Jurnal Pendidikan Ekonomi, Perkantoran, dan Akuntansi
E-ISSN: 2722-9750
Volume 6 No. 2 (2025)

DEVELOPMENT OF AUGMENTED REALITY MEDIA FOR AUTOMATION OF MANAGEMENT OF OFFICE FACILITIES AND INFRASTRUCTURE IN VOCATIONAL HIGH SCHOOLS

Lavia Meiras Putri
Faculty of Economics and Business, Universitas Negeri Jakarta, Indonesia
Email: laviameiras@yahoo.com

Roni Faslah
Faculty of Economics and Business, Universitas Negeri Jakarta, Indonesia
Email: ronifaslah@unj.ac.id

Marsofiyati
Faculty of Economics and Business, Universitas Negeri Jakarta, Indonesia
Email: marsofiyati@unj.ac.id

ABSTRACT
This study aims to develop Augmented Reality (AR)-based learning media called "kantAR" and measure its feasibility level for the subject of Automation of Office Facilities and Infrastructure Management at SMKN 48 Jakarta. The background of this study is the existence of problems in the learning process, such as monotonous media and students' difficulties in visualizing abstract office equipment in textbooks. The research method used is Research and Development (R&D) by adopting the 4D model consisting of the Define, Design, Develop, and Disseminate stages. The results of the study showed that the "kantAR" learning media obtained an average feasibility percentage of 89.5% from material experts and media experts, which is included in the "very feasible" category. Furthermore, the results of the trial on students in the one-to-one evaluation stage obtained a score of 99% and the small group evaluation stage obtained a score of 91%, both of which showed the "very practical" category. Thus, it is concluded that the AR media "kantAR" is very feasible and practical to be implemented as an innovative and interactive learning solution to improve student understanding
Keywords: Augmented Reality, Learning platform, 4D model

ABSTRAK
Latar belakang penelitian ini adalah adanya permasalahan dalam proses pembelajaran, seperti media yang monoton dan kesulitan siswa dalam memvisualisasikan peralatan kantor yang abstrak di buku teks. Metode penelitian yang digunakan adalah Penelitian dan Pengembangan (R&D) dengan mengadopsi model 4D yang terdiri dari tahap Define, Design, Develop, dan Disseminate. Hasil penelitian menunjukkan bahwa media pembelajaran "kantAR" memperoleh persentase kelayakan rata-rata sebesar 89,5% dari ahli materi dan ahli media, yang termasuk dalam kategori “sangat layak”. Selanjutnya, hasil uji coba pada siswa dalam tahap one-to-one evaluation memperoleh skor 99% dan tahap small group evaluation memperoleh skor 91%, keduanya menunjukkan kategori “sangat praktis”. Dengan demikian, disimpulkan bahwa media AR "kantAR" sangat layak dan praktis untuk diimplementasikan sebagai solusi pembelajaran yang inovatif dan interaktif untuk meningkatkan pemahaman siswa.
Kata kunci: Augmented Reality, Media pembelajaran, 4D model

INTRODUCTION
The teaching process plays a vital role in enhancing the quality of a nation's human resources. These efforts aim to develop spiritual and religious values, self-discipline, character,

Jurnal Pendidikan Ekonomi, Perkantoran, dan Akuntansi, 6 (2), August 2025: 286 – 295
DOI: https://doi.org/10.21009/jpepa.0602.05

intelligence, ethical conduct, and the essential skills required by individuals, society, the nation, and the state. In reference to this legal provision, it is evident that all members of society, regardless of background, must be granted fair and equal access to quality education. Schools are one of the teaching facilities that can be felt by all levels of society in Indonesia. Schools can also be interpreted as one of the main supporting elements of teaching that is useful for forming student character and correcting the teaching of these students (Simanjorang & Naibaho, 2023). As one of the teaching facilities that can be reached by the community, schools play an important role in efforts to improve individual quality. In schools, of course, there is an implementation of learning. The implementation of learning is a means to develop student competence. When learning takes place, there is a communication process that takes place between students, teaching staff (teachers) and learning materials. The communication that occurs will of course be effective if the teaching staff uses the right delivery facilities or learning media. The communication that occurs between teaching staff and students is certainly not far from the content of the learning material being carried out. The material or explanation delivered by teaching staff to students can be done directly (orally or verbally), not directly (non-verbally), to visualizing it directly.

When delivering a discussion, learning media is needed. The definition of learning media is a communication tool that aims to ensure that the message conveyed by the sender or teacher to students is conveyed properly so that students can be encouraged to think, pay attention, and even their interests and talents when learning takes place. According to Sudarsono and Evelin in (Adam, 2023), there are several functions of learning media, namely; as a reference for learning objectives; motivating students; a means of providing information; encouraging students to discuss; directing activities that will be carried out by students; the main reference for conducting evaluations and exams; strengthening the learning that has been taught and providing simulation experiences.

When the learning process takes place, teachers usually use various tools during the learning process such as photos to props in an effort to provide a more real impression to students and to increase their motivation and knowledge. As time goes by, learning media continues to develop with the aim of improving more interactive and comprehensive learning. One example of technology that can be developed as a learning medium is Augmented Reality (AR). Augmented Reality (AR) technology is a concept depiction of visual content layering (such as images) which is a science and which can display virtual objects in real time in two dimensions or three dimensions by integrating them into the real world environment. In addition, quoting from a book entitled Augmented reality a partial guide by Stephen Coward and Mark Faila, Augmented Reality (AR) is a natural way to explore 3D objects and AR data and a concept that combines visual reality with world reality. The advantage of this technology is that this technology can engineer images into real objects and can be viewed from various perspectives directly or in real time. This can be used as a means of learning, especially to show objects that are difficult to reach or not owned by schools due to limited facilities and infrastructure at the school.

Based on observations carried out by researchers during the 5-month Teaching Skills Practice (PKM) at SMKN 48 Jakarta for Phase F students (grade XI), the development of Augmented Reality (AR)-based learning media needs to be carried out especially for subjects that require visual media in them. The subject of Office Facilities and Infrastructure Management Automation is one of the subjects that requires the development of Augmented Reality (AR)-based technology in it. In the subject, there are learning elements that can utilize Augmented Reality (AR)-based learning media, namely the Office Equipment or Supplies element. This learning element aims to explain about office equipment or supplies.

In explaining the material of the two elements, the researcher still found several obstacles, including: (1) Teachers still rely too much on textbooks when explaining the material

Jurnal Pendidikan Ekonomi, Perkantoran, dan Akuntansi, 6 (2), August 2025: 286 – 295
DOI: https://doi.org/10.21009/jpepa.0602.05

on the elements of Office Equipment or Supplies. (2) Teachers do not provide enough visualization of the types of office equipment because they only rely on visual media in the form of images from textbooks or the internet. (3) The quality of the Office Infrastructure and Facilities Management Automation book does not sufficiently explain or visualize the forms of types of office equipment or supplies. In the Office Infrastructure and Facilities Management Automation book, the types of equipment or supplies are explained with the help of illustrations or sketches and the explanations are still narrative. This presentation is difficult for students to understand because it is still abstract. In addition, the images presented in the textbook are relatively small and only show one or two examples of types of office equipment or supplies so that with a size that is not too large it seems unrealistic. (4) Students who have physical limitations or special needs find it difficult to digest learning, thus hindering the learning process. (5) Lack of facilities and infrastructure for common office equipment and supplies such as typewriters, webcams, fax machines and paper shredders, so that students are still unfamiliar with these items.

After being reviewed from various learning perspectives, Office Facilities and Infrastructure Management Automation on the Office Equipment or Supplies element requires media that can overcome the limitations of the textbook in order to provide appropriate and concrete illustrations with the needs of the subject. According to Karuni et al. (2024), when learning uses learning media that resembles the original form, there will be two benefits, namely: (1) stimulating students' interest in learning. (2) concepts, ideas and learning objectives can be clearly understood by students. By using these learning media, it is easier for students to construct the material taught into their minds properly. Thus, to convey learning materials for Office Equipment or Supplies requires realistic, flexible and easy-to-use media. Based on several problems above, this motivates researchers to develop learning media through research on Office Facilities and Infrastructure Management Automation based on Augmented Reality (AR).

LITERATURE REVIEW

Model Development Concept

Development according to Dzulfiqar in (Ritonga et al., 2022) is a way to improve the quality of technical, theoretical, conceptual and moral abilities that will be adjusted to needs through teaching education and trials or training. Development also has another meaning, namely an activity to develop something by adding, improving, both based on quantity and quality based on the thing or object being studied (Waruwu, 2024). The Research and Development Method is a research method that aims to create or perfect a product in the world of teaching. In its implementation, there are several development approaches that can be used as references, namely: (1) Borg and Gall Approach (1983), (2) ADDIE Approach (2005), and (3) 4D Approach according to Thiagarajan et al (1974)

The Borg and Gall development model or what can be called a waterfall development model is a relatively long development model because there are 10 implementation steps in it. The 10 steps include preliminary studies, planning, design development, Preliminary Field Testing, revision of field test results, main field test, revision of wider field test results, feasibility test, final revision of feasibility test results, and dissemination and implementation of the final product. Then, the ADDIE development model is a type of development that has five stages, namely Analysis, Design, Develop, Implement, and Evaluation. Finally, the 4D development model has 4 stages, namely; (1) Define; (2) Design; (3) Develop; (4) Disseminate.

Learning Platform

In terms of language, "media" etymologically comes from Latin, namely medius, which literally means "middle" or "intermediary". Meanwhile, according to the Big Indonesian

Jurnal Pendidikan Ekonomi, Perkantoran, dan Akuntansi, 6 (2), August 2025: 286 – 295
DOI: https://doi.org/10.21009/jpepa.0602.05

Dictionary (KBBI), media is defined as a channel or channel used to communicate messages. The intermediary in the media itself means a link between the message given by the sender of the message to the recipient of the message. According to Briggs in (Junaidi, 2019). "media is any physical tool that can present a message to stimulate students during the learning process. According to Gerlach & Ely in (Mardiana, 2020), there are three characteristics of why media is used, namely fixative characteristics, manipulative characteristics, and distributive characteristics. The fixative characteristic explains that learning media must be able to demonstrate functions in documenting, archiving, and maintaining and re-displaying certain events or objects that have occurred. Then, the manipulative characteristic shows that the learning process that usually takes days can be presented to students in just two to three minutes by utilizing data recording techniques such as time-lapse recording. Finally, the distributive characteristic explains that an ideal learning aid can transfer an event across spatial boundaries, and simultaneously present it to many students with relatively uniform experiences of the event.

Augmented Reality

Quoted from "Augmented reality: a practical guide" Cawood and Mark Fiala define Augmented Reality (AR) as an organic step to explore 3D (three-dimensional) objects and data. This technology is also known as a combination of virtual reality and the real world, which allows digital objects in the form of 2D or 3D to appear as if they really exist in the physical environment. With Augmented Reality (AR), users can observe the real world around them which has been added with virtual elements from computer processing. According to Azuma, (1997) in Dani (2022),Augmented Reality (AR) has three main characteristics, including 1) Combining elements from the virtual world with the physical environment, 2) Interacting directly in real time, 3) Integrated 3D. This technology is designed with the real environment as the main foundation, which covers about 75% of the entire display. The rest, about 25%, is filled with virtual elements that are combined with contextual data to strengthen user understanding. The type of contextual data added can be audio, geographic information, historical background, or other forms as needed.

Office Equipment or Supplies and Furniture

According to Erika Revida in Nurrisma et al (2021) the definition of office equipment is tools used by employees to complete their work. The absence of equipment will make it difficult to achieve the goals of the office. Office equipment that is inadequate or does not meet the needs of workers can also hinder the work process of office workers so that the output produced by workers does not match the goals of the office itself. Office equipment includes supporting facilities related to activities in the office environment, such as filing cabinets, document racks, computers, and printers. In supporting work, of course, the company must be able to provide facilities for employees. According to Santoso, office equipment is a means that helps speed up the work process. This is also in line with the expression of The Liang Gie who stated that office equipment includes various tools that function to record, send, duplicate and manage information materials that work mechanically, electrically, electronically, typing or chemically.

METHOD

This study uses the Research and Development (R&D) method with the aim of producing a valid and practical product in the form of Augmented Reality (AR)-based learning media called *kantAR*. The development model adopted in this study is the 4D model (Define, Design, Develop, Disseminate) proposed by Thiagarajan et al (1974), which includes a systematic flow of analysis, design, validation, testing, and implementation. The entire process

was carried out at SMKN 48 Jakarta for the subject of *Automation of Office Facilities and Infrastructure Management.*

Define

This stage needs analysis was conducted through classroom observation and interviews with teaching staff and students during the Teaching Skills Practice. The analysis identified several issues in learning delivery, such as the lack of media variety, low student interest, and the absence of visual aids in textbooks. These findings confirmed the need to develop more interactive and visual learning tools using AR technology to help students visualize office equipment that is abstract or not available in the school environment.

Design

This stage involved planning the content and interface of the AR media, including 3D object modeling, interactive features, and user navigation. The AR media was designed to present 3D visuals of various office tools (e.g., typewriters, webcams, fax machines), along with their functions and usage. The instruments used to assess the product are summarized in Table 1. Each instrument used a 5-point Likert scale (Very Good to Very Poor). The score percentages were interpreted based on the following feasibility categories in Table 2.

Table 1. Instrument Summary and Source

Instrument type	Validator/Respondent	Indicators Assessed	Reference
Media Expert Questionnaire	Educational Technology Lecturer	Software Quality, Usability, Multimedia, Navigation	McCall's Software Quality Factors
Materials Expert Sheet	Subject Teacher at SMKN 48 Jakarta	Content Relevance, Clarity, Learning Objectives	Wahyono in Dewi, (2020)
Student Respon Sheet	Class XI students	Ease of Use, Visual appeal, Content Understanding	Martin & Betrus, (2019)

Table 2. The Percentage Analysis of Feasibility Criteria

Evaluation (%)	Information
81 - 100	Very Worth It
61 – 80	Worth
41 - 60	Quite Decent
21 - 40	Not feasible
0 – 20	Totally Unworthy

Develop

At this stage, the media was developed using Unity, Vuforia SDK, Blender, and CorelDraw. The prototype was validated by two experts: one in subject matter and one in media. Validity was determined through expert judgment using Aiken's V formula (all items scored > 0.80), and reliability was tested using Cronbach's Alpha with scores > 0.70, indicating strong internal consistency.

Usability and practicality were evaluated through two stages: (a) One-to-one testing with 3 students selected by purposive sampling (high, medium, and low academic performance); and (b) Small group testing with seven randomly selected students to assess collaborative usage and general usability.

Disseminate

The development of the AR-based instructional media *kantAR* was conducted using the 4D model (Define, Design, Develop, Disseminate) proposed by (Thiagarajan et al., 1974) .The

Jurnal Pendidikan Ekonomi, Perkantoran, dan Akuntansi, 6 (2), August 2025: 286 – 295
DOI: https://doi.org/10.21009/jpepa.0602.05

purpose of this product is to help students visualize and better understand various types of office equipment that are difficult to access or abstract in nature.

RESULTS AND DISCUSSION

The development of Augmented Reality-based instructional media *kantAR* was carried out using the 4D development model, consisting of four stages: Define, Design, Develop, and Disseminate in Thiagarajan et al (1974).This section presents the product outcomes at each stage and discusses the evaluation results, both quantitative and qualitative, supported by relevant literature. The final product is an Android-based application named *kantAR* (Figure 1), which utilizes Augmented Reality (AR) technology to visualize 3D models of various office equipment. The application includes four main features: (1) AR Visualization that projects 3D images of office tools when scanned using a camera and marker, (2) Material Menu with textual explanations, (3) Quiz Menu to test students' understanding, and (4) Navigation features such as back buttons and homepage access. The AR content focuses on tools such as paper shredders, typewriters, safes, fingerprint machines, and others that are often abstract and unavailable in schools. To ensure the media was appropriate for classroom use, three evaluation instruments were used: expert validation sheets (media and material) and a student response questionnaire.

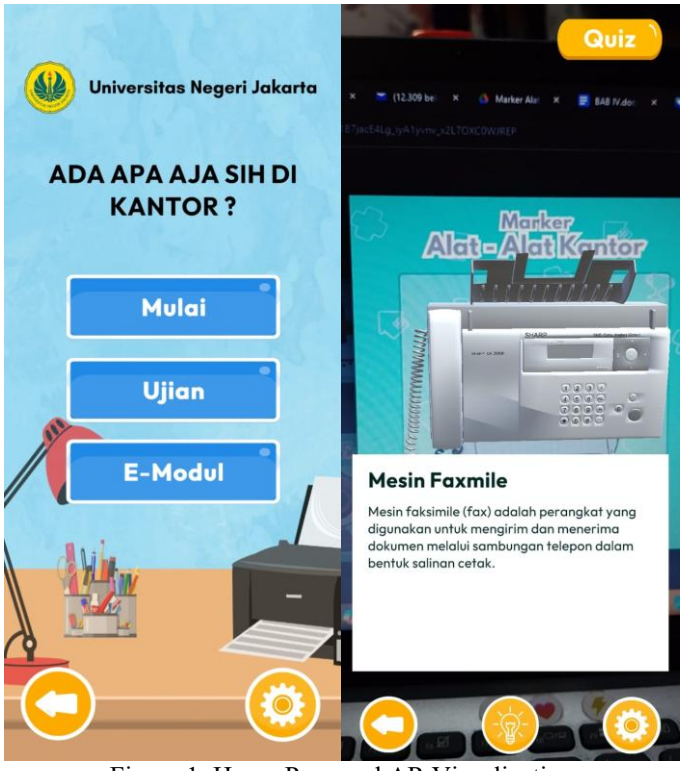

Figure 1. Home Page and AR Visualization

Feasibility Evaluation by Experts

Two experts were involved in validating the media: a subject matter expert (a teacher of the *Automation of Office Facilities and Infrastructure Management* subject at SMKN 48 Jakarta) and a media expert (a university lecturer in instructional media). The material expert focused on the accuracy, relevance, and pedagogical appropriateness of the content, while the media expert evaluated usability, multimedia elements, interface design, and software stability.

The result of the expert assessments are presented in Table 3. The experts' suggestions included improving the readability of on-screen text, adjusting the animation speed of 3D

models, and harmonizing the color theme with student visual comfort. These revisions were applied before further testing.

These findings are in line with Habibi et al. (2023) ,who found that learning media with high interactivity and immersive features such as AR-tend to receive high feasibility ratings. Darojat et al. (2022) also reported that expert validation in AR-based learning development often results in "very feasible" scores when media is designed to align closely with learner needs and content relevance.

Table 3. Expert Validation Results

Validator	Total Score	Max Score	Percentage	Category
Expert 1	89	100	89%	Very Feasible
Expert 2	90	100	90%	Very Feasible
Amount	**-**	**-**	**89,5%**	**Very Feasible**

Source: Processed by Reasearcher (2025)

Practicality Evaluation by Students

After validation and revision, kantAR was evaluated for practicality through two stages: one-to-one testing and small group testing. The results are shown in Tables 4 and 5.

Table 4. One-To-One Evaluation

Respondents	Score	Max Score	Percentage	Category
Student 1	54	55	98%	Very Practical
Student 2	55	55	100%	Very Practical
Student 3	54	55	98%	Very Practical
Amount	**163**	**165**	**99%**	**Very Practical**

Source: Processed by Reasearcher (2025)

Table 5. Small Group Trial

Respondents	Score	Max Score	Percentage	Category
Student 1	54	55	98%	Very Practical
Student 2	54	55	98%	Very Practical
Student 3	44	55	80%	Very Practical
Student 4	54	55	98%	Very Practical
Student 5	44	55	80%	Very Practical
Student 6	55	55	100%	Very Practical
Student 7	45	55	82%	Very Practical
Amount	**350**	**385**	**91%**	**Very Practical**

Source: Processed by Reasearcher (2025)

While the numerical scores indicate strong acceptance, qualitative observations revealed deeper insights into student experiences. Most students expressed enthusiasm when first interacting with the 3D models, noting that the visualization helped them better understand the tools being studied. One student commented, *"It feels like the tools are right in front of me; I finally understand how they work."* In addition, the quiz feature was perceived as enjoyable and intellectually stimulating, with students describing it as both "fun" and "challenging," which appeared to boost their learning motivation. However, some students particularly in the early stages of use reported difficulty in aligning the AR marker correctly. This suggests the need for clearer operational guidance, such as step-by-step instructions or an in-app tutorial, to support smoother navigation during initial use

These responses confirm the findings of Lee et al. (2020) who emphasized that AR improves learner engagement and motivation, especially when abstract materials are visualized

in 3D. Martin & Betrus (2019) also noted that learners tend to perform better when media combines visual, textual, and interactive elements.

Discussion

The feasibility and practicality scores of kantAR mirror trends found in similar AR development research. In a study by Habibi et al. (2023), AR media in higher education was perceived as highly practical due to the realism and autonomy it offers in student-centered learning. Similarly, Azuma (cited in Dani, 2022) outlined that the key features of AR—real-time interaction, 3D integration, and virtual-real merging—are especially valuable in vocational contexts. Compared to traditional methods relying on 2D textbooks, AR-based learning makes the content more tangible, flexible, and accessible. This supports Cawood & Fiala (2008), who assert that AR functions as a bridge between abstract conceptualization and real-world experience.

In this study, kantAR successfully addressed several problems identified during the Define phase: limited media variation, low student interest, and minimal visualization. The media not only visualized objects but also fostered active learning through interaction, in line with experiential learning theory. Furthermore, the integration of AR increased student engagement and provided an authentic learning experience that supported deeper understanding of the material (Lim & Lim, 2020). The positive response from students and the high feasibility and practicality scores suggest that kantAR has strong potential to enhance vocational learning outcomes. Future implementation could focus on scaling its use to different subjects or integrating gamification features to further improve motivation and retention.

CONCLUSION AND RECOMMENDATION

The findings of this study suggest that *kantAR* has strong potential as a complementary learning tool in vocational education, particularly in subjects that require the visualization of physical tools and equipment. Its interactive features, 3D visualization capabilities, and user-friendly interface make it a valuable asset for teachers aiming to enhance student engagement and understanding. To maximize its effectiveness, future development should consider expanding the application to be compatible with multiple operating systems and improving usability under various lighting conditions. Furthermore, the inclusion of guided tutorials or onboarding features within the application would help new users interact more effectively with the AR environment. From an instructional standpoint, integrating AR media such as *kantAR* into daily teaching practice can support more flexible, student-centered learning and contribute to the digital transformation of vocational education.

Although the development and implementation of *kantAR* showed positive results, this study has several limitations that should be acknowledged. First, the application was only developed and tested for Android devices, which restricts its accessibility for users of other platforms such as iOS or Windows-based systems. This technological limitation may hinder broader adoption in diverse classroom settings. Second, the Augmented Reality functionality was found to be less optimal in environments with poor lighting conditions, which can disrupt marker detection and user interaction during learning sessions. Additionally, the media was implemented and evaluated in a single vocational school with a relatively small number of student respondents. As a result, the generalizability of the findings may be limited.

Based on these findings and the limitations, several recommendations can be made. Future researchers are encouraged to further improve the interactivity and dynamic features of the AR application, such as adding audio explanations, more complex object animations, or real-time simulations. Larger-scale testing across multiple schools and with a more diverse student population is also recommended to strengthen the generalizability of the results. In

Jurnal Pendidikan Ekonomi, Perkantoran, dan Akuntansi, 6 (2), August 2025: 286 – 295
DOI: https://doi.org/10.21009/jpepa.0602.05

addition, exploring other instructional design models such as ADDIE or SAM may provide new perspectives in structuring AR-based learning.

For educators and institutions, adopting AR tools like *kantAR* should be considered a strategic move toward more interactive and student-centered instruction. Teachers are advised to continuously improve their digital competencies, particularly in integrating AR into lesson planning. Schools should also invest in adequate technological infrastructure to support the use of such media, including device availability and classroom connectivity. Finally, AR integration should be viewed not merely as a novelty, but as a pedagogical innovation aligned with the demands of 21st-century education.

REFERENCES

Adam, A. (2023). Pengaruh Media Pembelajaran Audio Visual Terhadap Minat Belajar Siswa Sekolah Dasar. *Journal of Contemporary Issue in Elementary Education (JCIEE)*, 29-37.

Azuma, R. T. (1997). A survey of augmented reality. *Presence: Teleoperators & Virtual Environments*, *6*(4), 355–385. https://doi.org/10.1162/pres.1997.6.4.355

Borg, & Gall. (1983). *Educational research: An introduction*. New York Longman.

Cawood, S., & Fiala, M. (2008). *Augmented reality: A practical guide*. Pragmatic Bookshelf.

Dani, H. (2022). Effect of financial literacy on investment decision among economics students. *Journal of Finance & Economics Research*, *7*(1), 16–30. https://doi.org/10.20547/jfer2207102

Darojat, M. A., Ulfa, S., & Wedi, A. (2022). Pengembangan virtual reality sebagai media pembelajaran sistem tata surya. *Jurnal Kajian Teknologi Pendidikan*, *5*(1), 91–99. https://doi.org/10.17977/um038v5i12022p091

Habibi, A., Muhaimin, M., Danibao, B. K., Wibowo, Y. G., Wahyuni, S., & Octavia, A. (2023). ChatGPT in higher education learning: Acceptance and use. *Computers and Education: Artificial Intelligence*, *5*, 100190.

Junaidi, J. (2019). Peran Media Pembelajaran Dalam Proses Belajar Mengajar. *Diklat Review : Jurnal Manajemen Pendidikan Dan Pelatihan*, *3*(1), 45–56. https://doi.org/10.35446/diklatreview.v3i1.349

Karuni, R. D., Fauzi, A., & Adha, M. A. (2024). Boosting Learning Independence: The Role of Youtube, Creativity, and Peer Influence in Vocational Education. *Jurnal Pendidikan Ekonomi, Perkantoran, Dan Akuntansi*, *5*(1), 197–208. https://doi.org/10.21009/jpepa.0501.19

Lim, K.Y.T. and Lim, R. (2020), Semiotics, memory and augmented reality: History education with learner-generated augmentation. *Br J Educ Technol*, 51: 673-691. https://doi.org/10.1111/bjet.12904

Lee, J., Park, Y., & Kim, H. J. (2020). The effects of augmented reality-based learning on students' motivation and achievement in science education. *Educational Technology Research and Development*, *68*(1), 2921–2941. https://doi.org/10.1007/s11423-020-09714-2

Mardiana, E. (2020). Penerapan Model Pembelajaran Gerlach and Ely untuk Meningkatkan Hasil Belajar IPA Siswa kelas IV MIN 12 Bandar Lampung. *Jom Ftk Uniks*, *1*(2), 70–85.

Martin, F., & Betrus, A. K. (2019). Digital Media for Learning. In *Digital Media for Learning*. Springer. https://doi.org/10.1007/978-3-030-33120-7

Nurrisma, N., Munadi, R., Syahrial, S., & Meutia, E. D. (2021). Perancangan Augmented Reality dengan Metode Marker Card Detection dalam Pengenalan Karakter Korea. *Informatika Mulawarman : Jurnal Ilmiah Ilmu Komputer*, *16*(1), 34. https://doi.org/10.30872/jim.v16i1.5152

Ritonga, A. P., Andini, N. P., & Iklmah, L. (2022). Pengembangan Bahan Ajaran Media. *Jurnal Multidisiplin Dehasen (MUDE*, *1*(3), 343–348. https://doi.org/10.37676/mude.v1i3.2612

Simanjorang, R. R., & Naibaho, D. (2023). Fungsi Sekolah. *Jurnal Pendidikan Sosial Dan Humaniora*, *2*(4), 12706–12715. Retrieved from https://publisherqu.com/index.php/pediaqu/article/view/698.

Thiagarajan, S., Semmel, D. S., & Semmel, M. I. (1974). *Instructional development for training teachers of exceptional children: A sourcebook*. Indiana University.

Wahyono, T., & Dalam Dewi, P. O. (2020). *Instrumen validasi media dan bahan ajar dalam pembelajaran*. Universitas Negeri Jakarta.

Waruwu, M. (2024). Metode Penelitian dan Pengembangan (R&D): Konsep, Jenis, Tahapan dan Kelebihan. *Jurnal Ilmiah Profesi Pendidikan*, *9*(2), 1220–1230. https://doi.org/10.29303/jipp.v9i2.2141