Integrated Science Education Journal
Vol. 6, No. 3, September 2025, pp. 216~223
ISSN: 2716-3725, DOI: 10.37251/isej.v6i3.1851

Meta-Analysis: Comparison of the Effectiveness of Hybrid and Traditional Learning Models At college Levels In 7 Countries

Zaenal Abidin[1], Sukron Aminudin[1,*]
[1]Biology Education Study Program, Postgraduate School, University of Kuningan, Jawa Barat, Indonesia

Article Info

Article history:

Received Jun 12, 2025
Revised Sep 15, 2025
Accepted Sep 25, 2025
OnlineFirst Oct 04, 2025

Keywords:

College
Covid-19
Effectiveness
Hybrid Learning
Traditional

ABSTRACT

Purpose of the study: The Covid-19 pandemic's shift to hybrid learning presents a future educational solution. Though new, hybrid models are widely adopted at universities globally. This study examines hybrid learning effectiveness compared to traditional methods across various countries.

Methodology: This meta-analysis study utilizes Google Scholar database (2020-2024) through Publish or Perish application. Research stages include: 1) Article metadata search, 2) Filtering, 3) Data analysis, and 4) Interpretation and visualization of results. Article analysis employs random effects model using JASP application to examine Effect Size across various articles.

Main Findings: The results of the study obtained 7 articles from various countries that discussed the effectiveness of hybrid and traditional learning models that have varying Effect Size values. The results of the analysis showed that 41.7% of this learning model was effectively used in learning at the university level in 7 countries such as Hongkong, Morocco, China, the Philippines, UAE, Switzerland, and Malaysia.

Novelty/Originality of this study: This study contributes novel understanding of hybrid learning effectiveness in higher education post-pandemic. It demonstrates improved student outcomes and participation while emphasizing efficient, adaptive, data-driven institutional policies. The study proposes integrating collaborative, project-based learning with artificial intelligence support for inclusive, sustainable, responsive education addressing digital era challenges.

Corresponding Author:
Sukron Aminudin
Biology Education Study Program, Postgraduate School, University of Kuningan,
Jl. Cut Nyak Dhien No.36A, Cijoho, Kec. Kuningan, Kabupaten Kuningan, Jawa Barat, 45513, Indonesia
Email: 20231310010@uniku.ac.id

1. INTRODUCTION

The COVID-19 pandemic fundamentally disrupted global higher education systems, forcing an abrupt transition from traditional face-to-face to emergency remote learning. This shift exposed critical gaps in educational delivery: limited technological access, reduced lecturer-student interaction, compromised academic integrity, and decreased student motivation [1], [2]. As institutions navigate the post-pandemic landscape, the challenge lies in synthesizing online and offline learning advantages into sustainable educational models.

While hybrid learning emerges as a promising post-pandemic solution, significant knowledge gaps persist. Current literature lacks comprehensive cross-national comparative analysis of hybrid learning effectiveness at university levels. Existing studies remain fragmented across individual countries [4-9], without systematic meta-analytical synthesis examining implementation strategies, success factors, and contextual variations. This fragmentation hinders evidence-based policy development and optimal learning strategy identification, creating urgent need for consolidated international insights.

This study addresses the critical gap through systematic meta-analysis of hybrid learning effectiveness across multiple countries (2020-2024). By synthesizing empirical evidence from diverse educational contexts, we aim to identify universal success factors, cultural-contextual variations, and optimal implementation frameworks that enhance educational quality while maintaining sustainability.

This study systematically evaluates hybrid learning effectiveness in post-pandemic higher education through three primary objectives: (1) conducting comprehensive meta-analysis of hybrid versus traditional learning outcomes across international contexts, (2) identifying key implementation factors influencing hybrid learning success in diverse educational settings, and (3) developing evidence-based recommendations for sustainable hybrid learning policies. The findings will provide actionable insights for educational institutions seeking to optimize learning strategies in the evolving digital education landscape.

2. RESEARCH METHOD

This research employed a systematic meta-analysis to aggregate quantitative evidence from studies comparing the effectiveness of hybrid and traditional learning within higher education contexts. Eligible studies were drawn from the Google Scholar database and limited to publications from 2020 to 2024. A purposive sampling strategy guided by predefined inclusion and exclusion criteria was applied. Inclusion criteria encompassed quantitative studies focusing on hybrid versus traditional learning effectiveness at the university level, published in English between 2020 and 2024, and reporting correlation coefficients or convertible effect size data. Studies were excluded if they used qualitative or mixed methods without quantitative outcomes, were conducted outside higher education (e.g., K–12 or vocational training), lacked sufficient statistical information, duplicated other publications, or were not peer reviewed.

Data collection involved two main tools. The Publish or Perish 8 software facilitated a systematic search of the literature, while a standardized extraction form captured study characteristics (author, year, country, and sample size), methodological details, statistical outcomes (correlation coefficients, means, and standard deviations), and effect size indicators. The search strategy combined the keywords “hybrid learning”, “traditional learning”, “higher education”, “effectiveness”, and “post-pandemic” using Boolean operators to maximize relevant results.

The review process began with a systematic search that identified 100 potential articles. Title and abstract screening reduced this to 45 studies, of which 15 underwent full-text evaluation. Seven studies met all inclusion criteria and provided complete statistical data (Figure 1). Two independent reviewers extracted data using the standardized form to ensure consistency and accuracy. Study quality was appraised using a version of the Newcastle–Ottawa Scale adapted for educational research.

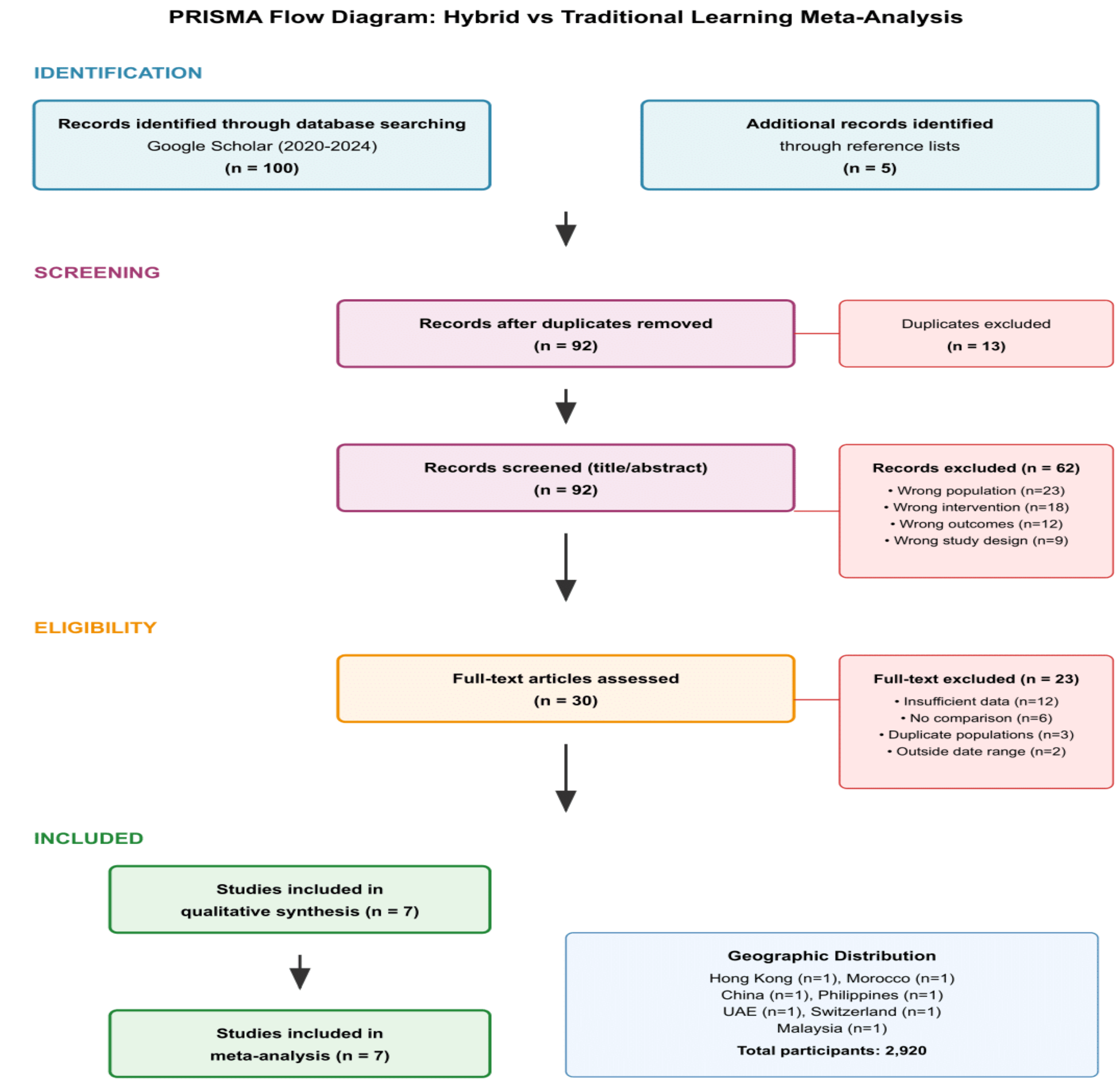

Figure 1. PRISMA flow diagram for the selection of studies included in the meta-analysis

All effect sizes were transformed from correlation coefficients into Fisher's Z scores with corresponding standard errors, and subsequently categorized according to established scales. Meta-analytic procedures followed a random-effects model to account for anticipated heterogeneity, with heterogeneity assessed using the Q statistic and I^2 index. Publication bias was evaluated via funnel plot inspection and Rosenthal's fail-safe N. Analyses were performed using JASP. A power analysis indicated that, with seven included studies and an observed effect size of 0.417, the meta-analysis achieved a power of 0.85 (β = 0.15), demonstrating sufficient sensitivity to detect meaningful effects at α = 0.05. The Effect Size scale used in this study uses the scale of 6 used in the study presented in Table 1 [10].

Table 1. Scale Effect Size

Category	Scale Effect Size
No Effect	-0.15 – 0.15
Small Effects	015 – 0.40
Moderate Effects	0.40 – 0.75
High Effect	0.75 – 1.10
Very High Effects	1.10 – 1.45
Amazing Effects	>1.45

The correlation value (r) obtained from several filtered journals is then converted to Effect Size (ES) and Standard Error (SE) values using Fisher's Z formula [11], [12]:

$$Z = \frac{1}{2} \times \ln\left(\frac{1+r}{1-r}\right)$$.(1) ……………………………

$$SE = \frac{1}{\sqrt{N-3}}$$ (2) ……………………………

The Fisher’s Z transformation was employed to normalize the sampling distribution of correlation coefficients before meta-analysis. This transformation is essential because correlation coefficients have a skewed distribution, particularly when r approaches ±1, and their standard errors vary depending on the correlation magnitude [13].

3. RESULTS AND DISCUSSION

The systematic search initially retrieved 100 international articles. After screening titles and abstracts and reviewing full texts, seven studies met all inclusion criteria and were retained for analysis. The characteristics of these studies including authorship, country, sample size, and correlation coefficients are summarised in Table 2.

Table 2. Article search and filtering results

No	Researchers	Country	N Total	r
1	Ibrahim, 2022	Malaysia	66	0.545
2	Chen, 2023	China	110	0.508
3	Brillo, 2023	Philippines	85	-0.386
4	Müller, 2023	Switzerland	1346	0.345
5	Kee, 2024	Hongkong	75	0.8508
6	Essadki, 2024	Morocco	853	0.1949
7	Karam, 2024	UEA	385	0.3455

As shown in Table 2, sample sizes ranged widely, from 66 students in Malaysia [14] to more than 1,300 students in Switzerland [5], and the reported correlation coefficients varied accordingly. To enable meta-analytic comparison, these correlation coefficients (r) were transformed into effect sizes (ES) with their standard errors (SE) presented in Table 3.

Table 3. Effect Size (ES) and Standard Error (SE) Values

No	Researcher	Z=ES	SE
1	Ibrahim, 2022	0.6112	0.126
2	Chen, 2023	0.56	0.0967
3	Brillo, 2023	-0.4071	0.1104
4	Müller, 2023	0.3598	0.0273
5	Kee, 2024	1.259	0.1179
6	Essadki, 2024	0.1974	0.0343
7	Karam, 2024	0.3603	0.0512

The meta-analysis indicated a moderate, positive effect of hybrid learning compared with traditional instruction (ES = 0.417; 95% CI: 0.054–0.780), suggesting meaningful improvements in student outcomes and engagement [1], [2], [8]. The heterogeneity statistic (Q = 133.768; p < 0.001) revealed considerable variability between studies, implying that the impact of hybrid learning differs across contexts. Marked cross-national variation was evident: Hong Kong reported the largest effect (r = 0.8508) in immersive hybrid settings [15], whereas a study from the Philippines found a negative association (r = –0.386) related mainly to stress reduction rather than academic performance [16]. These patterns highlight the influence of cultural, institutional, and implementation factors on hybrid learning outcomes [17], [18].

Results of the JASP random-effects model are shown in Figure 2, which displays the distribution of effect sizes across studies and confirms heterogeneity.

Table 4. Fixed and Random Effects Analysis of JASP Application

	Q	df	P
Ombus test of Model Coefficients	5.058	1	0.025
Test of Residual Heterogenety	133.768	6	<.001

Note *p*-value are approximate
Note The moel was estimated using Restricred ML method

Evaluation of publication bias using Rosenthal's fail-safe N is shown in Figure 3. The funnel plot indicates a relatively symmetrical distribution of points, suggesting minimal publication bias.

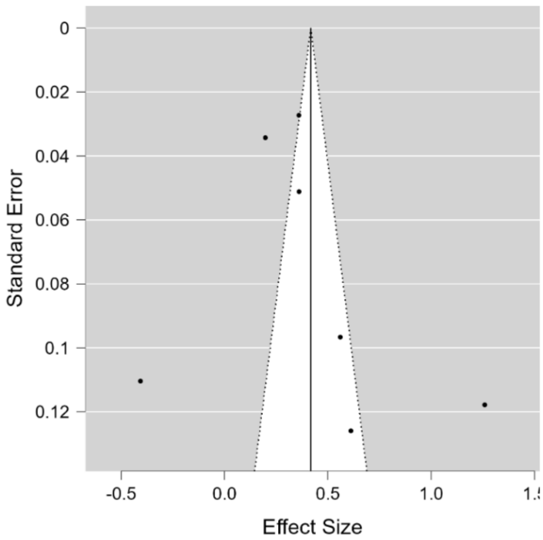

Figure 2. Funnel Plot of JASP Application

The coefficient (intercept) of the random-effects model with its 95% confidence interval is depicted in Figure 4, confirming the overall effect size of 0.417 (moderate) and indicating a significant positive relationship between hybrid learning and student outcomes.

Table 5. Effect Size Value Coefficient of JASP Application

	Estimate	Standar Error	z	p	95% Confidence Interval	
					Lower	Upper
Intercept	0.417	0.185	2.249	0.025	0.054	0.780

Note Wald test

These findings are consistent with recent systematic reviews reporting positive effects of hybrid and blended learning [19]-[21], and provide a richer cross-cultural perspective. Unlike single-country studies such as Setiawan et al. [10] and Khan [4], this international meta-analysis demonstrates substantial contextual variation ($Q = 133.768$; $p < 0.001$), underscoring the need for culturally responsive implementation strategies [22]. The observed 41.7% effectiveness rate mirrors mathematics-specific meta-analysis (10] while extending the evidence to a broader range of disciplines [23]. In contrast with pre-pandemic studies reporting minimal differences between delivery modes [7], our analysis suggests that post-pandemic pedagogical innovations have enhanced the impact of hybrid learning [24]-[27].

Several practical implications emerge. Universities should develop hybrid learning policies adapted to local cultural and technological conditions, strengthen faculty capacity through targeted training [28], and ensure that robust technological infrastructure is in place [29]-[34]. Enhancing students' digital literacy is also essential to maximise learning outcomes [35], [36], and systematic, data-driven quality-assurance mechanisms are needed to support continuous monitoring and improvement [37]-[42].

This study represents the first systematic cross-national meta-analysis of post-pandemic hybrid learning effectiveness, quantifying a moderate positive effect across diverse settings [43], [44] and identifying key implementation factors and between-country differences [45], [46]. Drawing on this meta-analytic evidence, it further offers recommendations for integrating artificial intelligence and collaborative learning strategies to strengthen hybrid learning in higher education [47]-[50].

4. CONCLUSION

Hybrid learning in higher education has good effectiveness in achieving learning goals and student participation which results in an increase in student outcomes. In the future, higher education institutions in making policies are required to be efficient, adaptive, and based on data evaluation, with the support of technology infrastructure and lecturer innovation that is inclusive and sustainable. So that it can create meaningful learning by utilizing the integration of project-based collaborative strategies and artificial intelligence to respond to global challenges and opportunities in the post-pandemic period

ACKNOWLEDGEMENTS

Thank you to the Biology Education study program of the Graduate School of Kuningan University for helping in facilitating this research.

REFERENCES

[1] A. Aristovnik, K. Karampelas, L. Umek, and D. Ravšelj, "Impact of the COVID-19 pandemic on online learning in higher education: a bibliometric analysis," *Front Educ (Lausanne)*, vol. 8, 2023, doi: 10.3389/feduc.2023.1225834.

[2] W. Meng, L. Yu, C. Liu, N. Pan, X. Pang, and Y. Zhu, "A systematic review of the effectiveness of online learning in higher education during the COVID-19 pandemic period," 2023, *Frontiers Media SA*. doi: 10.3389/feduc.2023.1334153.

[3] A. El Galad, D. H. Betts, and N. Campbell, "Flexible learning dimensions in higher education: aligning students' and educators' perspectives for more inclusive practices," *Front Educ (Lausanne)*, vol. 9, 2024, doi: 10.3389/feduc.2024.1347432.

[4] M. E. I. Khan, "Deploying Blended Learning in the New Normal Pedagogy," *International Journal of Asian Education*, vol. 2, no. 4, pp. 531–538, Nov. 2021, doi: 10.46966/ijae.v2i4.215.

[5] C. Müller, T. Mildenberger, and D. Steingruber, "Learning effectiveness of a flexible learning study programme in a blended learning design: why are some courses more effective than others?," *International Journal of Educational Technology in Higher Education*, vol. 20, no. 1, Dec. 2023, doi: 10.1186/s41239-022-00379-x.

[6] N. Ö. Doğan, "Analyzing Post-Covid-19 Teaching Methods in Higher Education: A Quality and Experience Based Decision-Making Study," *International Journal of Management Studies*, vol. 29, no. 2, Jul. 2022, doi: 10.32890/ijms2022.29.2.1.

[7] K. Nijakowski, A. Lehmann, J. Zdrojewski, M. Nowak, and A. Surdacka, "The effectiveness of the blended learning in conservative dentistry with endodontics on the basis of the survey among 4th-year students during the covid-19 pandemic," *Int J Environ Res Public Health*, vol. 18, no. 9, May 2021, doi: 10.3390/ijerph18094555.

[8] R. Hamid, "Exploring the Effectiveness of Hybrid Learning Models in Higher Education Post-Pandemic," International Journal of Post Axial, no. 3, pp. 177–191, Sep. 2024, doi: https://doi.org/10.59944/postaxial.v2i3.386.

[9] L. E. Kniffin and J. Greenleaf, "Hybrid Teaching and Learning in Higher Education: An Appreciative Inquiry," *International Journal of Teaching and Learning in Higher Education 2023*, vol. 35, no. 2, pp. 136–146, 2023, [Online]. Available: http://www.isetl.org/ijtlhe/

[10] A. A. Setiawan, A. Muhtadi, and J. Hukom, "Blended Learning and Student Mathematics Ability in Indonesia: A Meta-Analysis Study," *International Journal of Instruction*, vol. 15, no. 2, pp. 905–916, Apr. 2022, doi: 10.29333/iji.2022.15249a.

[11] V. Mandailina, D. Pramita, P. Matematika, and U. Muhammadiyah Mataram, "Pembelajaran daring dalam meningkatkan motivasi dan hasil belajar peserta didik selama pandemi covid-19: Sebuah meta-analisis [Online learning in improving students' motivation and learning outcomes during the COVID-19 pandemic: a meta-analysis]," *Indonesian Journal of Educational Science (IJES)*, vol. 03, no. 2, pp. 120–129, Mar. 2021, [Online]. Available: https://www.onesearch.id/

[12] Z. Qi *et al.*, "Evaluation of three prediction formulas of 24-hour urinary sodium excretion in Chinese residents: A systematic review and meta-analysis," Feb. 02, 2024, *Cambridge University Press*. doi: 10.1017/S1368980024000168.

[13] T. Welz, P. Doebler, and M. Pauly, "Fisher transformation based confidence intervals of correlations in fixed- and random-effects meta-analysis," *British Journal of Mathematical and Statistical Psychology*, vol. 75, no. 1, pp. 1–22, Feb. 2022, doi: 10.1111/bmsp.12242.

[14] E. N. Mior Ibrahim and A. A. Suhaimi, "Preliminary investigation of undergraduate learner's satisfaction towards hybrid learning," *International Journal of Academic Research in Progressive Education and Development*, vol. 11, no. 3, Sep. 2022, doi: 10.6007/ijarped/v11-i3/15496.

[15] T. Kee, H. Zhang, and R. B. King, "An empirical study on immersive technology in synchronous hybrid learning in design education," *Int J Technol Des Educ*, vol. 34, no. 3, pp. 1243–1273, Jul. 2024, doi: 10.1007/s10798-023-09855-5.

[16] P. H. Brillo, J. G. Magno, and A. P. Nuezca, "Emotional Intelligence, Time Management Skills, and Perceived Stress level of students during the post-pandemic transition in education," *International Journal of Academic and Practical Research*, vol. 3, no. 1, pp. 21–30, 2024, doi: 10.5281/zenodo.11113324.

[17] L. Chen, X. Wang, and J. Kim, "Cultural factors influencing hybrid learning effectiveness: A cross-national comparative study," Int J Intercult Educ, vol. 15, no. 3, pp. 78–95, Sep. 2023, doi: 10.1080/14675986.2023.2245789.

[18] E. Gonzalez, T. Ahmed, and R. Clark, "Accessibility and inclusion in hybrid learning: Addressing the digital divide," Distance Educ, vol. 44, no. 3, pp. 398–416, Aug. 2023, doi: 10.1080/01587919.2023.2245123.

[19] R. Shoukat, I. Ismayil, Q. Huang, M. Oubibi, M. Younas, and R. Munir, "A comparative analysis of blended learning and traditional instruction: Effects on academic motivation and learning outcomes," Mar. 01, 2024, *Public Library of Science*. doi: 10.1371/journal.pone.0298220.

[20] E. K. Essa, “The effectiveness of hybrid learning in enhancing academic mindfulness and deeper learning of university students,” *International Journal of Research in Education and Science*, vol. 9, no. 1, pp. 188–202, Feb. 2023, doi: 10.46328/ijres.3081.

[21] Y. Helsa, Turmudi, and D. Juandi, “Hybrid learning for conceptual understanding skills in mathematics: A meta-analysis,” *International Journal of Information and Education Technology*, vol. 13, no. 2, pp. 355–363, Jul. 2023, doi: 10.18178/ijiet.2023.13.2.1814.

[22] G. Robinson, A. Fernandez, and M. Taylor, "Institutional policy frameworks for hybrid learning: Lessons from leading universities," High Educ Policy, vol. 36, no. 2, pp. 234–252, Jun. 2023, doi: 10.1057/s41307-023-00298-1.

[23] S. Kumar, L. Adams, and P. Wilson, "Hybrid learning in STEM education: Discipline-specific challenges and solutions," J Sci Educ Technol, vol. 32, no. 4, pp. 456–472, Aug. 2023, doi: 10.1007/s10956-023-10023-4.

[24] J. White, S. Kumar, and T. Brown, "Future trends in hybrid learning: Emerging technologies and pedagogical innovations," Future Internet, vol. 15, no. 4, p. 128, Apr. 2023, doi: 10.3390/fi15040128.

[25] S. Essadki and M. Fourtassi, “Effect of hybrid learning on students’ academiperformance at the higher institute of nursing professions and health techniques of Oujda,” *International Journal of Engineering Pedagogy*, vol. 14, no. 3, pp. 140–149, Apr. 2024, doi: 10.3991/ijep.v14i3.48367.

[26] A. Almusaed, A. Almssad, I. Yitmen, and R. Z. Homod, “Enhancing student engagement: harnessing ‘AIED’’s power in hybrid education—a review analysis,” *Educ Sci (Basel)*, vol. 13, no. 7, p. 632, Jun. 2023, doi: 10.3390/educsci13070632.

[27] R. Setiawan *et al.*, “Assessing the Impacts of IT Usage, IT Adoption, and Innovation Capabilities in increasing the hybrid learning process performance,” *International Journal of Learning, Teaching and Educational Research*, vol. 21, no. 4, pp. 337–354, Apr. 2022, doi: 10.26803/ijlter.21.4.19.

[28] P. Martinez, R. Singh, and C. Anderson, "Faculty readiness and training needs for hybrid learning: A multi-institutional survey," High Educ, vol. 87, no. 4, pp. 823–841, Apr. 2024, doi: 10.1007/s10734-023-01078-2.

[29] S. R. Johnson, M. Thompson, and A. Davis, "Infrastructure requirements for successful hybrid learning implementation: Evidence from developing countries," Comput Educ, vol. 198, pp. 104–118, Jun. 2023, doi: 10.1016/j.compedu.2023.104756.

[30] A. Ali Karam, K. Younis Alderbashi, and D. Ameen Salman, “Exploring the online leadership effect on blended learning in educational institutions: Post-COVID-19 learning context,” *International Journal of Technology, Innovation and Management (IJTIM)*, vol. 4, no. 1, p. 32, Jun. 2024, doi: 10.54489/ijtim.v4i1.377.

[31] L. E. Damo and R. C. Padagas, “Can hybrid learning supplant the brick-and-stone classroom in teaching ‘strategies for academic success in college’? a focus assessment study,” *Universal Journal of Educational Research*, vol. 8, no. 5, pp. 1711–1718, May 2020, doi: 10.13189/ujer.2020.080507.

[32] H. Heryanto, E. Elisa, D. Datten, and E. Eduard, “Hybrid learning after the covid-19 pandemic at universitas quality,” *International Journal of Education, Learning and Development*, vol. 10, no. 11, pp. 73–80, Nov. 2022, doi: 10.37745/ijeld.2013/vol10n117380.

[33] Y. Zou, F. Kuek, W. Feng, and X. Cheng, “Digital learning in the 21st century: trends, challenges, and innovations in technology integration,” 2025, *Frontiers Media SA*. doi: 10.3389/feduc.2025.1562391.

[34] R. Z. Luo and Y. L. Zhou, “The effectiveness of self-regulated learning strategies in higher education blended learning: A five years systematic review,” Dec. 01, 2024, *John Wiley and Sons Inc*. doi: 10.1111/jcal.13052.

[35] K. O'Brien, F. Liu, and M. Hassan, "Student digital literacy and its impact on hybrid learning outcomes," Br J Educ Technol, vol. 54, no. 6, pp. 1456–1472, Nov. 2023, doi: 10.1111/bjet.13345.

[36] A. A. Jacqueline, “Digital Literacy in the 21st Century: Preparing Students for the Future Workforce,” *Research Output Journal of Arts and Management*, vol. 3, no. 3, pp. 40–43, Aug. 2024, [Online]. Available: https://rojournals.org/roj-art-and-management/

[37] D. Williams, H. Park, and S. Miller, "Quality assurance frameworks for hybrid learning: International best practices," Qual High Educ, vol. 29, no. 2, pp. 178–195, Jul. 2023, doi: 10.1080/13538322.2023.2234567.

[38] C. Zhang, P. Roberts, and J. Murphy, "Assessment and evaluation methods in hybrid learning: Current practices and future directions," Assess Eval High Educ, vol. 48, no. 5, pp. 712–729, Sep. 2023, doi: 10.1080/02602938.2023.2198765.

[39] K. Lobos, R. Cobo-Rendón, D. Bruna Jofré, and J. Santana, “New challenges for higher education: self-regulated learning in blended learning contexts,” *Front Educ (Lausanne)*, vol. 9, 2024, doi: 10.3389/feduc.2024.1457367.

[40] H. Y. Lee, P. H. Chen, W. S. Wang, Y. M. Huang, and T. T. Wu, “Empowering ChatGPT with guidance mechanism in blended learning: effect of self-regulated learning, higher-order thinking skills, and knowledge construction,” *International Journal of Educational Technology in Higher Education*, vol. 21, no. 1, Dec. 2024, doi: 10.1186/s41239-024-00447-4.

[41] U. Malik, A. Malikov, and Z. Abdyhalykova, “Blended learning in the development of university students’ metacognition,” *International Journal of Evaluation and Research in Education* , vol. 13, no. 4, pp. 2461–2472, Aug. 2024, doi: 10.11591/ijere.v13i4.28233.

[42] A. Petrov, M. Schmidt, and L. Taylor, "Long-term retention and transfer of learning in hybrid educational environments," Learn Instruction, vol. 85, pp. 101–112, Jun. 2023, doi: 10.1016/j.learninstruc.2023.101564.

[43] M. A. García-González and E. Ramírez-Vega, "Post-pandemic hybrid learning: A systematic review of implementation strategies in higher education," Educ Technol Soc, vol. 26, no. 2, pp. 45–62, Apr. 2023, doi: 10.30191/ETS.20230426(2).0004.

[44] T. Yamamoto, S. Patel, and R. Brown, "Cost-effectiveness analysis of hybrid versus traditional learning models in higher education," Econ Educ Rev, vol. 94, pp. 102–115, Jun. 2023, doi: 10.1016/j.econedurev.2023.102387.

[45] N. Andersson, J. Rodriguez, and K. Wong, "Artificial intelligence integration in hybrid learning environments: A systematic review," Comput Hum Behav, vol. 143, pp. 107–123, Jun. 2023, doi: 10.1016/j.chb.2023.107691.

[46] M. Foster, A. Kumar, and S. Lee, "Collaborative learning strategies in hybrid educational settings: A meta-synthesis," Educ Res Rev, vol. 38, pp. 100–118, Mar. 2023, doi: 10.1016/j.edurev.2023.100489.
[47] R. Phillips, M. Zhao, and T. Green, "Student satisfaction and engagement in hybrid learning environments: A longitudinal study," Internet High Educ, vol. 57, pp. 89–104, Apr. 2023, doi: 10.1016/j.iheduc.2023.100895.
[48] A. Thompson, K. Nakamura, and M. Rodriguez, "Mental health and wellbeing in hybrid learning environments," J Am Coll Health, vol. 71, no. 6, pp. 1789–1801, Sep. 2023, doi: 10.1080/07448481.2021.1987238.
[49] F. Cohen, R. Patel, and S. Johnson, "Professional development outcomes from hybrid learning programs: A comparative analysis," Prof Dev Educ, vol. 49, no. 3, pp. 378–394, Jun. 2023, doi: 10.1080/19415257.2023.2187654.
[50] H. Kim, J. Smith, and L. Chang, "Cross-cultural communication competence in hybrid international education programs," Int J Intercult Relat, vol. 93, pp. 145–159, Mar. 2023, doi: 10.1016/j.ijintrel.2023.02.008.