

## Student Acceptance of Augmented Reality as a Learning Tool

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### Abstract

The current education system has been shaped and enhanced by technological advancements. Among these new technologies, Augmented Reality (AR) holds great potential in providing innovative educational techniques. The use of AR applications has been increasingly adopted in the educational sector, positively impacting the learning process. This paper focuses on students' acceptance of AR applications as a learning tool, specifically using the AR application, Storybook. Data was collected via a questionnaire and analyzed using the Statistical Package for Social Sciences (SPSS). The results indicate a positive acceptance of AR applications among users, particularly in their learning experience.

**Keywords:** Augmented Reality, Application, Students Acceptance, Educational Tools, Technology

### 1.0 Introduction

The evolution of the education system is closely aligned with technological progress. In the 21st century, rapid technological developments have significantly influenced the current state of education (Amalina & Melor, 2021). Olena Lutsenko et al. (2023) assert that educators must adapt to the latest technological trends to provide the best learning experience for

students. Consequently, the adoption of innovative approaches is necessary to keep up with the changing times (Zilong et al., 2021).

Augmented Reality (AR) has become increasingly recognized across various sectors, including education, tourism, art, manufacturing, rehabilitation, entertainment, and healthcare (Yunqiang et al., 2019). As stated by Amalina & Melor (2021), AR's growing application in education enriches the teaching and learning process. The AR is defined as a physical, real-world environment that has been enhanced in real-time through computer-generated information (Julie & Borko 2014 & Ammar et al., 2017).

Besides, AR is also considered as a technology that enables interactions between the physical and digital worlds (Hassan et al., 2021, Fatih & Monika 2021). AR makes the interaction between computer-generated objects and the real world, an application concept that combines the physical world with the digital world. Researchers (Marina et. al. 2021 & Ammar et al., 2017), further explain that AR serves as a virtual visual approach in classrooms, creating an interactive learning environment that resembles the real world. Through AR, digital information is integrated into physical settings, making learning more engaging (Chen et al., 2020).

In addition, researchers (Valarmathie et al., 2019 & Wang & Yang, 2016), highlight that AR's primary objective is not only to display information but also to facilitate teaching approaches that process the presented information. By increasing user interaction and engagement, AR helps produce an environment that mirrors real-world settings through a combination of text, audio, video, and images (Duzyol et al., 2022). This technology, characterized by 3D virtual objects, allows users to interact using devices like cameras, smartphones, and tablets (Fatih & Monika, 2021; Lee et al., 2017).

### **Augmented Reality as Learning Tools**

The ability of AR to create a virtual environment that closely resembles the real world makes it an attractive teaching tool, particularly for delivering blended learning materials in the classroom (Amalina & Melor, 2021; Marina et al., 2021; Barrow et al., 2019). AR's features, such as providing real-world-like settings and displaying additional visual

information, significantly support children's learning (Fatih & Monika, 2021). Its potential as a teaching method has led to its widespread use in the education sector (Danaei et al., 2020).

Studies by Fatih & Monika (2021) and Dobrovská & Vanecek (2021) confirm that AR is suitable for various educational fields and that its application effectively diversifies the learning process. AR not only enriches students' experiences and facilitates their learning but also boosts their motivation and engagement (Chen et al., 2017). Various studies agree that the integration of AR into the learning and teaching process offers numerous benefits, including enhanced student achievement, motivation, and more effective teaching approaches by educators (Amalina & Melor, 2021; Fatih & Monika, 2021; Rambli et al., 2013).

Moreover, Fatih & Monika (2021) and Hossain & Ahmed (2021) acknowledge the growing use of AR across different educational domains aimed at improving the learning process. Mohamed et al. (2022) assert that AR leads to a more positive effect and fosters creative thinking when used to understand learning content. This is supported by multiple studies showing that the use of AR not only expands students' thinking but also enhances their learning experience (Amalina & Melor, 2021; Safar et al., 2017). AR's interactive input using visual and sound elements further enhances real-world environments, helping students focus and concentrate during the learning process (Duzyol et al., 2022). With various AR production methods such as communicating with 3D objects makes AR learning materials more interesting than traditional learning methods (Ong et al 2021). The use of AR applications as a teaching tool enhances children's focus, attention, and concentration during the learning process, making it more enjoyable (Duzyol et al., 2022; Hassan et al., 2021; Kuzgun, 2019). According to Duzyol et al. (2022) and Chen et al. (2017), AR not only adds an element of fun to learning but also stimulates children's senses, increases their curiosity, enhances focus and attention, and encourages exploration.

### **Student Acceptance Augmented Reality as Learning Tool**

Research indicates a high rate of student acceptance of AR as an educational tool. For instance, Juan Li (2021) reported that 70% of children accepted learning through AR, which also improved their understanding. AR helps students gain deeper insights and develop a

greater interest in subjects (Juan Li, 2021; Zongzhen, 2020). Duzyol et al. (2022). In addition, Y. Ma (2020) found that AR technology's immersive experience enhances students' hands-on abilities and increases their interest through visual and auditory stimulation. Furthermore, the study of Duzyol et al., 2022, Gül & Şahin, 2017, states that students accept the use of AR technology in the learning process because the virtual learning environment as if it were the real world helps improve student creativity.

Moreover, research by Fatih & Monika (2021) revealed that AR not only enhances children's learning efficiency but also increases their interest, motivation, and skill level. Duzyol et al. (2022) demonstrated that AR applications are more effective in teaching spatial knowledge to preschool children than traditional two-dimensional visuals. This reinforces the idea that students are excited about using AR in their learning processes. Additionally, studies by Irma Savitri & Erista (2020) and Zheyu (2022) indicate that AR as a learning tool in subjects like English vocabulary makes the learning process more engaging and well-received by students. Norazilawati et al. (2022) found that students showed a high level of interest in learning Science using AR applications, demonstrating that AR significantly boosts students' engagement. Similarly, studies by Fatih (2022) and Necla & Neslihan (2022) indicate that using AR in learning leads to positive changes in children, including an increase in their observation skills and an overall sense of enjoyment. Phil et al. (2018) further support these findings, stating that AR enables students to learn more quickly and effectively compared to traditional methods.

## **2.0 Method**

This study was designed to explore user acceptance of Augmented Reality as a learning tool. The AR application "Storybook - The Curious Rabbit" was employed for this purpose. The application was developed using Unity and utilized Vuforia for marker creation. It was installed on Android mobile phones to facilitate the study.

## **2.1 Data Collection and Analysis**

The study employed a random sampling method, involving a total of 31 students. Among them, 7 students were under 10 years old, and 24 were over 10. Questionnaires were distributed to collect data, focusing on demographic information, knowledge of augmented reality technology, and attitudes towards AR as a learning tool. The questionnaire used a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Data analysis was conducted using descriptive methods such as frequency, percentage, and mean, utilizing the Statistical Package for Social Sciences (SPSS).

## **3.0 Result**

### **3.1 Users Perception on the An AR Storybook**

As shown in Table 3.1, 54.8% of respondents agreed, and 41.9% strongly agreed that the content of the AR storybook aided their understanding. For the item, "The graphics used in the storybook are interesting and exciting," 51.6% strongly agreed, while 32.3% agreed. Additionally, 54.8% of respondents strongly agreed, and 32.3% agreed that "The Augmented Reality (AR) concept in the storybook is fun and exciting." This positive perception extended to the use of animation and audio elements in the AR application, with 51% strongly agreeing and 35.5% agreeing that these features enhanced their understanding.

**Table: 3.1 The Users Perception on the An AR Storybook**

Item	The Users Perception on the An AR Storybook	SD %	D %	NA %	A %	SA %	MIN
1.	This content helps in the process of understanding the storybook.	0	0	3.2	54.8	41.9	4.4
2.	The graphic used in the storybook are interesting and exciting.	0	3.2	12.9	32.3	51.6	4.3
3.	I think the Augmented Reality (AR) concept in the storybook is really fun and exciting.	3.2	3.2	9.7	32.3	54.8	4.4
4.	I am satisfied with the information obtained.	3.2	0	9.7	41.9	48.4	4.4
5.	The use of animation element in Augmented Reality (AR) is very attracting and exciting.	0	3.2	6.5	35.5	51.6	4.3
6.	The use of audio elements in Augmented Reality (AR) really helps with the understanding the content.	0	3.2	6.5	38.7	48.4	4.3

\*-The average: 4.3

\* SD - Strongly Disagree, D – Disagree, NA - Neither, A – Agree and SA – Strongly Agree

### 3.2 Users Acceptance on The Augmented Reality as Learning Tool

Table 3.2 illustrates that 42% of respondents agreed, and 38.7% strongly agreed with the statement, "I am very interested in learning educational content using Augmented Reality (AR)." Furthermore, 41.9% strongly agreed that the AR application in learning was "interesting and pleasant to use." Nearly half (48.4%) of the students agreed, and 38.6% strongly agreed that "Augmented Reality (AR) helps improve my understanding of learning." A significant 54.6% strongly agreed, and 39% agreed with the statement,

Students also found that AR promotes creativity, with 51.6% strongly agreeing and 29% agreeing with the statement, "This method of learning (Augmented Reality) can make me more

creative." Additionally, 48.4% of respondents agreed, and 35.5% strongly agreed that "The AR application increases my focus during the learning process."

**Table 3.2 The Users Acceptance on The Augmented Reality as Learning Tool**

Item	The Users Acceptance on The Augmented Reality as Learning Tool	SD %	D %	NA %	A %	SA %	MIN
1.	I am very interested to learn educational content using Augmented Reality (AR).	0	3.2	16.1	42	38.7	4.2
2.	Augmented Reality (AR) application in learning was interesting and pleasant to use.	0	3	16.1	39	41.9	4.2
3.	Augmented Reality (AR) helps me improve in understanding the learning.	6.5	0	6.5	48.4	38.6	4.1
4.	The used of Augmented Reality (AR) make me more interested in learning session.	3.2	3.2	6.5	41.9	45.2	4.2
5.	Learning using this method does not bored me.	3.2	0	3.2	39	54.6	4.4
6.	This method of learning (Augmented Reality) can make me more creative.	0	6.5	12.9	29	51.6	4.3
7.	Augmented Reality (AR) is very useful for me in learning.	0	9.7	9.7	45.1	35.5	4.1
8.	I'm feel comfortable using Augmented Reality (AR) in learning	0	0	16.1	48.4	35.5	4.2

9.	Augmented Reality (AR) application increase my focus during learning process.	3.2	0	12.9	48.4	35.5	4.1
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\*-The average: 4.2

\* SD - Strongly Disagree, D – Disagree, NA - Neither, A – Agree and SA – Strongly Agree

### 3.3 The Users Perception on the Augmented Reality as a Learning Tool

Table 3.3 summarizes students' perceptions of AR as a learning tool. The analysis shows that 54.8% of the respondents agreed, and 41.9% strongly agreed that they are skilled at using AR, indicating a high level of confidence in their ability to use this technology. Regarding comfort and interest in using AR, 51.6% agreed, and 29% strongly agreed, while only 9.7% disagreed. This suggests that most students find AR applications easy to use and enjoyable, although a small fraction may face challenges in its usage.

Moreover, when asked if AR is an effective way to attract users to the application for learning purposes, 51.6% of respondents strongly agreed, and 32.3% agreed. Additionally, 51.6% of respondents strongly agreed, and 35.5% agreed that the animation elements in AR are very attractive, further emphasizing the importance of visual and interactive components in enhancing the learning experience.

Overall, the data in Table 3.3 underscores the versatility of AR as a tool that not only facilitates learning but also actively engages students through interactive elements. However, it is essential to consider the minority of students who expressed neutrality or disagreement with certain aspects of AR's usability. This finding indicates the need for ongoing efforts to refine AR applications to ensure they are accessible and beneficial for all students.



**Table 3.3: The Users Perception on the Augmented Reality as a Learning Tool**

Item	The Users Perception on the Augmented Reality as a Learning Tool	SD %	D %	NA %	A %	SA %	MIN
1.	I am very skilled at using Augmented Reality (AR).	0	0	3.2	54.8	41.9	4.4
2.	I am very interested and comfortable using Augmented Reality (AR).	0	9.7	9.7	51.6	29	4.0
3.	It is easy learning using Augmented Reality (AR).	3.2	3.2	9.7	58.1	25.8	4.0
4.	The use of Augmented Reality (AR) is one of the ways to attract users to use the application in learning.	0	0	16.1	32.3	51.6	4.4
5.	The use of animation element in Augmented Reality (AR) is very attracting.	3.2	3.2	6.5	35.5	51.6	4.3
6.	The use of audio elements in Augmented Reality (AR) really helps with the understanding and enjoyable.	3.2	3.2	6.5	38.7	48.4	4.3

\*-The average: 4.2

\* SD - Strongly Disagree, D – Disagree, NA - Neither, A – Agree and SA – Strongly Agree

#### 4.0 Discussion

In conclusion, this study aimed to identify students' acceptance of the use of AR applications as a learning tool. The study found that the use of elements such as animation, visuals, and text built into the AR application helped respondents understand the learning content. Previous research, such as studies by Fatih (2022), Ong et al. (2021), and Rasslenda et al. (2014), supports this finding, noting that AR is widely used in educational environments and has proven successful in improving learning experiences. Furthermore, studies by Phil et

al. (2018) and Nurullizam & Noor Fatin Nadia (2019) demonstrate that many AR applications effectively enhance student engagement, understanding, and knowledge retention.

Additionally, the study results show that most respondents are interested and comfortable using AR in learning. The positive reception toward AR indicates that its interactive elements contribute to creating a fun and engaging learning environment, aligning with findings by Marina et al. (2021) and Zheyu (2022). These studies suggest that the inclusion of AR in educational practices not only sparks interest and motivation but also enhances students' cognitive skills, such as imagination, focus, and memory.

However, while this study's findings are promising, it is important to critically examine potential challenges associated with implementing AR in education. One of the key concerns is accessibility. Not all schools or students have access to the necessary devices or infrastructure to use AR effectively (Akçayır & Akçayır, 2017). To ensure the widespread adoption of AR in education, policymakers and educators need to work together to make AR technology more accessible, especially in less privileged areas.

Another potential issue is the need for adequate training for both educators and students. The results in Table 3.3 indicate that while most students feel skilled in using AR, a small portion remains neutral or disagrees, possibly due to a lack of familiarity with the technology. Bacca et al. (2014) emphasize that proper training is essential for students and educators to utilize AR effectively in educational settings. Without sufficient training, there is a risk that AR may not be integrated into the curriculum as effectively as it could be, potentially leading to underutilization of this powerful tool.

Moreover, while the interactive and sensory-rich nature of AR has been shown to enhance engagement (Ibáñez & Delgado-Kloos, 2018), there is a potential risk of distraction. If AR content is not carefully designed with educational objectives in mind, students might focus more on the technological aspects rather than the learning content itself (Chen & Tsai, 2019). This finding underscores the importance of designing AR content that balances engagement with educational value. Future research should focus on how AR applications can be optimized to maximize learning outcomes without overwhelming or distracting students.

Furthermore, integrating AR with traditional teaching methods can create a balanced learning environment. Hung et al. (2016) suggest that while AR significantly increases engagement, it should complement rather than replace conventional teaching methods. A mixed approach can cater to various learning styles, providing a more holistic educational experience.

Lastly, while this study provides insights into the immediate acceptance of AR, long-term effects on learning outcomes, retention, and cognitive development need further exploration. Garzón and Acevedo (2019) argue that more extensive, longitudinal studies are necessary to understand the sustained impact of AR on students' academic performance and skill development.

## **5.0 Conclusion**

This study indicates that students exhibit positive acceptance of AR as a learning tool, as reflected in their enhanced engagement, interest, and comfort while using AR applications. The findings suggest that AR can significantly improve students' learning experiences by incorporating interactive elements such as animations, visuals, and audio. These elements stimulate students' curiosity, creativity, and understanding, making AR a versatile tool in education.

Despite the positive outcomes, several factors must be considered for the effective implementation of AR in educational settings. Accessibility remains a significant concern, and efforts must be made to ensure AR technology is available to a broader range of students. Additionally, educators and students require adequate training to fully utilize AR's potential, ensuring that the technology is integrated into the curriculum effectively. The potential risk of distraction from AR's interactive elements should also be addressed through careful content design that emphasizes educational objectives.

In conclusion, AR has the potential to transform educational practices by providing an immersive, engaging, and effective learning environment. Nevertheless, its success depends on strategic implementation, ongoing research, and a balanced integration with traditional teaching methods. Future research should focus on exploring the long-term effects of AR in education and developing guidelines for optimizing AR content to suit diverse learning needs.

## References

- Abutayeh, K., M. Kraishan, O., & Q. Kraishan, E., (2022). *The Use of Virtual and Augmented Reality in Science and Math Education in Arab Countries: A Survey of Previous Research Studies*. 10.3389/feduc.2022.979291.
- Abdullah, N., Baskaran, V. L., Mustafa, Z., Ali, S. R., & Zaini, S. H., (2022). *Augmented Reality: The Effect in Students' Achievement, Satisfaction and Interest in Science Education*. International Journal of Learning, Teaching and Educational Research Vol. 21, No. 5, pp. 326-350, May 2022.
- Akçayır, M., & Akçayır, G. (2017). *Advantages and challenges associated with augmented reality for education: A systematic review of the literature*. *Educational Research Review*, 20, 1-11. <https://doi.org/10.1016/j.edurev.2016.11.002>
- Ammar H. Safar, Ali A. Al-Jafar, Zainab H. Al-Yousefi (2017). *The Effectiveness of Using Augmented Reality Apps in Teaching the English Alphabet to Kindergarten Children: A Case Study in the State of Kuwait*. EURASIA Journal of Mathematics Science and Technology Education ISSN 1305-8223.
- Aydoğdu, F., (2022). *Augmented Reality for Preschool Children: An Experience with Educational Contents*. British Journal of Education Technology. Br J Educ Technol.
- Aydoğdu, F., & Kelpšiene, M., (2021). *Uses of Augmented Reality in Preschool Education*. International Technology and Education Journal Vol. 5 No. 1; June 2021 ISSN: 2602-2885.
- Bacca, J., Baldiris, S., Fabregat, R., Graf, S., & Kinshuk. (2014). *Augmented reality trends in education: A systematic review of research and applications*. *Educational Technology & Society*, 17(4), 133-149.
- Barrow, J., Forker, C., Sands, A., O'Hare, D., & Hurst, W. (2019). *Augmented Reality for Enhancing Life Science Education*. Proceedings of The Fourth International Conference on Applications and Systems of Visual Paradigms, Rome: Italy.
- Carlo H. Godoy Jr. (2020). *Augmented Reality for Education: A Review*. International Journal of Innovative Science and Research Technology. Volume 5, Issue 6, June – 2020. ISSN No: -2456-2165.
- Chen, M.-P., Wang, L.-C., Zou, D., Lin, S.-Y., Xie, H., & Tsai, C.-C. (2020). *Effects of Captions and English Proficiency On Learning Effectiveness, Motivation And Attitude In Augmented-Reality-Enhanced Theme-Based Contextualized EFL Learning*. Computer Assisted Language Learning, 1–31. doi:10.1080/09588221.2019.1704787.

- Chen, C.-H., & Tsai, C.-C. (2019). Examining the effects of students' perceived relevance, intrinsic, and extrinsic motivation on augmented reality (AR) learning application use. *Computers & Education*, 137, 45-57. <https://doi.org/10.1016/j.compedu.2019.04.014>
- Chen, Y., Wang, Q., Chen, H., Song, X., Tang, H., Tian, M., (2019). *An Overview of Augmented Reality Technology*. Conf. Series: Journal of Physics: Conf. Series 1237 (2019) 022082. ICSP 2019. IOP Publishing doi:10.1088/1742-6596/1237/2/022082
- Chen, Y., Zhou, D., Wang, Y., & Yu, J. (2017, June). *Application of Augmented Reality for Early Childhood English Teaching*. In 2017 International Symposium on Educational Technology (ISET) (pp. 111-115). IEEE.
- Danaei, D., Jamali, H. R., Mansourian, Y., & Rastegarpour, H. (2020). *Comparing Reading Comprehension Between Children Reading Augmented Reality and Print Storybooks*. *Computers & Education*, 103900. doi: 10.1016/j.compedu.2020.103900.
- Delianidi, M., Papanikolaou, A., Ilioudis, C. (2021). *A Mobile Augmented Reality (mAR) Blended Learning Application for Primary School Pupils*.
- Diegman, P., Kraepelin, M. S., Eynde, S., and Basten, D., (2018). *Benefits of Augmented Reality in Educational Environments – A Systematic Literature Review*. 12th International Conference on Wirtschaftsinformatik.
- Dobrovaska, D., & Vanecek, D. (2021). *Implementation of Augmented Reality into Student Practical Skills Training*. In International Conference on Intelligent Human Systems Integration (pp. 212-217). Springer, Cham.
- Düzyol, E., Yıldırım, G. & Özyılmaz, G., (2022). *Investigation of The Effect of Augmented Reality Application on Preschool Children's Knowledge of Space*. *Journal of Educational Technology & Online Learning* Volume 5. Issue 1.
- Garzón, J., & Acevedo, J. (2019). Meta-analysis of the impact of augmented reality on students' learning gains. *Educational Research Review*, 27, 244-260. <https://doi.org/10.1016/j.edurev.2019.04.001>
- Gopalan, V., Abu Bakar, J., Zulkifli, A., N., and Alwi, A., (2019). *A Review of Augmented Reality Elements in Science Learning*. *Journal of Telecommunication, Electronic and Computer Engineering* e-ISSN: 2289-8131 Vol. 10 No. 1-10.
- Hassan, S. A., Rahim, T., & Shin, S. Y., (2021). *ChildAR: An Augmented Reality-Based Interactive Game for Assisting Children in Their Education*. *Universal Access in the Information Society*, 1-12.

- Hasbi, A., & Md Yunus, M., (2019). *A Systematic Review of Augmented Reality in English Language Learning*. International Journal of Academic Research in Progressive Education and Development Vol. 10, No. 2, 2021, E-ISSN: 2226-6348.
- Hossain, M. J., & Ahmed, T. (2021). *Augmented Reality-Based Elementary Level Education for Bengali Character Familiarization*. SN Computer Science, 2(1), 1-9.
- Hung, Y.-C., Lin, M.-Y., & Hwang, G.-J. (2016). The formative assessment design for AR-based learning in authentic contexts. *Journal of Educational Technology & Society*, 19(4), 212-225.
- Ibáñez, M. B., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers & Education*, 123, 109-123. <https://doi.org/10.1016/j.compedu.2018.05.002>
- Jamiat, N., & Othman, N, F, N. (2019). *Effects of Augmented Reality Mobile Apps on Early Childhood Education Students' Achievement*. ICDTE 2019, October 25–27, 2019, Yamanashi, Japan © 2019 Association for Computing Machinery. ACM ISBN 978-1-4503-7220-6/19/10.
- Jie, O., H., Mohammed, N., Feng, L., C., (2021). *An Augmented Reality-Based Solution for Visualization of Crystal Model and Composition to Improve Students' Learning*. *Journal of Advanced Computing Technology and Application*. ISSN: 2672-7188 Vol. 3 No. 2 November 2021.
- Juan Li (2021). *Research on the Reform and Innovation of Preschool Education Informatization under the Background of Wireless Communication and Virtual Reality*. *Wireless Communications and Mobile Computing* Volume 2021, Article ID 3176309,
- J. Zongzhen, (2020). *Preschool Education Information Technology Innovation and Application Research Comment On "Basics and Application of Preschool Education Information Technology*. *Science and Technology Management Research*, Vol. 40, No. 24, P. 263.
- Lee, L. K., Chau, C. H., Chau, C. H., & Ng, C. T. (2017, June). *Using Augmented Reality to Teach Kindergarten Students English Vocabulary*. In 2017 International Symposium on Educational Technology (ISET) (pp. 53- 57). IEEE. 10.1109 / ISET.2017.20.
- Lutsenko O., Seminikhyna N., Svyrydiuk T., (2023). *Teachers' Perspectives on Teaching and Learning Methods*. ISSN 2308-4855 (Print), ISSN 2308-4863

- Pan, A., (2022). *Application of Augmented Reality in the Teaching of English in Early Childhood*. Education Advances in Social Science, Education and Humanities Research, volume 670. Proceedings of the 2022 3rd International Conference on Mental Health, Education and Human Development (MHEHD 2022).
- Pan, Z., Lopez, M. F., Li, C., & Liu, M., (2021). *Introducing Augmented Reality in Early Childhood Literacy Learning*. Research in Learning Technology Vol. 29, 2021.
- P. Diegmann, M. Schmidt-Kraepelin, S. Eynden, and D. Basten, (2015). *Benefits of Augmented Reality in Educational Environments-A Systematic Literature Review, Benefits*, vol. 3, no. 6, 2015.
- Rambli, D. R. A., Matcha, W., & Sulaiman, S. (2013). *Fun Learning with AR Alphabet Book for Preschool Children*. Procedia Computer Science, 25, 211-219.
- Rasalingam, R., Muniandy, B., & Rasalingam (2014). *Exploring the Application of Augmented Reality Technology in Early Childhood Classroom in Malaysia*. IOSR Journal of Research & Method in Education (IOSR-JRME) e-ISSN: 2320-7388, p-ISSN: 2320-737X Volume 4, Issue 5 Ver. IV (Sep-Oct. 2014), PP 33-40.
- Sadikin, I. S. & Martyani, E., (2020). *Integrating Augmented Reality (Ar) In Efl Class for Teaching Vocabulary*. Project (Professional Journal of English Education) p-ISSN 2614-6320 Volume 3, No. 2, March 2020 e-ISSN 2614-6258.
- Safar, A. H. (2017). *The Effectiveness of Using Augmented Reality Apps in Teaching the English Alphabet to Kindergarten Children: A Case Study in the State of Kuwait*. EURASIA Journal of Mathematics, Science and Technology Education, 13(1). doi:10.12973/eurasia.2017.00624a
- Sunarti. Widyatmoko, T., & Bukhori, H, A., (2021). *An Experimental Approach in Implementation of Virtual Reality for Improving Psychomotor Skill in Listening Course*. Advances in Social Science, Education and Humanities Research, volume 612 International Seminar on Language, Education, and Culture (ISoLEC 2021).
- T.H. Wang and K.T. Yang, (2016). *Technology-Enhanced Science Teaching and Learning*. Issues and trends, In Science Education Research and Practice in Asia, pp. 461-481.
- Usta, N. D., & Ultay, N., (2022). *Augmented Reality and Animation Supported-STEM Activities in Grades K12: Water Treatment*. Indonesian Society for Science Educator. Journal of Science Learning. J. Sci.Learn.2022.5(3).439-451.
- Y. Ma, (2020). *Current Status and Prospects of Preschool Education Informatization Research*. China Educational Technology and Equipment, vol. 15, pp. 66-69+79.

Zahran, M., B., Youssef, A., Y., Ahmed, E., W., Ouf, G., M., Elazony, M., A., Mohamed, M., B., (2022). *Designing a Program using Augmented Reality Technologies and some Interactive Educational Aids to Simplify Science of Remote sensing for Elementary School Students*. Information Sciences Letters an International Journal. Inf. Sci. Lett. 11, No. 5, 1791-1803 (2022).