JURNAL PENDIDIKAN IPS
https://doi.org/10.37630/jpi.v16i2.4195
Vol.16 No.2, Tahun 2026 | ISSN: 2088-0308 | e-ISSN: 2685-0141

The Effectiveness of Hypernatural Video-Based Learning Media in Enhancing Students' Digital Literacy in Social Studies

Asmaul Husni[1),*], Fawziah Zahrawati B[1)], Hasmiah Herawaty[1)], Fuad Guntara[1)]

[1)]Institut agama Islam Negeri Parepare

*Correspondence: asmaulhusni1901@gmail.com

ABSTRACT

This study analyzes the effectiveness of hypernatural video-based learning media on students' digital literacy in Social Studies. A quantitative approach with a quasi-experimental design (Nonequivalent Control Group Design) was employed. The sample consisted of 40 seventh-grade students at SMPN 8 Parepare. Data were collected through questionnaires, observation, and documentation, and analyzed using descriptive and inferential statistics, including a independent samples t-test. The results showed an increase in the mean score from 57.73 to 61.20, with a significance value of 0.005 ($p < 0.05$), indicating a significant effect. However, the N-Gain score of 0.0661 was categorized as low. These findings suggest that hypernatural video-based learning media effectively improve students' digital literacy, although the magnitude of improvement remains limited. This study reinforces multimedia learning theory while practically providing a reference for developing innovative, technology-based instructional media.

Keywords: Digital Literacy; Hypernatural Video; Social Studies Learning

INTRODUCTION

The integration of digital technology in Indonesian secondary education has increased significantly in recent years, particularly following the COVID-19 pandemic, which accelerated the adoption of technology-based learning in classroom practices (Pradana & Syarifuddin, 2021). Despite this rapid development, students' digital literacy remains a critical concern. Preliminary observations conducted in junior secondary schools indicate that many students tend to use digital devices primarily for accessing information without demonstrating adequate abilities to critically evaluate, interpret, or utilize digital content effectively. This condition reflects a gap between the availability of digital learning media and the development of higher-order digital literacy skills, as also highlighted in previous studies (Rioseco-Pais et al., 2024; Viguer & Picó-Garcés, 2025).

In the context of Social Studies education, this issue becomes more complex, as learning requires students to analyze social phenomena, interpret contextual information, and construct meaningful understanding rather than merely receive information (Hattan et al., 2025). However, classroom practices often show that the use of digital media, particularly video-based learning, is still limited to one-way content delivery, which does not sufficiently support the development of critical and evaluative competencies. This indicates the need for instructional media that not only enhance engagement but also facilitate deeper cognitive processing and digital literacy development.

One emerging approach is the use of hypernatural video-based learning media. In this study, hypernatural video is defined as a form of instructional video that enhances real-world representations through the integration of augmented visual elements, such as intensified visuals, contextual overlays, and semi-immersive representations, to create a more engaging and cognitively stimulating learning experience. Unlike conventional instructional videos, which tend to present information linearly, hypernatural video emphasizes enriched realism and perceptual amplification to support deeper understanding and interpretation of learning content (Pellas, 2025).

Previous studies reveal three major trends in research on video-based learning media and digital literacy. First, a body of research focuses on the effectiveness of conventional video media in improving students'

ISSN: 2088-0308 | e-ISSN: 2685-0141
https://doi.org/10.37630/jpi.v16i2.4195

conceptual understanding and learning outcomes (Brame, 2016; Navarrete et al., 2025; Zhang et al., 2025). Second, a growing number of studies emphasize digital literacy as a critical competency in 21st-century learning, encompassing critical thinking, information evaluation, and digital ethics (Falloon, 2020; Spante et al., 2018). Third, recent research has begun to explore the use of immersive and advanced visual technologies, such as augmented reality, virtual reality, and hypervisual media in educational settings (Chen et al., 2020; Makransky & Petersen, 2021; Radianti et al., 2020). Despite these developments, there remains a significant limitation in integrating hypernatural visual approaches with the development of digital literacy, particularly within the context of Social Studies learning. Most existing studies primarily focus on cognitive outcomes without explicitly linking them to comprehensive digital literacy competencies. Furthermore, research specifically examining the effectiveness of hypernatural video media in enhancing students' digital literacy remains limited, particularly in the Indonesian educational context. Accordingly, a significant research gap exists regarding the integration of hypernatural visual innovation with the strengthening of students' digital literacy in Social Studies. The novelty of this study lies in the application of a hypernatural approach as a learning medium specifically designed to enhance students' digital literacy holistically.

Based on the aforementioned background, this study aims to analyze the effectiveness of hypernatural video-based learning media in improving students' digital literacy in Social Studies. Specifically, the objectives of this study are: (1) to measure the improvement in students' digital literacy following the use of hypernatural video media; (2) to compare the effectiveness of hypernatural media with conventional learning media; and (3) to identify the aspects of digital literacy that are most significantly enhanced through the use of this medium. Furthermore, this research aims to contribute empirically to the creation of novel learning materials that meet the needs of education in the twenty-first century. It is anticipated that educators would use the findings as a guide to create technology-based learning practices that are more successful and contextually relevant. As a result, this research makes both theoretical and practical contributions, especially in the area of social studies teaching. In order to provide a thorough knowledge of the efficacy of hypernatural media in promoting digital literacy, the study focuses on students as the main subjects of digital learning processes.

METHODS

Research Design

The Nonequivalent Control Group Design, a quasi-experimental design, was used in this study's quantitative methodology. In this design, two groups were chosen without random assignment: an experimental class (VII-1) and a control class (VII-2) (Denny et al., 2023). The selection of this design was based on the existing classroom conditions, where intact groups had already been formed, making full randomization impractical. Therefore, the quasi-experimental approach was considered the most appropriate to examine the causal effect of the treatment in a natural classroom setting. The research design is illustrated as follows:

Table 1. The research design

Group	Pretest	Treatment	Posttest
Experimental Class	O_1	X	O_2
Control Class	O_1	-	O_2

In this study, O_1 represents the pretest conducted before the treatment to determine students' initial abilities. X refers to the treatment, which involves the use of hypernatural video-based learning media in the instructional process. After the treatment, O_2 is administered as a posttest to measure changes or improvements in learning outcomes. Meanwhile, the symbol (–) indicates learning conducted without the use of hypernatural video-based media as a comparison.

Research Setting and Participants

This study was conducted at SMPN 8 Parepare over a period of three months, adjusted to the research schedule. The population consisted of all seventh-grade students at SMPN 8 Parepare. The sample included 40 students, divided equally into two groups: 20 students in class VII-1 (experimental group) and 20 students in class VII-2 (control group). The sampling technique employed was cluster sampling, in which intact classes were selected as research groups. The assignment of the experimental and control groups followed the existing

ISSN: 2088-0308 | e-ISSN: 2685-0141
https://doi.org/10.37630/jpi.v16i2.4195

classroom structure without randomization. This approach was considered appropriate given the natural classroom setting, while still allowing for adequate representation of the population.

Data Collection Techniques and Instruments

Questionnaires, documentation, and observation were used to gather data. Observation was conducted systematically using structured observation sheets to assess students' participation and the implementation of hypernatural video-based learning, involving two observers to ensure objectivity. Students' digital literacy was measured using a 15-item questionnaire developed based on five indicators: information understanding, information interpretation, digital communication, critical evaluation, and content creation. The questionnaire employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Documentation was used to support data completeness and validity. Before use, all research instruments underwent validity and reliability testing. Content validity was evaluated by experts to ensure alignment with digital literacy indicators, and reliability was tested using Cronbach's Alpha, with coefficients exceeding 0.70 indicating acceptable internal consistency.

Data Analysis Techniques

Both descriptive and inferential statistics were used in this study's data analysis. The data distribution was described using descriptive statistics, which included percentages, frequency distributions, graphs, histograms, mean, median, mode, and standard deviation. Multiple steps of inferential statistical analysis were carried out:

Assumption testing

Before hypothesis testing, the data were tested for: 1) Normality was tested using the Shapiro–Wilk test for small sample sizes; 2) Homogeneity of variance using Levene's Test. These tests were conducted to ensure that the data met the assumptions required for parametric testing.

Independent sample t-test

The independent sample t-test was employed to compare the posttest scores between the experimental and control groups. This analysis aimed to determine whether the hypernatural video-based learning media produced significantly better outcomes compared to conventional learning methods.

N-Gain analysis

To measure the magnitude of improvement in students' digital literacy, the normalized gain (N-Gain) was calculated using the formula:

$$\text{N-Gain} = \frac{Posttest\ score - Pretest\ score}{Maximum\ score - pretest\ score}$$

The interpretation of N-Gain values is categorized into three levels. A value is considered high if g is greater than 0.70, medium if g ranges between 0.30 and 0.70, and low if g is less than 0.30.

Effect size (Cohen's d)

To determine the strength of the treatment effect, Cohen's d was calculated. The effect size is interpreted as small when d equals 0.20, medium when d equals 0.50, and large when d is greater than or equal to 0.80.

Hypothesis testing criteria

The hypothesis testing criteria were defined: The null hypothesis (H_0) was rejected if the significance value (Sig. 2-tailed) was less than 0.05; otherwise, H_0 was not rejected.

RESULTS AND DISCUSSION

The Improvement in Students' Digital Literacy Following the Use of Hypernatural Video Media

This section analyzes the improvement in students' digital literacy following the implementation of hypernatural video-based learning media in Social Studies. Digital literacy in this study includes students' ability to access, evaluate, and utilize digital information effectively. The use of hypernatural video was intended to provide an immersive learning experience that supports deeper understanding by connecting abstract concepts with real-world contexts. The analysis is based on empirical data supported by relevant theoretical perspectives.

ISSN: 2088-0308 | e-ISSN: 2685-0141
https://doi.org/10.37630/jpi.v16i2.4195

Table 2. Summary of digital literacy improvement and statistical results

Indicator	Pre-Test	Post-Test	Change/Result	Interpretation
Mean Score	57.73	61.20	+3.47	Increased
Standard Deviation	8.115	6.958	Decreased	More consistent scores
Achievement Level (%)	76%	81%	+5%	Good - Good (improved)
Independent sample t-test (Sig.)	-	0.005	$p < 0.05$	Significant difference
N-Gain Score	-	0.0661	Low category	Low improvement magnitude

The findings indicate that students' digital literacy scores increased from a pre-test mean of 57.73 to a post-test mean of 61.20, reflecting a positive gain after the implementation of hypernatural video-based learning media. The standard deviation decreased from 8.115 to 6.958, suggesting that students' performance became more consistent after the intervention. Additionally, the overall achievement level increased from 76% to 81%, both categorized as "good," indicating an upward trend in digital literacy levels. Statistical testing using the independent sample t-test yielded a significance value of 0.005 ($p < 0.05$), confirming that the improvement was statistically significant. However, the N-Gain score was 0.0661, which falls into the low category, indicating that the magnitude of improvement was relatively modest.

This finding aligns with the Cognitive Theory of Multimedia Learning (Carpenter et al., 2020; Mayer, 2021), which suggests that visual and verbal integration enhances learning by optimizing cognitive processing. Several studies have also reported that video-based learning can improve students' understanding and engagement (Jelinek, 2021; Yoon et al., 2021). However, the relatively low N-Gain observed in this study is consistent with findings by Falloon (2020), who noted that improvements in digital literacy often require sustained and repeated exposure rather than short-term interventions. Conversely, some studies have reported higher gains when multimedia learning is combined with interactive or collaborative approaches (Petersen et al., 2022), indicating that media alone may not be sufficient to produce substantial learning improvements. Therefore, while the results confirm the effectiveness of hypernatural video media, they also highlight limitations in terms of impact magnitude.

The implications of these findings suggest that hypernatural video-based learning media can serve as an effective tool for enhancing students' digital literacy, particularly in increasing engagement and improving consistency in performance (Pellas, 2025; Tang, 2024). However, to achieve more substantial improvements, educators should consider integrating this media with other pedagogical strategies, such as problem-based learning or collaborative activities. Additionally, longer implementation periods may be necessary to maximize the benefits of hypernatural media. These findings also emphasize the importance of aligning instructional media with learning objectives, particularly when targeting higher-order digital literacy skills. From a practical perspective, the use of hypernatural video media offers a promising approach to modernizing classroom instruction, although its effectiveness depends on how it is implemented within a broader instructional framework.

Comparing the Effectiveness of Hypernatural Media with Conventional Learning Media

The comparison between hypernatural video-based learning media and conventional learning media is essential to determine the relative effectiveness of innovative instructional approaches. Conventional learning methods, which often rely on teacher-centered instruction and textual materials, may not fully support the development of digital literacy skills required in the 21st century. In contrast, hypernatural video media offers a more dynamic and visually enriched learning experience that is expected to enhance student engagement and comprehension. This section examines whether the use of hypernatural video media leads to better learning outcomes compared to conventional methods, based on both statistical evidence and observational findings.

Table 3. Independent sample t-test results for digital literacy

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	f	Sig. (2-tailed)
					Lower	Upper			
Digital Literacy	Control Class – Experimental Class	-3.475	7.452	1.178	-5.858	-1.092	-2.949	39	.005

ISSN: 2088-0308 | e-ISSN: 2685-0141
https://doi.org/10.37630/jpi.v16i2.4195

An independent samples t-test was conducted to examine the difference in digital literacy scores between the control and experimental groups. The results indicate a statistically significant difference between the two groups. The mean difference of -3.475 suggests that students in the experimental group achieved higher scores than those in the control group. This finding is supported by the t-test results ($t = -2.949$, $df = 39$) with a significance value of 0.005 ($p < 0.05$), indicating that the difference is statistically significant. Furthermore, the 95% confidence interval, ranging from -5.858 to -1.092, does not include zero, confirming the robustness of the observed difference. These findings demonstrate that students exposed to hypernatural video-based learning media performed better than those who received conventional instruction, suggesting that such media provide a more effective and engaging learning environment that enhances students' digital literacy.

These results are consistent with previous studies highlighting the superiority of multimedia-based learning over traditional methods (Mayer, 2021; Noetel et al., 2021). Research by Radianti et al. (2020) also demonstrated that immersive media can enhance learning engagement and motivation. However, some studies argue that the effectiveness of multimedia depends heavily on instructional design and learner characteristics (Mayer, 2021). In cases where multimedia is not well-integrated into the learning process, its impact may be limited. The findings of this study support the argument that while hypernatural media is more effective than conventional methods, its success is influenced by how it is implemented in the classroom context.

The implications of this comparison indicate that educators should move beyond traditional instructional approaches and adopt more innovative media to enhance learning outcomes. Hypernatural video-based learning media can be particularly useful in subjects like Social Studies (Feni Haryati & Nursaptini, 2021; Zakiyyah et al., 2025), where contextual understanding is crucial. However, teachers must ensure that the use of such media is aligned with pedagogical objectives and does not merely serve as a visual enhancement. Additionally, training and support for teachers are essential to maximize the effectiveness of multimedia-based instruction. These findings reinforce the need for a shift toward more student-centered and technology-enhanced learning environments.

Identifying the Aspects of Digital Literacy Most Significantly Enhanced

Understanding which aspects of digital literacy are most significantly enhanced is crucial for evaluating the effectiveness of hypernatural video-based learning media. Digital literacy is a multifaceted construct that includes information understanding, information interpretation, digital communication, critical evaluation, and content creation. This study seeks to identify which of these aspects benefited the most from the intervention, providing insights into the strengths and limitations of hypernatural video media. By analyzing these aspects, the study aims to offer a more nuanced understanding of how digital literacy develops in a technology-enhanced learning environment.

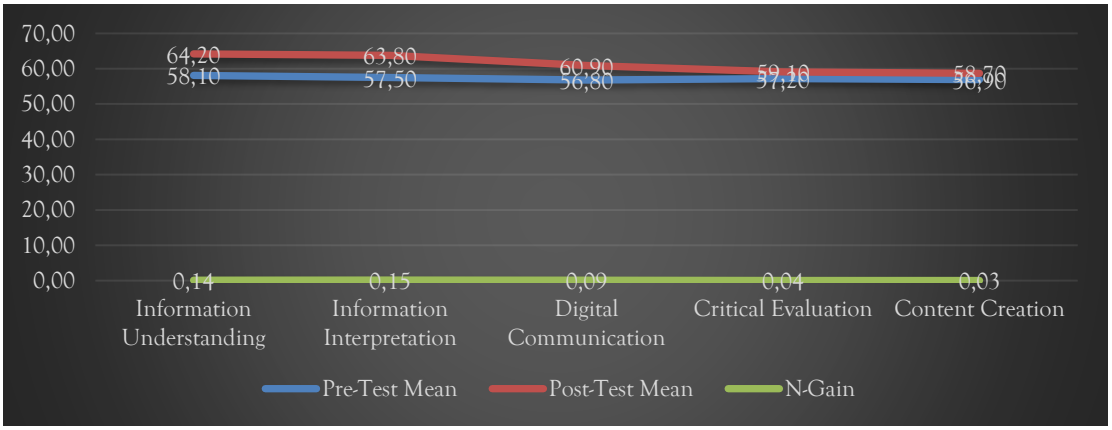

Figure 1. Improvement in digital literacy aspects

The findings indicate that the most substantial improvements were observed in students' abilities related to information understanding (mean increased from 58.10 to 64.20; N-Gain = 0.14) and information interpretation (57.50 to 63.80; N-Gain = 0.15), suggesting that students became more capable of comprehending learning materials and identifying relevant information presented through hypernatural video content. Moderate improvement was also observed in digital communication (56.80 to 60.90; N-Gain = 0.09), although the increase

ISSN: 2088-0308 | e-ISSN: 2685-0141
https://doi.org/10.37630/jpi.v16i2.4195

remained within the low category. This limited gain is attributed to the relatively short duration of the intervention and the nature of communication skills, which require sustained practice and interaction. In contrast, higher-order digital literacy skills, such as critical evaluation (57.20 to 59.10; N-Gain = 0.04) and content creation (56.90 to 58.70; N-Gain = 0.03), showed minimal improvement. The low N-Gain in these domains can be explained by the complexity of higher-order cognitive processes, which demand deeper engagement, reflective thinking, and extended learning time. Additionally, the use of hypernatural video-based media tends to emphasize content delivery rather than active skill construction, thereby limiting opportunities for students to develop critical evaluation and content creation abilities.

Hypernatural video, with its immersive and realistic visual characteristics, tends to facilitate dual-channel processing, enabling students to more easily capture and organize the presented information (Mayer, 2024). This explains why the aspects of information understanding and interpretation demonstrated greater improvement compared to other dimensions. These results are consistent with studies by Navarrete et al. (2025) and Sablić et al. (2021), which indicate that video-based media are effective in enhancing conceptual understanding. However, the limited improvement observed in higher-order skills, such as critical evaluation and content creation, suggests that video-based media tend to be unidirectional, providing fewer opportunities for students to engage in critical thinking and creative production. This is further supported by findings from Spante et al. (2018) and Falloon (2020), which emphasize that the development of advanced digital literacy requires more interactive and reflective learning activities. Additionally, the relatively short duration of the intervention may have constrained the development of higher-order skills, as highlighted by Makransky & Petersen (2021), who argue that technology-enhanced learning requires sustained exposure to produce meaningful outcomes.

The implications of these findings suggest that hypernatural video-based learning media hold strong potential for improving foundational aspects of digital literacy, particularly in terms of information comprehension and interpretation. However, to foster more complex digital literacy skills, such as critical thinking and content creation, it is necessary to integrate these media with more participatory instructional strategies, such as problem-based learning or project-based learning. This aligns with constructivist theory, which emphasizes the importance of active learner engagement in constructing knowledge through meaningful experiences (DeVries, 2000). Furthermore, research by Makransky & Petersen (2021) demonstrates that combining immersive media with interactive learning activities can produce more substantial learning gains. Therefore, educators should design instructional practices that not only leverage the visual strengths of hypernatural video but also incorporate activities that promote analysis, evaluation, and creation. Practically, these findings provide direction for developing more comprehensive technology-based instructional designs, while theoretically reinforcing the notion that the effectiveness of learning media depends on the alignment between technological tools and pedagogical approaches.

CONCLUSION

This study concludes that hypernatural video-based learning media are effective in improving students' digital literacy in Social Studies, as indicated by the increase in posttest scores, although the low N-Gain value shows that the magnitude of improvement remains limited. Compared to conventional learning methods, hypernatural video media demonstrate more effective outcomes. The improvement is most evident in basic digital literacy aspects, particularly in understanding and interpreting information, while higher-order skills such as critical evaluation and content creation show minimal development. These findings indicate that the effectiveness of hypernatural media is constrained by the short duration of implementation and the limited integration of interactive learning strategies. Therefore, future research is recommended to extend the duration of intervention, integrate participatory approaches such as collaborative and problem-based learning, and apply more comprehensive evaluation frameworks to better enhance higher-order digital literacy skills.

References

Brame, C. J. (2016). Effective educational videos: Principles and guidelines for maximizing student learning from video content. *CBE–Life Sciences Education, 15*(4), es6. https://doi.org/10.1187/cbe.16-03-0125

ISSN: 2088-0308 | e-ISSN: 2685-0141
https://doi.org/10.37630/jpi.v16i2.4195

Carpenter, S. K., Endres, T., & Hui, L. (2020). Students' use of retrieval in self-regulated learning: Implications for monitoring and regulating effortful learning experiences. *Educational Psychology Review, 32*(4), 1029–1054. https://doi.org/10.1007/s10648-020-09562-w

Chen, X., Zou, D., Cheng, G., & Xie, H. (2020). Detecting latent topics and trends in educational technologies over four decades using structural topic modeling: A retrospective of all volumes of *Computers & Education*. *Computers & Education, 151*, 103855. https://doi.org/10.1016/j.compedu.2020.103855

Denny, M., Denieffe, S., & O'Sullivan, K. (2023). Non-equivalent control group pretest–posttest design in social and behavioral research. In *The Cambridge handbook of research methods and statistics for the social and behavioral sciences* (pp. 314–332). Cambridge University Press. https://doi.org/10.1017/9781009010054.016

DeVries, R. (2000). Vygotsky, Piaget, and education: A reciprocal assimilation of theories and educational practices. *New Ideas in Psychology, 18*(2–3), 187–213. https://doi.org/10.1016/S0732-118X(00)00008-8

Falloon, G. (2020). From digital literacy to digital competence: The teacher digital competency (TDC) framework. *Educational Technology Research and Development, 68*(5), 2449–2472. https://doi.org/10.1007/s11423-020-09767-4

Feni Haryati, L., & Nursaptini, N. (2021). Konferensi video sebagai alternatif media pembelajaran pada masa pandemi COVID-19. *AL MA'ARIEF: Jurnal Pendidikan Sosial dan Budaya, 3*(2), 85–91. https://doi.org/10.35905/almaarief.v3i2.2477

Hattan, C., Baumann, J., Parkinson, M. M., & MacPhee, D. (2025). Exploring the power and possibility of contextually relevant social studies–literacy integration. *Education Sciences, 15*(10), 1401. https://doi.org/10.3390/educsci15101401

Jelinek, J. A. (2021). Children's astronomy: Development of the shape of the Earth concept in Polish children between 5 and 10 years of age. *Education Sciences, 11*(2), 75. https://doi.org/10.3390/educsci11020075

Makransky, G., & Petersen, G. B. (2021). The cognitive affective model of immersive learning (CAMIL): A theoretical research-based model of learning in immersive virtual reality. *Educational Psychology Review, 33*(3), 937–958. https://doi.org/10.1007/s10648-020-09586-2

Mayer, R. E. (2021). Evidence-based principles for how to design effective instructional videos. *Journal of Applied Research in Memory and Cognition, 10*(2), 229–240. https://doi.org/10.1016/j.jarmac.2021.03.007

Mayer, R. E. (2024). The past, present, and future of the cognitive theory of multimedia learning. *Educational Psychology Review, 36*(1), 8. https://doi.org/10.1007/s10648-023-09842-1

Navarrete, E., Nehring, A., Schanze, S., Ewerth, R., & Hoppe, A. (2025). A closer look into recent video-based learning research: A comprehensive review of video characteristics, tools, technologies, and learning effectiveness. *International Journal of Artificial Intelligence in Education, 35*(4), 1631–1694. https://doi.org/10.1007/s40593-025-00481-x

Noetel, M., Griffith, S., Delaney, O., Sanders, T., Parker, P., del Pozo Cruz, B., & Lonsdale, C. (2021). Video improves learning in higher education: A systematic review. *Review of Educational Research, 91*(2), 204–236. https://doi.org/10.3102/0034654321990713

Pellas, N. (2025). The impact of AI-generated instructional videos on problem-based learning in science teacher education. *Education Sciences, 15*(1), 102. https://doi.org/10.3390/educsci15010102

Petersen, G. B., Petkakis, G., & Makransky, G. (2022). A study of how immersion and interactivity drive VR learning. *Computers & Education, 179*, 104429. https://doi.org/10.1016/j.compedu.2021.104429

ISSN: 2088-0308 | e-ISSN: 2685-0141
https://doi.org/10.37630/jpi.v16i2.4195

Pradana, M., & Syarifuddin, S. (2021). The struggle is real: Constraints of online education in Indonesia during the COVID-19 pandemic. *Frontiers in Education, 6*. https://doi.org/10.3389/feduc.2021.753776

Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education, 147*, 103778. https://doi.org/10.1016/j.compedu.2019.103778

Rioseco-Pais, M., Silva-Quiroz, J., & Vargas-Vitoria, R. (2024). Digital competences and years of access to technologies among Chilean university students: An analysis based on the DIGCOMP framework. *Sustainability, 16*(22), 9876. https://doi.org/10.3390/su16229876

Sablić, M., Mirosavljević, A., & Škugor, A. (2021). Video-based learning (VBL)—Past, present and future: An overview of the research published from 2008 to 2019. *Technology, Knowledge and Learning, 26*(4), 1061–1077. https://doi.org/10.1007/s10758-020-09455-5

Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. *Cogent Education, 5*(1). https://doi.org/10.1080/2331186X.2018.1519143

Tang, F. (2024). Understanding the role of digital immersive technology in education. *BMC Psychology, 12*(1), 144. https://doi.org/10.1186/s40359-024-01636-6

Viguer, P., & Picó-Garcés, M.-J. (2025). Development and validation of an intervention protocol to promote media and information literacy for critical thinking in adolescents' use of social media. *Social Sciences & Humanities Open, 12*, 101807. https://doi.org/10.1016/j.ssaho.2025.101807

Yoon, M., Lee, J., & Jo, I.-H. (2021). Video learning analytics: Investigating behavioral patterns and learner clusters in video-based online learning. *The Internet and Higher Education, 50*, 100806. https://doi.org/10.1016/j.iheduc.2021.100806

Zakiyyah, A. Q., Surahman, E., Fadhli, M., & Thaariq, Z. Z. A. (2025). Effectiveness of Edpuzzle interactive video on student interest and learning outcomes. *AL MA'ARIEF: Jurnal Pendidikan Sosial dan Budaya, 7*(2), 57–70. https://doi.org/10.35905/almaarief.v7i2.13462

Zhang, Y., Li, R., Pi, Z., & Yang, J. (2025). Active learning strategies in video learning: A meta-analysis. *Educational Research Review, 48*, 100708. https://doi.org/10.1016/j.edurev.2025.100708