The Effect of Augmented Reality-Based Qur'anic Natural Science into Student's Motivation and Learning Outcomes

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Abstract

Augmented reality-based quranic natural science (QURRACI, for short) is one solution to increase students' motivation and learning outcomes on quranic natural science topics using the media. To develop the media employed an ADDIE approach (Analysis, Design, Develop, Implement, and Evaluate). Based on the study's findings, the developed media was in the form of a smartphone-based book and was successfully validated for its relevancy by media experts, material experts, teachers, peer reviewers, and students. Specifically, the validation reveals (1) 87.27% for the product relevancy; (2) 90.66% for the qur'anic natural science materials; (3) 82.85% for the peer reviewers' and teachers' responses; and (4) 86.2% for the students' responses, particularly on the multiple representation materials. Implementation carried out on 100 students, showed that QURRACI had a positive influence and increased student motivation in learning qur'anic natural science. In addition from this research, based on the results of the pretest and post-test trials using paired sample t-test analysis of 50 students, a significance value of 0.000 was obtained. The findings showed an overall there are with the implementation of QURRACI students' motivation and learning outcomes in learning increased. This shows that the QURRACI learning media is proven to be able to improve student motivation and learning outcomes.

Keywords: *Augmented Reality; Learning Media; Multiple Representations; Qur'anic Natural Science*

I. Introduction

The rapid development of science that continues to expand today can bring up opportunities and challenges that must be faced as a consequence of the progress of the times. One of these challenges is moral degradation due to ongoing globalization [1]. Therefore, in this era students must get spiritual guidance. The development of knowledge recently leads spiritual education an important aspect of the learning process [2]. Among them is by integrating science learning with verses of the Qur'an, so as to increase the responsibility, morals, morals, and religious character of students [3]. One alternative that can be done in carrying out spiritual education in schools is optimizing the learning of Islamic Religious Education materials [4]. The role of Islamic Religious Education is very strategic in realizing the formation of student character. Islamic education is the main means of transforming Islamic teachings in the school environment so that they become an integral part of students' lives. Islamic teachings are truly understood, practiced as a way of life, and become controllers of actions, thoughts, and mentality [5].

One of the difficult materials in learning Islamic Religious Education is the material of the Kauniyah verse (qur'anic natural science), which explains natural phenomena, namely the subject matter of Q.S. Ali Imran/3: 190-191. The survey that the researchers conducted showed that 84% of the 100 respondents of college students in Indonesia had difficulty learning the verses of the Kauniyah. This

is because the material is abstract and the learning process carried out seems monotonous and boring. The ineffectiveness of learning is also reinforced by the results of Pulungan's research [6], which states that Islamic Religious Education learning in the classroom still uses conventional learning, lectures, and assignments. Generally, the delivery of material still seems boring, both in terms of material presentation, discussion, and use of Information and Communication Technology.

The ineffectiveness of this learning raises the phenomenon of the dichotomy of science in students. Where currently, the understanding of the Qur'an seems to be separated from scientific learning. The facts on the ground show that there is still segmentation between the Qur'an and science which are considered separate from each other [7]. Even though there are more than 800 verses of the Qur'an explaining natural phenomena that can be used in the natural science learning process [8]. In addition to the lack of innovation in the learning media used, efforts to integrate the Qur'an with science have not been optimal but are also caused by several obstacles, such as the direction of educational orientation that is not based on Faith and Taqwa, students have difficulty in abstract material, and not all teachers have the ability to integrate the Qur'an and science [9]. These various problems result in less student motivation in learning Qur'anic Natural Science and impact on low learning outcomes.

Motivation has an important role in learning. When learning requires increasingly complicated and complex thinking, the learning atmosphere will become less enthusiastic, so motivation is needed to reactivate the learning atmosphere to be more enthusiastic and enthusiastic. De Decce and Grawford [10] said that student learning motivation must always be grown and maintained in students. Learning motivation has its own role in achieving successful learning at school. Students who are highly motivated in learning tend to be actively involved in the learning process, as well as students who are successful in learning will have high motivation to continue learning. Therefore, teachers must be able to encourage and inspire students to be able to follow the learning process well.

One way to increase student interest in learning is to use interactive learning media. The use of interactive learning media in learning is proven to increase students' learning motivation [11]. The method of delivering material suitable for abstract material is using the multiple representations learning model. Multiple representations are a method or way of explaining a concept using several different forms of representation, including presenting verbal, audio, and image representations [12]. The use of multiple representations can form a complementary arrangement making it easier for students to draw conclusions from the concepts they are studying. The use of multiple representations models can be combined with augmented reality technology. Image representation using augmented reality technology can make images into 3D objects and more real [13]. This is because augmented reality technology allows real and virtual objects side by side in the same space to interact in real-time [14]. The use of this augmented reality base can also improve students' ability to think critically about natural phenomena in everyday life [15].

Based on previous research journal studies, the models that have been used to increase student learning motivation in Islamic Religious Education are the Student Teams-Achievement Divisions method, Teacher Efforts to Increase Learning Motivation, and the Assure model. Meanwhile, the application of the multiple representations method has been widely used in several natural science learning models, including the Inquiry model and the 5E Learning Cycle model for physics, and the Problem Based Learning model for chemistry. In addition to the importance of efforts to increase student motivation in natural science quranic material, problems with student learning outcomes also require a solution. Researchers have conducted a pre-test on 50 college student respondents and the results showed that on average the 50 students had low scores. Therefore, it is necessary to conduct research on the development of augmented reality-based multiple representations of learning media on the Quranic natural science material for college students.

This study aims to develop multiple representations of learning media based on augmented reality on the verses of Kauniyah, which explain natural phenomena, test the feasibility of the developed learning media, and test the increase in motivation and learning outcomes to learn qur'anic natural science. Furthermore, this paper describes the research process and results of the development of

augmented reality-based multiple representations learning media on natural science quranic material. The first part describes the process of developing learning media from the analysis to the evaluation stages. The second part describes the results of the implementation of learning media. The third section presents the discussion and conclusions.

II. Method

The study made use of the ADDIE approach to developing the product. ADDIE stands for Analysis, Design, Develop, Implement, and Evaluate [16]. The ADDIE model is often used in developing various forms of product development such as models, learning strategies, learning methods, media, and teaching materials. ADDIE is described as a framework for developing learning, especially in the process of making learning media [17]. ADDIE is often used in the development of learning media, especially in Indonesia. Previous research and development using the ADDIE process have proven that this method can improve students' learning skills.

1.1 Analysis

This research step starts from the analysis stage. The analysis is the initial stage which is used as a basis for consideration in developing learning media. The analysis stage is carried out to determine learning needs and identify problems that occur in students. Analysis of the problem in this study was carried out using a Google form for college students with as many as 100 respondents. Based on this analysis, the data obtained is that 84% of college students have difficulty learning the verses of the Kauniyah. In addition, 87% of college students have difficulty visualizing legal and theoretical material in abstract natural science lessons. The second stage of analysis is target analysis, which is carried out to define students' initial skills acquired through learning. Based on this analysis, it was found that the learning process was still not fully effective due to the teacher's explanation only through modules or student worksheets. One solution is to develop multiple representations of learning media based on augmented reality on natural science quranic material that can increase students' motivation and interest in learning the material.

1.2 Design

Based on the analysis, the next stage of planning learning media is carried out. Planning (design) is the stage where all research planning is carried out. At this stage, the researcher determines the components that must be included in the learning media that will be developed. In addition, this step also determines the evaluation instrument to measure the success of the development. The research team compiled the materials and developed research instruments to validate the materials by material experts. At this stage, the initial design in the form of a storyboard is started to make it easier to make teaching materials and learning media. The design is done manually. The results of this stage are in the form of a framework of teaching materials to be developed as well as a manual sketch design to facilitate the design of the user interface.

1.3 Develop

The stages carried out at the development stage are starting to develop learning media based on the results of material design that will be included in the media, then validation of learning media by media experts is carried out. At this stage, the learning media has begun to be made. The steps for making augmented reality-based learning media are as follows: (1) making a book using CorelDRAW software to facilitate image editing. The material contained in the learning media made contains verses from the Qur'an which explain the laws and theories of natural science. This learning media product is named by the researchers with the brand "QURRACI", (2) making 3D object applications for augmented

reality through blender and Adobe XD software, (3) creating 3D objects as objects that appear, (4) designing Unity 3D software to link and matchbooks as markers of 3D objects, (5) after the components are processed into objects, the object is given an order, (6) then publish or export it in the form of an application so that it can be played on a mobile phone. Instruments in material validation and media validation are in the form of a questionnaire using a Likert scale. The percentage of the final value of the validation results using the formula:

$$V = \frac{T}{U} \times 100\%$$

V : Validity
T : Obtained validity score
U : Maximum validity score [18].

The percentage of validation criteria was then calculated. The validation criteria used can be seen in Table 1.

Table 1.

Feasibility Criteria adapted by Riduwan

Percentage (%)	Criteria
0-20	Not feasible
21-40	Less Feasible
41-60	Moderate
61-80	Feasible
81-100	Very Feasible

1.4 Implement

When the learning media has been declared valid by the validator, then a limited trial phase is carried out, which is carried out in a simple way with college student trials. The purpose of the trial was to determine the level of influence of the use of QURRACI learning media on students' motivation and learning outcomes in quranic natural science material. This implementation phase was carried out in the form of a trial of 100 college students to determine the level of differences in learning motivation and a trial of 50 college students to determine the level of student learning outcomes after using the QURRACI learning media.

1.5 Evaluate

The evaluation stage is the final stage for improvement (revision) after receiving suggestions, comments, and input from validators, teachers, peer reviews, and students. The evaluation results were obtained from a questionnaire via Google form. This stage includes all improvements to the QURRACI learning media. The evaluation is carried out using formative evaluation during the design process. The formative evaluation uses quantitative and qualitative methods. Formative evaluation includes evaluations and suggestions from material experts and media experts' validation.

III. Results and Discussion

The Development of the Product

1. Product Design

The learning media product developed by the research team is in the form of a book with the delivery of material using the multiple representations method based on augmented reality. This book describes the verses of Kauniyah in the Qur'an, which are related to legal material and natural science theory. At the beginning of the book page, there is a QR-Code used to connect to the application on the smartphone, as shown in Figure 1. Furthermore, one of the book page views, it can be seen in Figure 2. Each book page is presented briefly with pictures to make it easier to read. understand the material, and increase students' motivation and interest in reading the Qur'anic natural science material. The book page will contain a study of the theory and law of natural science, and the content of the material displayed has been adjusted to the basic competencies that students must master. The components contained in the book pages include (1) AR markers, (2) verses of the Qur'an, and (3) laws of natural science.

Figure 1. Scan

Figure 2. Book Page

Books that can be integrated with smartphones will make it easier for students to learn qur'anic natural science. This is based on research by Lisana and Suciadi [19] that the use of smartphones in college student learning can increase fun and be a complement to learning. When opening the application, a splash screen will appear. In the menu display section, the title "Al-Quran and Natural Science: Learning Kauniyah Verses based on Augmented Reality" is at the top of the application. The application color selection uses a combination of green, blue, and white. This color combination provides a calming feel, improves verbal expression and communication of the material presented so that students are comfortable when using it.

Figure 3. Splash screen and menu display

The menu display section consists of several features, including (1) verse audio, (2) AR animation video, (3) verse interpretation, and (4) gamification-based evaluation. The display of some of these

features can be seen in Figure 4. The audio verse feature will contain the reading of the verses presented in the book. The audio feature of the Qur'anic verse uses Imam Nafi's qiro'at warsy history. The use of this method provides a reference to qiro'at or how to pronounce each verse in the Qur'an. The animated video feature will display 3D animation through augmented reality as a visualization of abstract natural science quranic material. In addition, visualization through 3D animated videos also contains murottal verses of the Qur'an with a nahawand rhythm that makes the feel of augmented reality visualization more alive. Furthermore, the verse interpretation feature will present several interpretations: Al-Munir's Tafsir, Ibn Asyur's Tafsir, and Ibn Kathir's Tafsir. The last feature, is a gamification-based evaluation that will feature several practice questions, some of the questions in this evaluation are connected to augmented reality technology that detects faces, making natural science qur'anic learning more interesting and fun. The use of gamification in the context of learning can help increase student motivation of learning [20], [21],

(a) (b) (c) (d)

Figure 4. (a) verse audio feature, (b) AR animation video feature, (c) verse interpretation feature, and (d) gamification-based evaluation feature

The AR video feature will be connected to a smartphone camera to detect AR markers on book pages. A calibrated camera will detect the given marker, and then it will display an animated video object in 3D. The use of Augmented Reality technology can explain abstract phenomena in material theory and natural science laws are well visualized, thus making learning more interactive. Ozdamli [22] explained that augmented reality features supported by mobile devices can create a more effective learning environment. In addition, the application of Augmented Reality in learning has an impact on learning attitudes, learning motivation, and ability to understand concepts [23]. Several features in books and applications in this learning media can present material content comprehensively.

2. Data Development Analysis

The analysis stage was carried out by distributing a questionnaire in the form of a google form to 100 college students and the results showed that 84% of college students did not understand the material about the Kauniyah verse. In addition, 87% of college students also find it difficult to represent microscopic objects in natural science material. The results of the analysis show that the learning process applied in college still uses learning modules or student worksheets, and there has been no development of the natural science qur'anic learning media. Through the distribution of the questionnaire, researchers also obtained data that 87% of college students were interested in using learning media with augmented reality technology. Based on the needs analysis results, the researchers developed an augmented reality-based learning media of qur'anic natural science that aims to make

abstract material well visualized and can increase students' motivation in learning qur'anic natural science.

At the product development stage, testing is carried out to ensure the product conforms to the specified specifications. The tests included expert validation (material experts and media experts), responses from three natural science teachers, and responses from three peer reviewers. The validation stage is carried out to consider assessments, criticisms, and suggestions from experts to produce appropriate and good learning media products to be applied in learning the Qur'anic natural science. Validation was carried out by experts in three fields: natural science experts, material experts on the verses of kauniyah and tafsir, and media experts. The material validation technique using the material validation sheet instrument was given to material experts, namely three lecturers of the Faculty of Mathematics and Natural Sciences consisting of physics lecturers, chemistry lecturers, and biology lecturers as natural science material experts, as well as Islamic religious education lecturers as experts on the verses of kauniyah and tafsir. The study results reveal that the feasibility test through the material validation process by three natural science material experts showed an average percentage of 89.33% with the criteria for the material to be tested with revisions according to suggestions.

The validation of the material experts on the Kauniyah verse and interpretation obtained an average percentage of 92% with the criteria for the material to be tested with revisions according to suggestions. The input given by the expert on the material of the Kauniyah verse and interpretation is that it is necessary to include several Kauniyah verses based on scientific interpretation. The details of the average percentage of validation results from three natural science material experts are presented in Figure 5, and the details of the percentage of validation results from material experts on verses of Kauniyah and interpretation are presented in Figure 5.

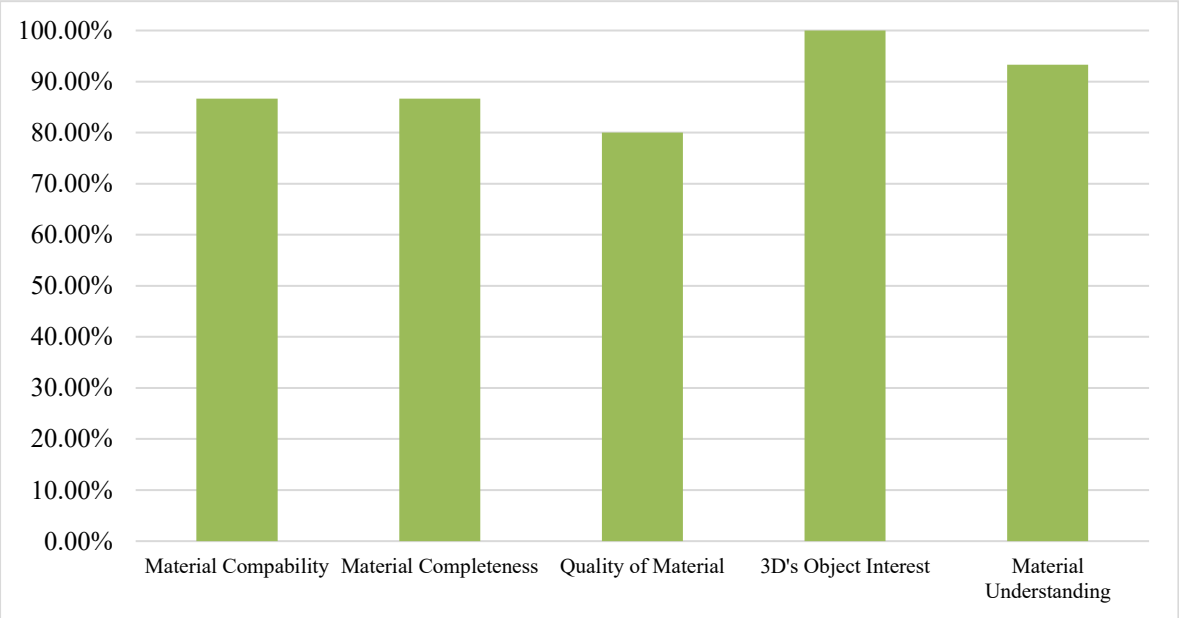

Figure 5. Validation Test of Natural Science Materials

After going through a validation test by a material expert, then media validation is carried out by a learning media expert. The testing technique carried out by media experts aims to ensure that the product developed has good criteria from the software engineering aspect. The validation of the media aspect was carried out by media experts from the field of learning media technology. The results of media validation are 87.27% with a very valid media category and can be used without revision. In addition, the results of responses and responses from three college natural science teachers and three peer reviewers from master's degree students majoring in natural science regarding the material in

learning media were also obtained. Aspects of the assessment include the suitability of the material, the quality of the material's content, the visual appearance of the media, and media illustrations. The results of responses and responses were obtained from a google form questionnaire. Assessments from three natural science teachers and three peer reviewers got average results, respectively, namely 80% and 85.71%. The overall assessment is presented in the following details:

Table 2.
Learning Media Assessment

Aspect	Average	Criteria
Three Natural Science Material Experts	89.33%	Very Feasible
Three Kauniyah Verse Material and Tafsir Experts	92%	Very Feasible
Media Experts	87.27%	Very Feasible
Three Natural Science Teachers	80%	Feasible
Three Peer Reviewers	85,71%	Very Feasible

The learning media was declared very valid by media experts and deserved to be tested with revisions according to suggestions by material experts. The product is said to be feasible, with the percentage of each aspect reaching 81-100% for validation by material experts and media experts. These results indicate that the instrument used is reliable and the quality of the QURRACI product developed is good. Information obtained from this validation stage shows that QURRACI meets material quality at 90.66% and media quality at 87.27%.

Furthermore, a trial was conducted on 100 college students to determine the effect of using QURRACI learning media on students' learning motivation for the natural science quranic material. Students know how to use and display the learning media of books and applications developed, and then they are asked to fill out a questionnaire. The questionnaire given to students consisted of 13 questions, including the media's attractiveness, the suitability of the display of 3D objects, support for learning motivation, ease of understanding the material, and ease of media operations. This trial resulted in an assessment with a percentage of 86.2%. These results indicate that the instrument used is reliable and the developed product has a very good quality and is feasible. In addition, from these results, it can be said that the media can be accepted and used by students and teachers, and in general, it can be used by teachers as a medium for learning Islamic religious education, especially in the material of the Kauniyah verse at the college level.

The Effectiveness of QURRACI on Students' Motivation and Learning Outcomes

1. The Ease of Material Visualization on Multiple Representations

Quality improvement in the learning process is influenced by the facilities or media used, especially the optimal use of technology in learning. This is reinforced by the results of interviews with three college students who stated that they felt interested and could focus more on learning when using technology-based learning media. The use of technology in their favorite learning media is in the form of 3D visualization of abstract material in natural science using augmented reality. The role of learning media is as an intermediary to facilitate an effective teaching and learning process to channel messages and stimulate students' thoughts and interests [24]. The more varied the media used, the more the material delivered will be maximized so that it can improve student understanding. Mark and Brian

[25] said that multiple representations learning has relatively high effectiveness in embedding the concepts covered in natural science material.

These multiple representations use a variety of information presentations, including verbal representations, fictional representations, mathematical representations, and graphic representations in static and dynamic displays (animation and simulation of physical phenomena) [26]. Submission of material with various forms of information presentation, such as in the form of 3D animation, sound, graphics, and video is referred to as multiple representations. The product of the development of this method is in the form of learning media QURRACI. This media presents various forms of representation in order to make it easier for students to visualize abstract concepts in natural science quranic material. With the development of information and communication technology, multiple representation learning media has become easy and simple [27]. Some features of using the concept of multiple representations in the QURRACI learning media are in the form of material representation through interactive writing and images in books, material representation in the form of sound through the audio verse feature in the application, and material representation in the form of 3D animation through the AR (augmented reality) video feature in the application. In the field of education, especially in Indonesia, augmented reality technology has great development opportunities.

This is because augmented reality can be used to help visualize abstract concepts for understanding and structuring an object model. The uses of learning media that are integrated with augmented reality technology in teaching and learning activities include (1) clarifying the presentation of messages; (2) overcoming the limitations of space, time, and senses; (3) overcoming passive students; (4) overcoming differences in the environment and experience of both teachers and students [28]. The use of multiple representations of quranic natural science learning media makes students gain real experience because of the visualization of augmented reality technology; this causes the subject matter delivered to be absorbed easily. QURRACI learning media can be an effective, interesting, and interactive learning resource for college students to learn qur'anic natural science. This is in line with the results of research by Syahri [29], which reveals that the use of multiple representations-based learning media makes the delivery of material more interesting and can increase students' motivation and learning outcomes.

2. The Effectiveness of QURRACI to Improve Students' Motivation and Learning Outcomes

The learning media of multiple representations of qur'anic natural science developed positively influences students' learning motivation. This positive effect is supported by research data obtained through trials on how to use learning media to 100 college students with very interesting and interesting value interpretations on several aspects measured, namely the attractiveness of the media, the suitability of the 3D object display, supporting learning motivation, ease of understanding the material, and ease of media operations. Details of the percentage of trials and student responses are presented in Figure 9.

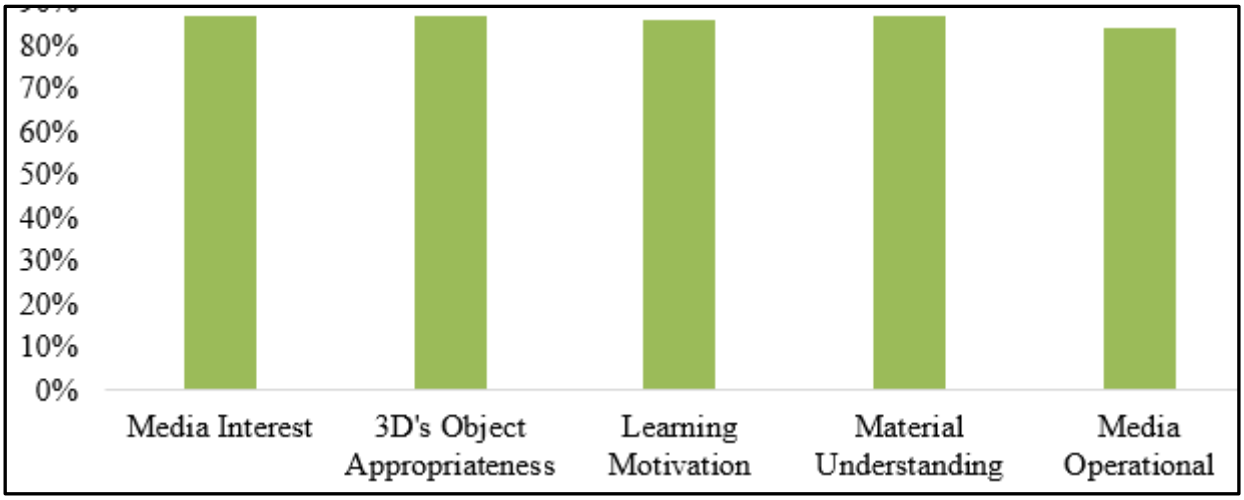

Figure 6. Try Out and Students' Responses

Student responses to the learning media developed have an average of 86.2% in the attractiveness aspect of learning media, including the appearance of books and applications, the suitability of displaying 3D objects so that they can visualize abstract material, the effectiveness of learning media in fostering students' enthusiasm and motivation in learning, ease of understanding the material so that students can link the Kauniyah verse with natural science, as well as the ease of media operations so that it can support the optimization of learning in the 4.0 era. These results indicate that the augmented reality-based multiple representations learning media on the Qur'anic natural science material that has been developed can increase students' interest and motivation to learn. Augmented reality-based learning media has characteristics, namely attractive visualization, can be used anytime, and has varied application features, so that students can repeat the material independently without being bound by time and place and improve their memory of the material. According to the research results of Shih, Chuang, and Hwang [30] that digital learning media can facilitate students in learning anytime and anywhere and can increase students' motivation and memory because they can be used repeatedly.

In addition, QURRACI learning media also has a significant influence on improving student learning outcomes. This is with research data obtained from trials through pretest and posttest to 50 college students. Through the test data that the researchers did, the post-test score was higher than the pretest score that had been done by the students. Furthermore, the data can be tested differently using paired sample t-test to find out how big the difference is in the increase.

Table 3.

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pre Test - Post Test	-27.60000	12.70706	1.79705	-31.21131	-23.98869	-15.359	49	.000

Based on the results of the paired sample t-test, a significance value of 0.000 was obtained. This value is less than 0.05, so it can be concluded that the difference between the pretest and posttest scores is significant, as explained by Morgan, Leech, Gloeckner, and Barrett [31] that the value means that the posttest score is higher than the pretest score so it can be concluded that the Qur'anic Natural Sciences learning media has been proven to improve student learning outcomes. In addition, students can use this media as independent learning material, with the multiple representations method making learning more comprehensive through various representations. On basis of augmented reality, it can

make the learning process more interactive so that students have high enthusiasm and motivation to learn. Augmented reality technology in learning media is designed to provide more detailed information and can stimulate students' mindsets in thinking critically about problems [32] and provide motivation so as to foster student interest in learning [33]. The results of this study are in line with Sakat, Zin, Muhammad, Ahmad, and Kasmo [34], who said that using technology-based learning media can increase motivation because learning becomes more interactive.

This research was conducted in a college environment. Similar studies in the future could include Islamic College, so that the effectiveness of using this instructional media can be evaluated in a wide sample of different educational backgrounds. Thus, the impact of the QURRACI learning media can be studied more deeply. This media is proven to increase the motivation and learning outcomes in quranic natural science material. Then what about other science materials, such as social science? This question requires further research, which will be discussed in our next paper. In the future, it is necessary to develop learning media regarding qur'anic social science to find out whether this learning media has a significant impact on student behavior.

IV. Conclusion

This study concludes that augmented reality-based multiple representations learning media effectively increase students' learning motivation in the natural science quranic material. And based on the results of paired sample t-test analysis of 50 students, a significance value of 0.000 was obtained, showing that the QURRACI learning media is proven to be able to improve student learning outcomes. The validation results from three experts on natural science material as well as material experts on Kauniyah verses and interpretations get an average percentage of 90.66%. The validation results from media experts got a percentage of 87.27%. The results of the trial of college students obtained an average score of 86.2% with very interesting categories. Based on the results found, it can be concluded that the QURRACI learning media can be applied effectively in learning qur'anic natural science. This media can also be used as spiritual and intellectual guidance for college students in the 4.0 era. QURRACI has high potential in supporting and strengthening more modern Islamic religious education.

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