

DAFTAR PUSTAKA

- Academic, C., Database, J., Academic, C.-S., Database, J., New, T., Times, Y., Archiue, S., New, T., Times, Y., Library, L., Library, L., Web, T., Library, L., & Using, I. (n.d.). *Research in Education*.
- Aditya, D. S. (2020). Journal of Technology and Science Education. *Journal of Technology and Science Education*, 5(3), 184–193.
- Aydin-Gunbatar, S., Ekiz-Kiran, B., & Oztay, E. S. (2020). Pre-service chemistry teachers' pedagogical content knowledge for integrated STEM development with LESMeR model. *Chemistry Education Research and Practice*, 21(4), 1063–1082. <https://doi.org/10.1039/d0rp00074d>
- Aydin-Gunbatar, S., Tarkin-Celikkiran, A., Kutucu, E. S., & Ekiz-Kiran, B. (2018). The influence of a design-based elective STEM course on pre-service chemistry teachers' content knowledge, STEM conceptions, and engineering views. *Chemistry Education Research and Practice*, 19(3), 954–972. <https://doi.org/10.1039/c8rp00128f>
- Aydın-günbatar, S. (2020). Making homemade indicator and strips : a STEM + activity for acid-base chemistry with entrepreneurship applications. *Science Activities*, 0(0), 1–10. <https://doi.org/10.1080/00368121.2020.1828794>
- Bayram, S. (2021). World journal on educational technology: Current issues. *World Journal on Educational Technology: Current Issues*, 13(4), 902–910.
- Baysal, E. A. (2018). the Effect of Instructional Material Design Process To Mathematics Teacher Candidates' Tpack. *European Journal of Education Studies*, 4(5), 35–45. <https://doi.org/10.5281/zenodo.1222082>
- Blonder, R., & Rap, S. (2017). I like Facebook: Exploring Israeli high school chemistry teachers' TPACK and self-efficacy beliefs. *Education and Information Technologies*, 22(2), 697–724. <https://doi.org/10.1007/s10639-015-9384-6>
- Bybee, R. W. (2015). The Case for STEM Education: Challenges and Opportunities. In *The Case for STEM Education: Challenges and Opportunities*. <https://doi.org/10.2505/9781936959259>
- Çengel, M., Alkan, A., & Yıldız, E. P. (2019). Evaluate the attitudes of the pre-service teachers towards STEM and STEM's sub dimensions. *International Journal of Higher Education*, 8(3), 257–267. <https://doi.org/10.5430/ijhe.v8n3p257>
- Cetin-Dindar, A., Boz, Y., Yildiran Sonmez, D., & Demirci Celep, N. (2018). Development of pre-service chemistry teachers' technological pedagogical content knowledge. *Chemistry Education Research and Practice*, 19(1), 167–183. <https://doi.org/10.1039/C7RP00175D>
- Chai, C. S., Jong, M. S. Y., Yin, H. biao, Chen, M., & Zhou, W. (2019). Validating and modelling teachers' technological pedagogical content knowledge for integrative science, technology, engineering and mathematics education.

Educational Technology and Society, 22(3), 61–73.

- Chai, C. S., Rahmawati, Y., & Jong, M. S. Y. (2020). Indonesian science, mathematics, and engineering preservice teachers' experiences in stem-tpack design-based learning. *Sustainability (Switzerland)*, 12(21), 1–14. <https://doi.org/10.3390/su12219050>
- Chang, R. (2005). General Chemistry: The Essential Concepts Third Editions. Trj. Suminar Setiati Achmadi, Kimia Dasar Konsep- Konsep Inti. In L. Simarmata (Ed.), *Erlangga (Ketiga)*. Erlangga.
- Chen, C. (2021). Effects of the application of webquest to technology education on business management students' critical thinking psychology and operation capability. *Contemporary Educational Technology*, 13(1), 1–8. <https://doi.org/10.30935/cedtech/9320>
- Chonkaew, P., Sukhummek, B., & Faikhamta, C. (2016). Development of analytical thinking ability and attitudes towards science learning of grade-11 students through science technology engineering and mathematics (STEM education) in the study of stoichiometry. *Chemistry Education Research and Practice*, 17(4), 842–861. <https://doi.org/10.1039/c6rp00074f>
- Chorrojprasert, L. (2021). Learners' perceptions on peer assessment in team-based learning classroom. *LEARN Journal: Language Education and Acquisition Research Network*, 14(1), 522–545.
- Cohen, L., Manion, L., & Morrison, K. (2017). Research Methods in Education. In *Research Methods in Education*. <https://doi.org/10.4324/9781315456539>
- Danckwardt-Lillieström, K., Andrée, M., & Enghag, M. (2020). The drama of chemistry—supporting student explorations of electronegativity and chemical bonding through creative drama in upper secondary school. *International Journal of Science Education*, 42(11), 1862–1894. <https://doi.org/10.1080/09500693.2020.1792578>
- Dean, N. L., Ewan, C., Braden, D., & McIndoe, J. S. (2019). Open-Source Laser-Cut-Model Kits for the Teaching of Molecular Geometry. *Journal of Chemical Education*, 96(3), 495–499. <https://doi.org/10.1021/acs.jchemed.8b00553>
- Deng, F., Chai, C. S., So, H. J., Qian, Y., & Chen, L. (2017). Examining the validity of the technological pedagogical content knowledge (TPACK) framework for preservice chemistry teachers. *Australasian Journal of Educational Technology*, 33(3), 1–14. <https://doi.org/10.14742/ajet.3508>
- Dikmen, C. H., & Demirer, V. (2022). The role of technological pedagogical content knowledge and social cognitive variables in teachers' technology integration behaviors. *Participatory Educational Research*, 9(2), 398–415. <https://doi.org/10.17275/per.22.46.9.2>
- Dökme, İ., Açıksöz, A., & Koyunlu Ünlü, Z. (2022). Investigation of STEM fields motivation among female students in science education colleges. *International Journal of STEM Education*, 9(1). <https://doi.org/10.1186/s40594-022-00326-2>

- Evagorou, M., Erduran, S., & Mäntylä, T. (2015). The role of visual representations in scientific practices: from conceptual understanding and knowledge generation to ‘seeing’ how science works. *International Journal of STEM Education*, 2(1), 1–13. <https://doi.org/10.1186/s40594-015-0024-x>
- Fitriyana, N., Wiyarsi, A., Sugiyarto, K. H., & Ikhsan, J. (2021). The Influences of Hybrid Learning with Video Conference and “Chemondro-Game” on Students’ Self-Efficacy, Self-Regulated Learning, and Achievement toward Chemistry. *Journal of Turkish Science Education*, 18(2), 233–248. <https://doi.org/10.36681/tused.2021.62>
- Gonzalez, H. B., & Kuenzi, J. (2012). What Is STEM Education and Why Is It Important? *Congressional Research Service*, August, 1–15. https://www.ccc.edu/departments/Documents/STEM_labor.pdf
- Gozukucuk, M. (2020). *Preservice Teachers’ Design of Technology – Based Reading Texts to Improve Their TPACK*. <https://doi.org/10.1177/0022057420966763>
- Guba, E. G., & Lincoln, Y. . (1989). *Fourth generation evaluation*. Sage Publications.
- Gürgil, F., Ünal, M., & Aksoy, B. (2019). Social Studies Preservice Teachers’ Views on and Experiences with WebQuest. *Journal of Education and Training Studies*, 7(4), 131. <https://doi.org/10.11114/jets.v7i4.4061>
- Huang, J. (2020). Successes and Challenges: Online Teaching and Learning of Chemistry in Higher Education in China in the Time of COVID-19. *Journal of Chemical Education*, 97(9), 2810–2814. <https://doi.org/10.1021/acs.jchemed.0c00671>
- Huri, N. H. D., & Karpudewan, M. (2019). Evaluating the effectiveness of Integrated STEM-lab activities in improving secondary school students’ understanding of electrolysis. *Chemistry Education Research and Practice*, 20(3), 495–508. <https://doi.org/10.1039/c9rp00021f>
- Jang, S. J., & Chen, K. C. (2010). From PCK to TPACK: Developing a Transformative Model for Pre-Service Science Teachers. *Journal of Science Education and Technology*, 19(6), 553–564. <https://doi.org/10.1007/s10956-010-9222-y>
- Jones, B. A., Peterson-Ahmad, M., Fields, M., & Williams, N. (2021). Training Preservice Teachers to Match Assistive Technology to Student Needs. *Journal of Special Education Technology*, 36(4), 271–283. <https://doi.org/10.1177/0162643420918337>
- Kang, N.-H. (2019). A review of the effect of integrated STEM or STEAM (science, technology, engineering, arts, and mathematics) education in South Korea. *Asia-Pacific Science Education*, 5(1). <https://doi.org/10.1186/s41029-019-0034-y>
- Karataş, F. (2016). Pre-service chemistry teachers’ competencies in the laboratory: A cross-grade study in solution preparation. *Chemistry Education Research*

- and Practice*, 17(1), 100–110. <https://doi.org/10.1039/c5rp00147a>
- Koehler, M. J., Mishra, P., & Cain, W. (2013). What is Technological Pedagogical Content Knowledge (TPACK)? *Journal of Education*, 193(3), 13–19. <https://doi.org/10.1177/002205741319300303>
- Korkman, N., & Metin, M. (2021). The Effect of Inquiry-Based Collaborative Learning and Inquiry-Based Online Collaborative Learning on Success and Permanent Learning of Students. *J.Sci.Learn*, 2021(2), 151–159. <https://doi.org/10.17509/jysl.v4i2.29038>
- Lai, C. (2021). *Exploring Taiwanese Teachers' Preferences for STEM Teaching in Relation to their Perceptions of STEM Learning*. 24, 123–135.
- Learners, M. G., Expectations, M. H., Gerrold, D., Committee on Highly Successful Schools or Programs in K-12 STEM, & Education; National Research Council. (2011). Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics Committee on Highly Successful Schools or Programs in K-12 STEM Education; National Research Council. In *Mathematics Education in the Middle Grades*. <https://www.ltrr.arizona.edu/~sheppard/TUSD/NRC2011.pdf>
- Marchak, D., Shvarts-Serebro, I., & Blonder, R. (2021). Teaching Chemistry by a Creative Approach: Adapting a Teachers' Course for Active Remote Learning. *Journal of Chemical Education*, 98(9), 2809–2819. <https://doi.org/10.1021/acs.jchemed.0c01341>
- Meydan, E. (2020). Students' Metaphors on Formation of Molecules from Atoms. *Educational Policy Analysis and Strategic Research*, 15(3), 482–501. <https://doi.org/10.29329/epasr.2020.270.23>
- Morgan, H. (2022). Alleviating the Challenges with Remote Learning during a Pandemic. *Education Sciences*, 12(2). <https://doi.org/10.3390/educsci12020109>
- Murphy, S., MacDonald, A., Danaia, L., & Wang, C. (2019). An analysis of Australian STEM education strategies. *Policy Futures in Education*, 17(2), 122–139. <https://doi.org/10.1177/1478210318774190>
- Ozgeldi, M., & Yakin, I. (2021). How do pre-service mathematics teachers organize information sources in the webquest? *Eurasian Journal of Educational Research*, 2021(91), 237–256. <https://doi.org/10.14689/ejer.2021.91.11>
- Özkan, B., & Tekeli, F. N. (2021). The effects of information and communication technology engagement factors on science performance between singapore and turkey using multi-group structural equation modeling. *Journal of Baltic Science Education*, 20(4), 639–650. <https://doi.org/10.33225/jbse/21.20.639>
- Öztürk, A. (2021). Meeting the Challenges of STEM education in K-12 Education through Design Thinking. *Design and Technology Education – An International Journal*, 26(1), 70–88.
- Pakshina, N. A., Emelianova, J. P., Pravdina, M. V., & Pakshin, P. V. (2015).

Modification of Traditional WebQuests with Applications to the Study of the Control History. *IFAC-PapersOnLine*, 48(29), 313–318. <https://doi.org/10.1016/j.ifacol.2015.11.254>

Prabha, S., & Care, U. G. C. (2022). शोध प्रभा. 47(8), 2018–2023.

Prof, A., Williams, P. J., & Science, C. (2011). STEM Education: Proceed with caution. *Design and Technology Education*, 16(1), 26–35.

Rahmawati, Y., Andanswari, F. D., Ridwan, A., Gillies, R., & Taylor, P. C. (2020). STEM Project-Based Learning in Chemistry: Opportunities and Challenges to Enhance Students' Chemical Literacy. *International Journal of Innovation, Creativity, and Change*, 13(7), 1673–1694.

Raman, A., & Thannimalai, R. (2019). Importance of Technology Leadership for Technology Integration: Gender and Professional Development Perspective. *SAGE Open*, 9(4). <https://doi.org/10.1177/2158244019893707>

Razali, F. (2021). Exploring Crucial Factors of an Interest in STEM Career Model among Secondary School Students. *International Journal of Instruction*, 14(2), 385–404. <https://doi.org/10.29333/iji.2021.14222a>

Rodríguez-Becerra, J., Cáceres-Jensen, L., Díaz, T., Druker, S., Bahamonde Padilla, V., Perna, J., & Aksela, M. (2020). Developing technological pedagogical science knowledge through educational computational chemistry: A case study of pre-service chemistry teachers' perceptions. *Chemistry Education Research and Practice*, 21(2), 638–654. <https://doi.org/10.1039/c9rp00273a>

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (Track): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education*, 42(2), 123–149. <https://doi.org/10.1080/15391523.2009.10782544>

Seibert, J., Kay, C. W. M., & Huwer, J. (2019). EXPLAINistry: Creating Documentation, Explanations, and Animated Visualizations of Chemistry Experiments Supported by Information and Communication Technology to Help School Students Understand Molecular-Level Interactions. *Journal of Chemical Education*, 96(11), 2503–2509. <https://doi.org/10.1021/acs.jchemed.8b00819>

Smith, D. W., Lampley, S. A., Dolan, B., Williams, G., Schleppenbach, D., & Blair, M. (2020). Effect of 3D Manipulatives on Students with Visual Impairments Who Are Learning Chemistry Constructs: A Pilot Study. *Journal of Visual Impairment and Blindness*, 114(5), 370–381. <https://doi.org/10.1177/0145482X20953266>

Struyf, A., De Loof, H., Boeve-de Pauw, J., & Van Petegem, P. (2019). Students' engagement in different STEM learning environments: integrated STEM education as promising practice? *International Journal of Science Education*, 41(10), 1387–1407. <https://doi.org/10.1080/09500693.2019.1607983>

- Tsybulsky, D. (2020). Digital curation for promoting personalized learning: A study of secondary-school science students' learning experiences. *Journal of Research on Technology in Education*, 52(3), 429–440. <https://doi.org/10.1080/15391523.2020.1728447>
- Wahono, B., Lin, P. L., & Chang, C. Y. (2020). Evidence of STEM enactment effectiveness in Asian student learning outcomes. *International Journal of STEM Education*, 7(1), 1–18. <https://doi.org/10.1186/s40594-020-00236-1>
- Wang, Y. H. (2021). Integrating modified WebQuest activities for programming learning. *Journal of Computer Assisted Learning*, 37(4), 978–993. <https://doi.org/10.1111/jcal.12537>
- Williams, A. T., & Svensson, M. (2020). Student Teachers' Collaborative Learning of Science in Small-Group Discussions. *Scandinavian Journal of Educational Research*, 0(0), 1–14. <https://doi.org/10.1080/00313831.2020.1788141>
- Yen, A. Y., Ho, R., Chen, L., Chou, K., Chen, Y., Yen, Y., Ho, R., Chen, L., Chou, K., & Chen, Y. (2010). *International Forum of Educational Technology & Society Development and Evaluation of a Confidence-Weighting Computerized Adaptive Testing Published by: International Forum of Educational Technology & Society Development and Evaluation of a Confidence-We.* 13(3), 163–176.
- Yenmez, A. A., Özpınar, İ., & Gökçe, S. (2017). Use of WebQuests in Mathematics Instruction: Academic Achievement, Teacher and Student Opinions. *Universal Journal of Educational Research*, 5(9), 1554–1570. <https://doi.org/10.13189/ujer.2017.050913>
- York, S., Lavi, R., Dori, Y. J., & Orgill, M. K. (2019). Applications of Systems Thinking in STEM Education. *Journal of Chemical Education*, 96(12), 2742–2751. <https://doi.org/10.1021/acs.jchemed.9b00261>
- Zohar, A. R., & Levy, S. T. (2019). Attraction: vs. repulsion-learning about forces and energy in chemical bonding with the ELI-Chem simulation. *Chemistry Education Research and Practice*, 20(4), 667–684. <https://doi.org/10.1039/c9rp00007k>