

DAFTAR PUSTAKA

- Abdinejad, M., Ferrag, C., Qorbani, H. S., & Dalili, S. (2021). Developing a simple and cost-effective markerless augmented reality tool for chemistry education. *Journal of Chemical Education*, 98(5), 1783–1788. <https://doi.org/10.1021/acs.jchemed.1c00173>
- Abdul Hanid, M. F., Mohamad Said, M. N. H., Yahaya, N., & Abdullah, Z. (2022). Effects of augmented reality application integration with computational thinking in geometry topics. *Education and Information Technologies*, 27(7), 9485–9521. <https://doi.org/10.1007/s10639-022-10994-w>
- Abdullah, A. H., & Zakaria, E. (2013). The Effects of Van Hiele's Phases of Learning Geometry on Students' Degree of Acquisition of Van Hiele Levels. *Procedia - Social and Behavioral Sciences*, 102, 251–266. <https://doi.org/10.1016/j.sbspro.2013.10.740>
- Adipat, S., Laksana, K., Busayanon, K., Ausawasowan, A., & Adipat, B. (2021). Engaging students in the learning process with Game-Based Learning: The fundamental concepts. *International Journal of Technology in Education*, 4(3), 542–552. <https://doi.org/10.46328/ijte.169>
- Agwu, U. D., & Nmadu, J. (2023). Students' interactive engagement, academic achievement and self concept in chemistry: an evaluation of cooperative learning pedagogy. *Chemistry Education Research and Practice*, 24(2), 688–705. <https://doi.org/10.1039/d2rp00148a>
- Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. *Educational and Psychological Measurement*, 45(1), 131-142. <https://doi.org/10.1177/0013164485451012>
- Alibraheim, E. A., Hassan, H. F., & Soliman, M. W. (2023). Efficacy of educational platforms in developing the skills of employing augmented reality in teaching mathematics. *Eurasia Journal of Mathematics, Science and Technology Education*, 19(11). <https://doi.org/10.29333/ejmste/13669>
- Almaiah, M. A., Hajjej, F., Lutfi, A., Al-Khasawneh, A., Shehab, R., Al-Otaibi, S., & Alrawad, M. (2022). Explaining the factors affecting students' attitudes to using online learning (Madrasati Platform) during COVID-19. *Electronics (Switzerland)*, 11(7). <https://doi.org/10.3390/electronics11070973>
- Alrige, M., Bitar, H., Al-Suraihi, W., Bawazeer, K., & Al-Hazmi, E. (2021). MicroWorld: An augmented-reality arabian app to learn atomic space. *Technologies*, 9(3). <https://doi.org/10.3390/technologies9030053>

- Angeli, C., Voogt, J., Fluck, A., Webb, M., Cox, M., Malyn-Smith, J., & Zagami, J. (2016). A K-6 computational thinking curriculum framework: Implications for teacher knowledge. *Education Technology and Society*, 19(3), 47–57.
- Angraini, L. M., Susilawati, A., Noto, M. S., Wahyuni, R., & Andrian, D. (2024). Augmented Reality for Cultivating Computational Thinking Skills in Mathematics Completed with Literature Review, Bibliometrics, and Experiments for Students. *Indonesian Journal of Science and Technology*, 9(1), 225–260. <https://doi.org/10.17509/ijost.v9i1.67258>
- Anshari, M., Almunawar, M. N., Shahrill, M., Wicaksono, D. K., & Huda, M. (2017). Smartphones usage in the classrooms: Learning aid or interference? *Education and Information Technologies*, 22(6), 3063–3079. <https://doi.org/10.1007/s10639-017-9572-7>
- Azuma, R., Bailiot, Y., Behringer, R., Feiner, S., Julier, S., & Macintyre, B. (2001). Recent Advances in Augmented Reality. *IEEE Computer Graphics and Applications*, 34–47.
- Azwar, S. (2000). Asumsi-asumsi dalam inferensi statistika. *Buletin Psikologi*, 9(1), 8–17. <http://dx.doi.org/10.22146/bpsi.7436>
- Baiduri, Ismail, A. D., & Sulfiyah, R. (2020). Understanding the concept of visualization phase student in geometry learning. *International Journal of Scientific and Technology Research*, 9(2), 2353–2359.
- Barr, V., & Stephenson, C. (2011). Bringing computational thinking to K-12: What is involved and what is the role of the computer science education community? *ACM Inroads*, 2(1), 48–54. <https://doi.org/10.1145/1929887.1929905>
- Berland, M., & Wilensky, U. (2015). Comparing Virtual and Physical Robotics Environments for Supporting Complex Systems and Computational Thinking. *Journal of Science Education and Technology*, 24, 628–647. <https://doi.org/10.1007/s10956-015-9552-x>
- Bi, J., & Kuesten, C. (2012). Intraclass Correlation Coefficient (ICC): A Framework for Monitoring and Assessing Performance of Trained Sensory Panels and Panelists. *Journal of Sensory Studies*, 27(5), 352–364. <https://doi.org/10.1111/j.1745-459X.2012.00399.x>
- Biró, P., Csernoch, M., Máth, J., & Abari, K. (2015). Measuring the Level of Algorithmic Skills at the End of Secondary Education in Hungary. *Procedia - Social and Behavioral Sciences*, 176, 876–883. <https://doi.org/10.1016/j.sbspro.2015.01.553>
- Bouaziz, R., Alhejaili, M., Al-Saedi, R., Mihdhar, A., & Alsarrani, J. (2020). Using marker based Augmented Reality to teach autistic eating skills.

Proceedings - 2020 IEEE International Conference on Artificial Intelligence and Virtual Reality, AIVR 2020, 239–242. <https://doi.org/10.1109/AIVR50618.2020.00050>

- Butler, A., Camilleri, M. A., Creed, A., & Zutshi, A. (2021). The use of mobile learning technologies for corporate training and development: A contextual framework. *Strategic Corporate Communication in the Digital Age*, 115-130. <https://doi.org/10.1108/978-1-80071-264-520211007>
- Campos, E., Hidrogo, I., & Zavala, G. (2022). Impact of Virtual Reality use on the teaching and learning of vectors. *Frontiers in Education*, 7. <https://doi.org/10.3389/educ.2022.965640>
- Çetin, H., & Türkan, A. (2022). The Effect of Augmented Reality based applications on achievement and attitude towards science course in distance education process. *Education and Information Technologies*, 27(2), 1397–1415. <https://doi.org/10.1007/s10639-021-10625-w>
- Chang, R. (2010). *Chemistry* (10th Ed.). New York: McGraw-Hill.
- Chathuranga, M. M. N., & Jaysundara, J. M. D. P. (2020). Impact of smartphone usage on academic performance: a study on undergraduates in fmsc of University of Sri Jayewardenepura, Sri Lanka. *Journal of Management*, 15(1).
- Chittleborough, G., & Treagust, D. (2007). The modelling ability of non-major chemistry students and their understanding of the sub-microscopic level. *Chemistry Education Research and Practice*, 8(3), 274-292.
- Chu, H.C., Chen, J.M., Hwang, G.J., Chen, T.W. (2019) Effects of formative assessment in an augmented reality approach to conducting ubiquitous learning activities for architecture courses. *Univ Access Inf Soc* 18, 221–230. <https://doi.org/10.1007/s10209-017-0588-y>
- Chung, C.-Y., & Hsiao, I.-H. (2020). Computational Thinking in Augmented Reality: An Investigation of Collaborative Debugging Practices. *6th International Conference of the Immersive Learning Research Network*, 54-61.
- Chun, H., Lee, H., & Kim, D. (2012). The integrated model of smartphone adoption: Hedonic and utilitarian value perceptions of smartphones among Korean college students. *Cyberpsychology, Behavior, and Social Networking*, 15(9), 473–479. <https://doi.org/10.1089/cyber.2012.0140>
- Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th Ed.). New York: Routledge.
- Cresswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th Ed.). Boston: Pearson.

- Csizmadia, A., Curzon, P., Humphreys, S., Ng, T., Selby, C., & Woollard, J. (2015). Computational thinking: A guide for teachers. California, United States: Computing At School. *Mark Dorling Digital Schoolhouse London Project*.
- Dağ, F., Şumuer, E., & Durdu, L. (2023). The effect of an unplugged coding course on primary school students' improvement in their computational thinking skills. *Journal of Computer Assisted Learning*, 39(6), 1902–1918. <https://doi.org/10.1111/jcal.12850>
- Del Olmo-Muñoz, J., Bueno-Baquero, A., Cózar-Gutiérrez, R., & González-Calero, J. A. (2023). Exploring gamification approaches for enhancing computational thinking in young learners. *Education Sciences*, 13(5). <https://doi.org/10.3390/educsci13050487>
- Deslauriers, L., McCarty, L. S., Miller, K., Callaghan, K., & Kestin, G. (2019). Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. *Proceedings of the National Academy of Sciences of the United States of America*, 116(39), 19251–19257. <https://doi.org/10.1073/pnas.1821936116>
- Di Serio, Á., Ibáñez, M. B., & Kloos, C. D. (2013). Impact of an augmented reality system on students' motivation for a visual art course. *Computers and Education*, 68, 586–596. <https://doi.org/10.1016/j.compedu.2012.03.002>
- Doleck, T., Bazelais, P., Lemay, D. J., Saxena, A., & Basnet, R. B. (2017). Algorithmic thinking, cooperativity, creativity, critical thinking, and problem solving: exploring the relationship between computational thinking skills and academic performance. *Journal of Computers in Education*, 4(4), 355–369. <https://doi.org/10.1007/s40692-017-0090-9>
- Echeverría, L., Cobos, R., Morales, M., Moreno, F., & Negrete, V. (2019). Promoting computational thinking skills in primary school students to improve learning of geometry. *IEEE Global Engineering Education Conference*, 424–429. <https://doi.org/10.1109/EDUCON.2019.8725088>
- Eh Phon, D. N., Ali, M. B., & Halim, N. D. A. (2014). Collaborative augmented reality in education: A review. *Proceedings - 2014 International Conference on Teaching and Learning in Computing and Engineering, LATICE 2014*, 78–83. <https://doi.org/10.1109/LaTiCE.2014.23>
- Elmqaddem, N. (2019). Augmented Reality and Virtual Reality in education. Myth or reality? *International Journal of Emerging Technologies in Learning*, 14(3), 234–242. <https://doi.org/10.3991/ijet.v14i03.9289>

- El-Sofany, H. F., & El-Haggar, N. (2020). The effectiveness of using mobile learning techniques to improve learning outcomes in higher education. *International Journal of Interactive Mobile Technologies*, 14(8), 4–18. <https://doi.org/10.3991/IJIM.V14I08.13125>
- Fabián, H., & Muñoz, T. (2017). *SUPPORTING TECHNOLOGY FOR AUGMENTED REALITY GAME-BASED LEARNING*. <http://hdl.handle.net/10803/132xxx>
- Fadzil, M., Haruzuan, M. N., Noraffandy, & Fadhilah, N. (2018). Application development of augmented reality in geometry topic Based on multimedia learning cognitive theory. In *SSRN Electronic Journal*, 68-70. <https://ssrn.com/abstract=3513799>
- Fatimah, F. N., Riyadi, & Sari, D. R. (2019). The implementation of problem based learning (PBL) model viewed from mathematical connection competence on x year students of vocational high school. *Journal of Physics: Conference Series*, 1280(4). <https://doi.org/10.1088/1742-6596/1280/4/042004>
- Field, A.P. (2018) *Discovering Statistics Using IBM SPSS Statistics*. 5th Edition, Sage, Newbury Park.
- Fujiwara, D., Pietroszek, K., Kellar, K., Eckhardt, C., & Humer, I. (2020). VSEPR theory, an interactive and immersive Virtual Reality. In *2020 6th International Conference of the Immersive Learning Research Network*.
- Garcia-Ruiz, M. A., C. Santana, P., & Molina, I. (2014). Using effective stereoscopic molecular model visualizations in undergraduate classrooms. *International Journal for Cross-Disciplinary Subjects in Education*, 5(1), 1593–1598. <https://doi.org/10.20533/ijcdse.2042.6364.2014.0223>
- Garzon, J., & Acevedo, J. (2019). Meta-analysis of the impact of Augmented Reality on students' learning gains. *Educational Research Review*, 27, 244-260. <https://doi.org/10.1016/j.edurev.2019.04.001>
- Gerald, B. (2018). A brief review of independent, dependent and one sample t-test. *International Journal of Applied Mathematics and Theoretical Physics*, 4(2), 50. <https://doi.org/10.11648/j.ijamtp.20180402.13>
- Gibson, J. P. (2012). Teaching graph algorithms to children of all ages. Annual Conference on Innovation and Technology in Computer Science Education, *ITiCSE*, 34–39. <https://doi.org/10.1145/2325296.2325308>
- Gillespie, R. J. (2004). Commentary teaching molecular geometry with the VSEPR Model. In *Chemical Education Today 298 Journal of Chemical Education*, 81(3). www.JCE.DivCHED.org

- González, N. A. A. (2015). How to include augmented reality in descriptive geometry teaching. *Procedia Computer Science*, 75, 250–256. <https://doi.org/10.1016/j.procs.2015.12.245>
- González, F., López, C., & Castro, C. (2018). Development of Computational Thinking in High School Students: A Case Study in Chile. *Proceedings - International Conference of the Chilean Computer Science Society, SCCC*. <https://doi.org/10.1109/SCCC.2018.8705239>
- Gulacar, O., Milkey, A., & Mclane, S. (2019). Exploring the effect of prior knowledge and gender on undergraduate students' knowledge structures in chemistry. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(8). <https://doi.org/10.29333/ejmste/106231>
- Hamzah, M. L., Ambiyar, Rizal, F., Simatupang, W., Irfan, D., & Refdinal. (2021). Development of Augmented Reality application for learning computer network device. *International Journal of Interactive Mobile Technologies*, 15(12), 47–64. <https://doi.org/10.3991/ijim.v15i12.21993>
- Harangus, K., & Kátai, Z. (2020). Computational thinking in secondary and higher education. *Procedia Manufacturing*, 46, 615–622. <https://doi.org/10.1016/j.promfg.2020.03.088>
- Hill, A. M. (1998). Problem Solving in Real-Life Contexts: An Alternative for Design in Technology Education. *International Journal of Technology and Design Education*, 8(3), 203–220. <https://doi.org/10.1023/A:1008854926028>
- Hou, H. T., & Lin, Y. C. (2017). The development and evaluation of an educational game integrated with Augmented Reality and Virtual Laboratory for chemistry experiment learning. *Proceedings - 2017 6th IIAI International Congress on Advanced Applied Informatics, IIAI-AAI 2017*, 1005–1006. <https://doi.org/10.1109/IIAI-AAI.2017.14>
- Huang, S.-Y.; Tarng, W.; Ou, K.-L. (2023). Effectiveness of AR Board Game on Computational Thinking and Programming Skills for Elementary School Students. *Systems*, 11, 25. <https://doi.org/10.3390/systems11010025>
- Irnidayanti, Y., & Fadhilah, N. (2023). Teaching quality in Indonesia: What needs to be improved? In R. Maulana et al. (eds.), *Effective Teaching Around the World*, 225-244. Switzerland: Springer. <https://doi.org/10.1007/978-3-031-31678-4>
- Johnstone, A. H. (1991). Why is science difficult to learn? Things are seldom what they seem. *Journal of Computer Assisted Learning*, 7, 75-83.

- Kalelioğlu, F. (2018). Characteristics of studies conducted on computational thinking: a content analysis. *Computational Thinking in the STEM Disciplines*, 11–29. Cham, Switzerland: Springer. https://doi.org/10.1007/978-3-319-93566-9_2
- Kaya, O. S., & Bicen, H. (2019). Study of augmented reality applications use in education and its effect on the academic performance. *International Journal of Distance Education Technologies*, 17(3), 25–36. <https://doi.org/10.4018/IJDET.2019070102>
- Kemendikbud. (2017). Modul pengembangan keprofesian berkelanjutan mata pelajaran kimia sekolah menengah atas (SMA). Jakarta: Kementerian Pendidikan dan Kebudayaan.
- Kiernan, N. A., Manches, A., & Seery, M. K. (2021). The role of visuospatial thinking in students' predictions of molecular geometry. *Chemistry Education Research and Practice*, 22(3), 626–639. <https://doi.org/10.1039/d0rp00354a>
- Koch, S., Barkmann, J., Strack, M., Sundawati, L., & Bögeholz, S. (2013). Knowledge of Indonesian university students on the sustainable management of natural resources. *Sustainability (Switzerland)*, 5(4), 1443–1460. <https://doi.org/10.3390/su5041443>
- Kumar Singh, Y. (2006). *Fundamental of research methodology and statistics*. New Delhi: New Age International.
- Lam, M. C., Tee, H. K., Muhammad Nizam, S. S., Hashim, N. C., Suwadi, N. A., Tan, S. Y., Abd Majid, N. A., Arshad, H., & Liew, S. Y. (2020). Interactive augmented reality with natural action for chemistry experiment learning. *TEM Journal*, 9(1), 351–360. <https://doi.org/10.18421/TEM91-48>
- Lampropoulos, G., Keramopoulos, E., Diamantaras, K., & Evangelidis, G. (2022). Augmented reality and gamification in education: A systematic literature review of research, applications, and empirical studies. *Applied Sciences (Switzerland)*, 12(13). <https://doi.org/10.3390/app12136809>
- Liao, Y-T., Yu, C. -H. & Wu, C. -C. (2015). Learning Geometry with Augmented Reality to Enhance Spatial Ability. *International Conference on Learning and Teaching in Computing and Engineering*, 221-222. <https://doi.org/10.1109/LaTiCE.2015.40>
- Lim, T.-S., & Loh, W.-Y. (1996). A comparison of tests of equality of variances 1. *Computational Statistics & Data Analysis*, 22, 287-301.
- Lin, Y. S., Chen, S. Y., Tsai, C. W., & Lai, Y. H. (2021). Exploring Computational Thinking Skills Training Through Augmented Reality and

- AIoT Learning. *Frontiers in Psychology*, 12. 1–9. <https://doi.org/10.3389/fpsyg.2021.640115>
- Liu, Q., Ma, J., Yu, S., Wang, Q., & Xu, S. (2023). Effects of an augmented reality-based chemistry experiential application on student knowledge gains, learning motivation, and technology perception. *Journal of Science Education and Technology*, 32(2), 153–167. <https://doi.org/10.1007/s10956-022-10014-z>
- Liu, X., Sohn, Y.-H., & Park, D.-W. (2018). Application development with augmented reality technique using unity 3D and vuforia. *In International Journal of Applied Engineering Research*, 13(21), 15068-15071. <http://www.ripublication.com>
- Lutfi, A., Saad, M., Almaiah, M. A., Alsaad, A., Al-Khasawneh, A., Alrawad, M., Alsyouf, A., & Al-Khasawneh, A. L. (2022). Actual use of mobile learning technologies during social distancing circumstances: Case study of king faisal University students. *Sustainability (Switzerland)*, 14(12). <https://doi.org/10.3390/su14127323>
- Lytridis, C., Tsinakos, A., & Kazanidis, I. (2018). ARTutor—An augmented reality platform for interactive distance learning. *Education Sciences*, 8(1). <https://doi.org/10.3390/educsci8010006>
- Mohd Razali, N., & Bee Wah, Y. (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics*, 2, 21-33.
- Muganga, L., & Ssenkusu, P. (2019). Teacher-Centered vs. Student-Centered: An examination of student teachers' perceptions about pedagogical practices at Uganda's Makerere University. *Cultural and Pedagogical Inquiry*, 11(2), 16–40. <http://ejournals.library.ualberta.ca/index.php/cpi/index>
- Myers, Richard. (1951). *The Basics of Chemistry*. Greenwood Press, USA.
- Park, Y. (2011). A pedagogical framework for mobile learning: Categorizing educational applications of mobile technologies into four types. *International Review of Research in Open and Distance Learning*, 12(2).
- Peel, A., Sadler, T. D., & Friedrichsen, P. (2021). Using Unplugged Computational Thinking to Scaffold Natural Selection Learning. *American Biology Teacher*, 83(2), 112-117. <https://doi.org/10.1525/abt.2021.83.2.112>
- Peter Ifeanyi Joshua Ebere Chukwuere, I., Peter Ifeanyi, I., & Ebere Chukwuere, J. (2018). The impact of using smartphones on the academic performance of undergraduate students. *Knowledge Management & E-Learning: An International Journal Knowledge Management & E-Learning*, 10(3), 290–308.

- Psycharis, S. (2018). Steam in Education: A literature review on the role of computational thinking, engineering epistemology and computational science. *Scientific Culture*, 4(2), 51-72. <https://doi.org/10.5281/zenodo.1214565>
- Quintero, E.; Salinas, P.; González-Mendivil, E.; Ramírez, H. (2015). Augmented reality app for calculus: A proposal for the development of spatial visualization. *Procedia Comput.*, 75, 301–305. <https://doi.org/10.1016/j.procs.2015.12.251>
- Radosavljevic, S., Radosavljevic, V., & Grgurovic, B. (2020). The potential of implementing augmented reality into vocational higher education through mobile learning. *Interactive Learning Environments*, 28(4), 404–418. <https://doi.org/10.1080/10494820.2018.1528286>
- Ross, A., Willson, V.L. (2017). Paired Samples T-Test. In: Basic and advanced statistical tests. Sense Publishers, Rotterdam. https://doi.org/10.1007/978-94-6351-086-8_4
- Saidin, N. D., Khalid, F., Martin, R., Kuppusamy, Y., & Mumusamy, N. (2021). Benefits and challenges of applying computational thinking in education. *International Journal of Information and Education Technology*, 11(5). <https://doi.org/10.18178/ijiet.2021.11.5.1519>
- Saidin, N. F., Halim, N. D. A., & Yahaya, N. (2015). A review of research on augmented reality in education: Advantages and applications. *International Education Studies*, 13, 1–8. <https://doi.org/10.5539/ies.v8n13p1>
- Sırakaya, M., Alsancak Sırakaya, D., & Korkmaz, Ö. (2020). The Impact of STEM Attitude and Thinking Style on Computational Thinking Determined via Structural Equation Modeling. *Journal of Science Education and Technology*, 29(4), 561–572. <https://doi.org/10.1007/s10956-020-09836-6>
- Setiawan, A., Rostianingsih, S., & Widodo, T. R. (2018). Application of Compound Bonding Based On Augmented Reality. *ESTIC*, 248. <https://doi.org/10.1051/mateconf/2018248050>
- Shetgovekar, S. (2021). Unit-2 introduction to parametric and non-parametric statistics. New Delhi: Indira Gandhi National Open University. <https://egyankosh.ac.in/handle/123456789/79649>
- Singh, A., & Masuku, M. (2014). Sampling techniques & determination of sample size in applied statistics research: an overview. *International Journal of Economics, Commerce and Management*, 2(11), 1-22.

- Singhal, S., Bagga, S., Goyal, P., Sexena, V. (2012). Augmented chemistry: Interactive education system. *International Journal of Computer Applications*, 49(15). <https://doi.org/10.5120/7700-1041>
- Smith, R. C., Schaper, M. M., Tamashiro, M. A., Van Mechelen, M., Petersen, M. G., & Iversen, O. S. (2023). A research agenda for computational empowerment for emerging technology education. *International Journal of Child-Computer Interaction*, 38. <https://doi.org/10.1016/j.ijcci.2023.100616>
- Southam, D. C., & Lewis, J. E. (2013). Supporting alternative strategies for learning chemical applications of group theory. *Journal of Chemical Education*, 90(11), 1425–1432. <https://doi.org/10.1021/ed400063t>
- Sreedevi, S. (2022). 86 Study of test for significance of pearson's correlation coefficient. *Peer Reviewed and Refereed Journal*, 2, 11. <http://ijmer.in.doi./2022/11.02.15>
- Statcounter GlobalStats. (1999-2023). statcounter.com. Diakses tanggal 17 Desember 2023 dari <https://gs.statcounter.com/os-market-share/mobile/indonesia>
- Subu, M. A., Waluyo, I., Al-Yateem, N., Riana, I., Dias, J. M., Saifan, A., Rahman, S. A., Ahamed, S. I., Jumiati, J., Ahmed, F. R., & Al-Marzouqi, A. (2022). Smartphone addiction and self-esteem among Indonesian teenage students. *Proceedings - 2022 IEEE International Conference on Digital Health, ICDH 2022*, 104–106. <https://doi.org/10.1109/ICDH55609.2022.00024>
- Sung, N. J., Ma, J., Choi, Y. J., & Hong, M. (2019). Real-time augmented reality physics simulator for education. *Applied Sciences (Switzerland)*, 9(19). <https://doi.org/10.3390/app9194019>
- Tarng, W., Tseng, Y. C., & Ou, K. L. (2022). Application of augmented reality for learning material structures and chemical equilibrium in high school chemistry. *Systems*, 10(5).
- Tarng, W., Yu, C. S., Liou, F. L., & Liou, H. H. (2013). Development of a virtual butterfly ecological system based on augmented reality and mobile learning technologies. *IEEE*, 674–679. <https://doi.org/10.3390/systems10050141>
- Taufik, R. R., Mulyani, S., & Susilowati, E. (2019). Analysis of item difficulties and students' computational thinking skills assessment bias on electrolyte and non electrolyte solutions: An applications of Many Facets Rasch Model. *AIP Conference Proceedings*, 2194. <https://doi.org/10.1063/1.5139858>

- Téllez, A., García, C. H., & Corral-Verdugo, V. (2015). Effect size, confidence intervals and statistical power in psychological research. *Psychology in Russia: State of the Art*, 8(3), 27–47. <https://doi.org/10.11621/pir.2015.0303>
- Tobar-Muñoz, H., Baldiris, S., & Fabregat, R. (2017). Augmented reality game-based learning: Enriching students' experience during reading comprehension activities. *Journal of Educational Computing Research*, 55(7), 901–936. <https://doi.org/10.1177/0735633116689789>
- Tobar-Muñoz, H., Baldiris, S., & Fabregat, R. (2023). Co-Design of Augmented Reality Games for Learning with Teachers: A Methodological Approach. *Technology, Knowledge and Learning*, 28(2), 901–923. <https://doi.org/10.1007/s10758-023-09643-z>
- Toquero, C. M. D. (2021). “Real-world:” preservice teachers' research competence and research difficulties in action research. *Journal of Applied Research in Higher Education*, 13(1), 126–148. <https://doi.org/10.1108/JARHE-03-2019-0060>
- Tsai, M. J., Liang, J. C., & Hsu, C. Y. (2021). The computational thinking scale for computer literacy education. *Journal of Educational Computing Research*, 59(4), 579–602. <https://doi.org/10.1177/0735633120972356>
- Virata, R.O., & Castro, J.D. (2019). Augmented reality in science classroom: perceived effects in education, visualization and information processing. *Proceedings of the 10th International Conference on E-Education, E-Business, E-Management and E-Learning*. <https://doi.org/10.1145/3306500.3306556>
- Volioti, C., Orovas, C., Sapounidis, T., Trachanas, G., & Keramopoulos, E. (2023). Augmented reality in primary education: An active learning approach in mathematics. *Computers*, 12(10). <https://doi.org/10.3390/computers12100207>
- Wagan, A. A., Khan, A. A., Chen, Y.-L., Yee, P. L., Yang, J., & Laghari, A. A. (2023). Artificial intelligence-enabled game-based learning and quality of experience: A novel and secure framework (B-AIQoE). *Sustainability*, 15(6), 5362. <https://doi.org/10.3390/su15065362>
- Wannapiroon, P., Nilsook, P., Kaewrattanapat, N., Wannapiroon, N., Supa, W. (2021). Augmented reality interactive learning model, using the imagineering process for the SMART classroom. *TEM Journal*, 10(3), 1404-1417. <https://doi.org/10.18421/TEM103-51>
- Weintrop, D., Beheshti, E., Horn, M., Orton, K., Jona, K., Trouille, L., & Wilensky, U. (2016). Defining computational thinking for mathematics and science classrooms. *Journal of Science Education and Technology*, 25(1), 127–147. <https://doi.org/10.1007/s10956-015-9581-5>

- Wen, Y., Wu, L., He, S., Ng, N. H. E., Teo, B. C., Looi, C. K., & Cai, Y. (2023). Integrating augmented reality into inquiry-based learning approach in primary science classrooms. *Educational Technology Research and Development*, 71(4), 1631–1651. <https://doi.org/10.1007/s11423-023-10235-y>
- Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, 3, 33–35.
- Wing, J. M. (2008). Computational thinking and thinking about computing. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 366(1881), 3717–3725. <https://doi.org/10.1098/rsta.2008.0118>
- Wing, J. M. (2011). Research Notebook: Computational Thinking – What and Why. <https://people.cs.vt.edu/~kafura/CS6604/Papers/CT-What-and-why.pdf>
- Wong, G. K. W., & Jiang, S. (2019). Computational Thinking Education for Children: Algorithmic Thinking and Debugging. *Proceedings of 2018 IEEE International Conference on Teaching, Assessment, and Learning for Engineering*, 328–334. <https://doi.org/10.1109/TALE.2018.8615232>
- Wong, S. Y., Abdullah, Z., Hussin, M. S. H., Kadri, N. A., Obaidellah, U. H., & Zubir, M. N. M. (2021). Influence of augmented reality (AR) technology via mobile application for knowledge transfer program in fourth industrial revolution era. *ASEAN Journal of Community Engagement*, 5(1), 130–153. <https://doi.org/10.7454/ajce.v5i1.1123>
- Xiao, M., & Yu, X. (2017). A model of cultivating computational thinking based on visual programming. *Proceedings - 6th International Conference of Educational Innovation Through Technology, EITT 2017, 2018-March*, 75–80. <https://doi.org/10.1109/EITT.2017.26>
- Yalçınkaya, E., & Boz, Y. (2015). The effect of case-based instruction on 10th grade students' understanding of gas concepts. *Chem. Educ. Res. Pract*, 16, 104–120. <https://doi.org/10.1039/C4RP00156G>
- Yang, F. Y., & Wang, H. Y. (2023). Tracking visual attention during learning of complex science concepts with augmented 3D visualizations. *Computers and Education*, 193. <https://doi.org/10.1016/j.compedu.2022.104659>
- Yoon, S., Anderson, E., Lin, J., & Elinich, K. (2017). How augmented reality enables conceptual understanding of challenging science content. *In Educational Technology & Society*, 20(1), 156–168.
- Yuen, S., Yaoyuneyong, G., & Johnson, E. (2011). Augmented reality: An overview and five directions for AR in education. *In Journal of Educational Technology Development and Exchange*, 4(1).

- Yusoff, M. B. (2019). ABC of content validation and content validity index calculation. *Education in Medicine Journal*, 11(2). 49-54. <https://doi.org/10.21315/eimj2019.11.2.6>
- Zhang, G., Wang, X., Liang, Y. C., & Liu, J. (1993). Fast and robust spectrum sensing via Kolmogorov-Smirnov test. *IEEE Workshop on Local and Metropolitan Area Networks*, 3410–3416. <https://doi.org/10.1109/TCOMM.2010.11.090209>
- Zumdahl, S. S., & Zumdahl, S. A. (2014). *Chemistry, Ninth Edition*. Belmont, CA: Brooks/Cole, Cengage Learning.
- Zvoch, K., Holveck, S., & Porter, L. (2021). Teaching for conceptual change in a density unit provided to seventh graders: A comparison of Teacher-Centered and Student-Centered approaches. *Research in Science Education*, 51(5), 1395–1421. <https://doi.org/10.1007/s11165-019-09907-8>

