

# THE EFFECT OF AUGMENTED REALITY MEDIA AND MOTIVATION TOWARDS STUDENTS' LEARNING OUTCOMES IN TRADITIONAL GAMES: PHYSICAL, SPORT, AND HEALTH EDUCATION

## O EFEITO DA MÍDIA DE REALIDADE AUMENTADA E A MOTIVAÇÃO NOS RESULTADOS DE APRENDIZAGEM DE ALUNOS EM JOGOS TRADICIONAIS: EDUCAÇÃO FÍSICA, ESPORTIVA E DE SAÚDE

**Gede Eka Budi Darmawan**

Universitas Pendidikan Ganesha, Indonesia

[budi.darmawan@undiksha.ac.id](mailto:budi.darmawan@undiksha.ac.id)

**Ni Nyoman Parwati**

Universitas Pendidikan Ganesha, Indonesia

[nyoman.parwati@undiksha.ac.id](mailto:nyoman.parwati@undiksha.ac.id)

**I Wayan Sukra Warpala**

Universitas Pendidikan Ganesha, Indonesia

[wayan.sukra@undiksha.ac.id](mailto:wayan.sukra@undiksha.ac.id)

**Dewa Gede Hendra Divayana**

Universitas Pendidikan Ganesha, Indonesia

[hendra.divayana@undiksha.ac.id](mailto:hendra.divayana@undiksha.ac.id)

---

**Received:** 16 Mar 2023

**Accepted:** 25 Jul 2023

**Published:** 04 Aug 2023

**Corresponding author:**

[budi.darmawan@undiksha.ac.id](mailto:budi.darmawan@undiksha.ac.id)

---



**Abstract:** This study aimed at investigating the effect of augmented reality media and motivation towards students' learning outcomes in traditional games as a subject in Physical, Sport, and Health Education. Quantitative approach was adapted as the research design particularly in the form of Quasi Experimental with 2x2 Factorial Model. The population was eight-grade students at SMPN 1 Singaraja in which there were 80 students selected as research sample by using random sampling technique. The data were collected through post-test and pre-test by using biometric test (written test) as the research instrument. The obtained data were analysis descriptively and inferentially with the assistance of SPSS 25. The findings showed 1) there is a difference in learning outcomes between students who are taught by augmented reality and students who are taught by conventional learning; 2) there is an interaction effect between media and motivation towards learning outcomes; 3) high motivated students taught by augmented reality outperform high motivated students taught by conventional learning ; 4) less motivated students taught by augmented reality show less performance than low motivated students taught by conventional learning.

**Keywords:** Augmented reality. Motivation. Learning outcomes. Traditional games.

**Resumo:** Este estudo teve como objetivo investigar o efeito da mídia de realidade aumentada e a motivação nos resultados de aprendizagem dos alunos em jogos tradicionais como disciplina de Educação Física, Esporte e Saúde. A abordagem quantitativa foi adaptada como o desenho de pesquisa particularmente na forma de Quasi Experimental com Modelo Fatorial 2x2. A população era composta por alunos da oitava série da SMPN 1 Singaraja, na qual havia 80 alunos selecionados como amostra de pesquisa usando a técnica de amostragem aleatória. Os dados foram coletados por meio de pós-teste e pré-teste, utilizando-se o teste biométrico (teste escrito) como instrumento de pesquisa. Os dados obtidos foram analisados de forma descritiva e inferencial com o auxílio do SPSS 25. Os resultados mostraram 1)

há uma diferença nos resultados de aprendizagem entre alunos que são ensinados por realidade aumentada e alunos que são ensinados por aprendizagem convencional; 2) existe um efeito de interação entre mídia e motivação para os resultados de aprendizagem; 3) alunos altamente motivados ensinados por realidade aumentada superam alunos altamente motivados ensinados por aprendizagem convencional; 4) alunos menos motivados ensinados por realidade aumentada apresentam menor desempenho do que alunos pouco motivados ensinados por aprendizagem convencional.

**Palavras-chave:** Realidade aumentada. Motivação. Resultados de aprendizagem. Jogos tradicionais.

## 1. Introduction

Physical, Sport, and Health Education (PE) is commonly recognized as a learning process dominantly dealing with a practical or physical activity (Hyndman et al., 2020). It is relevant to the recent problem occurs at SMPN 1 Singaraja as one of state junior high schools which adapts Physical, Sport, and Health Education (PE) as a compulsory learning subject. The preliminary observation shows that most of eighth-grade students not passing the minimum standard set in the curriculum due to the lack of comprehension on the concepts of traditional games in Physical, Sport, and Health Education subject. It directly affects their psychomotor since the students' have a low competence towards traditional games skills. It becomes a serious problem considering that Physical, Sport, and Health Education has been manifested in a new paradigm in which it is regarded as a learning subject aims at developing students' cognition, psychomotor, and affective through healthy life style, mobility skills, and physical fitness (Aktop & Karahan, 2012; Haris, 2018; Gholy et al., 2022; Rosmi; 2016).

Traditional games as one of the topics emphasized in Physical, Sport, and Health Education has an objective to build students' cognition, affective, and psychomotor through the provision of games-based traditional values (Arifin & Haris, 2018). The traditional games are integrated in Physical, Sport, and Health Education purposed for junior high school students where they are involved in playing many traditional schools consisting of local culture values (Widodo & Lumintuarso, 2017). There are various traditional games applied in Physical, Sport, and Health Education where the primary students are trained physically in a fun way, for example; *Engklek* (jumping using bamboo), *Slodor* (crossing lines), and *Balap Karung* (sack racing). Those traditional games improve students' biometric skills through muscles training, feasibility, flexibility, and balance (Bile et al., 2021). Anggita et al., (2019) state that students are supposed to have a rich conceptualized understandings on traditional games since the games dealing with students' cognition before developing their biometric

skills. It indicates that students not only deal with physical activity in traditional games but they are supposed to master the traditional games concepts.

Since conceptual comprehension is important in Physical, Sport, and Health Education, the lack of conceptual comprehension is perceived as an issue leading students to have a low competence in traditional games (Syafriadi et al., 2021). The lack of conceptual comprehension is commonly related to students' learning motivation. Peng and Fu (2021) argue that learning motivation is a significant factor influencing students' understanding in which the higher students' motivation, then the students are able to comprehend the learning materials faster. Learning motivation drives students' understanding by improving their learning enthusiasm and directs their learning behaviours reflected on students' learning outcomes (Eriyanto et al., 2021). Therefore, learning motivation is a crucial factor in determining students' comprehension in the learning process.

Increasing students' learning motivation to lead students' learning comprehension can be achieved by applying appropriate learning media since it has a function to deliver the learning materials for the students (Akbar & Hariyanto, 2022; Hidayat, 2018; Sulasteri et al., 2018). The rapid development of technology allows teachers to integrate technology in the learning process including in Physical, Sport, and Health Education. Augmented reality is a recent technology means which is commonly used in Physical, Sport, and Health Education (Baabdullah et al., 2022). Moreno-Guerrero et al., (2020) define augmented reality as a learning media combining the real-world complementary information and technological device to promote an interaction increasing students' active participations and motivation. Briefly, augmented reality is a technology device combining the real world and virtual world presented in the real-time interaction (Suryadi et al., 2023).

The use of augmented reality in the learning process has attracted many researchers in examining its effectiveness. Chang et al., (2020) compare the augmented reality effectiveness and video-instruction effectiveness in Physical, Sport, and Health Education. It reveals that the augmented reality is more effective than video-instruction in improving students' motor skills. Liang et al., (2023) examine the contribution of augmented reality as an innovative learning media in Physical, Sport, and Health Education. It is found out the augmented reality has a high contribution in appealing students' learning motivation directly influencing their learning outcomes. Another study also shows that augmented reality significantly influences students' learning outcomes in football basic passing subject (Kumalasari &

Ridwan, 2023). Regarding to those previous studies, it indicates that augmented reality has a significant role in Physical, Sport, and Health Education but there is no recent study discussing about the augmented reality effectiveness in traditional games as a learning topic in Physical, Sport, and Health Education since the recent problem related to students' lack conceptual understanding. The augmented reality has been perceived as an effective media to increase students' learning motivation and outcomes. Therefore, this study is conducted as further research to investigate the effect of augmented reality media and motivation towards students' learning outcomes in traditional games: physical, sport, and health education.

## **2. Research design and methods**

The research design of this study was in the form of Quasi Experimental with 2x2 factorial model underlined by quantitative approach. There were three variables in this research such as; The augmented reality media as independent variable, students' learning motivation as moderator variable, and students' learning outcomes in traditional games subject as dependent variable. The population was eight-grade students at SMPN 1 Singaraja in which there were 80 students involved as a research sample. They were selected by using random sampling technique. The data were collected by conducting pre-test and post-test where the students were divided into four main groups, such as; 1) control group with high motivation, 2) control group with low motivation, 3) experimental group with high motivation, and 4) experimental group with low motivation. The instruments used in this study was biometric cognitive test (written test) related to traditional games. The data were analysed descriptively and inferentially by using descriptive statistical analysis and One-Way ANOVA with the assistance of SPSS 25.

## **3. Results**

After collecting the data, then, the obtained data from students' tests were analyzed both descriptively and inferentially. The result of descriptive statistics can be seen in Table 1 as follows.

Table 1. Descriptive Statistics

Groups	Mean	Std. Deviation
High motivation of the experimental group	85.30	4.079
Low motivation of the experimental group	74.40	4.570
High motivation of the control group	77.40	4.914
Low motivation of the control group	81.25	4.723

Table 1 shows the result of descriptive statistics from the students in the experimental and control group. It shows that high motivated students who followed augmented reality obtained a mean score of 85.30 with standard deviation of 4.079. Then, low motivated students who followed augmented reality obtained a mean score of 74.40 with a standard deviation of 4.570. Next, high motivated students who followed conventional learning obtained a mean score of 77.40 with a standard deviation of 4.914. Lastly, low motivated students who followed conventional learning obtained a mean score of 81.25 with a standard deviation of 4.723. From the result of Table 1, it can be concluded that there is a different result between the experimental and control group based on their motivation. High motivation of the experimental group outperforms low motivation of the experimental group, whereas low motivation of the control group outperforms high motivation of the control group.

Then, further analysis was conducted on inferential statistics. It preceded with a prerequisite test, namely normality, and homogeneity. The results of normality test and homogeneity were presented in Table 2 and 3 as follows.

Table 2. Normality Test

Tests of Normality							
	students	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Groups	1	.179	20	.091	.927	20	.134
	2	.198	20	.039	.948	20	.343
	3	.249	20	.002	.927	20	.137
	4	.154	20	.200*	.933	20	.177
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

Table 2 shows the result of normality test. The sample of each group was less than 50 samples indicating sig. value of Shapiro-Wilk was considered. The sig value of group 1 (high motivation of experimental group) was 0.134, group 2 (low motivation of experimental group) was 0.343, group 3 (high motivation of control group) was 0.137, and group 4 (low motivation of

control group) was 0.177. The results of sig. value from the four groups above were over 0.05 indicating the obtained data were normal.

Table 3. Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Groups	Based on Mean	.224	3	76	.879
	Based on Median	.153	3	76	.928
	Based on Median and with adjusted df	.153	3	72.462	.928
	Based on trimmed mean	.290	3	76	.833

Table 3 shows the result of homogeneity test. The sig. value based on mean was 0.879. It showed that the sig. value was over 0.05. It indicated that the obtained data were homogeneous.

Since the prerequisite test was completed in which the data were normal and homogeneous, inferential analysis was conducted to examine the different results of experimental and control groups. The results of the inferential analysis can be seen in Tables 4 to 7 as follows.

***The Difference in Learning Outcomes Between the Experimental and Control Group***

Table 4. Different Effects Between the Experimental and Control Group

ANOVA					
Groups					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1341.837	3	447.279	21.305	.000
Within Groups	1595.550	76	20.994		
Total	2937.387	79			

Table 4 shows the result of different results through ANOVA test. It showed that the sig. value of analysis was 0.000. The value was less than 0.05. It indicated that there was a significant difference between the experimental and control group. It can be concluded that there is a difference in students learning outcomes between students who are taught by augmented reality and conventional learning.

***Interactional Effect between Augmented Reality and Motivation***

Table 5. Interactional Effect between Augmented Reality and Motivation

Tests of Between-Subjects Effects	
Dependent Variable: Students	

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1341.837 <sup>a</sup>	3	447.279	21.305	.000	.457
Intercept	506733.613	1	506733.613	24136.978	.000	.997
Motivation	248.513	1	248.513	11.837	.001	.135
Media	5.513	1	5.513	.263	.610	.003
Motivation * Media	1087.813	1	1087.813	51.815	.000	.405
Error	1595.550	76	20.994			
Total	509671.000	80				
Corrected Total	2937.387	79				

a. R Squared = .457 (Adjusted R Squared = .435)

Table 5 shows the interactional effect between motivation and media (augmented reality). It shows that the result of sig. value of Motivation \* Media was 0.00 and the value of Partial Eta Squared was 0.405. The sig. value showed that there was a significant effect between motivation and media on students' learning outcomes. In addition, the value of Partial Eta Squared showed the contribution effect of motivation and media about 40% on students' learning outcomes.

***Differences in Learning Outcomes Between Students with High Motivation Taught by Augmented Reality and Students Taught by Conventional Learning***

Table 6. Differences in Learning Outcomes Between Students with High Motivation Taught by Augmented Reality and Students Taught by Conventional Learning

Scheffe						
		Mean Difference (I-J)			95% Confidence Interval	
(I) Group	(J) Group		Std. Error	Sig.	Lower Bound	Upper Bound
High Experimental	High Control	7.900*	1.449	.000	3.76	12.04

\*. The mean difference is significant at the 0.05 level.

Table 6 shows the results of the Scheffe test. It showed the difference in learning outcomes between students with high motivation taught by augmented reality and students taught by conventional learning. The sig. value was 0.000. It was less than 0.050 indicating a significant difference between students with high motivation who are taught by augmented reality and conventional learning. Students with high motivation taught by augmented reality outperformed students taught by conventional learning. It was reflected in the mean of the groups in which high experimental group obtained 85.30 and high control group obtained 77.40. as presented in previous Table 1 above.

***Differences in Learning Outcomes Between Students with Low Motivation Taught by Augmented Reality and Students Taught by Conventional Learning***

Table 7. Differences in Learning Outcomes Between Students with Low Motivation Taught by Augmented Reality and Students Taught by Conventional Learning

Scheffe						
		Mean Difference (I-J)			95% Confidence Interval	
(I) Group	(J) Group		Std. Error	Sig.	Lower Bound	Upper Bound
Low Experimental	Low Control	6.850*	1.449	.000	2.71	10.99

\*. The mean difference is significant at the 0.05 level.

Table 7 shows the results of the Scheffe test. It showed the difference in learning outcomes between students with low motivation taught by augmented reality and students taught by conventional learning. The sig. value was 0.000. It was less than 0.050 indicating a significant difference between students with low motivation who are taught by augmented reality and conventional learning. Students with low motivation taught by conventional learning outperformed students taught by conventional learning. It was reflected in the mean of the groups in which low experimental group obtained 74.40 and high control group obtained 81.25 as presented in previous Table 1 above.

#### 4. Discussion

The first finding of this study revealed that there was a difference in the learning outcomes between experimental and control group. It happens due to the use of augmented reality and students' motivation itself during the learning process. Augmented reality gives benefits as learning media for students in which the learning process presents reality to the students (Mahendra, 2016; Mustaqim, 2016). Students can feel real situation due to the use of technology as initiated by augmented reality. In addition, augmented reality provides interesting and interactive display for students (Seviana et al., 2022). Students can see the three dimensions as presented in this media to visualize a real word condition. Moreover, augmented reality also avoids students' boredom during the learning process (Iskandar & Mayarni, 2022). The involvement of technology presents a new atmosphere for students in joining the learning process. Students are presented with a virtual condition which emphasizes the understanding of the students. Therefore, the involvement of augmented reality presents new condition for



students in their learning. The effectiveness of the augmented reality has been also revealed by some previous studies. Ozdemir et al. (2018), Abdullah et al. (2022), Shaumiwaty et al. (2022), Shiue et al. (2019), and Talan et al. (2022) found that augmented reality has a significant effect on students' achievement. It shows that augmented reality provides a chance for students to increase their achievement.

The second finding of the study revealed that there was interactional effect between motivation and media. It showed that both motivation and media gave effect on students' learning outcomes. Students' motivation can be increased by the use of media (Akbar & Hariyanto, 2022; Hidayat, 2018; Sulasteri et al., 2018). It is because media can be used to deliver learning content which can increase students' motivation since students understand what they learn. Some previous studies have revealed the effect of augmented reality on students' motivation. Erbas and Demirer (2019), Kaur et al. (2020), Kusumo and Afandi (2021), and Kul and Berber (2022) revealed that augmented reality give significant effect on students' motivation. It indicated that augmented reality media can strengthen students' motivation in learning process. Thus, there is interactional effect between augmented reality media and motivation contributing on the learning process.

The third finding revealed that higher motivated students of experimental group outperformed higher motivated students of control group. It is because students with high motivation try to get better result in their environment (Muhammad, 2017). They are willing to do something in order to reach the goal. In addition, high motivated students tended to be serious during the learning process (Sartina & Indartono, 2019). They put their attention on what they are doing. Therefore, students with high motivation will get better result since they are willing to do something attentively.

The last finding reveal that low motivated students of experimental group got less score than control group. Low motivated students do not show seriousness in participating in learning activities (Muhammad, 2017). Moreover, low motivated students are less enthusiastic in learning and participating in class learning (Sartina & Indartono, 2019). Then, it is supported by Annisa (2020) in which low motivation directs students to be lazy in listening listen and paying attention to the lessons delivered by the teacher. In this case, low motivated students taught by augmented reality show less score because they needed to be directed by teachers as what they get in conventional learning. They do something based on the request of their teachers.

## 5. Conclusion

The presents study concludes four main points, namely 1) there is a difference in learning outcomes between students who are taught by augmented reality and students who are taught by conventional learning; 2) there is an interaction effect between media and motivation towards learning outcomes; 3) high motivated students taught by augmented reality outperform high motivated students taught by conventional learning ; 4) less motivated students taught by augmented reality show less performance than low motivated students taught by conventional learning. The result of the present study implicates that learning process needs to be considered the level of student's motivation in using particular media for teaching and learning process. Teachers are suggested to apply augmented reality in the learning process.

---

## References

- Abdullah, N., Baskaran, V. L., Mustafa, Z., Ali, S. R., & Zaini, S. H. (2022). Augmented reality: The effect in students' schievement, satisfaction and interest in science education. *International Journal of Learning, Teaching and Educational Research*, 21(5), 326–350. <https://doi.org/10.26803/ijlter.21.5.17>
- Akbar, R., & Hariyanto, E. (2022). Pengembangan Bahan Ajar Pencak silat Untuk Siswa Sekolah Dasar. *Sport Science and Health*, 2(7), 350–356. <https://doi.org/10.17977/um062v2i72020p350-356>
- Aktop, A., & Karahan, N. (2012). Physical Education Teacher's Views of Effective Teaching Methods in Physical Education. *Procedia - Social and Behavioral Sciences*, 46(2003), 1910–1913. <https://doi.org/10.1016/j.sbspro.2012.05.401>
- Anggita, G. M., Mukarromah, S. baitul, & Ali, M. A. (2019). Eksistensi permainan tradisional sebagai warisan budaya bangsa. *JOSSAE: Journal of Sport Science and Education*, 3(2), 55. <https://doi.org/10.26740/jossae.v3n2.p55-59>
- Annisa, A. N. (2020). Pengaruh Motivasi Belajar Terhadap Prestasi Siswa di Sekolah. *Al-Ittizaan: Jurnal Bimbingan Konseling Islam*, 2(2), 1. <https://doi.org/10.24014/0.8710124>
- Arifin, L. T., & Haris, I. N. (2018). Pengaruh Penerapan Permainan Tradisional Terhadap Kebugaran Jasmani Siswa Kelas VIII SMPN 1 Ciasem Kabupaten Subang (Studi eksperimen Pada Siswa Kelas VIII SMPN 1 Ciasem). *Jurnal Biomekanika*, 4(1), 1–7.
- Baabdullah, A. M., Alsulaimani, A. A., Allamnakhrah, A., Alalwan, A. A., Dwivedi, Y. K., & Rana, N. P. (2022). Usage of augmented reality (AR) and development of e-learning outcomes: An empirical evaluation of students' e-learning experience. *Computers and Education*, 177(3), 1–9. <https://doi.org/10.1016/j.compedu.2021.104383>
- Bile, R. L., Tapo, Y. B. O., & Desi, A. K. (2021). Pengembangan Model Latihan Kebugaran Jasmani Berbasis Permainan Tradisional Sebagai Aktivitas Belajar Siswa Dalam Pembelajaran PJOK. *Jurnal Penjakora*, 8(1), 71. <https://doi.org/10.23887/penjakora.v8i1.30752>
- Chang, K. E., Zhang, J., Huang, Y. S., Liu, T. C., & Sung, Y. T. (2020). Applying augmented reality in physical education on motor skills learning. *Interactive Learning Environments*, 28(6), 685–697. <https://doi.org/10.1080/10494820.2019.1636073>
- Erbas, C., & Demirer, V. (2019). The effects of augmented reality on students' academic achievement and motivation in a biology course. *Journal of Computer Assisted Learning*, 35(3), 450–458. <https://doi.org/10.1111/jcal.12350>

- Eriyanto, G., Roesminingsih, M. ., Soedjarwo, & Soeherman, I. K. (2021). The Effect of Learning Motivation on Learning Independence and Learning Outcomes of Students in the Package C Equivalence Program. *IJORER: International Journal of Recent Educational Research*, 2(4), 455–467. <https://doi.org/10.46245/ijorer.v2i4.122>
- Gholy, M. S., Sumardi, S., & Hadi, S. R. (2022). Pengembangan Model Pembelajaran PJOK Melalui Program SIBBER Untuk Meningkatkan Kebugaran Jasmani Berkarakter Sportivitas. *JOSSAE Journal of Sport Science and Education*, 6(2018), 134–145. <https://doi.org/10.26740/jossae.v6n2.p134-145>
- Haris, I. N. (2018). Model pembelajaran peer teaching dalam pembelajaran pendidikan jasmani. *Biomatika: Jurnal Ilmiah Fakultas Keguruan Dan Ilmu Pendidikan*, 4(1), 1–8.
- Hidayat, R. (2018). Game-Based Learning: Academic Games sebagai Metode Penunjang Pembelajaran Kewirausahaan. *Buletin Psikologi*, 26(2), 71. <https://doi.org/10.22146/buletinpsikologi.30988>
- Hyndman, B., SueSee, B., McMaster, N., Harvey, S., Jefferson-Buchanan, R., Cruickshank, V., Barnes, M., & Pill, S. (2020). Physical education across the international media: a five-year analysis. *Sport, Education and Society*, 25(3), 274–291. <https://doi.org/10.1080/13573322.2019.1583640>
- Iskandar, M. F., & Mayarni, M. (2022). Pengembangan media augmented reality pada materi pengenalan planet dan benda langit pembelajaran IPA sekolah dasar. *Jurnal Basicedu*, 6(5), 8097–8105. <https://doi.org/10.31004/basicedu.v6i5.3730>
- Kaur, D. P., Mantri, A., & Horan, B. (2020). Enhancing student motivation with use of augmented reality for interactive learning in engineering education. *Procedia Computer Science*, 172(2019), 881–885. <https://doi.org/10.1016/j.procs.2020.05.127>
- Kul, H. H., & Berber, A. (2022). The effects of augmented reality in a 7th-grade science lesson on students' academic achievement and motivation. *Journal of Science Learning*, 5(2), 193–203. <https://doi.org/10.17509/jsl.v5i2.42952>
- Kumalasari, A. N., & Ridwan, M. (2023). Pengaruh Penggunaan Media Augmented Reality Terhadap Hasil Belajar Passing Sepak Bola Peserta Didik. *JUMPER (Jurnal Mahasiswa Pendidikan Olahraga)*, 3(2), 101–112.
- Kusumo, D., & Afandi, R. (2021). The effect of augmented reality learning media on motivation and social studies learning outcomes in elementary schools. *Academia Open*, 4, 1–11. <https://doi.org/10.21070/acopen.4.2021.2729>
- Liang, L., Zhang, Z., & Guo, J. (2023). The Effectiveness of Augmented Reality in Physical

- Sustainable Education on Learning Behaviour and Motivation. *Sustainability*, 15(6), 5062. <https://doi.org/10.3390/su15065062>
- Mahendra, I. B. M. (2016). Implementasi augmented reality ( AR ) menggunakan unity 3D dan vuforia sdk. *Jurnal Ilmiah ILMU KOMPUTER Universitas Udayana*, 9(1), 1–5.
- Moreno-Guerrero, A.-J., Garcia, S. A., Navas-Parejo, M. R., Campos-Soto, M. N., & Garcia, G. G. (2020). Augmented reality as a resource for improving learning in the physical education classroom. *International Journal of Environmental Research and Public Health*, 17(10), 2–13. <https://doi.org/10.3390/ijerph17103637>
- Muhammad, M. (2017). Pengaruh Motivasi Dalam Pembelajaran. *Lantanida Journal*, 4(2), 87. <https://doi.org/10.22373/lj.v4i2.1881>
- Mustaqim, I. (2016). Pemanfaatan augmented reality sebagai media pembelajaran. *Jurnal Pendidikan Teknologi Dan Kejuruan*, 13(2). <https://doi.org/10.1109/SIBIRCON.2010.5555154>
- Ozdemir, M., Sahin, C., Arcagok, S., & Demir, M. K. (2018). The effect of augmented reality application in the learning process: A meta-analysis study. *Egitim Arastirmalari - Eurasian Journal of Educational Research*, 74(2018), 165–186. <https://doi.org/10.14689/ejer.2018.74.9>
- Peng, R., & Fu, R. (2021). The effect of Chinese EFL students' learning motivation on learning outcomes within a blended learning environment. *Australasian Journal of Educational Technology*, 37(6), 61–74. <https://doi.org/10.14742/ajet.6235>
- Rosmi, Y. F. (2016). Pendidikan Jasmani Dan Pengembangan Karakter Siswa Sekolah Dasar. *Wahana*, 66(1), 55–61. <https://doi.org/10.36456/wahana.v66i1.482>
- Sartina, S., & Indartono, S. (2019). Pengaruh motivasi belajar, lingkungan sosial, dan sikap belajar terhadap hasil belajar Ekonomi di SMA/MA. *SOCLA: Jurnal Ilmu-Ilmu Sosial*, 16(1), 87–100. <https://doi.org/10.21831/socia.v16i1.27646>
- Seviana, R., Rosyida, F., & Atmoko, R. A. (2022). Pengembangan media pembelajaran augmented reality pada pembelajaran geografi materi planet di tata surya. *Geodika: Jurnal Kajian Ilmu Dan Pendidikan Geografi*, 6(2), 198–208. <https://doi.org/10.29408/geodika.v6i2.6122>
- Shaumiwaty, S., Fatmawati, E., Sari, H. N., Vanda, Y., & Herman, H. (2022). Implementation of augmented reality (AR) as a teaching media in English language learning in elementary school. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 6(6), 6332–6339. <https://doi.org/10.31004/obsesi.v6i6.3398>
- Shiue, Y.-M., Hsu, Y.-C., Sheng, M.-H., & Lan, C.-H. (2019). Impact of an augmented reality

- system on students' learning performance for a health education course. *International Journal of Management, Economics and Social Sciences*, 8(3), 195–204. <https://doi.org/10.32327/ijmess/8.3.2019.12>
- Sulasteri, S., Rusydi Rasyid, M., & Akhyar, M. (2018). the Effect of the Use of Learning Media Based on Presentation Media on Interest and Mathematical Learning Outcomes. *MaPan: Jurnal Matematika Dan Pembelajaran*, 6(2), 221–236. <https://doi.org/10.24252/mapan.2018v6n2a8>
- Suryadi, R., Pratiwi, A., & Suwo, R. (2023). Persepsi Mahasiswa Terhadap Media Pembelajaran Berbasis Augmented Reality Pada Mata Kuliah English for Specific Purpose. *EPIGRAM (e-Journal)*, 20(1), 32–42.
- Syafriadi, S., Lalu Sapta Wijaya Kusuma, & Rusdiana Yusuf. (2021). Integrasi Permainan Tradisional Dalam Metode Pembelajaran Praktik untuk Meningkatkan Minat Belajar PJOK. *Reflection Journal*, 1(1), 14–21. <https://doi.org/10.36312/rj.v1i1.487>
- Talan, T., Yilmaz, Z. A., & Batdi, V. (2022). The effects of augmented reality applications on secondary students' academic achievement in science course. *Journal of Education in Science Environment and Health*, 8(4), 333–347. <https://doi.org/10.55549/jeseh.1193695>
- Widodo, P., & Lumintuarso, R. (2017). Pengembangan model permainan tradisional untuk membangun karakter pada siswa SD kelas atas. *Jurnal Keolahragaan*, 5(2), 183. <https://doi.org/10.21831/jk.v5i2.7215>