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# Implementation of Augmented Reality (AR) Learning Media on Learning Comprehension of Ship Safety Device Introduction

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**Abstract.** The development of digital technology brings major changes in the world of education, including the maritime sector. One of the relevant and potential technologies is Augmented Reality (AR), which can integrate virtual objects into the real world in real-time, thus providing an immersive and interactive learning experience. This study aims to implement AR-based learning media introducing ship safety devices, such as life jackets, ring buoys, lifeboats, and fire extinguishers, and measure its effectiveness compared to conventional methods. The research method used a quantitative approach with a quasi-experimental design (pretest-post test control group design). The research sample was fourth semester Nautical students at Makassar Polytechnic of Shipping Science (PIP), with the division of experimental groups using AR and control groups using conventional methods. The results showed a significant increase in students' understanding of ship safety devices. The average score increased from 58.49 (pretest) to 66.94 (post test). The Wilcoxon Signed Ranks test result-ed in a p value = 0.003 ($p < 0.05$), which confirms the effectiveness of AR in improving learning outcomes. This finding shows that AR not only helps visualize abstract concepts to be more concrete but also increases student motivation and engagement. This study recommends the use of AR as a learning media innovation in the maritime field, while encouraging the development of broader, collaborative, and sustainable interactive content.

**Keywords:** Augmented Reality, Learning Media, Maritime Safety.

## 1 Introduction

The development of digital technology has brought significant transformation in the world of education, including in the maritime sector. The Indonesian government, through the Ministry of Education, Culture, Research, and Technology, encourages the utilization of technology in learning to improve the efficiency and effectiveness of the teaching and learning process[1] [2] . One technology that is growing rapidly and has great potential in education is Augmented Reality (AR). AR enables the incorporation of two- or three-dimensional virtual objects into real environments in real-time, thus creating immersive and interactive learning experiences [3], [4]. Frameworks text of maritime education, the use of AR can help students understand abstract concepts, such

 

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as ship safety devices, more easily and deeply, according to [5], the development of AR frameworks is needed to improve the learning experience of maritime students, because traditional methods have not adequately met the needs of visualizing abstract concepts. 3D visualization of safety equipment can improve understanding and retention of information and motivate students to learn actively. [6]stated that AR allows the integration of virtual information with the real world, making the understanding of the material more profound.

Previous research shows that the implementation of AR in learning can improve the effectiveness and efficiency of the learning process. For example, [7] developed an AR-based work safety tool introduction application that successfully helped workers understand the function and use of safety tools better. Similarly, [8] developed an AR application to introduce navigational aids, which received a positive response from users. Shipping safety is a crucial aspect in the maritime industry. However, there are still many cases of accidents at sea caused by the crew's lack of understanding of the use of safety devices [9], The development of information and communication technology has presented Augmented Reality (AR) as an innovative solution in education. AR allows the incorporation of virtual objects into the real world in real-time, thereby improving interactivity and learners' understanding of the material being taught.

Shipping safety equipment plays an important role in ensuring the safety of passengers and crew. Various studies have identified a variety of safety equipment on board, including life jackets, buoys, lifeboats, and personal protective equipment. However, there are concerns regarding the adequacy and condition of these safety devices, with some vessels not meeting Life Safety at Sea requirements [10] . The unbalanced ratio between students and lecturers, limited safety equipment facilities on the ship in direct learning, limited learning time, and several other conditions during the learning process to students, are some indicators that cause the learning process to be less effective, in introducing safety equipment to students. This will certainly make it difficult for lecturers to deliver learning objectives. Overcoming this, it is considered necessary to make innovations so that learning objectives can be achieved properly. Interactive learning media has consistently proven to have a positive impact on student involvement in the learning process, as well as improving their ability to understand and master subject concepts [11]. Learning innovation is one of the updates that can be made by Lecturers / Teachers through efforts that are different from before, in implementing learning programs in teaching and learning activities in the classroom [12]. One form of innovation that can be done by lecturers includes the use of in-formation and communication technology in learning, Information Communication and Technology (ICT).

Augmented Reality (AR) is part of information technology which is a technology that combines 2D and 3D virtual objects into a real environment, then projects these virtual objects in real time [13]Augmented Reality (AR) based learning media has great potential in bringing more interactive and effective learning. The integration of AR with social media opens up opportunities to create learning environments that are inclusive, accessible, and engaging for today's digital generation [2], The use of Augmented Reality Media as a learning media can visualize objects that are abstract to be more concrete. According to. The use of AR as a means of introducing ship-ping navigation,

 

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successfully increasing user understanding of the material. This study aims to implement Augmented Reality (AR) based learning media to improve students' understanding of the introduction of ship safety devices [14] [15]. By utilizing AR technology, it is expected that students can see and interact visually with 3D models of ship safety equipment such as life jackets, ring buoys, lifeboats, and fire extinguishers realistically and contextually. Another objective is to measure the effectiveness of AR media compared to conventional methods, as well as evaluate learners' perceptions and learning experiences towards the use of technology.

## 2 Methods

This type of research uses a quantitative approach with a quasi-experimental method. This approach was chosen to measure the effect of Augmented Reality (AR) learning media implementation on student under-standing in the introduction of ship safety devices. The research design used was pretest-posttest control group design, [2], The research was conducted at the Makassar Polytechnic of Shipping Science (PIP), The research population was all students majoring in Nautical Semester IV 2025, The sample used was selected purposively, the total number of cadets in semester IV was 356 people, the sample consisted of Class A as an experimental group (using AR media) and Class B as a control group (using conventional methods).

## 3 Results and Discussions

### 3.1 Normality Test Result

**Table 1**: Normality Test

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| **Pre-test** | 0,115 | 35 | ,200* | 0,942 | 35 | 0,062 |
| **Post-test** | 0,197 | 35 | 0,001 | 0,813 | 35 | 0,000 |

***. This is a lower bound of the true significance.**

**a. Lilliefors Significance Correction**

The normality test results show that in the post-test data the significance value using both the Kolmogorov-Smirnov (p = 0.001) and Shapiro-Wilk (p = 0.000) tests is smaller than 0.05, so the data is not normally distributed. Therefore, the analysis continued using the non-parametric Wilcoxon Signed Ranks Test to test the difference between pre-test and post-test scores.

 

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### 3.2 Descriptive Test Results

**Table 2:** Descriptive Statistics

| Descriptive Statistics | | | | | |
|---|---|---|---|---|---|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| **Pre-test** | 45 | 30 | 75 | 58,49 | 11,685 |
| **Post-test** | 35 | 45 | 75 | 66,94 | 8,516 |
| **Valid N (listwise)** | 35 | | | | |

The results of descriptive analysis show that the pre-test scores of 35 respondents have a minimum score of 30 and a maximum of 75, with an average (Mean) of 58.49 and a standard deviation of 11.685, which indicates a fairly wide variation in values before treatment. After learning how to use Augmented Reality (AR) media, post-test scores increased with a minimum score of 45 and a maximum of 75, an average (Mean) of 66.94 and a standard deviation of 8.516, which indicates an increase in the average score and a more even distribution of scores. This finding indicates an increase in participants' understanding after the learning intervention.

### 3.3 Wilcoxon Test Results (Non Parametric)

**Table 3**: Wilcoxon Ranks

| Ranks | | | | |
|---|---|---|---|---|
| | | N | Mean Rank | Sum of Ranks |
| **Post-test - Pre-test** | Negative Ranks | 7[a] | 10,21 | 71,50 |
| | Positive Ranks | 21[b] | 15,93 | 334,50 |
| | Ties | 7[c] | | |
| | Total | 35 | | |
| a. Post-test < Pre-test | | | | |
| b. Post-test > Pre-test | | | | |
| c. Post-test = Pre-test | | | | |

Based on the results of the Wilcoxon Signed Ranks test, it is known that there are 7 respondents (Mean Rank = 10.21; Sum of Ranks = 71.50) who experienced a decrease in post-test scores compared to pre-test (Negative Ranks). Meanwhile, 21 respondents (Mean Rank = 15.93; Sum of Ranks = 334.50) showed an increase in post-test scores compared to pre-test (Positive Ranks), and 7 respondents had the same score between post-test and pre-test (Ties). This difference illustrates that most participants experienced an increase in learning outcomes after the intervention using Augmented Reality (AR) based learning media.

 

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**Table 4:** Statistical Test Results

| **Test Statistics**[a] | |
|---|---|
| | Post-test - Pre-test |
| Z | -2,996[b] |
| Asymp. Sig. (2-tailed) | 0,003 |

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

The statistical test results show a value of Z = -2.996 with a *p-value* (Asymp. Sig. 2-tailed) of 0.003. Since the *p-value* is <0.05, it can be concluded that there is a significant difference between the *pre-test* and *post-test* scores. This finding indicates that the use of AR-based learning media significantly improves students' understanding of the introduction of ship safety devices compared to conventional learning methods.

### 3.4 Analysis of Research Results

Based on the results of statistical tests that have been carried out, it appears that learning using Augmented Reality (AR) media has a positive impact on students' understanding. The normality test results show that the post-test data is not normally distributed, so the Wilcoxon Signed Ranks Test non-parametric test is used. This finding is in line with the principles in statistical analysis, where the selection of test methods is adjusted to the characteristics of the data distribution, to ensure valid interpretation of the results.

The increase in the average score from 58.49 in the pre-test to 66.94 in the post-test indicates that AR is able to present the material in a more interactive way, making it easier for participants to understand the concepts and procedures for introducing ship safety devices. The presentation of material in the form of realistic 3D visuals is thought to accelerate the knowledge internalization process and help participants remember important information.

In addition, from a pedagogical perspective, this improvement also indicates that a visually rich and interactive approach can accommodate students' various learning styles, whether visual, auditory, or kinesthetic. By utilizing AR, participants can explore learning objects from various perspectives, repeat the simulation as many times as needed, and get immediate feedback on their interactions. This creates a constructive and participatory learning experience, where participants not only passively receive information, but also build their understanding through independent exploration.

The application of AR also opens up opportunities to integrate gamification elements, such as scoring, achievements and challenges that can increase students' intrinsic motivation. In this way, the learning process no longer feels boring or stressful, but rather a fun yet educational experience. This positive psychological impact is important to ensure participants' engagement remains high throughout the learning process.

 

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### 3.5 Comparison with Previous Research

The results of this study are consistent with the findings of several previous studies highlighting the effectiveness of AR in improving learning outcomes. For example, research by, showed that the use of AR in engineering learning was able to significantly improve participants' post-test scores compared to conventional methods. Similarly, an international study concluded that AR provides a more immersive learning experience and motivates students to be actively involved in the learning process. The main difference from this study lies in the context of the subject and the material taught, namely the introduction of ship safety devices. With the characteristics of the material that is procedural and requires clear visualization, AR proves to be the right media to bridge theory and practice and minimize misunderstanding that often occurs in text-based learning methods or static images.

This finding has important implications for the world of education, especially in the field of shipping and maritime safety. First, AR can be used as a complementary medium in the safety training curriculum, so that learners can practice repeatedly without the risks inherent in direct practice on the ship. Second, AR can be used to standardize teaching materials, so that each participant receives the same information with consistent delivery quality. In addition, AR integration also has the potential to reduce training operational costs, as some materials can be learned independently using digital devices. This approach is also in line with the trend of digital transformation in education, where technology is used to improve the efficiency and effectiveness of the learning process. Although the results obtained show a significant improvement, this study has several limitations. First, the number of respondents was limited to 35 people, so generalization of the findings needs to be done with caution. Second, the duration of the intervention using AR is relatively short, so it has not been able to measure the long-term impact on participants' knowledge retention.

In addition, the technical aspects of using AR are also a challenge. For example, the need for adequate hardware such as smartphones or tablets with certain specifications can be an obstacle for institutions or participants who have limited facilities. The availability and stability of internet connections also affect the smooth use of AR, especially for content that requires real-time data loading. In terms of content, developing quality AR materials requires a lot of time, money, and cross-disciplinary collaboration. If this process is not carefully planned, there is a risk of mismatch between AR materials and learning objectives, resulting in decreased effectiveness. Another factor to consider is the potential distraction that may arise when participants are too focused on the visual or entertainment aspects, thus forgetting the main learning objectives.

Another limitation that is rarely discussed is the lack of training for teachers in utilizing AR technology optimally. Teachers who are not familiar with this technology may need a longer adaptation time, which may affect the smoothness of the learning process. Therefore, training support and clear usage guidelines are necessary to maximize the benefits of AR. In addition, external factors such as individual learning motivation, previous experience, and learning environmental conditions also have the potential to affect the results obtained. These limitations can be taken into consideration in designing a more comprehensive follow-up study.

 

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## 4 Conclusion

The results showed that the use of Augmented Reality (AR) based learn-ing media had a significant impact on increasing students' understanding of ship safety devices. This can be seen from the increase in the average pre-test score of 58.49 to 66.94 in the post-test. The Wilcoxon Signed Ranks Test produced a significant value of 0.003 ($p < 0.05$), which means there is a significant difference between the results before and after the intervention. This finding confirms that AR can present the material more interactively and visually, so that participants are easier to understand concepts, remember procedures, and are actively involved in the learning process. Thus, AR is proven effective as an innovative learning media that supports the achievement of educational goals, especially in the field of maritime safety. Therefore, AR is not just an additional technology, but a strategic innovation that is able to answer educational challenges in the Society 5.0 era.

## References

[1] S. S. Sayyidah, A. Mutaqin, And Y. Setiani, "Development Of Augmented Reality-Based Learning Media Assisted By Assemblr Edu To Improve Students Mathematical Understanding Skills," *Emteka: Jurnal Pendidikan Matematika*, Vol. 6, No. 1, Pp. 52–67, Mar. 2025, Doi: 10.24127/Emteka.V6i1.7489.

[2] N. Hasanspahić, S. Vujičić, V. Frančić, And L. Čampara, "The Role Of The Human Factor In Marine Accidents," *J Mar Sci Eng*, Vol. 9, No. 3, Pp. 1–16, Mar. 2021, Doi: 10.3390/Jmse9030261.

[3] M. Adaptasi *Et Al.*, "Teknologi Augmented Reality (Ar) Sebagai Solusi Media Pembelajaran Sains Di," 2021. [Online]. Available: Http://Journal.Walisongo.Ac.Id/Index.Php/Bioeduca

[4] D. Rosita And S. Sih Dewanti, "Journal Of Integrated Elementary Education The Impact Of Augmented Reality-Based Learning Media On Primary Students' Retention Of Human Sensory System Concepts," Vol. 5, No. 2, Pp. 407–420, 2025, Doi: 10.21580/Jieed.

[5] D. P. Riananda, A. Z. Arfianto, I. Rachman, A. Sa'diyah, And W. E. Primaningtyas, "Innovative Maritime Learning Through Virtual Tour And Augmented Reality With An Interactive Approach For Competency Enhancement," *Jurnal Inovasi Pembelajaran*, Vol. 11, Pp. 118–134, 2025.

[6] G. Singh And F. Ahmad, "An Interactive Augmented Reality Framework To Enhance The User Experience And Operational Skills In Electronics Laboratories," *Smart Learning Environments*, Vol. 11, No. 1, Dec. 2024, Doi: 10.1186/S40561-023-00287-1.

[7] S. Adi Wibowo And K. Auliasari, "Pengenalan Tools Keselamatan Kerja Menggunakan Augmented Reality Berbasis Android," 2020. [Online]. Available: Http://Sibima.Pu.Go.Id/

 

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DOI: https://doi.org/10.58905/jse.v6i2.640

[8] E. H. Sanjaya, G. Harsemadi, N. Luh, And P. Srinadi, "Augmented Reality Pengenalan Sarana Bantu Navigasi Pelayaran Di Distrik Navigasi Benoa Berbasis Android," Vol. 1, Pp. 561–567, Apr. 2024.

[9] J. Jamil, F. Mallapiang, And A. M. Multazam, "Analisis Unsafe Action Dan Unsafe Condition Dengan Kecelakaan Kerja Pada Awak Kapal Penyeberangan Bira-Pamatata," *Journal Of Muslim Community Health (Jmch) 2023*, Vol. 4, No. 1, Pp. 251–264, 2023, Doi: 10.52103/Jmch.V4i1.1285.

[10] C. I. Ilham, B. Priyono, And R. Haviz, "Review Of Safety Equipment In Shipping (Case Study: Tools Birth Of Float) In The Kmp. Tanjung Burang, On Track Ulee Lheue-Balohan," 2019.

[11] H. Aulia, M. Hafeez, H. Usman Mashwani, J. Deen Careemdeen, And M. Mirzapour, "The Role Of Interactive Learning Media In Enhancing Student Engagement And Academic Achievement," 2024. [Online]. Available: Http://Journal.Ummat.Ac.Id/Index.Php/Issrestec

[12] A. Fakih, Y. Setiowati, And R. Sepriyanti Burano, "Inovasi Dan Pengembangan Pembelajaran Era Digital," *Jurnal Penelitian Dan Kajian Ilmiah*, Vol. 19, No. 1, Pp. 1–7, 2025.

[13] D. Frossinis, * -Anaxagora, And E. -Chatzopoulou, "Augmented Reality Technology As A Training Tool," 2021. [Online]. Available: Http://Www.Qjoest.Com

[14] A. P. Sari And M. Munir, "Pemanfaatan Teknologi Digital Dalam Inovasi Pembelajaran Untuk Meningkatkan Efektivitas Kegiatan Di Kelas," *Digital Transformation Technology*, Vol. 4, No. 2, Pp. 977–983, Dec. 2024, Doi: 10.47709/Digitech.V4i2.5127.

[15] D. Aditiawan, M. Denata Putriane, And I. A. Tnunay, "Implementasi Augmented Reality Menggunakan Assemblr Edu Sebagai Inovasi Pembelajaran Interaktif Pada Program Studi Permesinan Kapal Di Era Digital," *Haumeni Journal Of Education*, Vol. 5, No. 2, Pp. 67–77, 2025, Doi: 10.35508/Haumeni.V5i2.24081.

 