The Influence of Augmented Reality(AR) Technology on Sculpture Art Education

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ARTICLE INFO	ABSTRACT
      	Sculpture in the Visual Arts Education subject is one of the topics that is often said to be difficult to learn due to the lack of effective learning tools. Based on this background, this study was conducted to develop and test the effects of using a learning tool based on *Augmented Reality technology* called *the E-Seni Arca Toolkit* on the understanding of Form One secondary school students on the topic of sculpture. This study used a quantitative method involving a quasi-experimental study design. The study sample consisted of 50 Form One students from Sekolah Menengah Kebangsaan Mergong, Alor Setar, Kedah. They were randomly divided into a treatment group and a control group. The students in the treatment group used *the E-Seni Arca Toolkit* to learn the topic of sculpture, while the students in the control group used the conventional method. The study instrument was a set of test questions to measure students' understanding of aspects related to sculpture. An independent *t- test* was used to analyze the difference in mean scores of the test results between the two groups. The findings showed that the understanding of students in the treatment group about sculpture was higher than the understanding of students in the control group. Therefore, *the E-Seni Arca Toolkit* can be used as a learning tool in the teaching and learning process to help secondary school students learn sculpture topics more effectively.

1. Introduction

Augmented Reality (AR) technology is a technology that is currently developing that conceptualizes virtual reality with the real world. Objects produced through this AR technology are based on virtual concepts in 2 Dimensions (2D) and 3 Dimensions (3D), which is as if the object being viewed is real and integrates with the real world [1][2]. Through the results of this virtual reality, users can only interact virtually and limitedly. Users can only see these virtual objects through specialized applications. The advantage of this AR technology is that users can see the real world around them with the addition of real virtual objects produced by electronic devices such as smartphones, tablets or computers that have AR software [3][4]. Therefore, the information conveyed through this concept is only through virtual objects that show the results as if they were

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real. Through this AR concept approach, it is very suitable for current and future students when teaching and learning sessions are conducted [5][6].

A variety of technologies have been used in the field of education such as the internet, computer use, simulation, social web, e-learning and among the latest technologies are mobile devices such as virtual worlds and AR technology [1][2]. Through a report in the latest Horizon Reports, AR is one of the latest technologies with the potential to have a positive impact on Teaching and Learning (T&L) sessions, New Media Consortium [7]. The initiative through this research study is to renew the conventional learning method, which is only speaking in front of the teacher by referring to textbooks and reference books. This conventional learning method is a learning method that is no longer relevant to use because it fails to involve students to more effectively master a topic [8].

Existing forms of learning such as slides, printed pictures and lectures are one of the processes that are inherently less effective for information processing for students in remembering and acquiring information effectively [8][9]. Through this study, the main focus and emphasis is given to teaching methods, especially in the subject of Visual Arts Education (PSV) for the topic of Sculpture[10][11].

Sculpture is one of the topics under the heading of fine arts which has 4 types of works, namely painting, drawing, printmaking and sculpture. Fine arts is also an important branch in the PSV learning syllabus, where it is a topic that is given little attention. This is one of the factors that contributes to the decline in student performance in the PSV subject. Therefore, schools and teachers need to take the initiative in diversifying teaching aids, for example in describing works that are conceptualized using technology. Through this approach, students can clearly see the structure of a sculpture without technology. Also, fine arts are needed and it is also an important topic for schools and even in Higher Education Institutions (IPT).

Several applications of concepts in the use of technology have been used in this field of education, especially for effective learning methods. Among the applications of concepts in the use of technology used in the renewal of this learning method are such as using *Augmented Reality* (AR) technology, the Internet of Things (IoT) concept and emphasis through Multimedia elements. The use of AR technology is able to clearly depict the structure of the sculpture in detail based on the design of the sculpture[11][12].

The conceptual framework of this study aims to see the explanatory relationship between teachers, students and Teaching and Learning (T&L) methods by using two types of methods that allow it to be used for T&L sessions in the classroom. The methods used are important to ensure that the use of *Augmented Reality (AR) technology* is effective in learning the theory of Visual Arts Education (PSV) for lower secondary.

2. Research Method
2.1 Research Network

The research framework is a major and important aspect in a research study to ensure that every object created is achieved and every question is answered. The purpose of this research study is to see how effective the use of the Smart Card (AR) learning kit is through Teaching and Learning (T&L) sessions in the PSV subject for the topic of Sculpture[7][13][14]. Through this learning kit based on the AR concept, Form One students at Sekolah Menengah Kebangsaan Mergong, Kedah can use it and obtain maximum benefits in terms of understanding and ease of learning the topic of sculpture. In this research study, the researcher used the concept of comparison between two groups, namely conventionally (without the aid of the kit) and with the aid of the learning kit based on AR technology.

Therefore, in the data collection process, the use of quantitative methods was chosen to be used to obtain and process data for study findings. Figure 1 shows the form of a flowchart carried out by the researcher to evaluate the effectiveness of the research study:
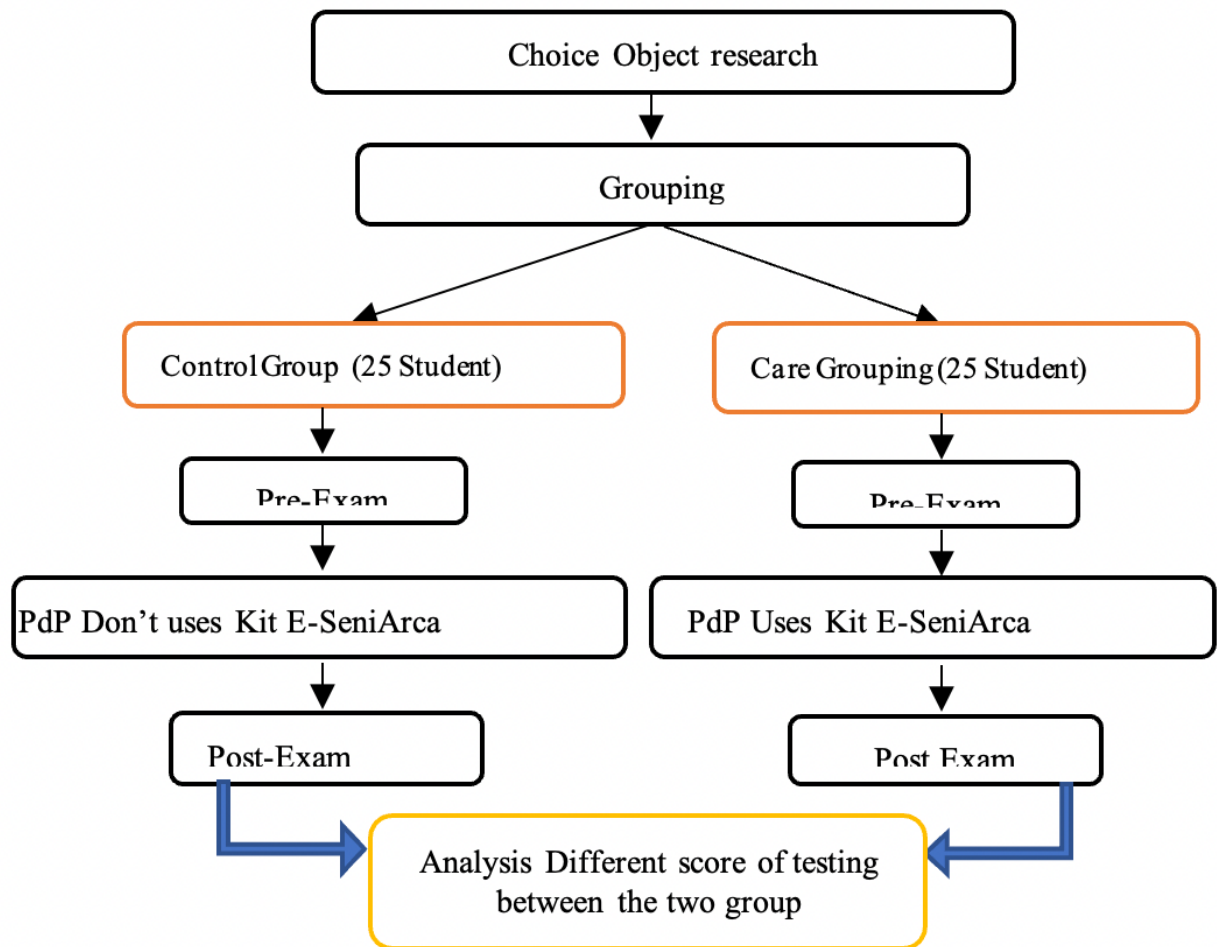

Fig. 1. Research Design

2.2 System development

Through this research framework, the use of the ADDIE model has been used as a process and procedure to develop a learning kit based on AR technology [16][17]. Meanwhile, the appropriate process to use in conducting experiments is quasi-experimental, which is to determine the impact on the effectiveness of using the developed learning kit [18].

Therefore, in the data collection process, the use of quantitative methods was chosen to be used to obtain and process data for study findings [16]. Figure 2 shows the form of a system development carried out by the researcher to evaluate the effectiveness of the research study:
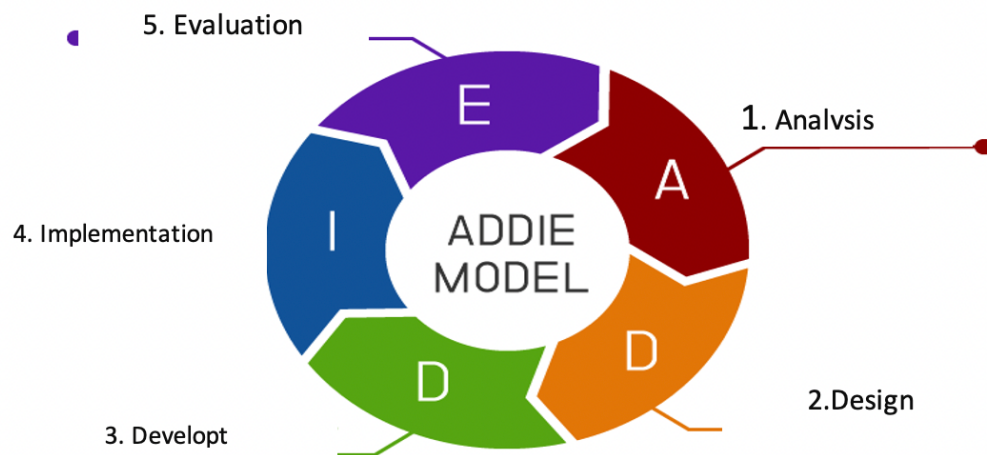
Fig. 2. System Developed

The first phase is the analysis phase. This phase will involve preliminary studies conducted on an organization and a specific party to identify current problems faced, for example through this study is a school. In this phase, there are also several requirements required through this E-SeniArca kit such as focusing on the target user, namely who will use the Smart Card (AR), the main function of the kit, how the Smart Card (AR) works, where, when and how long this kit will be used, the use of equipment for electronic devices, namely smartphones and tablets, and the technology used.

The second phase is the design phase, which is the phase that forms a development for the product, namely the development of the Smart Card (AR). The focus of this phase is to meet the needs that have been planned and drafted, and then create a suitable design.

The third phase is the development phase in this phase also involves processes related to the arrangement, layout and interface structure for the Smart Card (AR) which is developed according to the planned plan through the sketched storyboard. Focusing on planning for each procedure is the main ingredient so that a display does not become too dense and difficult to use.

The fourth phase, the implementation phase, involved the target users, namely students, to conduct a pilot test for the E-SeniArca Kit. Through the development of the E-SeniArca Kit, 50 Form One students who took the Visual Arts Education subject from Sekolah Menengah Kebangsaan Mergong (SMKM) were involved. Then, the students were divided into two different groups, namely 25 students for the control group and another 25 students for the treatment group. The fifth phase is the evaluation phase, which will involve testing the developed kit to see if it meets the needs of the target users.

3. Results
3.1 Implementation

Through the fourth phase, the implementation phase, it involved the target users, namely students, to conduct *a pilot test* for the E-SeniArca Kit. Through the development of the E-SeniArca Kit, it involved 50 Form One students who took the Visual Arts Education subject from Sekolah Menengah Kebangsaan Mergong (SMKM). Then, the students were divided into two different groups, namely 25 students for the control group and another 25 students for the treatment group. Each group was separated according to the same number. The first survey and process was carried out for approximately 3 weeks. After that, pre-tests and post-tests were distributed and given to both groups to find out about the effectiveness of using the E-SeniArca Kit on students throughout the learning

session. Through this test, it indirectly allows the researcher to make changes and improvements in terms of the development of the E-SeniArca Kit. The figure below shows the results of the pre- and post-tests on 50 students at SMKM, Alor Setar, Kedah.

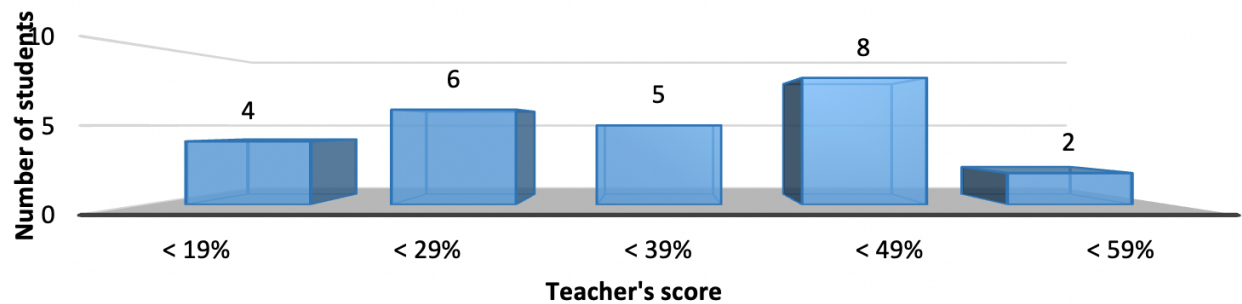**Total Student Marking Percentage in the Pre- Test for the Control Group**

Fig. 3. Percentage of Student Marks in the Pre-Test for the Control Group

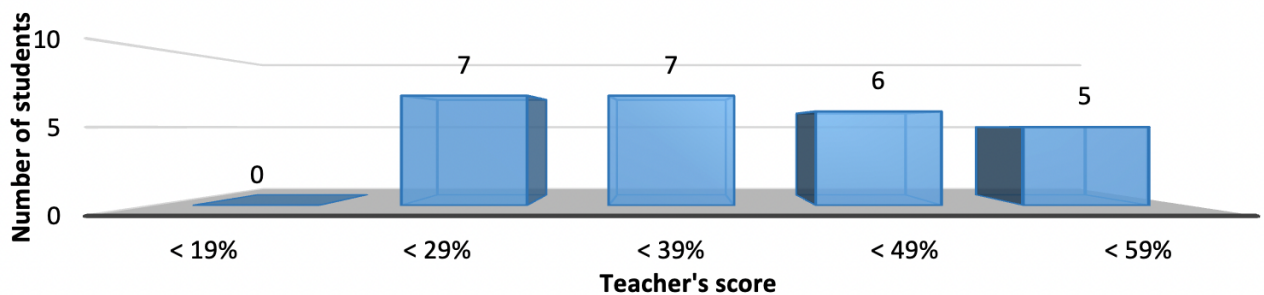**Total Student Marking Percentage in Post-Test for Control Group**

Fig. 4. Student Marking Percentage in Post-Test for Control Group

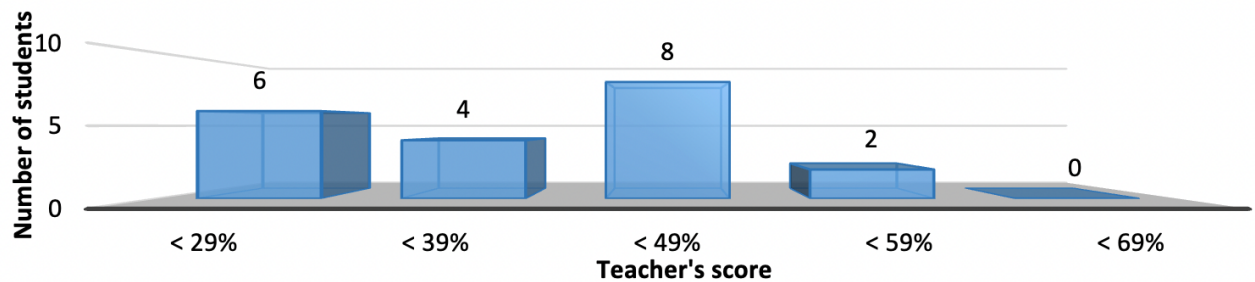**Total Student Marking Percentage in Pre-Test for Treatment Group**

Fig. 5. Percentage of Student Scores in the Pre-Test for the Treatment Group

**Total Student Marking Percentage
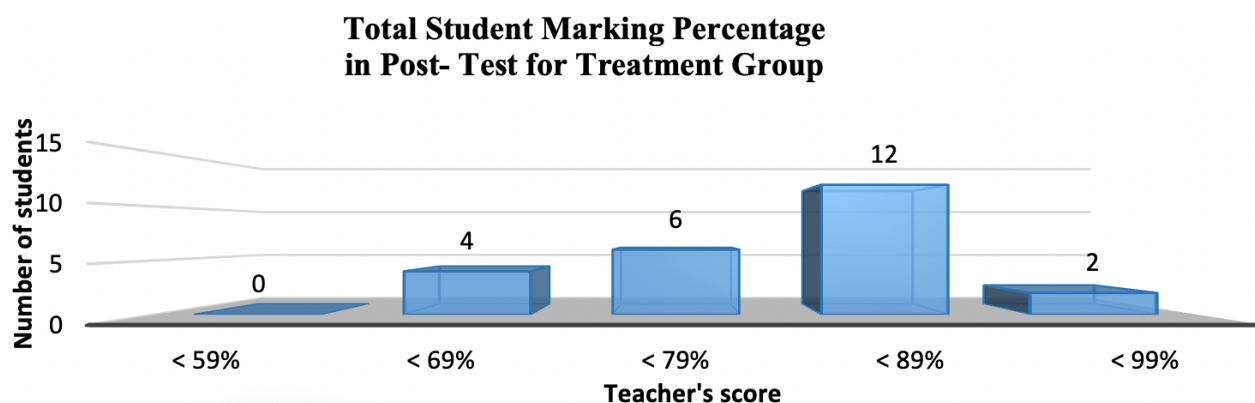in Post- Test for Treatment Group**

Fig. 6. Student Marking Percentage in Post-Test for Treatment Group

In the first week of this research study, the researcher went to Sekolah Menengah Kebangsaan Mergong, Alor Setar to conduct a pre-test on 50 students who were selected as respondents. This is because it is to find out the extent of students' knowledge related to the basic topic of this sculpture. This is also to ensure the level of individual student thinking through the initial exposure of students in recognizing the basic concept of sculpture correctly. In addition, the researcher also used the observation method. This is because it is to see the student reactions, especially through the student behavior while in class in learning the basics of this sculpture. Therefore, the research study was conducted on the first 25 students, who did not use the E-SeniArca Kit during the learning session while the next 25 students used the E-SeniArca Kit in the learning session as a medium of teaching aids (BBM).

Next, in the third week of the research study, the researcher went to SMKM again to see and find out whether the use of the E-SeniArca Kit helped students when using it or not. This was also to ensure that changes occurred. The same process was used in the third week, where the control group did not use the E-SeniArca Kit during the PdP session while the treatment group used the E-SeniArca Kit during the PdP session. Also, the researcher was in the back of the class during the learning session for both groups and saw and recorded important information. Next, after the learning session was completed, the researcher gave a post-test to the students and it showed a positive impact in terms of student scoring. It has proven that the use of the E-SeniArca Kit as the main medium of BBM for the sculpture topic really helps students in learning this topic effectively.

At the end of this research study session, a questionnaire was given to the treatment group to obtain views and comments on the E-SeniArca Kit while a questionnaire was also given to the control group after all post-tests were completed. A total of 50 questionnaires were given to students to evaluate the use of the E-SeniArca Kit.
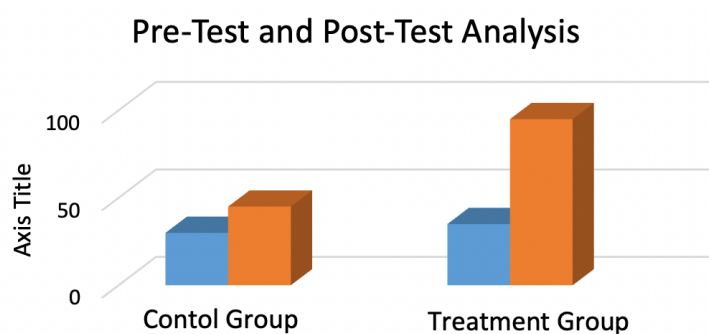
Pre-Test and Post-Test Analysis

Fig. 7. Pre-Test and Post-Test Analysis

Therefore. based on the bar graph that has been made, it has proven more clearly that the level of student understanding achievement is at a low and minimal level. The difference in the Pre-Test and Post-Test chapters is intended to see more clearly to show the level of student understanding and achievement in learning the PSV subject for this basic topic of Sculpture. Therefore, the data that can be done is that the level of student achievement is still at a minimal level. The next process is that students are required to answer each question that has been presented as in the diagram above. Through these questions, the difference can be seen through the answers given by the students. The time allocated by both groups is the same so that it does not provide a difference in terms of time use.

Therefore, the data obtained can be stated that the control group does not have a significant difference in terms of the Pre-Test and Post-Test that has been done. This is because the learning method used by the teacher is conventional compared to the use of technology. Therefore, it becomes difficult for students to understand this basic topic of Sculpture more clearly.

There is a lack of exposure received by students, which is also limited and limited in recognizing Sculpture. Meanwhile, the treatment group has shown significant changes in terms of students' understanding of learning the basic sculpture hat. Through the achievements that have been obtained, it can be stated that if a teaching and learning uses a medium such as technological materials, then it has a positive and very effective impact. Therefore, through the development of this E-SeniArca Kit, students can easily achieve the maximum level of understanding.

4. Conclusion

Through the development of this kit, what can be concluded is that it is very helpful for students in learning the basics of sculpture which is indeed difficult to understand through lecture-based learning. Also, with this kit, students are able to master the learning of sculpture topics to the maximum. By using the E-SeniArca Kit based on AR technology, it can indirectly create a difference in terms of Teaching and Learning (T&L) methods and also provide drastic changes in the field of education. This can bring the field of education in line with other fields that use AR technology as a main element in providing the effectiveness of users to operate it. Finally, it can give students more concentration during the T&L session.

References

[1] Wu, C., M. Huang, R. Yang, W. Sun, Y. Liu, and Y. Liu. 2023. "An Augmented Reality Platform with Gamification for Learning Based on Virtual Campus Scenes." *2023 IEEE 2nd International Conference on Cognitive Aspects of Virtual Reality (CVR)*, 51–56. https://doi.org/10.1109/CVR58941.2023.10395363.

[2] Aydin, Merve, and Ünal Çakiroğlu. 2025. "Learning Programming with Augmented Reality-Based Editor: A Dynamic Code Visualisation Approach." *Journal of Computer Assisted Learning* 41 (1): e13093. https://doi.org/10.1111/jcal.13093.

[3] Huang, Yizhenb, Mira Hansen, Eric Richter, Thilo Kleickmann, Katharina Scheiter, and Dirk Richter. 2025. "Enhancing Preservice Teachers' Noticing via Adaptive Feedback in a Virtual Reality Classroom." *Learning and Instruction* 95: 102053. https://doi.org/10.1016/j.learninstruc.2024.102053.

[4] Farajpour, Hekmat, Masoud Ghorbani, Mehrdad Moosazadeh Moghaddam, and Vahabodin Goodarzi. 2024. "Surface Modification of 3D-Printed Polycaprolactone–Human Decellularized Bone Matrix Composite Scaffold by Plasma for Bone Tissue Engineering." *Bioprinting* 44 (December): e00378. https://doi.org/10.1016/j.bprint.2024.e00378.

[5] Hajirasouli, Aso, Saeed Banihashemi, Paul Sanders, and Farzad Rahimian. 2024. "BIM-Enabled Virtual Reality (VR)-Based Pedagogical Framework in Architectural Design Studio." *Smart and Sustainable Built Environment* 13 (6): 1490–1510. https://doi.org/10.1108/SASBE-07-2022-0149.

[6]   Laubscher, Heino, Ben Loos, and Rensu P. Theart. 2024. "Engage and Learn: Improved Learning of Cellular Structures Using a Virtual Reality-Based Learning Experience." *Computers and Education: X Reality* 5: 100089. https://doi.org/10.1016/j.cexr.2024.100089.

[7]   Basumatary, Dipali S., Debojeet Das, and Ranjan S. Maity. 2024. "Impacts of AR in Learning Tribal Bodo Language." *International Journal of Modern Education and Computer Science* 16 (6): 64–79. https://doi.org/10.5815/ijmecs.2024.06.05.

[8]   Wahid, Abdul, Yusri Bin Kamin, Andi Sukri Syamsuri, Andi Paida, Syekh Adiwijaya Latief, and Arief Muhsin. 2025. "The Effect of Critical Literacy-Based Literature Reading on Critical Thinking Skills: A Study on the First-Year Students in University." *International Journal of Literacies* 32 (1): 53–73. https://doi.org/0136/CGP/v32i01/53-7.

[9]   Zapata, Mireya, Carlos Ramos-Galarza, Kevin Valencia-Aragón, and Lidia Guachi. 2024. "Enhancing Mathematics Learning with 3D Augmented Reality Escape Room." *International Journal of Educational Research* 7 (December): 100389. https://doi.org/10.1016/j.ijedro.2024.100389.

[10]   Krleža, Palmira. 2022. "The Role of Digital 3D Models in the Context of Museum Display of Sculpture." *Život Umjetnosti* 110: 156–71. https://doi.org/10.31664/zu.2022.110.08.

[11]   Firdaus, R., Y. Abdullah, S. Abadi, Muhamad Hariz Muhamad Adnan, Nursari S. R. C., and D. A. Dewi. 2025. "Wireless Local Area Network and Analytical Hierarchy Process: Technology Acceptance Model for Increasing Use of Online Learning." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 47 (1): 29–38. https://doi.org/10.37934/araset.47.1.2938.

[12]   Redjeki, S., S. Abadi, D. Kurniati, Sri Rezeki Candra Nursari, A. Damayanti, and E. Iskandar. 2025. "Clustering on Sentiment Analysis: Effect of Twitter Dataset." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 51 (1): 39–51. https://doi.org/10.37934/araset.51.1.3951.

[13]   Abadi, Satria, Muhamad Hariz Muhamad Adnan, Citrawati Jatiningrum, Hafizul Fahri Hanafi, Nurul Akhmal Mohd Zulkefli, and Deshinta Arrova Dewi. 2023. "Multi-Criteria Decision-Making in SMEs Venture Capital Allocation: Analytic Hierarchy Process and Double Auction Approach." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 54 (1): 80–90. https://doi.org/10.37934/araset.54.1.8090.

[14]   Abadi, S., M. H. M. Adnan, S. Redjeki, and C. Jatiningrum. 2023. "Using Analytical Hierarchy Process for Double Auction to Optimize Financial Performance of Private Higher Education Institutions." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 31 (3): 13–24. https://doi.org/10.37934/araset.31.3.1324.

[15]   Luo, He-Lin, Pei-Ying Lin, Tin-Kai Chen, and Andry Chowanda. 2024. "Research on the Utilization of Cloud Anchors in 5G Mobile Networks for Interactive Augmented Reality Display and Sculptural Art." *Proceedings of the 2024 IEEE 24th International Conference on Software Quality, Reliability and Security Companion (QRS-C 2024)*, 1213–22. https://doi.org/10.1109/QRS-C63300.2024.00159.

[16]   Du, Shaoxu, Mageswaran Sanmugam, Chuang Chen, and Jingru Zhang. 2024. "Design and Development of Seal Engraving Learning Application Based on Augmented Reality." In *Power of Persuasive Educational Technologies in Enhancing Learning*, 256–79. https://doi.org/10.4018/979-8-3693-6397-3.ch012.

[17]   Tsakeni, Maria. 2024. "Exploring Design Principles for STEAM Learning Activities Development by Science and Technology Teachers." *Educational Research for Social Change* 13 (1): 85–106. https://doi.org/10.17159/2221-4070/2023/v13i1a6.

[18]   Yusof, Norliana, Wan Nur Atikah Wan Mohd Pauzi, Nor Ziratul Aqma Norzaman, Ireana Yusra Abdul Fatah, Siti Maryam Sharun, Mohd Shahir Kasim, Sharih Ahmad Mohamad, and Teruaki Ito. 2025. "Development of an Educational Kit Using CAD Software for Simple Machine Learning." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 44 (2): 11–24. https://doi.org/10.37934/araset.44.2.1124.