

Evidence Search for XR

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Disclaimer: If you're visiting this page for the first time, first, let me acknowledge that this literature search does not include all papers published on this subject. If you know of a paper that you think should be included, please send me a link through LinkedIn. I am organizing and updating this literature search on an ongoing basis. I have listed the research papers according to the year published from 2016 to the present because VR/MR only truly became a viable and affordable medium that could be scaled in education at that time. Older publications are listed by author.

2027

Katooziani, A., Jayasinghe, R. R., Jeelani, I., Gheisari, M., & Castelblanco, G. (2027). [VirtuAI-Safe: Personalized situated safety learning through integration of VR and IImS](#). *Journal of Computing in Civil Engineering*, 41(1). (construction, AI)

2026

Alvarez, I., Johnson, E., Latour, M., & Yim, M. T. (2026). [Next dimension medical education: a pilot study exploring virtual reality in head and neck anatomy](#). *OTO Open*, 10(1).

Banbury, S., Phillips, O., Chandler, C., & Olvera, J. del R. (2026). [A cognitive mindfulness intervention using virtual reality and artificial intelligence for academic procrastination: A pilot waitlist randomised controlled trial](#). *Applied Psychology Research*, 5(2).

Bhasin, Vedika. (2026). [Virtual Reality as a Behavioral Intervention: Study of Distraction, Restlessness, Avoidance and Eroded Tolerance for Stillness A Mixed-Methods Behavioral in Sparse VR Environments](#). 10.5281/zenodo.20452374.

Brussoni, M., Sandseter, E. B. H., Sando, O. J., Kleppe, R., Zeni, M., & Bundy, A. (2026). [The developmental importance of risky play: A cross-national virtual reality study](#). *Journal of Environmental Psychology*, 112, 103062.

Carden, L. L., Hutchison, L. F., Crawley, D., & Ehmer, P. (2026). [Advancing firefighter training through online virtual reality: Firefighters' subjective reactions](#). *Technology, Knowledge and Learning*. Advance online publication.

Chellappa, V., & Luximon, Y. (2026). [XR for occupational health and safety training in construction: A systematic review of benefits and limitations](#). Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 18(4).

Dai, D., Tu, B., & Liu, J. (2026). [Generation of virtual reality landscape scenes for digital urban architecture based on AI](#). International Journal of Environment and Pollution, 1(1).

Dodson, T. M., Reed, J. M., Maguire, M. B., & White, A. (2026). [Beyond transcripts: Patterns of therapeutic communication learning gaps in virtual reality](#). Clinical Simulation in Nursing, 113, 101920.

Efe, Y. S., Usta, E., Roba, A. A., Çalışır, Ö., & Turan, C. (2026). [Preoperative virtual reality education for children undergoing surgery: A randomized controlled trial](#). Scientific Reports.

Ershad, R., Khan, I., Gilani, S., & Husam Al-Deen, R. (2026). [Virtual reality as an alternative to conventional anatomy teaching: a systematic review of randomised controlled trials](#). Cureus.

Fauville, G., Skantz, E., & Lantz-Andersson, A. (2026). ["I felt like a marine organism": Exploring underwater virtual reality experiences and their potential to foster ocean connectedness](#). Computers in Human Behavior Reports, 22, 101093.

Fokides, E. (2026). [Learning, motivation, gender, and epistemic emotions: How are they connected in the context of immersive virtual reality?](#) Education and Information Technologies.

Gardner, A., Cannac, F., Tallon, Q., Olson, A., & Autin, L. (2026). [The virus lesson: Teaching viral structure and quasi-symmetry in mixed reality](#). Protein Science, 35(5).

Ge, X., Qin, R., & Zi, X. (2026). [Attention mechanism-enhanced virtual reality scene generation for innovation and entrepreneurship education with cognitive load balancing](#). Scientific Reports.

Georgiou, Y., Kyriakides, E., Lanitis, A., & Stavroulia, K. E. (2026). [Reducing distance, increasing impact? Immersive media for fostering psychological proximity to environmental risks: A systematic literature review and meta-analysis](#). Journal of Environmental Psychology, 114, 103153.

Graf, L., Golz, V., Prehn, S., Masuch, M., & Gradl-Dietsch, G. (2026). [Virtual vs. standardized patients - A preliminary comparison of advantages and disadvantages of a VR and a conventional learning unit for medical students in child and adolescent psychiatry](#). BMC Medical Education.

Heinrich, F., Kohpeiß, M., Hansen, C., & Schott, D. (2026). [Mixed reality simulation of guided needle insertion: effects of interaction and visual fidelity](#). International Journal of Computer Assisted Radiology and Surgery. (skill)

Jiang, Y., Acheson, K., Bell, A., Smith, S. G., Ely, D., & Roberson, G. (2026). [Learning by experience: Using VR simulation for the intercultural competence development of manufacturing technicians](#). Human Resource Development International, 1–29.

Jiang, C., Saleme, P., Dietrich, T., & Durl, J. (2026). [Virtual reality in school-based health promotion: A mixed-methods evaluation of adolescent alcohol, vaping, and other drug use prevention](#). Health Promotion International, 41(1).

Jiang J, Ye MZ, Kwok TTO, Wong JYH (2026). [GenAI-Supported Virtual Patients in Health Care Education: Systematic Review](#). J Med Internet Res 2026;28:e82756.

Kakonge, J. S. N. (2026). [A systematic review evaluating the use of mixed reality technologies within undergraduate medical anatomical teaching](#). Cureus.

Keith, S. A., Jeannot, L., McKinley, E., Fauville, G., & Woolsey, E. S. (2026). [Enhancing motivation to learn marine ecology and increase ocean literacy through virtual reality in higher education](#). Ecosphere, 17(3).

Kim, H., Guimbretiere, F., & Lee, B. (2026). DanXeReflect: [Interacting with the spatio-temporal past movements for embodied, reflective choreographic collaboration](#). Proceedings of the 2026 CHI Conference on Human Factors in Computing Systems, 1–18.

Li, B., & Zhang, M. (2026). [The impact of virtual reality on curiosity, joy, and engagement](#). Frontiers. Frontiers in Psychology, 17.

Mahmoudi-Dehaki, M., & Nasr-Esfahani, N. (2026). [Socio-culturally responsive VR training for enhancing English teachers' pragmatic competence](#). ECNU Review of Education, 9(3).

Mergen, M., Graf, N., & Meyerheim, M. (2024). [Reviewing the current state of virtual reality integration in medical education: A scoping review](#). BMC Medical Education, 24, Article 788. (interprofessional)

Montiel Bravo, M. J., Ferrandini Price, M., Pardo Rios, M., Sanchez Gomez, M., Piuvezam, G., Silva de Medeiros, G. C. B., & Lopez Lopez, C. A. (2026). [The use of immersive technologies in learning about postpartum hemorrhage: Protocol for a systematic review and meta-analysis](#). PLOS One, 21(6), e0351749.

Oberst, J., Kemper, H., Pohl, M., & Günther, A. (2026). [Accelerated validation of advanced driver assistance systems with mixed reality](#). ATZ Worldwide, 128(10–11), 46–49. (driving, drive)

Özcan, E., Haşlaman, T., & Nur Yılmaz, G. (2026). [Using virtual reality to teach climate change in social studies: A case study in teacher education](#). Humanities and Social Sciences Communications.

Paull, S. N., Boyce, M. W., Thomas, C. A., Roncallo, H. R., Banziruk, C., Bickell, K., Zhang, L., Melendez, A., Mansour, A., Evans, L. V., & Vora, S. (2026). [Implementing the plan-do-study-act model of change on virtual reality simulation education in the emergency department](#). Proceedings of the International Symposium on Human Factors and Ergonomics in Health Care, 15(1), 185–189.

Phadnis, S. D., Hickey, C., Alter, S. M., Clayton, L. M., Solano, J. J., Shih, R. D., Levine, R., & Hughes, P. G. (2026). [Haptic training simulator use in emergency procedure education](#). Cureus.

Santoso, M., Petersen, G. B., Bailenson, J. N., & Fauville, G. (2026). [Underwater virtual reality and situated cognition: Comparing ground, docked, and floating conditions for ocean connectedness and psychological wellbeing](#). Journal of Environmental Psychology, 110, 102950.

Sarwar, M. N., Alharbi, A. M., & Nazar, M. F. (2026). [Fostering conceptual understanding of organic solar cells through immersive augmented reality: A quasi-experimental study in chemistry education](#). Scientific Reports.

Shao, J., Tang, S., & Ju, J. (2026). [Effects of an AI-VR enhanced flipped classroom on English achievement, metacognitive self-regulation, and learning motivation among EFL learners: The moderating role of technological literacy](#). Scientific Reports.

Sherif, M., Barakat, N., Hamdy, A., Haridy, M. F., Ahmed, H. S., Fouda, H. O., & Saber, S. (2026). [Adapt VR in dental education: Boosting preclinical skill and self-confidence](#). BDJ Open, 12(1).

Shrestha, S., Shan, Y., Manning-Ouellette, A., Willis, T., Emerson, R., & Hosseini, Z. (2026). [A qualitative study of students' experiences and perceptions of the use of social presence-enhanced augmented reality for online engineering education](#). Journal of Civil Engineering Education, 152(4).

Stefan, H., Mortimer, M., Wright, B., & Horan, B. (2026). [Drivers of self-efficacy and learning in virtual reality training: The roles of presence, cognitive load, interest, and motivation](#). Computers & Education: X Reality, 9, 100171.

Tolano Gutiérrez, H. K., Vázquez Moreno, E. E., Amavizca Valdez, L. O., López, E. J., Alonso Aldana, R., & Gaytán Martínez, L. Z. (2026). [Pedagogical Foundations of Immersive Virtual Reality for Programming Education: A Critical Review and Conceptual Framework](#). Information, 17(9), 843.

Vidak, A., Movre Šapić, I., Gomzi, V., & Mesic, V. (2026). [Immersive virtual reality in learning physics: A systematic review of opportunities and challenges](#). European Journal of Physics.

Vipahasna, P. P., Vipahasna, K., Khlaisang, J., & Numprasertchai, S. (2026). [Virtual reality technology to enhance English language acquisition in children with learning disabilities](#). International Journal of Innovation and Learning, 40(3).

Wang, X. M., Mazalek, A., Sabiston, C. M., & Welsh, T. N. (2026). [Virtual reality alters perceived functional body size](#). Virtual Reality, 30(3).

Synopsis: "If uncorrected, this systematic perturbation could add device-specific learning demands that may undermine transfer of VR-based motor skill training to UR"

Yang, C., Li, D., Dai, Z., & Feng, Y. (2026). [Virtual Reality pre-exposure supports wayfinding in a culturally and environmentally unfamiliar multi-level building: Short- and long-term evidence from a cross-national study](#). Safety Science, 204, 107346.

Yechiam, H., Shles, A., Fridler, D., Harel, D. S., Schildkraut, Y., Rimon, A., & Capua, T. (2026). [An immersive simulation and virtual reality-enhanced course for the recognition of pediatric Non-Accidental Trauma \(NAT\) and abuse: A proof-of-concept study](#). Child Abuse & Neglect, 177, 108128.

Zhang, Z. X. (2026). [AI-enhanced virtual reality martial arts training: How technology readiness, instructional design, usefulness, and instructor competency drive learning performance through cognitive absorption](#). Scientific Reports.

Zhang, X., Lyu, X., Weng, X., & Zhou, Y. (2026). [From conventional OSCE to virtual reality-enhanced OSCE: A narrative review of promise and pitfalls in medical education](#). Advances in Medical Education and Practice, Volume 17, 1–13.

2025

Ahuja, A., Paredes III, A., Eisel, M., Ahuja, S., Wagner, I., Vasu, P., Dorairaj, S., Miller, D., & Abubaker, Y. (2025). [The Utility of Virtual Reality in Ophthalmology: A review](#). Clinical Ophthalmology, Volume 19, 1683–1692.

Ahmed, A. A., Mohamed, M. Y. A., Galal, H. A., Hasanein, N. M. M., & Embaby, R. A. (2025). [Virtual reality-assisted learning: Enhancing psychomotor competence in midwifery nursing students](#). BMC Nursing, 24(1).

Al Turki, S., Skaff, D., Mujlli, G., Ozdemir, B., Maghraby, N., Iskandarani, L., Diab, C., Ashour, M. N., Almass, A., Othman, A., Alghosen, A., Alsalamah, I., Alotaibi, M., Alqahtani, N., Alguhaimi,

D., Al-Dawoud, A. T., & Alobaid, A. (2025). [Virtual reality vs. Manikin based training on emergency life saving basic rescue skills: A summative evaluation](#). BMC Medical Education, 25(1).

Alghanaim, N., Hart, J., & Finn, G. (2025). [Scoping review: The effectiveness of interprofessional virtual reality simulation](#). Journal of Medical Education and Curricular Development, 12, 23821205251346327.

Ali, L., & Di Fuccio, R. (2025). [Immersive mixed reality interventions for brain anatomy education: Impact on emotions and knowledge acquisition](#). Paper presented at the EAN Congress.

Alnuaimi, M. A., & Awad, M. (2025). [VR environment of digital design laboratory: A usability study](#). Springer Science and Business Media LLC.

Alshammari, F., Alharbi, M., & colleagues. (2025). [The combined impact of AI and VR on interdisciplinary learning and patient safety in healthcare education: A narrative review](#). BMC Medical Education, 25.

Antoun, M., Elhajj, I. H., Sayour, M., Papadopoulos, P. K., Zarpalas, D., Rizk, A., Islam, A. T., Huerta, I., Toledo, L., Arvanitis, G., Moustakas, K., Jevtić, A., Agustí, I., Vona, F., Voigt-Antons, J.-N., Warsinke, M., Bailer, W., Thallinger, G., Howkins, B., ... Asmar, D. (2025). [Interactive digital twins enabling responsible extended reality applications](#). Scientific Reports, 15(1).

Ariya, P., Wongwan, N., Worragin, P., Intawong, K., & Puritat, K. (2025). [Immersive realities in museums: Evaluating the impact of VR, VR360, and MR on visitor presence, engagement and motivation](#). Virtual Reality, 29(3).

Austermann, C., Von Blanckenburg, F., Von Blanckenburg, K., Utesch, T. (2025). [Exploring the impact of virtual reality on presence: Findings from a classroom experiment](#). Frontiers in Education, 10, Article 1560626.

Bailenson, J. N., DeVaux, C., Han, E., Markowitz, D. M., Santoso, M., & Wang, P. (2025). [Five canonical findings from 30 years of psychological experimentation in virtual reality](#). Nature Human Behaviour.

Bi, X., Hu, Y., Li, L., Zhang, J., & Yang, X. (2025). [Immersive virtual reality for classroom management training: Enhancing pre-service teachers' skills, emotions, and learning satisfaction](#). Education and Information Technologies.

Bodur, G., Turhan, Z., Altun, Y. E., Kılıçaslan, K., Alikan, B., Özer, F., & Can, G. (2025). [Evaluating the effectiveness of virtual reality simulation in CPR training for nursing students: A randomized controlled trial](#). Nurse Education in Practice. Advance online publication

Bozkurt, R., Doğu, Ö., Çit, G., Ayar, K., & Öz, C. (2025). [Development of a multi-skill, haptic-supported virtual reality simulation for first-year nursing students: A pilot study](#). BMC Nursing.

Burkhardt, V., Vallette, M., Speck, I., Flayyih, O., Huber, C., Widder, A., ... Albrecht, T. (2025). [Virtual reality cricothyrotomy – a tool in medical emergency education throughout various disciplines](#). BMC Medical Education, 25(1). (skill)

Synopsis: 146 participants. 74% reported an improvement in the speed of the procedure and in the procedural steps (87%). These subjective improvements were confirmed objectively by the time required for completion of the procedure and the points achieved. Real-life experience with cricothyrotomy had no significant effect on performance in VR.

Calisanie, N. N. P., Sansuwito, T. bin, Dioso, R. I., & Lindayani, L. (2025). [The impact of virtual reality simulation training on earthquake preparedness knowledge and practices among rural volunteers in Indonesia: quasi-experimental repeated-measures study](#). Journal of Medical Internet Research, 27, e74108–e74108. (emergency preparedness)

Cazalas, I., Peters, R. M., & Cazalas, J. M. (2025). [Pediatric OSCEs within the metaverse: A virtual reality solution to inefficiencies in modern nursing education](#). The Journal of Continuing Education in Nursing, 56(7), 271–276.

Chance, E. A. (2025). [The combined impact of AI and VR on interdisciplinary learning and patient safety in healthcare education: A narrative review](#). BMC Medical Education, 25(1).

Chen, S.-Y., Salcedo, D., Hsiao, B.-Y., Huang, W.-C., Su, B.-C., & Horng, J.-L. (2025). [Comparison of cooperative learning through use of an immersive virtual reality anatomy model and a 3D plastic anatomical model](#). BMC Medical Education, 25(1).

Cheng, H., Cang, M., & Zhou, W. (2025). [Evaluating knowledge transfer mechanisms and outcomes of VR/AR for cultural-heritage serious games](#). Npj Heritage Science, 13(1).

Chiang, S., Chiang, D., Chang, S.-H., & Yao, K.-C. (2025). [Innovative virtual reality teaching for the sustainable development of vocational high school students: A case study of hair braiding](#). MDPI AG.

Chou, C. C., Hart, R. K., Wharton-Beck, A., Yang, K. A., Nordstog, S. M., Alshareef, N., & Espeland, S. (2025). [A mixed-methods case study of participant insights in integrating virtual reality to promote inclusion in higher education](#). International Journal of Human–Computer Interaction, 1–23. (inclusive)

Dana, T., & Yevgeniya, D. (2025). [Approaches to real-time XR visualization](#). Procedia Computer Science, 265, 616–619.

Derakhshan, H. B., Shoorei, H., Hassanzadeh, G., Mansoorian, M. R., Moshari, J., Sajjadi, M., ... Majidpoor, J. (2025). [Production and educational value of anatomical megamoulages](#). BMC Medical Education, 25(1).

Dechamps, I., Doran, J., Forlani, C., Thadani, A., Theriault, R., & Madorin, S. (2025). [Student motivation using virtual reality in human anatomy and physiology courses](#). Canadian Journal of Learning and Technology, 51(2), 1–21.

Dong, C., Shin, C., McDonagh, J., & Champ-Gibson, E. (2025, May). [Comparing artificial intelligence-enhanced virtual reality and standardized patient simulations: Undergraduate nursing students' perceptions and experiences](#). Clinical Simulation in Nursing, 102(2), 101710.

Dumitrescu, C., (2025) [Use of Emerging Technologies in Rehabilitation Education and Practice](#). Frontiers in Rehabilitation Sciences. Advance online publication.

Dunmoye, I. D., Smith, L. T., Brown, J. S., Martin, J. P., May, D., & Hunsu, N. (2025). [A systematic review on the use of collaborative virtual reality in engineering education](#). Virtual Reality.

Esmaeeli, E., Soleimani, A., Khorashadizadeh, M. S., Shahmoradi, L., Nekoonam, S., & Rezayi, S. (2025). [A practical framework for developing a virtual reality-based anatomy education application: Key content and technical requirements](#). Scientific Reports, 15(1).

Gosavi, A., Kanneganti, A., Khoo, E. T., Singh, K., Shen, L., Rauff, M., Liu, C., & Choolani, M. (2025). [Virtual reality simulation training for childbirth: A cluster randomized crossover study](#). International Journal of Gynecology & Obstetrics, 170(2), 681–690. (obstetric)

Gu, L. (2025). Beyond the classroom - [Exploring the impact of virtual reality exposure on foreign language anxiety with the mediating role of ESL Chinese learners' communicative confidence and fluency](#). Humanities and Social Sciences Communications, 12(1).

Guan, J.-Q., Zhang, M.-L., Li, X.-Y., Chen, Q., & Hwang, G.-J. (2025). [Effects of a VR-based blended approach on tourist geographic literacy, satisfaction, and problem-solving in geography field trips](#). Interactive Learning Environments, 1–20. (tourism, geography)

Hadziomerovic, N., Caklovica, K., Ducic, N., Gundemir, M. G., Vejzovic, A., Fazlovic, N., Avdic, R., Caklovica, F., & Tandir, F. (2025). [Anatomy of Meat Cuts: Integrating 3D Scanning and Virtual Reality in Veterinary Education and Training Frontiers](#). Frontiers in Veterinary Science, 12.

Hammouda, S. B., Maoua, M., & Bouchahma, M. (2025). [The Effectiveness of VR Human Anatomy Simulation Training for Undergraduate Medical Students](#). Springer Science and Business Media LLC.

Han, X., Luo, H., Zhang, D., & Wang, Z. (2025). [Using virtual reality for teacher education: A systematic review and meta-analysis of the literature from 2014 to 2024](#). INPLASY - International Platform of Registered Systematic Review and Meta-analysis Protocols.

Heldring, S., Jirwe, M., Wihlborg, J., & Lindström, V. (2025). [Acceptability and applicability of using virtual reality for training mass casualty incidents- a mixed method study](#). BMC Medical Education, 25(1).

Jingru, Z., Wan Yahaya, W. A. J., & Sanmugam, M. (2025). [An educational mobile augmented reality system to enhance undergraduate performance and motivation in design theory courses](#). Interactive Learning Environments, 1–13.

Hong, Y. A., Shi, X., & Dogan, S. (2025). [A systematic review of virtual reality technology and human memory augmentation](#). International Journal of Human–Computer Interaction, 1–41.

Hořejší, P., Lochmannová, A., Jezl, V., Devorak, M., (2025). [Virtual reality locomotion methods differentially affect spatial orientation and cybersickness during maze navigation](#). Sci Rep 15, 26255.

Hung, L., Fisher, L., Wong, J., Zhao, Y., Yuen, K., & Ren, L. H. (2025). [Best practices and practical strategies for co-designing virtual reality with Indigenous peoples: A scoping review protocol](#). PLOS One, 20(6), e0325111.

Kang, Y., & Lee, I. (2025). [HoloPatient-based simulation education to improve nursing students' learning motivation and attitude: A mixed methods study](#). BMC Medical Education, 25(1).

Khoukhi, M., & Galal Ahmed, K. (2025). [Using Virtual Reality \(VR\) To Enhance Design Skills Of Architectural Engineering Students At Uae University](#). PUPIL: International Journal of Teaching, Education and Learning, 279–280.

Kumar, A., Alkhrijah, Y. M., & Raja, L. (2025). [Innovating medical education using a cost effective and scalable VR platform with AI-Driven haptics](#). Scientific Reports, 15(1).

Synopsis: participants trained with the VR platform demonstrated significant gains over those using conventional methods, with a 42% improvement in procedural accuracy, a 38% reduction in training time, and better skill retention. The VR system also led to a 45% decrease in error rates and a 48% increase in trainee confidence.

Kumar, V., & Kushwaha, B. P. (2025). [A systematic literature review of virtual reality in tourism marketing using a mixed method](#). Cogent Business & Management, 12(1).

Kumar M, Dr. K. (2025). Virtual reality tourism: [Transforming travel experiences through immersive technologies](#). INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN ENGINEERING AND MANAGEMENT, 09(03), 1–9.

Hu, S., & Lai, B. W. P. (2025). [Teaching dental students paediatric behaviour guidance with virtual reality](#): A three-year study. European Journal of Dental Education.

Kleygrewe, L., Hutter, R. I. V., Koedijk, M., & Oudejans, R. R. D. (2023). [Changing perspectives: Enhancing learning efficacy with the after-action review in virtual reality training for police](#). Ergonomics, 67(5), 628–637.

Lampropoulos, G. (2025). [Augmented reality, virtual reality, and intelligent tutoring systems in education and training: A systematic literature review](#). Applied Sciences, 15(6), 3223.

Lee, B., Mun, S., Noh, H., Han, S., Kang, J., Kim, H., & Lee, D. (2025). [Effectiveness of scenario-based dental hygiene education using virtual reality: Intraoral radiography training](#). European Journal of Dental Education.

Lee, Hyunkook. (2025). [A unified conceptual model of immersive experience in extended reality](#). Computers in Human Behavior Reports, 18, 100663.

Li, L., Zhu, X., Wan, S. et al. [Research on the improvement of daily living skills of children with autism in virtual campus environments](#). Sci Rep 15, 30102 (2025).

Li, Z., Qiu, G., Chen, W., Shi, L., Tang, Y., Qin, G., Mo, J., & Lyu, L. (2025). [Instructor-Led VR training in medical emergency rescue education for road traffic accidents: A questionnaire-based study](#). Scientific Reports, 15(1). (EMS, paramedic)

Liu, J., Hu, T., Xu, K., Cheng, Z., Bu, W., & Lin, A. (2025). [Does a virtual simulation teaching platform improve surgical training for medical undergraduate students?](#) BMC Surgery, 25(1).

Long, L. & Tsinakos, A. (2025). [The Use of Virtual Reality to Develop Presentation Skills in Entrepreneurship Education: A Systematic Review of the Literature and Select Commercial Technologies](#). Journal of Interactive Learning Research, 36(2), 157-189. Waynesville, NC: Association for the Advancement of Computing in Education (AACE).

McAdams, R., Trinh, G., T.T., B. H., & Eickhoff, J. (2025). [Feasibility of virtual reality-based simulation for neonatal resuscitation training: A pilot study at an international site](#). Springer Science and Business Media LLC.

Mastour, H., Choubdaran, E., Abbasi, B., Emadzadeh, A., & Khadem-Rezaiyan, M. (2025). [Augmented reality for training on commonly missed extremity fractures: A study on the efficacy](#)

[of technology-enhanced health professions education in learning outcomes and experience](#). BMC Medical Education, 25(1).

Mira, J., González, M., Villalba, C., Guerra, L., Ramirez-Moya, Y., Hernández, J., Moya, O., Pineda, L., & Pérez-Esteve, C. (2025). [Improving hand hygiene skills using virtual reality: Quasi-Experimental study](#) (preprint). JMIR Publications Inc.

Neher, A. N., Bühlmann, F., Müller, M., Berendonk, C., Sauter, T. C., & Birrenbach, T. (2025). [Virtual reality for assessment in undergraduate nursing and medical education – a systematic review](#). BMC Medical Education, 25(1).

Niu, S., Zhang, J., Lin, J., Wang, B., & Yan, J. (2025). [Enhancing anatomy education with virtual reality: Integrating three-dimensional models for improved learning efficiency and student satisfaction](#). Frontiers in Medicine, 12.

Odogwu, T. S., Abuelgassem Hagahmed Mohamed, E., Mishu, L., & Umahi, I. (2025). [Effect of virtual reality simulation on anatomy learning outcomes: A systematic review](#). Cureus.

Synopsis: The review included 14 studies...71% demonstrated statistically significant improvements in anatomy learning outcomes with [VR](#) compared to traditional methods, including enhanced spatial understanding, knowledge retention, and learner engagement

Park, S., Carlisle, D. D. E., Cheng, Z., Gillies, M., & Pan, X. (2025). [Reducing foreign language anxiety through repeated exposure to a customizable VR public speaking application](#). Frontiers in Virtual Reality, 6.

Pham, A. T., & Nguyen, T. B. (2025). [Students' perceptions of teaching presence in the virtual learning environment: A community of inquiry case study in Vietnam](#). Acta Psychologica, 261, 105810.

Prakash, A. (n.d.). [Decoding learner behavior in virtual reality education: Insights from epistemic network analysis and differential sequence mining](#)_supp1-3549899.pdf.

Rakhmawati, I., Kapelari, S., & Weinberg, L. (2025). [A systematic review and network visualization of virtual reality research in biology education](#). Cogent Education, 12(1).

Reddy, T., & Sinha, S. M. (2025). [Immersive virtual reality training to identify and investigate child abuse: A review of emerging progress and future directions](#). Frontiers in Virtual Reality, 6.

Ren, J., Li, R., Zhang, W., Yu, Z., & Chen, G. (2025). [Effect of digital virtual reality simulator on pre-clinical dental surgical skill training: A retrospective study](#). BMC Medical Education, 25(1).

Santilli, T., Ceccacci, S., Mengoni, M., & Giaconi, C. (2025). [Virtual vs. traditional learning in higher education: A systematic review of comparative studies](#). Computers & Education, 227, 105214.

Savir, S., Hannan, J., Saeed, S., Tran, C., Kapoor, S., Winterton, D., Sinai, Y. B., Mitchell, J., Mahmood, F., Matyal, R., & Neves, S. (2025). [Virtual reality \(VR\) training for anesthesiologist in invasive procedures \(VR TAIP\) - A single center randomized controlled trial](#). Journal of Cardiothoracic and Vascular Anesthesia.

Slater, M. (2025). [The role of sensorimotor contingencies and eye scanpath entropy in presence in virtual reality](#): A reinforcement learning paradigm_supp1-3547241.docx. (presence)

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Synopsis: “Overwhelmingly, faculty and students rated the VR airway laboratory as having high presence, no cybersickness, and significantly improving knowledge of airway management ($p < .0001$).”

Sapkaroski, D., Mundy, M., & Dimmock, M. R. (2020). [Virtual reality versus conventional clinical role-play for radiographic positioning training: A students' perception study](#). *Radiography* (London, England. 1995), 26(1), 57–62. (role play, interpersonal)

Seabrook, E., Kelly, R., Foley, F., Theiler, S., Thomas, N., Wadley, G., & Nedeljkovic, M. (2020). [Understanding How Virtual Reality Can Support Mindfulness Practice: Mixed Methods Study](#). *Journal of Medical Internet Research*, 22(3). doi:10.2196/16106

Shakirova, N. D., Said, N. A., & Konyushenko, S. M. (2020). [The Use of Virtual Reality in Geo-Education](#). *International Journal of Emerging Technologies in Learning (iJET)*, 15(20), 59. doi:10.3991/ijet.v15i20.15433

Shao, X., Yuan, Q., Qian, D., Ye, Z., Chen, G., Zhuang, K. L., . . . Qiang, D. (2020). [Virtual reality technology for teaching neurosurgery of skull base tumor](#). *BMC Medical Education*, 20(1). doi:10.1186/s12909-019-1911-5

Synopsis: “VR improves test scores moderately compared with other approaches”

Slater, M., Gonzalez-Liencre, C., Haggard, P., Vinkers, C., Gregory-Clarke, R., Jelley, S., Watson, Z., Breen, G., Schwarz, R., Steptoe, W., Szostak, D., Halan, S., Fox, D., Silver, J. (2020). [The Ethics of Realism in Virtual and Augmented Reality](#). *Frontiers in Virtual Reality*, 1. doi:10.3389/frvir.2020.00001

Stanney, K. M., Fidopiastis, C. M., & Foster, L. (2020). [Virtual reality is sexist: But it does not have to be](#). *Frontiers in Robotics and AI*, 7, 4. (time in headset)

Syrjämäki, A. H., Isokoski, P., Surakka, V., Pasanen, T. P., & Hietanen, J. K. (2020). [Eye contact in virtual reality – A psychophysiological study](#). *Computers in Human Behavior*, 106454. doi:10.1016/j.chb.2020.106454

Synopsis: “while eye contact with a live person evokes substantial attention and emotion related psychophysiological responses, the physiological effects of eye contact are diminished in VR.”

Tychsen, L., & Foeller, P. (2020). [Effects of Immersive Virtual Reality Headset Viewing on Young Children: Visuomotor Function, Postural Stability, and Motion Sickness](#). *American Journal of Ophthalmology*, 209, 151-159. doi:10.1016/j.ajo.2019.07.020

Synopsis: “Young children tolerate fully immersive 3D virtual reality game play without noteworthy effects on visuomotor functions. VR play did not induce significant post-VR postural instability or maladaptation of the vestibulo-ocular reflex. The prevalence of discomfort and aftereffects may be less than that reported for adults.”

Zahabi, M., Abdul Razak, A.M. Adaptive virtual reality-based training: a systematic literature review and framework. *Virtual Reality* (2020). <https://doi.org/10.1007/s10055-020-00434-w>

Zhao, J., Xu, X., Jiang, H., & Ding, Y. (2020). [The effectiveness of virtual reality-based technology on anatomy teaching: A meta-analysis of randomized controlled studies](#). doi:10.21203/rs.2.21254/v1

Synopsis: “most students have a greater interest in learning via VR methods, rather than conventional or 2D teaching methods”

2019

Bennett, J. A., & Saunders, C. P. (2019). [A Virtual Tour of the Cell: Impact of Virtual Reality on Student Learning and Engagement in the STEM Classroom](#). Journal of Microbiology & Biology Education, 20(2). doi:10.1128/jmbe.v20i2.1658

Synopsis: “a majority of students enjoyed the VR experience and felt that it had a positive impact on their education”

Bracq, M.-S., Michinov, E., & Jannin, P. (2019). [Virtual reality simulation in nontechnical skills training for healthcare professionals: A systematic review](#). Simulation in Healthcare, 14(3), 188–194.

Buchman, S., & Henderson, D. (2019). [Interprofessional empathy and communication competency development in healthcare professions' curriculum through immersive virtual reality experiences](#). Journal of Interprofessional Education & Practice, 15, 127–130. (empathy, communications)

Cerezo Espinosa C., Segura Melgarejo F., Melendreras Ruiz R., García-Collado Á.J., Nieto Caballero S., Juguera Rodríguez L., Pardo Ríos S., García Torrano S., Linares Stutz E., Pardo Ríos M. (2019). [Virtual reality in cardiopulmonary resuscitation training: a randomized trial](#). Emergencias. 2019 Feb;31(1) 43-46. PMID: 30656873.

Concannon, B. J., Esmail, S., & Roduta Roberts, M. (2019). [Head-Mounted Display Virtual Reality in Post-Secondary Education and Skill Training: A Systematic Review](#). In Frontiers in Education (Vol. 4, p. 80). Frontiers.

Davis, A., Linvill, D. L., Hodges, L. F., Costa, A. F., & Lee, A. (2019). [Virtual reality versus face-to-face practice: A study into situational apprehension and performance](#). Communication Education, 69(1), 70-84. doi:10.1080/03634523.2019.1684

Synopsis: “No significant difference was found for final speech grades between the test and control groups. The significance and implications of these finding are discussed as they related to public-speaking education.”

Donally, J., (2019). [New Realities](#). Educational Leadership, v76 n5 p41-44.

Synopsis: “Incorporating virtual reality or augmented reality into classroom instruction and activities not only engages students, it provides learning experiences otherwise unavailable, such as virtually walking on the moon or building a 360-degree animation of a Revolutionary War battle”

Engelbrecht, H., Lindeman, R. W., & Hoermann, S. (2019). [A SWOT analysis of the field of virtual reality for firefighter training](#). *Frontiers in Robotics and AI*, 6, Article 101.

Faric, N., Potts, H. W., Hon, A., Smith, L., Newby, K., Steptoe, A., & Fisher, A. (2019). [What Players of Virtual Reality Exercise Games Want: Thematic Analysis of Web-Based Reviews](#). *Journal of Medical Internet Research*, 21(9). doi:10.2196/13833

Fatimah, S., Setiawan, W., Juniati, E., & Surur, A. S. (2019). [Development of Smart Content Model-based Augmented Reality to Support Smart Learning](#). *Journal of Science Learning*, 2(2), 65. doi:10.17509/jsl.v2i2.16204

Feng, Z., González, V. A., Amor, R., Lovreglio, R., & Cabrera-Guerrero, G. (2018, 12). [Immersive virtual reality serious games for evacuation training and research: A systematic literature review](#). *Computers & Education*, 127, 252-266. doi:10.1016/j.compedu.2018.09.002
Synopsis: “a discussion about the efficacy of using immersive VR to prepare teachers is offered that confirms that these types of technologies can enrich and enhance learning opportunities for future teachers, but research in this area is greatly lacking.”

Garzón, J., & Acevedo, J. (2019). [Meta-analysis of the impact of Augmented Reality on students' learning gains](#). *Educational Research Review*, 27, 244-260. doi:10.1016/j.edurev.2019.04.001

Goldhammer, F., Scherer, R., & Greiff, S. (2019). Advancements in Technology-Based Assessment: Emerging Item Formats, Test Designs, and Data Sources. *Frontiers in Psychology*, 10.

Hine, K., & Tasaki, H. (2019). [Active View and Passive View in Virtual Reality Have Different Impacts on Memory and Impression](#). *Frontiers in Psychology*, 10. doi:10.3389/fpsyg.2019.02416

Ho, L., Sun, H., & Tsai, T. (2019). [Research on 3D Painting in Virtual Reality to Improve Students' Motivation of 3D Animation Learning](#). *Sustainability*, 11(6), 1605. doi:10.3390/su11061605

Huang, K., Ball, C., Francis, J., Ratan, R., Boumis, J., & Fordham, J. (2019). [Augmented Versus Virtual Reality in Education: An Exploratory Study Examining Science Knowledge Retention When Using Augmented Reality/Virtual Reality Mobile Applications](#). *Cyberpsychology, Behavior, and Social Networking*, 22(2), 105-110. doi:10.1089/cyber.2018.0150

Huang, Y., Backman, S. J., Backman, K. F., McGuire, F. A., & Moore, D. (2018, 08). [An investigation of motivation and experience in virtual learning environments: A self-determination theory](#). *Education and Information Technologies*, 24(1), 591-611.

doi:10.1007/s10639-018-9784-5

Synopsis: "This study extends existing literature in the field by showing that psychological needs and hedonic experience are important components in understanding virtual reality technology and human interaction. The findings are important in explaining the value of 3D virtual reality technology in educational applications that contribute to the overall enhancement of the learner's motivation and learning experience."

Kim-Berman, H., Karl, E., Sherbel, J., Sytek, L., & Ramaswamy, V. (2019). [Validity and User Experience in an Augmented Reality Virtual Tooth Identification Test](#). *Journal of Dental Education*, 83(11), 1345-1352. doi:10.21815/jde.019.139

Klippel, A., Zhao, J., Oprean, D. et al. The value of being there: toward a science of immersive virtual field trips. *Virtual Reality* (2019). <https://doi.org/10.1007/s10055-019-00418-5>

Synopsis: With immersive experiences becoming a medium for mass communication, we need pedagogies as well as scientific, evidence-based design principles for immersive learning. To foster evidence-based designs of immersive learning, we detail an empirical evaluation of a geosciences field trip, common in undergraduate education across numerous disciplines. The study builds on a previously proposed research framework in which we detailed a basic taxonomy of virtual field trips distinguishing between basic, plus, and advanced immersive virtual field trip experiences.

Koutitas, G., Smith, K. S., Lawrence, G., Metsis, V., Stamper, C., Trahan, M., & Lehr, T. (2019). [A virtual and augmented reality platform for the training of first responders of the ambulance bus](#). *Proceedings of the 12th ACM International Conference on Pervasive Technologies Related to Assistive Environments*. doi:10.1145/3316782.3321542

Synopsis: The VR group had a 29% reduction on time on task and a 46% reduction in number of errors when compared to the traditional group

Krokos, E., Plaisant, C., & Varshney, A. (2019). [Virtual memory palaces: Immersion aids recall](#). *Virtual Reality*, 23(1), 1-15. doi:10.1007/s10055-018-0346-3

Synopsis: "Students have better recall — an 8.8 percent increase — when working in immersive environments as opposed to traditional computer screens."

Kuziek, J. W., Redman, E. X., Tayem, A. R., Burrell, J., Murray, J., Reinen, J., . . . Mathewson, K. E. (2019). [Real brains in virtual worlds: Validating a novel oddball paradigm in virtual reality](#). doi:10.1101/749192

Kyaw, B. M., Saxena, N., Posadzki, P., Vseteckova, J., Nikolaou, C. K., George, P. P., ... & Car, L. T. (2019). [Virtual reality for health professions education: systematic review and](#)

[meta-analysis by the digital health education collaboration](#). Journal of Medical Internet Research, 21(1), e12959. (interprofessional)

Makransky, Guido (2019). [Adding immersive virtual reality to a science lab simulation causes more presence but less learning](#). Learning and instruction (0959-4752), 60, p. 225.

Synopsis: In spite of its motivating properties (as reflected in presence ratings), learning science in VR may overload and distract the learner (as reflected in EEG measures of cognitive load), resulting in less opportunity to build learning outcomes (as reflected in poorer learning outcome test performance).

Logishetty, K., Rudran, B., & Cobb, J. P. (2019). [Virtual reality training improves trainee performance in total hip arthroplasty: A randomized controlled trial](#). The Bone & Joint Journal, 101-B(12), 1585-1592. doi:10.1302/0301-620x.101b12.bjj-2019-0643.r1

Madden, J. H., Won, A. S., Schuldt, J. P., Kim, B., Pandita, S., Sun, Y., . . . Holmes, N. G. (2019). [Virtual Reality as a Teaching Tool for Moon Phases and Beyond](#). 2018 Physics Education Research Conference Proceedings. doi:10.1119/perc.2018.pr.madden

Synopsis: "We found a strong participant preference for VR relative to the traditional methods. However, we observed no difference across conditions in average levels of performance on a pre/post knowledge test."

Makransky, G., Borre-Gude, S., & Mayer, R. E. (2019). [Motivational and cognitive benefits of training in immersive virtual reality based on multiple assessments](#). Journal of Computer Assisted Learning, 35(6), 691-707. doi:10.1111/jcal.12375

Makransky, G., Terkildsen, T. S., & Mayer, R. E. (2019). [Adding immersive virtual reality to a science lab simulation causes more presence but less learning](#). Learning and Instruction, 60, 225-236. doi:10.1016/j.learninstruc.2017.12

Mills, B., Dykstra, P., Hansen, S., Miles, A., Rankin, T., Hopper, L., . . . Bartlett, D. (2019). [Virtual Reality Triage Training Can Provide Comparable Simulation Efficacy for Paramedicine Students Compared to Live Simulation-Based Scenarios](#). Prehospital Emergency Care, 1-12. doi:10.1080/10903127.2019.167634

Nas, J. (2019). [Effect of Face-to-Face vs Virtual Reality Training on Cardiopulmonary Resuscitation Quality](#). JAMA Cardiology. DOI: 10.1001/jamacardio.2019.4992

Synopsis: VR not quite as good as F2F training for CPR and "In this randomized noninferiority trial, VR training resulted in comparable chest compression rate but inferior compression depth compared with face-to-face training."

Piccione, J., Collett, J., & De Foe, A. (2019). [Virtual skills training: The role of presence and agency](#). Heliyon, 5(11), e02583. (key words: presence)

Paxinou, E., Panagiotakopoulos, C. T., Karatrantou, A., Kalles, D., & Sgourou, A. (2019). [Implementation and Evaluation of a Three-Dimensional Virtual Reality Biology Lab versus Conventional Didactic Practices in Lab Experimenting with the Photonic Microscope](#).

Biochemistry and Molecular Biology Education. doi:10.1002/bmb.21307

Synopsis: This study presents three different teaching scenarios, during biology laboratory lessons, with the overall aim of exploring the potential predominant effectiveness of teaching and improvement of students' learning, by the use of the three-dimensional virtual reality educational tool Results of the present study provide evidence in favor of the virtual reality application.

Putman, et al. [“I Can See It!”: Math Understanding through Virtual Reality.](#) Educational Leadership, v76 n5 p36-40. 1703 North Beauregard Street, Alexandria, VA.

Queiroz, A. C., Nascimento, A. M., Tori, R., & Leme, M. I. (2019). [Immersive Virtual Environments and Learning Assessments](#). Communications in Computer and Information Science Immersive Learning Research Network, 172-181. doi:10.1007/978-3-030-23089-0_13

Quintero, J., Baldiris, S., Rubira, R., Cerón, J., & Velez, G. (2019). [Augmented Reality in Educational Inclusion. A Systematic Review on the Last Decade](#). Frontiers in psychology, 10, 1835. doi:10.3389/fpsyg.2019.01835

Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2019). [A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda](#). Computers & Education, 103778. doi:10.1016/j.compedu.2019.103778
Synopsis: “Technologies described in most of the reviewed articles remained in an experimental state and were mostly tested in terms of their performance and usability.”

Servotte, J., Goosse, M., Campbell, S. H., Dardenne, N., Pilote, B., Simoneau, I. L., Campbell, S. H., Guillaume, M., Bragard, I., & Ghuysen, A. (2019). [Virtual Reality Experience: Immersion, Sense of Presence, and Cybersickness](#).

Simmering, V. R., Ou, L., & Bolsinova, M. (2019). [What technology can and cannot do to support assessment of non-cognitive skills](#). Frontiers in Psychology, 10, 2168.

Tychsen, L., & Foeller, P. (2019). [Effects of Immersive Virtual Reality Headset Viewing on Young Children: Visuomotor Function, Postural Stability, and Motion Sickness](#). American Journal of Ophthalmology. doi:10.1016/j.ajo.2019.07.020

Ulrich, F., Helms, N.H., Frandsen, U.P. & Rafn. A.V. (2019) [Learning effectiveness of 360° video: experiences from a controlled experiment in healthcare education, Interactive Learning Environments](#), DOI: [10.1080/10494820.2019.1579234](#)

Synopsis: 360 degree video was no more effective than 2D video.

Weng, C., Rathinasabapathi, A., Weng, A., & Zagita, C. (2018, 03). [Mixed Reality in Science Education as a Learning Support: A Revitalized Science Book](#). Journal of Educational Computing Research, 57(3), 777-807. doi:10.1177/0735633118757017

Synopsis: "The sample for this study consisted of 80 fifth-grade students, divided into a control and an experimental group. The results revealed that using mixed reality (augmented reality and virtual reality) as a learning supplement to the printed book could improve students' learning outcomes, particularly for low spatial ability students."

Zweifach, S., & Triola, M. (2019). [Extended Reality in Medical Education: Driving Adoption through Provider-Centered Design](#). Digital Biomarkers, 3(1), 14-21. doi:10.1159/000498923

2018

Allcoat, D., & Mühlenen, A. V. (2018). [Learning in virtual reality: Effects on performance, emotion and engagement](#). Research in Learning Technology, 26(0). doi:10.25304/rlt.v26.2140

Synopsis: "breakdown of the learning data showed that participants in the VR condition were better at 'remembering' than those in the video and traditional conditions, and participants in both VR and traditional conditions were better at 'understanding' than those in the video condition."

Banakou, D., Kishore, S., & Slater, M. (2018). [Virtually being Einstein results in an improvement in cognitive task performance and a decrease in age bias](#). Frontiers in Psychology, 9. <https://doi.org/10.3389/fpsyg.2018.00917>

Beck, D., Allison, C., Morgado, L., Pirker, J., Peña-Rios, A., Ogle, T., ... & Gütl, C. (Eds.). (2018). [Immersive Learning Research Network](#). Springer International Publishing.

Bertrand, P., Guegan, J., Robieux, L., McCall, C. A., & Zenasni, F. (2018). [Learning Empathy Through Virtual Reality: Multiple Strategies for Training Empathy-Related Abilities Using Body Ownership Illusions in Embodied Virtual Reality](#). Frontiers in Robotics and AI, 5. doi:10.3389/frobt.2018.00026 [Download](#)

Cheng, A., Nadkarni, V. M., Mancini, M. B., Hunt, E. A., Sinz, E. H., Merchant, R. M., . . . Bhanji, F. (2018). [Resuscitation Education Science: Educational Strategies to Improve Outcomes From Cardiac Arrest](#): A Scientific Statement From the American Heart Association. Circulation, 138(6). doi:10.1161/cir.0000000000000583

Synopsis: Virtual training for AED use and training has also been shown to be feasible and favorable for knowledge and skills acquisition.

Dyer, E., Swartzlander, B. J., & Gugliucci, M. R. (2018). [Using virtual reality in medical education to teach empathy](#). Journal of the Medical Library Association, 106(4). doi:10.5195/jmla.2018.518

Gabunilas, Lowell & Burns, Kim & Chiu, Jiff & Sanchez, Stephen & Adlao, Eva Mae. (2018). [UTILIZING PORTABLE VIRTUAL REALITY IN TEACHING CHEMISTRY](#). 30. 263-266.

Herrera, F., Bailenson, J.N., Weisz, E., Ogle, E. & Zaki J. (2018) [Building long-term empathy: A large-scale comparison of traditional and virtual reality perspective-taking](#). PLoS ONE 13(10): e0204494. <https://doi.org/10.1371/journal.pone.0204494>

Huang, H., & Liaw, S. (2018). [An Analysis of Learners' Intentions Toward Virtual Reality Learning Based on Constructivist and Technology Acceptance Approaches](#). The International Review of Research in Open and Distributed Learning, 19(1). doi:10.19173/irrodl.v19i1.2503

Jiang, B., Ju, H., Zhao, Y., Yao, L., & Feng, Y. (2018). [Comparison of the efficacy and efficiency of the use of virtual reality simulation with high-fidelity mannequins for simulation-based training of fiberoptic bronchoscope manipulation](#). Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare, 13(2), 83–87. ([pdf](#))

Synopsis: “some studies concluded that [VR technology](#) was significantly more efficient than mannequin training with a pronounced positive effect for novices ([Jiang et al., 2018](#)).”

Krokos, E., Plaisant, C., & Varshney, A. (2018). [Virtual memory palaces: Immersion aids recall](#). Virtual Reality, 23(1), 1–15. ([related article](#))

Synopsis: “The overall average recall performance of participants in the HMD condition was 8.8% higher compared to the desktop condition with the mean recall accuracy percentage for HMD condition at 84.05% and the desktop condition at 75.24%.”

Markowitz, D.M., Laha, R., Perone, B.P., Pea, R.D. & Bailenson J.N. (2018). [Immersive Virtual Reality Field Trips Facilitate Learning About Climate Change](#). Frontiers in Psychology, 9, DOI=10.3389/fpsyg.2018.02364

Synopsis: Tested the efficacy of immersive Virtual Reality (VR) as an education medium for teaching the consequences of climate change, particularly ocean acidification. After experiencing immersive VR people demonstrated knowledge gains or inquisitiveness about climate science and in some cases, displayed more positive attitudes toward the environment after comparing pre- and post-test assessments.

Mystakidis, S., & Berki, E. (2018). The Case of Literacy Motivation: Playful 3D Immersive Learning Environments and Problem-Focused Education for Blended Digital Storytelling. International Journal of Web-Based Learning and Teaching Technologies, 13(1), 64–79. <https://doi.org/10.4018/IJWLTT.2018010105>

Oh, S.Y., Bailenson, J.N. & Welch, G.F. (2018) [A Systematic Review of Social Presence: Definition, Antecedents, and Implications](#). Frontiers in Robotics and AI, 5 (14), 1-34.
doi.org/10.3389/frobt.2018.00114 [PDF](#)

Papanastasiou, G., Drigas, A., Skianis, C., Lytras, M., & Papanastasiou, E. (2018). [Virtual and augmented reality effects on K-12, higher and tertiary education students' twenty-first century skills](#). Virtual Reality, 23(4), 425-436. doi:10.1007/s10055-018-0363-2

Parish-Morris, J., Solórzano, R., Ravindran, V., Sazawal, V., Turnacioglu, S., Zitter, A., Miller, J. & McCleery, J. (2018). [Immersive Virtual Reality to Improve Police Interaction Skills in Adolescents and Adults with Autism Spectrum Disorder: Preliminary Results of a Feasibility and Safety Trial](#). Proc of the 23rd Annual CyberPsychology, CyberTherapy & Social Networking Conference, Gatineau, Canada.

Park, M., Im, H., & Kim, D. Y. (2018). [Feasibility and user experience of virtual reality fashion stores](#). Fashion and Textiles, 5(1). doi:10.1186/s40691-018-0149-x

Price, M. F., Tortosa, D. E., Fernandez-Pacheco, A. N., Alonso, N. P., Madrigal, J. J., Melendreras-Ruiz, R., . . . Rodriguez, L. J. (2018). [Comparative study of a simulated incident with multiple victims and immersive virtual reality](#). Nurse Education Today, 71, 48-53.
doi:10.1016/j.nedt.2018.09.006

Siegle, D. (2018). [Seeing Is Believing: Using Virtual and Augmented Reality to Enhance Student Learning](#). Gifted Child Today, 42(1), 46-52. doi:10.1177/1076217518804854

Samadbeik M, Yaaghobi D, Bastani P, Abhari S, Rezaee R, Garavand A., (2018). [The Applications of Virtual Reality Technology in Medical Groups Teaching](#). Journal of Advances in Medical Education and Professionalism. 123-129. PMID: 30013996; PMCID: PMC6039818.

van Loon, A., Bailenson, J.N., Zaki, J., Bostick, J. & Willer, R. (2018) [Virtual reality perspective-taking increases cognitive empathy for specific others](#). PLoS ONE 13(8):e0202442.
doi: 10.1371/journal.pone.0202442

Vazquez, C., Xia, L., Aikawa, T., & Maes, P. (2018). Words in Motion: [Kinesthetic Language Learning in Virtual Reality](#). 2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT). doi:10.1109/icalt.2018.00069

Synopsis: “virtual kinesthetic learners showed significantly higher retention rates after a week of exposure than all other conditions and higher performance than non-kinesthetic virtual reality learners. Positive correlation between the times a word-action pair was executed and the times a word was remembered by the subjects, supports that virtual reality can impact language learning by leveraging kinesthetic elements. [Website](#).

Wang, H., Jiang, S., & Wu, J. (2018). [A Virtual Reality Based Simulator for Training Surgical Skills in Procedure of Catheter Ablation](#). 2018 IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR). doi:10.1109/aivr.2018.00057

Synopsis: "The beating of human heart is also simulated in real time with our method within the position based dynamics framework. Results demonstrate that our simulator provides a realistic, effective, and stable environment for trainees to acquire essential surgical skills."

Yildirim, G., Elban, M., & Yildirim, S. (2018). [Analysis of Use of Virtual Reality Technologies in History Education: A Case Study](#). Asian Journal of Education and Training, 4(2), 62-69. doi:10.20448/journal.522.2018.42.62.69

2017

Birt, J., Moore, E., & Cowling, M. (2017). [Improving paramedic distance education through mobile mixed reality simulation](#). Australasian Journal of Educational Technology, 33(6). doi:10.14742/ajet.3596 [Full Text](#)

Synopsis: "results from the two rounds of this study show a statistically significant improvement for students who were provided with the paramedic simulation tools ahead of the residential school."

Daher, S., Kim, K., Lee, M., Bruder, G., Schubert, R., Bailenson, J., & Welch, G. F. (2017). [Can social presence be contagious? Effects of social presence priming on interaction with Virtual Humans](#). 2017 IEEE Symposium on 3D User Interfaces (3DUI). IEEE.

Fox, B. I., & Felkey, B. G. (2017). [Virtual Reality and Pharmacy: Opportunities and Challenges](#). Hospital Pharmacy, 52(2), 160-161. doi:10.1310/hpj5202-160

Kim, K., Maloney, D., Bruder, G., Bailenson, J.N., & Welch, G.F. (2017). [The effects of virtual human's spatial and behavioral coherence with physical objects on social presence in AR](#) [Computer Animation and Virtual Worlds](#). 2017;28:e1771. ([PDF](#))

Lin, M. T. (2017). [A Study on the Effect of Virtual Reality 3D Exploratory Education on Students' Creativity and Leadership](#). EURASIA Journal of Mathematics, Science and Technology Education, 13. doi:10.12973/eurasia.2017.00709a [PDF](#)

Liu, D., Dede, C., Huang, R., & Richards, J. (Eds.). (2017). Virtual, augmented, and mixed realities in education. Springer. <https://link.springer.com/book/10.1007%2F978-981-10-5490-7>

Lloyd, A., Rogerson, S., & Stead, G. (2017). [Imagining the potential for using virtual reality technologies in language learning](#). In Digital Language Learning and Teaching (pp. 222–234). Routledge.

McGrath, J. L., Taekman, J. M., Dev, P., Danforth, D. R., Mohan, D., Kman, N., ... Bond, W. F. (2017). [Using virtual reality simulation environments to assess competence for emergency medicine learners](#). *Academic Emergency Medicine*, 25(2), 186–195. (analytics, summative)

Schöne, B., Wessels, M., & Gruber, T. (2017). [Experiences in Virtual Reality: A Window to Autobiographical Memory](#). *Current Psychology*, 38(3), 715-719. doi:10.1007/s12144-017-9648-y

Skarbez, R., Neyret, S., Brooks, F. P., Slater, M., & Whitton, M. C. (2017). A psychophysical experiment regarding components of the plausibility illusion. *IEEE Transactions on Visualization and Computer Graphics*, 23(4), 1369-1378. doi: 10.1109/TVCG.2017.2657158.

Vazquez, C. D., Nyati, A. A., Luh, A., Fu, M., Aikawa, T., & Maes, P. (2017). [Serendipitous Language Learning in Mixed Reality](#). Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '17. doi:10.1145/3027063.3053098

2016

Bailey, J.O., Bailenson, J.N., & Casasanto, D. (2016). [When does virtual embodiment change our minds? Presence: Teleoperators and Virtual Environments](#). 25(2), 222-233. (PDF)

Synopsis: “With cognition rooted in the body and learning occurring at an unconscious level, memories and mental representations may be extended out from the physical body onto technology, blurring the physical and the mediated.”

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