing rather than doing lab experiments or virtual demonstrations. The presentation of chemistry subjects consists of three levels: macroscopic, submicroscopic, and symbolic. Therefore, learning that emphasizes presentation at only one of the three levels of representation in chemistry makes it difficult to understand chemistry lessons as a whole. So these three levels of representation must be linked together so that students' understanding of chemical concepts alkane, alkene and alkynes will be complete and chemistry will be easier to learn, giving rise to the perception that chemistry subjects are theoretical subjects that are more interesting, easier to understand, and more useful in everyday life. Fernández-Enríquez and Delgado-Martín (2020) explained that learning through experimentation provides someone with experience. In this way, learning can occur actively and be fun for students. So far, learning has taken place conventionally. The teacher explains the concept, gives example questions, and then students do the exercises. Because the teacher's motivation and skills in guiding practice are low or because the teacher thinks that students can only grasp the concept with the explanations.

Based on this, AR applications are sustainable for massive adoption in various educational fields. AR as a learning media was developed with Assemblr EDU software for students to improve cognitive learning outcomes of science concepts. Apart from creating a sense of enjoyment in learning, the use of this media is also expected to increase knowledge and understanding of the subject matter, which in turn can improve students' learning outcomes and offer significant pedagogical affordances when used in tutoring in various domains, such as science or the natural environment.

Science education researchers have widely applied mobile AR in learning. However, they have only been developing game-based learning and have not paid attention to curriculum designations. In this case, researchers develop AR media for chemistry subjects with highly representative or abstract concepts, such as alkanes, alkenes and alkynes, according to school conditions and needs and the fulfillment of the Merdeka curriculum. Furthermore, the media was tested to determine students' science process skills and concept mastery and see the acceptance of AR media developed. In line with this, findings regarding learning conditions in schools that have yet to be digitized underlie the need for AR integration in inquiry learning for high school students in Lhokseumawe City, Aceh. Inquiry in science education is a framework for conceptualizing authentic science teaching and learning priorities and values.

METHODS

This research aims to improve students' science process skills and mastery of concepts through inquiry learning based on AR media. AR media was developed through 4-D (Define, Design, Develop, Disseminate) procedures proposed by Thiagarajan et al. (1974) (Figure 1) using Assemblr EDU software. This virtual media makes it possible to find the results of students' chemical representations using three-dimensional augmented reality (3D-AR) media.

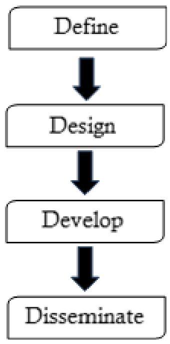


Figure 1. 4-D Procedures

Media integration in learning is done by applying Three-Dimensional visualization based on Augmented Reality (3D-AR) using a quasi-experimental method with a non-equivalent control group design (Creswell, 2012). The learning process uses an inquiry learning model, effectively improving students' science process skills and chemistry concept mastery by calculating N-gain scores.

Learning method-based mobile AR application through inquiry instructions in several stages: observation, asking questions/problems, formulating a hypothesis, data gathering, data analysis, and making inferences using the AR learning media inquiry.

The technology acceptance model (TAM) created by Davis (1989) (Figure 2) is then used to examine how well students accept media. TAM is made up of four core constructs that are extended by two external variables (playfulness and quality output) to take into account how pedagogy and technology were modified and used to create AR learning media. The population in this research included 180 senior high school students in Lhokseumawe, Aceh.

Furthermore, the Technology Acceptance Model (TAM) measures students' acceptance of AR technology with dimensions presented in Figure 2.

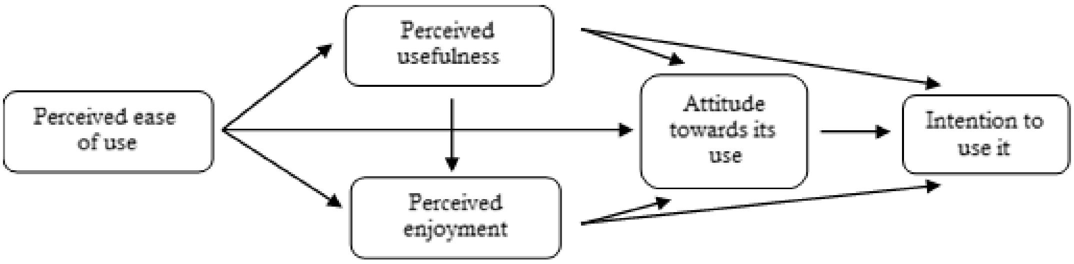
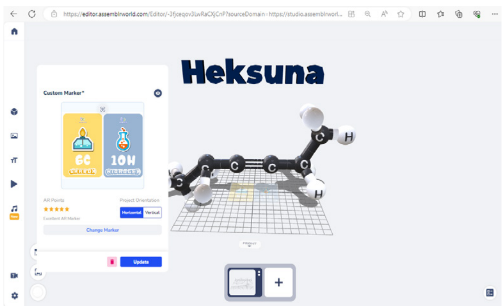


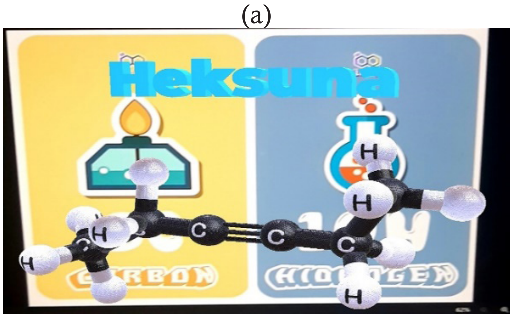
Figure 2. Technology Acceptance Model

RESULTS AND DISCUSSION

The development of AR learning media refers to the demands of the Merdeka Curriculum, which is in line with the program, to increase the capability and quality of the ICT-integrated Learning Resource Center by the Ministry of Education and Culture.



(a)



(b)

Figure 3. (a) AR Learning Media Development Process with Assemblr EDU, (b) Display of the AR Learning Media

The conceptual understanding and science process skills of students are significantly enhanced by AR learning materials. Assemblr EDU or Assemblr Studio Web were used to create this media. It includes reviews and feedback from teachers and validators, along with 3D science material content that is created following learning outcomes.

Table 1. Means and Standard Deviations Obtained with TAM

Items	Mean (SD)
Perceived usefulness	
AR learning media can improve my classroom learning.	6.65 (0.65)
AR learning media makes it easier for me to understand certain concepts.	6.38 (1.16)
AR learning media is useful for learning.	6.40 (1.14)
AR learning media can improve my learning.	6.82 (0.39)
Perceive ease of use	
AR learning media is user-friendly.	6.63 (0.70)
It is easy for me to learn to use and operate the AR media.	6.58 (0.81)
It is easy for me to be skillful in ICT when using AR.	5.72 (1.41)
Perceived enjoyment	
Utilizing the AR media is fun for me.	6.65 (0.65)
I enjoy myself using AR media.	6.58 (0.81)
AR media allows me to learn while playing.	6.40 (1.14)
Attitude towards its use	
4.1. Using the system makes learning become more joyful and interesting.	6.38 (1.16)
4.2. Using AR learning media in the classroom is a good idea.	6.62 (0.55)
Intention to use it	
I want to use these AR learning media in the future.	6.58 (0.81)
I want to use the AR learning media to learn about the topics presented to me.	6.40 (1.14)
TAM Global Values	6.49

To effectively integrate AR in education, user experience is crucial. It offers more proof of the best ways to plan and arrange educational events and to use the appropriate pedagogy. The TAM instrument's mean scores and standard deviations will be used to show the results, with the TAM instrument's results coming first (Table 1). The response scale runs from 1 (extremely disagree) to 7 (extremely agree), and it concludes with the academic performance results to ensure accurate interpretation.

The topic mastery, science process skills, student responses, and implementation design all demonstrated the potential of integrated inquiry-based augmented reality media. In order to facilitate the adoption process, this study identified schools that had appropriately impacted blended or online learning.

As indicated by the low standard deviation, students' acceptance of AR technology is extremely high and fairly uniform. The high mean scores achieved in the dimensions "intention to use" (6.54) and "Perceived enjoyment" (6.49) are also worth emphasizing. In addition, AR can positively impact student learning outcomes for students who have previous experience with AR rate the perceived benefits higher. According to Almenara et al. (2021), mobile AR applications can be incorporated into learning and teaching. Based on this, AR is believed to improve understanding of abstract concepts. AR has emerged as a novel, practical, and efficient pedagogical tool across all subject areas. Moreover, a number of studies believe that AR systems aid in the development of abilities that students can acquire in other contexts, but more successfully (Yoon et al., 2017; Syawaludin & Gunarhadi, 2019).

Table 2. Results of Science Process Skills Test

Science Process Skills	Experiment Class			Control Class		
	Test		*N-Gain*	Test		*N-Gain*
	Pretest	Posttest		Pretest	Posttest	
Maximum score	5,00	10,00	1,00	5,00	8,00	0,71
Minimum score	0,00	5,00	0,29	1,00	1,00	0,00
Average scores	2,15	6,58	0,57	2,26	5,37	0,40
Standard deviation	1,05	1,42	0,18	1,16	1,67	0,21

Typically, visual resources like images, movies, or animation can be used by students to learn about the characteristics and physical makeup of a chemical element. As a result, AR is a superior way to introduce new material, and students enjoyed the visual elements. Futhermore, the learning media based technology is effective in enriching the teaching and learning experience and improve spatial cognition abilities (Irwanto et al., 2022), reduce cognitive load (Allagui, 2019), and make it easier for students to understand context-specific skills and knowledge (Sugiyarto et al., 2018).

Thus, based on data, using AR with hydrocarbon chemical materials, alkanes, alkenes, and alkynes learning is believed to increase understanding of abstract concepts (Yoon et al., 2017), improve cognition abilities (Martín-Gutiérrez et al., 2010; Karakus et al., 2019), communication and argumentation skills (Squire & Jan, 2007), reduce cognitive load (Thees et al., 2020; Buchner et al., 2021), and understanding context-specific skills and knowledge (Wojciechowski & Cellary, 2013; Arici et al., 2019). Furthermore, AR Media can effectively promote and improve student learning achievement in Inquiry learning, improving digital understanding abilities.

The observation was used to inform the guided inquiry-based augmented reality learning activities that teachers and students engaged in. The guided inquiry-based learning stages serve as the foundation for the outcomes of the learning by observation approach. The learning activities are guided inquiry-based learning, according to the observation. Since both teachers' and students' enthusiasm levels are 3.65%, both groups are performing greatly during learning. According to this, learning through practical methods makes it easier for teachers to guide students through inquiry-based lesson plans and gives them the chance to build their own knowledge, which helps them meet learning objectives more successfully than they would with traditional teaching methods. The following are the results of improving students' science process skills (Table 2).

Inquiry learning strategies can enhance students' learning activities for student-centered learning is not the teachers, the students here not only as an object but also the subject of student learning. Additionally, using the guided inquiry learning model can increase students' excitement for carrying out learning activities and make them the center of attention (Kurniawati et al., 2014).

Table 2 shows that the N-Gain of the experiment class is 0.57% greater on average than the control class's 0.40%. Because students can utilize science procedures to validate what they have learned in class, the overall use of guided inquiry-based augmented reality can enhance the implementation of science process skills. Additionally, it is evident from the posttest results that the experimental class received, which equal 6.58%.

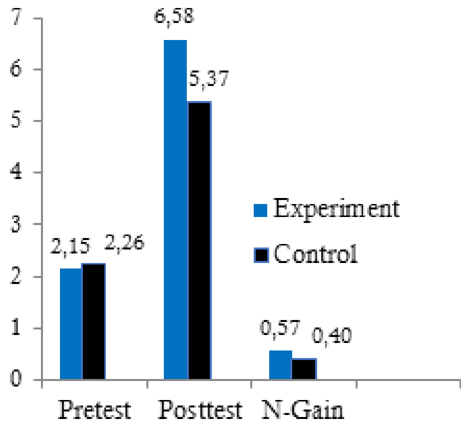


Figure 4. Comparison Average Scores of Pretest, Posttest, and *N-Gain* Science Process Skills

According to Mulyeni et al. (2019), the learning with several science process skills enables students to obtain experience and make relatively diversified learning more relevant. Setiawaty et al. (2023) showed that using the inquiry learning model yielded higher on science process skills than conventional learning models. The thinking styles of learners with divergent thinking style with inquiry learning model has higher ability than students who followed the conventional learning models. Furthermore, the results of the analysis of the prerequisites for the science process skills test are presented in Table 3.

Table 3. Normality Test Result Score of Pretest, Posttest, and *N-Gain* Science Process Skills

Data	Class	Conclusion
Pretest	Control	Abnormal
	Experiment	Abnormal
Posttest	Control	Normal
	Experiment	Abnormal
N-Gain	Control	Normal
	Experiment	Normal

Figure 5 shows the N-Gain of the science process skills.

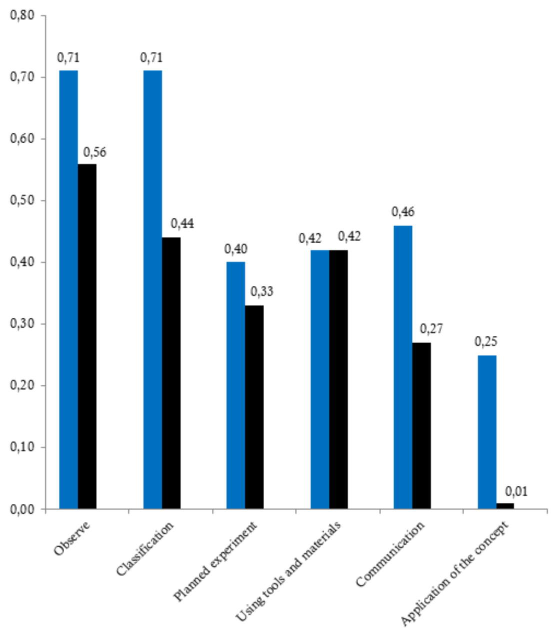


Figure 5. *N-Gain* of Science Process Skills

The pretest distribution is abnormal and homogeneous), according to Tables 3 and 4. The learning levels in the two classrooms are not at the same variance (inhomogeneous). This indicates that sig> $\alpha = 0.05$ for the majority of the data. Because the data were homogeneous and normally distributed, the N-Gain was utilized for the parametric test (t-test), while the mean test was conducted using the non-parametric test (Mann-Whitney test).

Table 4. Homogenity Test Result Score of Pretest, Posttest, and *N-Gain* Science Process Skills

Data	Conclusion
Pretest	Homogeneous
Posttest	Inhomogeneous
N-Gain	Homogeneous

Based on Table 5, inquiry-based AR learning can improve science process skills. This is shown by the data posttest and the N-Gain acquired, which is much lesser than the data of N-Gain (0.003 <α = 0.05) and α = 0.05 (0.018 <α = 0.05) in the data posttest. It displays variations in the students' activities in the experimental class using an AR-based inquiry learning method before and after a specific treatment.

Table 5. Different Test Average of Science Process Skills on Science Concept

Data	Mann-Whitney Test		*Inde-pendent sample t test*	Conclusion
	z value	Sign		
Pretest	-0,18	0,86	-	Not Different
Posttest	-2,36	0,018	-	Different
N-Gain	-	0,003	3,11	Different

This is consistent with Puspito et al. (2021) and Setiawaty et al. (2018), who showed a significant difference between the conventional and guided inquiry approaches to basic science process skills. Significant here means there are differences before and after treatment are given in the inquiry approach to learning application. Activities of students during the learning takes place mostly just sit before using inquiry approach.

Table 6. Results of Concept Mastery Test

Mastery of concepts	Experiment Class			Control Class		
	Pretest	Posttest	N-Gain	Pretest	Posttest	N-Gain
Maximum score	6,00	10,00	1,00	4,00	9,00	0,83
Minimum score	0,00	5,00	0,29	0,00	3,00	0,00
Average scores	2,58	7,62	0,67	2,11	4,89	0,35
Standard deviation	1,60	1,47	0,21	1,12	1,40	0,17

Futhermore, there are differences in the effect of guided inquiry-based learning with multimedia and real environments to achievement of learning. Learning with real environmental influence on achievement more positive than multimedia. Therefore, applying the learning environment as a vehicle for learning real ecosystems tends to be better than using multimedia (Maielfi, 2021; Wen et al., 2020; Widiyatmoko et al., 2023).

The study's overall findings suggest that guided inquiry can be utilized as a fallback tactic to supplement conventional teaching techniques. With the exception of the using tools and materials indication, which has an equivalent N-Gain value, the experimental class students demonstrated a better level of mastery of each science process skills indicator when compared to the control class. This is due to the fact that object materials and identification tools were initially provided to the control class in this indicator. in order for the control class's students to handle and utilize instruments in a safe manner and measure precisely. The experimental class exhibits the largest N-Gain on observation, with a classification indicator of 0.71. This is so that students can view and categorize these materials during science class. When comparing inquiry-based augmented reality experiences to verified smart object learning activities, students can learn through the investigation of items in their everyday life. This conclusion is based on the N-Gain scores on each indication.

However, the second class of N-Gain scores were lowest in the indicator that the application of the concept of 0.25 for the experimental class and the control class is 0.01. It so happened, because the students have not been able to apply the concepts or material being studied role in everyday life. Students tend to perform activities of memorizing not thinking activities, and more observing teachers' classroom course or activity is dominated by teachers' activities.

Meanwhile, based on students' mastery of concepts, it is known that the percentage ratio of the average pretest score for the experimental class is 2.58%. The control class is 2.11% of the ideal score of 10, meaning the two classes are not significantly different before implementing the learning method and have the same initial abilities.

However, after learning in both groups with different learning methods and given the posttest, students with learning methods guided inquiry-based AR demonstrated the ability to master concepts better than students who received conventional learning. The high acquisition posttest scores and N-Gain experiment class is because of this lesson provides an opportunity for students to be more active in their own learning, were in discussions with other peers in doing project-based module, and help each other in completing any task given by the teacher.

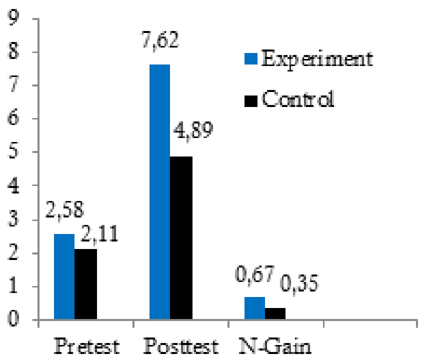


Figure 6. *N-Gain* of Students' Mastery of Concepts

The success of the learning process is also supported by the absence of discussion among my fellow students so that students better understand and remember what they had learned. Subsequently, the AR textbook was created to enable students to engage with the material firsthand through object observation and written communication of their understanding. As a result, the knowledge that students acquire from interacting with this textbook through Augmented Reality becomes the technology a possible teaching tool (Setiawaty et al., 2022; Yaniawati et al., 2023) Furthermore, the results of the analysis of the prerequisites for the mastery of concepts test are as follows.

Table 7. Normality Test Result Score of Pretest, Posttest, and *N-Gain* Mastery of Concepts

Data	Class	Conclusion
Pretest	Control	Abnormal
	Experiment	Normal
Posttest	Control	Abnormal
	Experiment	Normal
N-Gain	Control	Normal
	Experiment	Normal

Based on Table 7 and 8, the pretest and posttest scores have a variance that is not the same level (inhomogeneous), and the control class scores are not normally distributed, and the experimental class scores are normally distributed. This is because the control class students good spread of scores who scored high, medium, or low is not spread evenly.

Table 8. Homogenity Test Result Score of Pretest, Posttest, and *N-Gain* Mastery of Concepts

Data	Conclusion
Pretest	Inhomogeneous
Posttest	Inhomogeneous
N-Gain	Homogeneous

Futhermore, that guided inquiry learning can improve student mastery of science concepts. This is because a whole series of learning activities guided inquiry model with more emphasis on activities that learners are maximized through scientific activities to explore and discover their own concepts learned, so that learners will be easier to understand complex concepts and abstract because it is accompanied by real experience and avoid the traditional ways of learning (memorizing), the success of using AR in teaching and learning is the result of multiple factors (Garzón et al., 2020; Wilujeng et al., 2020), students are using inquiry learning based AR in classes showed significant improvement in the ability of creative thinking skills (Wen et al., 2023; Allagui, 2019).

Table 9. Different Test Average on Mastery of Science Concept

Data	Mann-Whitney Test		*Inde-pendent sample t test*	Conclu-sion
	z value	Sign		
Pretest	-0,124	0,214	-	Not Different
Posttest	-5,163	0,000	-	Different
N-Gain	-	0,000	6,126	Different

Table 9 shows that the improvement of students' mastery of concepts after learning has a significant difference, because it has a less than significant level α = 0.05. The posttest and N-Gain, which have values of 0.00 < α = 0.05, indicate significant differences in student concept mastery between the experimental group (guided-inquiry learning) and the control group (conventional learning). It indicates that the application of guided-inquiry learning has an impact on concept mastery in science learning.

Students' mastery of concepts for each cognitive can be seen in the following diagram.

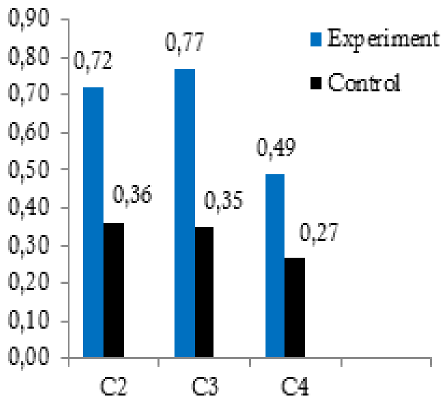


Figure 7. *N-Gain* Diagram of Mastery of Concepts for Each Cognitive

The average *N-Gain* students' concept mastery for each cognitive with inquiry learning based AR is higher than conventional learning. In the experimental class the highest level cognitive is at application domain (C3), the inquiry learning based AR improves students' understanding of a concept or material. Highest cognitive on control class is at the level of domain knowledge (C2), this is due to that the learning is done more focused on the explanation given by the teacher, thus causing students were only able to remember the concepts presented by the teacher but the student's ability to understand and implement any portions of the material is low.

AR-enabled inquiry activities may also put students in an immersive environment that improves scientific investigations. This environment would allow them to gather data outside of the classroom and engage in face-to-face interactions and communication with peers in a more genuine setting. In summary, students' science process skills and idea understanding can be enhanced by the effective implementation of AR-based inquiry learning that is integrated with local resources.

Furthermore, the improvements of students' science process skills and concept mastery in the experimental group are significantly higher than in the control group.

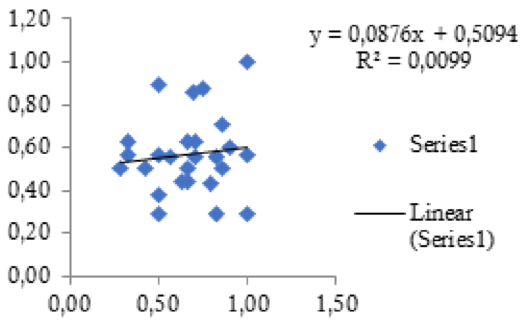


Figure 8. Correlation between Science Process Skills and Mastery of Concepts

Overall, inquiry learning-based AR is one of the innovative learning that can be applied in a more effective science teaching and learning science. However, the correlation of test results between the dependent variable was obtained, and there is no relationship between the mastery of science concepts and science process skills because the correlation between the two variables is very low at 0.009 (r = 0.009).

Between two dependent variables, there is no correlation, so mastery of science concepts cannot explain the variance in science process skills. This is due to the lack of emphasis on the application of learning chemistry concepts that can produce effects accompaniment learning in the form of students' process skills, and this can be seen from the *low N-Gain* scores is low on applying the concept indicators in the second class.

CONCLUSION

Based on the research findings, Augmented Reality (AR) learning media that was created with Assmblr EDU has been accepted by students and is a very good fit for intention to use indicator, a learning medium that greatly enhances students' concept mastery and science process skills. Because of this, AR can be utilized as a cutting-edge tool to teach abstract concepts in situations where direct experience is not possible. Using augmented reality (AR) as a teaching tool allows students to engage more deeply with the real world while also expanding their imagination.

Additionally, by maximizing the widespread use of media, it is expected that improvements to the learning media that researchers have conducted will occur. The findings suggest that AR-inquiry learning benefits science teaching and learning processes by fostering students' technological mastery.

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