PENGEMBANGAN *DIGITAL STATISTICS COMIC* PADA *STATISTICAL REASONING LEARNING ENVIRONMENT* UNTUK MENINGKATKAN KEMAMPUAN PENALARAN DAN MINAT STATISTIS SISWA

Disertasi

Diajukan Sebagai Salah Satu Syarat untuk Memperoleh

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ABSTRAK

Farid Gunadi (2105050). Pengembangan *Digital Statistics Comic* pada *Statistical Reasoning Learning Environment* untuk Meningkatkan Kemampuan Penalaran dan Minat Statistis Siswa.

Penelitian ini bertujuan untuk mengembangkan bahan ajar digital *Statistics Comic* pada *Statistical Reasoning Learning Environment* (SRLE) yang valid, praktis, dan efektif untuk meningkatkan penalaran dan minat statistis siswa. Pengembangan ini dilatarbelakangi oleh rendahnya kemampuan penalaran statistis dan kurangnya minat siswa karena dianggap jauh dari relevansi kehidupan sehari-hari. Untuk menjawab tantangan tersebut, dikembangkan bahan ajar dalam bentuk komik digital yang dikemas secara kontekstual, visual, dan interaktif agar lebih menarik serta mudah dipahami oleh siswa. Pendekatan ini mengintegrasikan visualisasi naratif dalam komik digital dengan prinsip SRLE untuk menciptakan pembelajaran statistis yang kontekstual dan interaktif serta relevan dengan kebutuhan literasi data di era Industri 4.0 dan Society 5.0. Model pengembangan yang digunakan adalah ADDIE (*Analysis, Design, Development, Implementation,* dan *Evaluation*). Pada tahap Analysis, dilakukan identifikasi kebutuhan siswa, guru, serta karakteristik materi statistis. Tahap *Design* mencakup perancangan konten, alur cerita, elemen visual, dan strategi pembelajaran berbasis SRLE. Pada tahap *Development*, produk dikembangkan melalui aplikasi desain grafis dan platform digital, kemudian divalidasi oleh ahli materi, media, dan pedagogi untuk memenuhi kriteria valid. Pada tahap ini juga produk diuji cobakan melalui *pilot test* untuk mengukur kepraktisan produk. Setelah itu, tahap *Implementation* dilakukan melalui uji coba pada siswa kelas X di dua sekolah tingkat menengah atas untuk mengukur efektivitas produk. Tahap terakhir, yaitu *Evaluation*, mencakup evaluasi formatif dan sumatif terhadap bahan ajar dalam meningkatkan penalaran statistis serta minat belajar siswa secara valid, praktis, dan efektif. Hasil penelitian menunjukkan bahwa bahan ajar *Statistics Comic* dinilai valid oleh para ahli dari segi isi, tampilan, bahasa, dan keterpaduan dengan SRLE. Uji kepraktisan menunjukkan bahwa guru, observer, dan siswa memberikan respons positif sebesar 86% terhadap kemudahan penggunaan, daya tarik, dan kejelasan isi komik digital. Sementara itu, hasil uji efektivitas menunjukkan adanya peningkatan signifikan pada kemampuan penalaran statistis siswa setelah menggunakan bahan ajar, yang diukur melalui *pretest* dan *posttest*. Selain itu, minat siswa terhadap materi statistis meningkat secara nyata, tercermin dari antusiasme dalam berdiskusi, menyelesaikan tugas, dan keterlibatan aktif selama pembelajaran berlangsung. Dengan demikian, pengembangan bahan ajar digital *Statistics Comic* terbukti valid, praktis, dan efektif dalam meningkatkan penalaran dan minat statistis siswa. Penelitian ini memberikan kontribusi terhadap pengembangan sumber belajar yang sesuai dengan kebutuhan abad ke-21 dan mendukung pembelajaran berbasis penalaran statistis.

Kata Kunci: Bahan Ajar Digital *Statistics Comic*, *Statistical Reasoning Learning Environment*, Penalaran Statistis, dan Minat Statistis.

ABSTRACT

Farid Gunadi (2105050). The Development of Digital Statistics Comic in Statistical Reasoning Learning Environment to Enhance Students' Reasoning Ability and Statistical Interest.

This study aims to develop digital teaching materials of “Statistics Comic” on the Statistical Reasoning Learning Environment (SRLE) that are valid, practical, and effective to enhance students' statistical reasoning and interest. This development is motivated by the low statistical reasoning ability and lack of students’ interest, it is because considered as something that is not relevance to everyday life. To answer these challenges, open materials were developed in the form of digital comics that are packaged contextually, visually, and interactively to make students more interested and easy for them to understand. This approach integrates narrative visualization in digital comics with SRLE principles to create contextual and interactive statistical learning that is relevant to data literacy needs in the Industry 4.0 and Society 5.0 eras. The development model used is ADDIE (Analysis, Design, Development, Implementation, and Evaluation). In the phase of Analysis, it is focused on identifying the needs of students, teachers, and characteristics of statistical materials is carried out. The Design stage includes designing content, storylines, visual elements, and learning strategies based on SRLE. In terms of Development, the product is developed through graphic design applications and digital platforms, then validated by the experts in order to meet the criteria for validity. In this case, the product is also tested to measure the practicality of the product. Meanwhile, the phase of Implementation is applied to measure the effectiveness of the product, here, the product was tested to the 10th Grade students of two senior high schools. The last phase of ADDIE is Evaluation, it includes formative and summative evaluations which assess the validity, practicality, and efectivity of teaching materials in enhancing students’ statistical ability and interest. In relating to the result of study, experts aggree that the use Statistics Comic as learning media was considered valid dealing with content, appearance, language, and integration with the SRLE. Moreover, the Practicality tests showed that teachers, observers, and students gave positive response as many as 86% to the ease of use, attractiveness, and clarity of the contents of digital comics. Besides, the results of pretests and posttests also reflected a significant increase in students' statistical abilities after using the teaching materials. In addition, the students' interest in statistical materials increased significantly, it is indicated in their enthusiasm in doing discussions, assignments, and classroom activity. Therefore, the development of digital Statistics Comic as teaching materials has proven to be valid, practical, and effective in enhancing students' statistical ability and interest. In this regard, this study contributes to the development of learning resources that are in accordance with the needs of the 21st century and support statistical reasoning-based learning.

Keywords: Digital Statistics Comic Teaching Materials, Statistical Reasoning Learning Environment, Statistical Reasoning, and Statistical Interest.

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DAFTAR ISI

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DAFTAR GAMBAR

DAFTAR PUSTAKA

Adini, M. H., Purba, H. S., Sukmawati, R. A., & Nasrina, A. (2020). Evaluasi Usability Heuristics Pada Media Pembelajaran Matematika Berbasis Web. *EDU-MAT: Jurnal Pendidikan Matematika*, *8*(2), 180–189. https://doi.org/10.20527/edumatv8i2.9817

Adrian Jones, at A. (2023). Preferential monitoring site location in the Southern California Air Quality Basin. *Materials Evaluation*, *47*(3), 153. https://doi.org/10.4135/9781412963893.n349

Affeldt, F., Meinhart, D., & Eilks, I. (2018). The use of comics in experimental instructions in a non-formal chemistry learning context. International *Journal of Education in Mathematics, Science and Technology*, *6*(1), 93–104. https://doi.org/10.18404/ijemst.380620

Alakrash, H. M., & Razak, N. A. (2021). Technology-based language learning: Investigation of digital technology and digital literacy. *Sustainability (Switzerland)*, 13(21), 1–17. https://doi.org/10.3390/su132112304

Alamri, H., Lowell, V., Watson, W., & Watson, S. L. (2020). Using personalized learning as an instructional approach to motivate learners in online higher education: Learner self-determination and intrinsic motivation. *Journal of Research on Technology in Education*, *52*(3), 322–352. https://doi.org/10.1080/15391523.2020.1728449

Almusharraf, N. M., & Khahro, S. H. (2020). Students' Satisfaction with Online Learning Experiences during the COVID-19 Pandemic. *International Journal of Emerging Technologies in Learning*, *15*(21), 246–267. https://doi.org/10.3991/ijet.v15i21.15647

Ardiansyah, & Sari, H. F. A. (2023). Ketertarikan, Perhatian, Perasaan Senang, dan Keterlibatan Mahasiswa dalam Menggunakan Chatbot Akuntansi. *Jurnal Teknodik*, 27(1), 33–50. https://jurnalteknodik.kemdikbud.go.id/index.php/jurnalteknodik/article/view/1009

Arigiyati, T. A., Kusmanto, B., & Widodo, S. A. (2019). Validasi Instrumen Modul Komputasi Matematika. *Jurnal Riset Pendidikan Dan Inovasi Pembelajaran Matematika (JRPIPM)*, *2*(1), 23. https://doi.org/10.26740/jrpipmv2n1p023-029

Arthur, Y. D. (2019). Students Mathematics Interest in Senior High Schools: Empirical Evidence from Ashanti Region of Ghana. *Asian Research Journal of Mathematics*, *15*(3), 1–14. https://doi.org/10.9734/arjom/2019/v15i330147

Ashley Steel dan Peter GuttorpInter, D. (2020). *Berpikir statistik sebagai keterampilan penting untuk membaca berita*. International Scince Council. https://id.council.science/news/statistical-thinking-reading-news/?utmsource=chatgpt.com

Badrujaman A, B., A, B., & Cahyawulan, W. (2019). Internal Factors of Statistical Learning Outcomes. *Advances in Social Science, Education and Humanities Research*, *382*(Icet), 277–281. https://doi.org/ 10.299 1/icet-19.2019.70

Ben-Zvi, D. (2011). Statistical reasoning learning environment. *EM TEIA – Revista de Educação Matemática e Tecnológica Iberoamericana*, *2*(2), 1–13. https://www.academia.edu/5737672/Statistical_reasoning_learning_environment

Blanco, Á. (2011). Applying social cognitive career theory to predict interests and choice goals in statistics among Spanish psychology students. *Journal of Vocational Behavior*, *78*(1), 49–58. https://doi.org/10.1016/j.jvb.2010.07.003

Bojnec, Š., Daraz, U., & Khan, Y. (2024). Harvesting Sunlight: The Promise of Agro-Photovoltaic Fusion Systems for Sustainable Agriculture and Renewable Energy Generation. *Energies*, *17*(13), 1–29. https://doi.org/10.3390/en17133310

Bornmann, L., Haunschild, R., & Mutz, R. (2021). Growth rates of modern science: a latent piecewise growth curve approach to model publication numbers from established and new literature databases. *Humanities and Social Sciences Communications*, *8*(1), 49–58. https://doi.org/10.1057/s4 1599-021-00903-w

Branch, R. M. (2009). Approach, Instructional Design: The ADDIE. *In Department of Educational Psychology and Instructional Technology University of Georgia* (Vol. 53, Issue 9). https://www.researchgate.net/publication/286059899_Instructional_design_The_ADDIE_approach

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bringman, L., & Michael Hortsch. (2019). How students choose E-learning resources: The importance of ease, familiarity, and convenience. *FASEB BioAdvances*, *8*(2), 286–295. https://doi.org/10.1096/fba.2019-00094

Brown, E. N., & Kass, R. E. (2009). What Is Statistics? In *The American Statistician* (Vol. 63, Issue 2). https://doi.org/10.1198/tast.2009.0019

Buzharovski, S. (2022). Introducing Blockchain with Java. *In Introducing Blockchain with Java* (Vol. 13, Issue 2). https://doi.org/10.1007/978-1-4842-7927-4

Caballer-Tarazona, M., & Coll-Serrano, V. (2020). The Raising Factor, That Great Unknown. A Guided Activity for Undergraduate Students. *Journal of Statistics Education*, *28*(3), 304–315. https://doi.org/10.1080/10691898. 2020.1832006

Callingham, R., & Siemon, D. (2021). Connecting multiplicative thinking and mathematical reasoning in the middle years. *Journal of Mathematical Behavior*, 61(12), 1-33. https://doi.org/10.1016/j.jmathb .2020.100837

Cangombe, A. A., & Fátima, M. C. (2024). Material Design Incorporating Reflective and Flexible-Communicative Superior Institute of Bié. *MAESTRO y SOCIEDAD*, *21*(1), 199–210. http://scielo.sld.cu/pdf/mys/v21n1/1815-4867-mys-21-01-199.pdf

Capone, R., & Lepore, M. (2022). From Distance Learning to Integrated Digital Learning: A Fuzzy Cognitive Analysis Focused on Engagement, Motivation, and Participation During COVID-19 Pandemic. In *Technology, Knowledge and Learning* (Vol. 27, Issue 4). Springer Netherlands. https://doi.org/10.1007/s10758-021-09571-w

Carmichael, C., Watson, J., & Hay, I. A. N. (2009). Factors Influencing The Development of Middle School Students' Interest in Statistical Literacy. *Statistics Education Research Journal*, 8(1), 62–81. http://dx.doi.org/10.52041/serj.v8i1.459

Case, S. L. (2023). applied sciences Cognitive Load Approach to Digital Comics Creation : A. *MDPI*, *2*(13), 2–15. ttps://doi.org/10.3390/app13137896

Castro, M. D. B., & Tumibay, G. M. (2021). A literature review: efficacy of online learning courses for higher education institution using meta-analysis. *Education and Information Technologies*, 26(2), 1367–1385. https://doi.org/10.1007/s10639-019-10027-z

Chan, S. W., & Ismail, Z. (2012). The Role of Information Technology in Developing Students' Statistical Reasoning. *Procedia - Social and Behavioral Sciences*, *46*(1), 3660–3664. https://doi.org/10.1016/j.sbspro .2012.06.123

Chan, S. W., Ismail, Z., & Sumintono, B. (2015). The impact of statistical reasoning learning environment: A rasch analysis. *Advanced Science Letters*, *21*(5), 1211–1215. https://doi.org/10.1166/asl.2015.6077

Chiou, C.-C., Lee, L.-T., & Liu, Y.-Q. (2012). Effect of Novak Colorful Concept Map with Digital Teaching Materials on Student Academic Achievement.

Procedia - Social and Behavioral Sciences, *64*(1), 192–201. https://doi.org/10.1016/j.sbspro.2012.11.023

Cladera, M., Vich-i-Martorell, G., Rejón-Guardia, F., & Juaneda, C. (2019). Tourism students' Attitudes Toward Statistics. *Journal of Hospitality, Leisure, Sport and Tourism Education*, *24*(1), 202–210. https://doi.org/10.1016/j.jhlste.2019.03.002

Clark-Wilson, A., Robutti, O., & Thomas, M. (2020). Teaching with digital technology. *ZDM - Mathematics Education*, *52*(7), 1223–1242. https://doi.org/10.1007/s11858-020-01196-0

Conway, B., Gary Martin, W., Strutchens, M., Kraska, M., & Huang, H. (2019). The Statistical Reasoning Learning Environment: A Comparison of Students' Statistical Reasoning Ability. *Journal of Statistics Education*, *27*(3), 171–187. https://doi.org/10.1080/10691898.2019.1647008

Cooper, L. L. (2018). Assessing Students' Understanding of Variability in Graphical Representations that Share the Common Attribute of Bars. *Journal of Statistics Education*, *26*(2), 110–124. https://doi.org/10.1080/10691898.2018.1473060

Cotiangco, E. N. C., Huraño, N. J. B., Sodoso, E. R. G., Sumagang, M. G. P., Jumaoas, J. J. C., Canoy, J. H., Picardal, M. T., & Sanchez, J. M. P. (2024). Android-based Audio-Visual Comics in Enhancing Conceptual Understanding and Motivation of Chemistry Concepts. *Orbital*, *16*(2), 125–135. https://doi.org/10.17807/orbital.v16i2.19953

Crisdian, H. A., Prawistyasari, A., Kesehatan, F. I., Kusuma, U., Surakarta, H., Farmasi, F., & Budi, U. S. (2023). Abdimas Siliwangi Abdimas Siliwangi. *Abdimas Siliwangi*, *6*(1), 83–89. https://doi.org/10.22460/as.v7i3.26234

Cuffaro, M. E., & Doyle, E. P. (2021). Essay Review of Tanya and Jeffrey Bub's Totally Random: Why Nobody Understands Quantum Mechanics: A Serious Comic on Entanglement. *Foundations of Physics*, *51*(1), 1–16. https://doi.org/10.1007/s10701-021-00423-2

Dayal, H. C., & Sharma, S. (2020). Probability concepts of secondary pre-service teachers in a game context. *Australian Journal of Teacher Education*, *45*(5), 91–109. https://doi.org/10.14221/ajte.2020v45n5.6

delMas, R. C. (2002). Statistical Literacy, Reasoning, and Thinking: A Commentary. *Journal of Statistics Education*, *10*(2). https://doi.org/10.1080/10691898.2002.11910674

delMas, R. C. (2002). Statistical literacy, reasoning and learning: A commentary. *Journal of Statistics Education*, *10*(3). https://doi.org/10.1080/10691898.2002.11910679

Demirkan, Ö. (2019). Pre-service Teachers' Views about Digital Teaching Materials. *Educational Policy Analysis and Strategic Research, 14*(1), 40–60. https://doi.org/10.29329/epasr.2019.186.3

Dio, R. V. (2022). Utilization of Digital Module for Asynchronous Online Independent Learning in Advanced Mathematics Education. *Mathematics Teaching-Research Journal*, 14(1), 80–98. https://www.researchgate.net/publication/359920317_Utilization_of_Digital_Module_for_Asynchronous_Online_Independent_Learning_in_Advanced_Mathematics_Education

Dull, E., & Reinhardt, S. P. (2014). An analytic approach for discovery. In *CEUR Workshop Proceedings* (Vol. 1304, pp. 89–92). https://ceur-ws.org/Vol-1304/STIDS2014_P1_DullReinhardt.pdf

Elgeddawy, M., & Abouraia, M. (2024). Pragmatism as a Research Paradigm. *Proceedings of the European Conference on Research Methods in Business and Management Studies*, *23*(1), 71–74. https://doi.org/10.34190/ecrm.23.1.2444

Etikan, I. (2017). Sampling and Sampling Methods. *Biometrics & Biostatistics International Journal*, *5*(6), 215–217. https://doi.org/10.15406/bbij.2017.05.00149

Fabillar, R., Ummas, J., Pateyec, J., Domingo, M. G., Canuto, P. P., Choycawen, M., Pagdawan, R., & Lumidao, Y. (2024). Science Comics as Educational Materials and its Impact on Elementary Students' Science Academic Performance. *Pakistan Journal of Life and Social Sciences*, 22(1), 6176–6188. https://doi.org/10.57239/PJLSS-2024-22.1.00456

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

Fan, J., Li, R., Zhang, C.-H., & Zou, H. (2020). *Statistical Foundations of Data Science*. https://doi.org/10.1201/ 9780429096280

Fidarti, F. A., & Nurharini, A. (2023). Kelayakan Modul Digital Berbasis Milkshake Untuk Meningkatkan Hasil Belajar. *Jurnal Penelitian Dan Pengembangan Pendidikan*, *7*(3), 397–407. https://doi.org/10.23887/jppp.v7i3.67263

Fielding, J. (2024). Taking an argumentation approach to statistical investigations: Developing student data-ing practices. *ZDM–Mathematics Education*, *57*(1), 31–34. https://doi.org/10.1007/s11858-024-01639-y

Fiedler, D., Sbeglia, G. C., Nehm, R. H., & Harms, U. (2019). How strongly does statistical reasoning influence knowledge and acceptance of evolution? *Journal of Research in Science Teaching*, *56*(9), 1183–1206. https://doi.org/10.1002/tea.21547

Fitria, T. N., & Simbolon, N. E. (2024). English Language Teaching (ELT) for Students with Visual-Spatial Learning Style. *Journal of English Literature*, Linguistic, and Education, *5*(02), 2721–3390. https://doi.org/ 10.31941 /jele.v5i02.4916

Fonseca, D., Redondo, E., & Villagrasa, S. (2015). Mixed-methods research: a new approach to evaluating the motivation and satisfaction of university students using advanced visual technologies. *Universal Access in the Information Society*, *14*(3), 311–332. https://doi.org/10.1007/s10209-014-0361-4

Frischemeier, D. (2018). *Design, Implementation, and Evaluation of an Instructional Sequence to Lead Primary School Students to Comparing Groups in Statistical Projects*. 217–238. https://doi.org/10.1007/978-981-13-1044-7_13

Gamalo-Siebers, M. (2020). Journal of biopharmaceutical statistics editorial. *Journal of Biopharmaceutical Statistics*, *30*(1), 1–2. https://doi.org/10.1080/10543406.2019.1709697

Ganesan, N., & Leong, K. E. (2020). Impact of Fathom on Statistical Reasoning among Upper Secondary Students. *Journal of Research in Science Mathematics and Technology Education*, *3*(2), 35–50. https://doi.org/ 10.31756/jrsmte.321

Garfield, J. (2002). The challenge of developing statistical reasoning. *Journal of Statistics Education*, *10*(3). https://doi.org/10.1080/10691898.2002.11910676

Garfield, J., & Ben-Zvi, D. (2009). Helping students develop statistical reasoning: Implementing a statistical reasoning learning environment. *Teaching Statistics*, *31*(3), 72–77. https://doi.org/10.1111/j.1467-9639.2009.00363.x

Gil, E., & Gibbs, A. L. (2017). Promoting modeling and covariational reasoning among secondary school students in the context of big data. *Statistics Education Research Journal*, *16*(2), 163–190. https://doi.org/10.52041/serj.v16i2.189

Gravetter, F. J. (2021). *sample ─Essentials of Statistics for the Behavioral Sciences 10th*. Cangage. http://ndl.ethernet.edu.et/bitstream/123456789/ 29095/1/Frederick%20J%20Gravetter_2017.pdf

Gunadi, F and Juandi, D. (2022). What Methods are used for Statistical Reasoning Learning?: A Systematic Literature Review. *Jurnal Pendidikan Mipa*, *12*(11), 682–689. https://www.researchgate. net/publication /362059882_What_Methods_are_used_for_Statistical_Reasoning_Learning_A_Systematic_Literature_Review

Gunadi, F., Herman, T., & Prabawanto, S. (2022). Students ' Learning Obstacle in Solving Statistical Reasoning Problems: Epistemological Study. *Gema Wiralodra*, *13*(1), 285–294. https://gemawiralodra.unwir.ac.id/index.php/ gemawiralodra/ article/view/213

Gundlach, E., Richards, K. A. R., Nelson, D., & Levesque-Bristol, C. (2015). A comparison of student attitudes, statistical reasoning, performance, and perceptions for web-augmented traditional, fully online, and flipped sections of a statistical literacy class. *Journal of Statistics Education*, *23*(1). https://doi.org/10.1080/10691898.2015.11889723

Hadi, W., Yuksafa, R., Yarmi, G., Safitri, D., Lestari, I., Suntari, Y., Umasih, Marini, A., Sudrajat, A., & Iskandar, R. (2022). Enhancement of Students' Learning Outcomes through Interactive Multimedia. *International Journal of Interactive Mobile Technologies*, *16*(7), 82–98. https://doi.org/10.3991/ ijim.v16i07.25825

Han, F. (2021). The relations between teaching strategies, students' engagement in learning, and teachers' self-concept. *Sustainability (Switzerland)*, *13*(9). https://doi.org/10.3390/su13095020

Hasheminejad, S. M., & Sarvmili, M. (2018). S3PSO: Students' Performance Prediction Based on Particle Swarm Optimization. *Journal of Artificial Intelligence and Data Mining*, *7*(1), 77–96. https://doi.org/ 10.22044/jadm. 2018.5506.1662

Hidayah, N., Wahyudin, W., & Turmudi, T. (2019). *Building Ability of Sport Students Statistical Reasoning through Statistical Reasoning Learning Environment (SRLE)*. *11*(18), 129–132. https://doi.org/10.2991 /icsshpe-18.2019.37

Hidayah, N., Wahyudin, W., Turmudi, T., & Mulyana, D. (2018). *Building Sport Student Self-Esteem in Learning Statistics through SRLE - Statistical Reasoning Learning Environment*. *1*(17), 470–475. https://doi.org/10. 5220/0007063404700475

Hionis, J., & Ki, Y. H. (2019). The economics of the modern American comic book market. *In Journal of Cultural Economics*, *43*(4). Springer US. https://doi.org/10.1007/s10824-018-9333-5

Høgheim, S., & Reber, R. (2019). Interesting, but Less Interested: Gender Differences and Similarities in Mathematics Interest. *Scandinavian Journal of Educational Research*, *63*(2), 285–299. https://doi.org/10.1080 /00313831.2017.1336482

Hooker, G., & Mentch, L. (2021). Bridging Breiman's Brook: From Algorithmic Modeling to Statistical Learning. *Observational Studies*, *7*(1), 107–125. https://doi.org/10.1353/obs.2021.0027

Hui, Z. (2024). Enhancing Statistical Literacy: The Role of Statistical Reasoning Learning Environment (SRLE) in Vocational and Technical Education in Jiangsu Province, China. *International Journal of Social Science and Human Research*, *7*(07), 5107–5110. https://doi.org/10.47191/ijsshr/v7-i07-58

Ismail, F., Astuti, M., & Sholikhah, H. A. (2020). *Evaluasi Pembelajaran Berbasis Riset*. Karya Mandiri Sukses. https://repository.radenfatah.ac.id/ 8060/1/evaluasi pembelajaran.pdf

Junaedi, Y., Anwar, S., & Hilmi, Y. (2024). Pengembangan Bahan Ajar Digital Augmented Reality berbasis Ethno – RME Kebudayaan Suku Baduy dalam Optimasi Kemampuan Literasi Matematis Siswa. *Jurnal Penelitian dan Pembelajaran Matematika*, *17*(1), 140–149. https://jurnal.untirta.ac.id /i ndex.php/JPPM/article/view/28507

Jurečková, M., & Lucia Csachová. (2020). Statistical literacy of Slovak lower secondary school students. *Technium Social Sciences Journal*, *9*(8), 163–173. https://doi.org/10.47577/tssj.v9i1.966

Kim, J., Chung, M. S., Jang, H. G., & Chung, B. S. (2017). The use of educational comics in learning anatomy among multiple student groups. *Anatomical Sciences Education*, *10*(1), 79–86. https://doi.org/10.1002/ase.1619

Kjelvik, M. K., & Schultheis, E. H. (2019). Getting messy with authentic data: Exploring the potential of using data from scientific research to support student data literacy. *CBE Life Sciences Education*, *18*(2), 1–8. https://doi.org/10.1187/cbe.18-02-0023

Kovacs, P., Kuruczleki, E., Kazar, K., Liptak, L., & Racz, T. (2021). Modern teaching methods in action in statistical classes. *Statistical Journal of the IAOS*, *37*(3), 899–919. https://doi.org/10.3233/SJI-210843

Kurt, G. (2020). *An Investigation of Statistical Reasoning Skills of Middle School Students About Distribution*. July 2021. https://www.researchgate.net/publication/339843355_An_Investigation_of_Statistical_Reasoning_Skills_of_Middle_School_Students_About_Distribution

Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: A practical primer for t-tests and ANOVAs. *Frontiers in Psychology*, *4*(11), 1–12. https://doi.org/10.3389/fpsyg.2013.00863

Laurens, T., Batlolona, F. A., Batlolona, J. R., & Leasa, M. (2018). How does realistic mathematics education (RME) improve students' mathematics cognitive achievement? *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(2), 569–578. https://doi.org/10.12973/ejmste/76959

Lemer, A., Phone, O., Email, N. A., Location, O., Hours, A. O. O., Appointment, B., Title, M. T., Edition, E. S., Date, P. P., & Hours, C. (2022). *Course Syllabus Elementary Statistics MAT 115 ZA Instructor Contact Information*. https://allencc.simplesyllabus.com/api2/doc-pdf/cdas74ln2/S U24- MAT - 115- ZA-.pdf

Leone, J. M. (2018). Drawing Invisible Wounds: War Comics and the Treatment of Trauma. *Journal of Medical Humanities*, *39*(3), 243–261. https://doi.org/10.1007/s10912-017-9442-8

Liangsi, Y. (2025). Constructivism learning theory explains the nature of learning from a constructivist perspective. *Encyclopedia of education and pedagogy*, *12*(1), 311–313. https://link.springer.com/rwe/10.1007/978-981-97-7874-4_1077

Listianingsih, M., Astuti, I. A. D., Dasmo, D., & Bhakti, Y. B. (2021). Android-Based Comics: An Alternative Media to Improve Scientific Literacy. *Jurnal Penelitian dan Pembelajaran IPA*, *7*(1), 105-117. https://doi.org/10.30870/jppi.v7i1.8636

Logan, R. M., Johnson, C. E., & Worsham, J. W. (2021). Development of an e-learning module to facilitate student learning and outcomes. *Teaching and Learning in Nursing*, *16*(2), 139–142. https://doi.org/ 10.1016/j.teln.2020.10.007

Low, D. E., & Torres, F. L. (2022). Comics as literary compasses and kaleidoscopes: A pedagogical essay in fragments. *Study and Scrutiny: Research in Young Adult Literature*, *5*(2), 138–174. http://dx.doi.org/10.15763/issn.2376-5275.2022.5.2.138-174

Lugo-Armenta, J. G., & Pino-Fan, L. R. (2021). Inferential statistical reasoning of math teachers: Experiences in virtual contexts generated by the COVID-19

pandemic. *Education Sciences*, *11*(7), 2-19. https://doi.org/ 10.3390/educ sci1107 0363

Ma, V. J., & Ma, X. (2014). A comparative analysis of the relationship between learning styles and mathematics performance. *International Journal of STEM Education*, 1(1), 1–13. https://doi.org/10.1186/2196-7822-1-3

Maghfiroh, A., & Kuswanto, H. (2021). Development of Physics Comics Through Android-Assisted Benthik Game with Discovery Learning Model on Parabolic Motion. *Proceedings of the 7th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS 2020)*, *528*(Icriems 2020), 446–450. https://doi.org/ 10.2991/ assehr.k.210305.065

Maharani, L., Rahayu, D. I., Yuberti, Y., Komikesari, H., Sodikin, S., & Hidayah, R. (2019). Toondoo Application Based on Contextual Approach: Development of Comic Learning Media. *Journal of Physics: Conference Series*, *1155*(1), 1-12. https://doi.org/10.1088/1742-6596/1155/1/012023

Mahfud, M. H. (2020). Metode Penentuan Faktor-faktor Keberhasilan Penting dalam Analisis SWOT. *AGRISAINTIFIKA: Jurnal Ilmu-Ilmu Pertanian*, *3*(2), 109-121. https://doi.org/10.32585/ags.v3i2.546

Maknun, D., Prasetyo, Z. K., & Djukri, D. (2022). Guided inquiry laboratory to improve research skills of prospective biology teachers. *International Journal of Evaluation and Research in Education*, *11*(4), 2122–2128. https://doi.org/10.11591/ijere.v11i4.22104

Mamolo, L. A. (2019). Development of digital interactive math comics (DIMaC) for senior high school students in general mathematics. *Cogent Education*, *6*(1). https://doi.org/10.1080/2331186X.2019.1689639

Mares, T., Wolcott-MacCausland, N., Doucet, J., Kolovos, A., & Bennett, M. (2020). Using chiles and comics to address the physical and emotional wellbeing of farmworkers in Vermont's borderlands. *Agriculture and Human Values*, *37*(1), 197–208. https://doi.org/10.1007/s10460-019-099 60-z

Martin, E., Cupeiro, C., Pizarro, L., Roldán-Álvarez, D., & Montero-de-Espinosa, G. (2019). "Today I Tell" A Comics and Story Creation App for People with Autism Spectrum Condition. *International Journal of Human-Computer Interaction*, *35*(8), 679–691. https://doi.org/10.1080/ 10447318. 2018.1550178

Martin, N., Hughes, J., & Fugelsang, J. (2017). The roles of experience, gender, and individual differences in statistical reasoning. *Statistics Education Research Journal*, *16*(2), 454–475. https://doi.org/10.52041/serj.v16i2.201

Mascia, M. L., Perrone, S., Bardi, D., Agus, M., Penna, M. P., & Lucangeli, D. (2018). Digital life, mathematical skills and cognitive processes. *Proceedings of the 15th International Conference on Cognition and Exploratory Learning in the Digital Age, CELDA 2018*, *3*(5), 371–374. https://eric.ed.gov/?id=ED600769

Matheus, R., Janssen, M., & Maheshwari, D. (2020). Data science empowering the public: Data-driven dashboards for transparent and accountable decision-making in smart cities. *Government Information Quarterly*, *37*(3), 101284. https://doi.org/10.1016/j.giq.2018.01.006

Mayer, R. E. (2005). *Cognitive Theory of Multimedia Learning The Case for Multimedia Learning*. University of California, Santa Barbara. https:// lerenviapopulariseren.wordpress.com/wp-conte nt/uploads/2014/09/mayer-r-e-2005-cognitive-theory-of-multimedia-learning-the-cambridge-handbook-of-multimedia-learning-31-48.pdf

McMullin, J., Rushing, S., Sueyoshi, M., & Salman, J. (2021). Reanimating the Body: Comics Creation as an Embodiment of Life with Cancer. *Culture, Medicine and Psychiatry*, *41*(3), 1-20. https://doi.org/10.1007/s11013-020 09703-4

Mea, F., Tinggi, S., Kristen, A., Bangsa, A., Guru, K., Guru, I., & Dinamis, K. (2024). Peningkatan Efektivitas Pembelajaran Melalui Kreativitas dan Inovasi Guru Dalam Menciptakan Kelas yang Dinamis. *Inculco Journal of Christian Education*, *4*(3), 252–275. https://e-journal.stakanakbangsa.ac. id/index.php/ijce/article/viewFile/190/110

Mohamad Hasim, S., Rosli, R., & Halim, L. (2024). A Systematic Review on Teaching Strategies for Fostering Students' Statistical Thinking. *International Journal of Learning, Teaching and Educational Research*, *23*(1), 136–158. https://doi.org/10.26803/ijlter.23.1.8

Morari, V., Palmer, C., Carroll, C., Manning, D., & O'Rourke, S. (2024). Exploring the use and impact of online digital resources in a mathematics module. *European Journal of Science and Mathematics Education*, *12*(3), 335–355. https://doi.org/10.30935/scimath/14605

Muhazir, A., & Retnawati, H. (2020). The teachers' obstacles in implementing technology in mathematics learning classes in the digital era. *Journal of Physics: Conference Series, 1511*(1), 1–11. https://doi.org/10.1088/1742-6596/ 1511/1/012022

Nieto-Márquez, N. L., Baldominos, A., & Pérez-Nieto, M. Á. (2020). Digital teaching materials and their relationship with the metacognitive skills of students in primary education. *Education Sciences*, *10*(4), 1–18. https://doi.org/10.3390/educsci10040113

Nissen, J., & Stenliden, L. (2020). Processes in A Post Truth Era. *Association for the Advancement of Computing in Education*, *31*(1), 49–76. https://www.learntechlib.org/primary/p/210238/

Noll, J., Kirin, D., Clement, K., & Dolor, J. (2021). Revealing students' stories as they construct and use a statistical model in TinkerPlots to conduct a randomization test for comparing two groups. *Mathematical Thinking and Learning*, *33*(1), 1–20. https://doi.org/10.1080/10986065. 2021.1922858

Novelita, W., Yeni, F., Jasrial, & Hakim, R. (2024). Development of Android-based Comic Learning Media for Grade VII Science Subject in Junior High School. *Jurnal Penelitian Pendidikan IPA*, *10*(6), 3334–3341. https://doi.org/10.29303/jppipa.v10i6.6686

Numanovich, A. I., & Abbosxonovich, M. A. (2020). The Analysis Of Lands In Security Zones Of High-Voltage Power Lines (Power Line) On The Example Of The Fergana Region PhD of Fergana polytechnic institute, Uzbekistan PhD applicant of Fergana polytechnic institute, Uzbekistan. *EPRA International Journal of Multidisciplinary Research (IJMR)-Peer Reviewed Journal*, *2*(1), 198–210. https://doi.org/10.36713/epra2013

Nurdin, E., Saputri, I. Y., & Kurniati, A. (2020). Development of Comic Mathematics Learning Media Based on Contextual Approaches. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *8*(2), 85. https://doi.org/ 10.25273 /jipm.v8i2.5145

Nuriah, N., Syamsuri, S., Yuhana, Y., & Nindiasari, H. (2021). Analisis Kebutuhan Pengembangan E-modul Statistika Berbasis Kontekstual Untuk Siswa Kelas VIII. *TIRTAMATH: Jurnal Penelitian Dan Pengajaran Matematika*, *3*(2), 95. https://doi.org/10.48181/tirtamath. v3i2.12601

Nurhayati, S., Fitri, A., Amir, R., & Zalisman, Z. (2024). Analysis of the Implementation of Training on Digital-based Learning Media to Enhance Teachers' Digital Literacy. AL-ISHLAH: *Jurnal Pendidikan*, *16*(1), 545–557. https://doi.org/10.35445/alishlah.v16i1.4029

Oliveira, A. de, & Santos, P. (2021). The use of technological resources in teacher training as a contribution to teaching statistics, probability and combinatorial analysis at the National Meeting of Mathematical Education in Brazil. *International Journal of Engineering, Management and Humanities (IJEMH)*, *2*(1), 109–121. https://n9.cl/7x4t5

Oliveira, H., & Henriques, A. (2019). Teachers' Perspectives About Statistical Reasoning: Opportunities and Challenges for Its Development. *Springer International Publishing*, *2*(1), 309–328. https://doi.org/10.1007/978-3-030-03472-6_14

Oppermann, E., & Lazarides, R. (2021). Elementary school teachers' self-efficacy, student-perceived support and students' mathematics interest. *Teaching and Teacher Education*, *103*(1), 1-12. https://doi.org/ 10.1016/j.tate.2021.103351

Otoo, D., Iddrisu, W. A., Kessie, J. A., & Larbi, E. (2018). Structural Model of Students' Interest and Self-Motivation to Learning Mathematics. *Education Research International*, *2018*(1), 1-10. https://doi.org/10.1155 /2018/ 9417109

Pacheco-Vega, R. (2019). Writing Field Notes and Using Them to Prompt Scholarly Writing. *International Journal of Qualitative Methods*, 18(1), 1–2. https://doi.org/10.1177/1609406919840093

Padang, N. S. (2024). Respons Siswa Terhadap Bahan Ajar E-Modul Matematika Dalam Materi. *Prisma*, *3*(1), 33–38. https://doi.org/10.62388/prisma. v3i1.424

Paper, R., & Budde, R. (2020). Data Science Education In Secondary School: How To Develop Statistical Reasoning When Exploring Data Using Codap. *IASE 2020*. *7*(1), 1–9. https://www.researchgate. net/publication/ 352744406

Podworny, S., Frischemeier, D., & Biehler, R. (2018). Enhancing Civic Statistical Knowledge of Secondary Preservice Teachers for Mathematics. *The International Conference on Teaching Statistics, August. www. procivicstat.org*, *8*(1), 1–12. https://www.researchgate.net/publication/327 112529

Prasetya, B., Muchtar, H., & Syahrial, Z. (2019). Pengaruh Model Pembelajaran Dan Minat Belajar Terhadap Hasil Belajar Statistik. *Jurnal Teknologi Pendidikan (JTP)*, *11*(2), 87-104. https://doi.org/10.24114/jtp.v11i2.12591

Pratiwi, N. K. A., & Jayanta, I. N. L. (2023). Elementary School Science Skills Practical Digital Teaching Module. *Jurnal Edutech Undiksha*, *11*(2), 240–250. https://doi.org/10.23887/jeu.v11i2.61524

Qi, A. (2018). A study of the effect of implementing intellectual property education with digital teaching on learning motivation and achievements. Eurasia Journal of Mathematics, *Science and Technology Education*, *14*(6), 2445–2452. https://doi.org/10.29333/ejmste/89498

Rais, M., Hartoto, H., & Aryani, F. (2022). The Influence of Android-Based Digital Comics on the Social Skills to Prevent the Covid-19 Through Student Social Interaction. *Journal of Educational Science and Technology (EST)*, *8*(3), 180. https://doi.org/10.26858/est.v8i3.37318

Ramadhani, R., & Evans, B. R. (2022). Measuring students' statistical reasoning abilities using flipped classroom model with SPSS and STATCAL. *Journal of Honai Math*, *5*(1), 1–14. https://doi.org/ 10.30862/jhm.v5i1.246

Reinhart, A., Evans, C., Luby, A., Orellana, J., Meyer, M., Wieczorek, J., Elliott, P., Burckhardt, P., & Nugent, R. (2019). *Think-aloud interviews: A tool for exploring student statistical reasoning*, *4*(1), 1–26. http://arxiv.org/abs/ 1911.00535

Ridgway, J. (2016). Implications of the Data Revolution for Statistics Education. *International Statistical Review*, *84*(3), 528–549. https://doi.org/10.1111/ insr.12110

Rina, N., Suminar, J. R., Damayani, N. A., & Hafiar, H. (2020). Character education based on digital comic media. *International Journal of Interactive Mobile Technologies*, *14*(3), 107–127. https://doi.org/10.3991/ ijim.v14i03.12111

Rini, T., & Cholifah, P. (2020). Electronic Module With Project Based Learning (PjBL): Innovation Of Digital Learning Product On 4.0 Era. *Edcomtech Jurnal Kajian Teknologi Pendidikan*, *5*(2), 155–161. https://doi.org/ 10.17977/um039v5i22020p155

Rohana, R., & Ningsih, Y. L. (2019). Students' Statistical Reasoning in Statistics Method Course. *Jurnal Pendidikan Matematika*, *14*(1), 81–90. https://doi.org/10.22342/jpm.14.1.6732.81-90

Roldán-Nofuentes, J. A., Sheth, T. S., & Vera-Vera, J. F. (2024). Hypothesis Test to Compare Two Paired Binomial Proportions: Assessment of 24 Methods. *Mathematics*, *12*(2), 1–23. https://doi.org/10.3390/math12020190

Rolf Biehler, Dani Ben-Zvi, Arthur Bakker, and K. M. (2013). Technology for Enhancing Statistical Reasoning at the School Level. *In Third International Handbook of Mathematics Education*, *21*(1), 643–689. https://doi.org/ 10.1007/978-1-4614-4684-2

Roos, H. (2022). Repeated interviews with students–critical methodological points for research quality. *International Journal of Research and Method in Education*, *45*(5), 423–436. https://doi.org/10.1080/1743727X.2021. 1966622

Rose, N., Gunadi, F., Rosyadi, Nandang, & Sudirman. (2021). Comic Mathematics: A bridge to understanding the concept of social arithmetic for secondary school students. *Journal of Physics: Conference Series*, *1783*(1), 1–7. https://doi.org/10.1088/1742-6596/1783/1/012104

Rosidah, Ketut Budayasa, I., & Juniati, D. (2018). An Analysis of Statistical Reasoning Process of High School Students in Solving the Statistical

Problem. *Journal of Physics: Conference Series*, *1028*(1), 1–5. https://doi.org/10.1088/1742-6596/1028/1/012125

Sabbag, A., Garfield, J., & Zieffler, A. (2018). Assessing statistical literacy and statistical reasoning: The reali instrument. *Statistics Education Research Journal*, *17*(2), 141–160. https://doi.org/10.52041/serj.v17i2.163

Şahan, Z., & Atlı, E. (2024). International Journal of Educational Studies and Policy (IJESP) The Effect of the Use of Educational Digital Comics in Science Teaching on Academic Achievement. *International Journal of Educational Studies and Policy*, *6*(1), 34–50. https://doi.org/10.5281/zeno do.1507485

Saidi, S. S., & Siew, N. M. (2022). Assessing Secondary School Students' Statistical Reasoning, Attitudes Towards Statistics, and Statistics Anxiety. Statistics *Education Research Journal*, *21*(1), 1–19. https://doi.org/10.52 041/serj.v21i1.67

Saleh, A., Phillips, T. M., Hmelo-Silver, C. E., Glazewski, K. D., Mott, B. W., & Lester, J. C. (2022). A learning analytics approach towards understanding collaborative inquiry in a problem-based learning environment. *British Journal of Educational Technology*, *53*(5), 1321–1342. https://doi.org/ 10.1111/bjet.13198

Schütz, W. (2020). Interactions between Medicine and the Arts. *The Central European Journal of Medicine*, 132(3), 1–65. https://doi.org/10.1007/s00 508-020-01706-w

Seloraji, P., & Eu, L. K. (2021). Primary Pupils ' Attitudes toward Learning Statistical Reasoning using TinkerPlots in Statistical Reasoning Learning Environment (SRLE) Class. *Malaysian Journal Management System*. *0832*(15), 139–155. https://myjms.mohe.gov.my/index.php/lsm/issue/dow nload/1333/2021_9_PS_139155

Senjaya, A. J. (2020). *Analisis Statistik dalam Bidang Sosial dan Pendidikan*. (Vol. 53, Issue 9). K-Media. https://www.academia.edu/50853638/Langka h_Langkah_Analisis_Statistik_dalam_Riset_Bidang_Pendidikan_dan_Sos ial_Edisi_Revisi

Setiyani, Putri, D. P., Ferdianto, F., & Fauji, S. H. (2020). Designing a digital teaching module based on mathematical communication in relation and function. *Journal on Mathematics Education*, *11*(2), 223–236. https://doi.org/10.22342/jme.11.2.7320.223-236

Sharma, A. (2020). A Review on Unstructured Data using k-Mean Algorithm. *Smart Moves Journal Ijoscience*, *6*(6), 11–14. https://doi.org/10.24113/ijo science.v6i6.290

Sheromova, T. S., Khuziakhmetov, A. N., Kazinets, V. A., Sizova, Z. M., Buslaev, S. I., & Borodianskaia, E. A. (2020). Learning styles and development of cognitive skills in mathematics learning. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(11), 1–13. https://doi.org/10.29333/EJMSTE/8538

Shin, D. (2021). A framework for understanding how preservice teachers notice students' statistical reasoning about comparing groups. *International Journal of Mathematical Education in Science and Technology*, *52*(5), 699–720. https://doi.org/10.1080/0020739X.2019.1699968

Shin, J., Lee, H., & Kim, Y. (2009). Student and school factors affecting mathematics achievement: International comparisons between Korea, Japan and the USA. *School Psychology International*, *30*(5), 520–537. https://doi.org/10.1177/0143034309107070

Shofwan, I., Aminatun, S., Handoyo, E., & Kariadi, M. T. (2021). The Effect of E-Learning on Students' Learning Interest in the Equivalence Education Program. *Journal of Nonformal Education*, *7*(1), 103–111. https://doi.org/10.15294/jne.v7i1.29276

Showalter, D. A. (2021). Attitudinal changes in face-to-face and online statistical reasoning learning environments. *Journal of Pedagogical Research*, *5*(2), 1–18. https://doi.org/10.33902/jpr.2021269257

Smith, J., & Brown, R. (2025). What do Your Students Struggle with? A Survey of Statistics Instructors. *Xenobiotica*, *1*(5), 19–36. https://doi.org/10.1080/26939169.2025.2455560

Stamper, C. N. (2019). "You Are My [Camp]fire": Tradition and Structure in Maggie Thrash's Graphic Memoir Honor Girl. *Children's Literature in Education*, *50*(2), 110–124. https://doi.org/10.1007/s10583-017-9336-4

Suh, H., Kim, S., Hwang, S., & Han, S. (2020). Enhancing preservice teachers' key competencies for promoting sustainability in a university statistics course. *Sustainability (Switzerland)*, *12*(21), 1–21. https://doi.org/10.3390/su12219051

Sulyanah, S., Hasanah, F. N., & Untari, R. S. (2021). Application of Web Based Learning to Measure Students Learning Interest. *Journal of Physics: Conference Series*, *1764*(1), 1–7. https://doi.org/10.1088/1742-6596/1764/1/012099

Sun, A. Y., & Scanlon, B. R. (2019). How can Big Data and machine learning benefit environment and water management: A survey of methods, applications, and future directions. *Environmental Research Letters*, *14*(7). https://doi.org/10.1088/1748-9326/ab1b7d

Sunarti, S., & Rusilowati, A. (2021). Pengembangan Bahan Ajar Digital Gerak Melingkar Berbantuan Scratch Berbasis Science, Technology, Engineering, and Mathematics. *Unnes Physics Education Journal*, *9*(3), 283–290. http://journal.unnes.ac.id/sju/index.php/upej

Sung, Y. T., Chang, K. E., & Liu, T. C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers and Education*, *94*(1), 252–275. https://doi.org/10.1016/j.compedu.2015.11.008

Tintle, N., Clark, J., Fischer, K., Chance, B., Cobb, G., Roy, S., Swanson, T., & VanderStoep, J. (2018). Assessing the Association Between Precourse Metrics of Student Preparation and Student Performance in Introductory Statistics: Results from Early Data on Simulation-Based Inference vs. Nonsimulation-Based Inference. *Journal of Statistics Education*, *26*(2), 103–109. https://doi.org/10.1080/10691898.2018.1473061

Toh, T. L., Cheng, L. P., Ho, S. Y., Jiang, H., & Lim, K. M. (2017). Use of comics to enhance students' learning for the development of the twenty-first century competencies in the mathematics classroom. *Asia Pacific Journal of Education*, *37*(4), 437–452. https://doi.org/10.1080/02188791.2017.1339344

Tondeur, J., Scherer, R., Siddiq, F., & Baran, E. (2017). A comprehensive investigation of TPACK within pre-service teachers' ICT profiles: Mind the gap! *Australasian Journal of Educational Technology*, *33*(3), 46–60. https://doi.org/10.14742/ajet.3504

Tursunalievich, A. Z., & Rahmat, A. (2021). Challenges In Developing A Digital Educational Environment. Aksara: *Jurnal Ilmu Pendidikan Nonformal*, *7*(2), 247. https://doi.org/10.37905/aksara.7.2.247-254.2021

Ufer, S., Rach, S., & Kosiol, T. (2017). Interest in mathematics = interest in mathematics? What general measures of interest reflect when the object of interest changes. *ZDM - Mathematics Education*, *49*(3), 397–409. https://doi.org/10.1007/s11858-016-0828-2

Ulusoy, C. A., & Altay, M. K. (2017). Analyzing the statistical reasoning levels of pre-service elementary school teachers in the context of a model eliciting activity. *International Journal of Research in Education and Science*, *3*(1), 20–30. https://files.eric.ed.gov/fulltext/EJ1126697.pdf

Utami, W. A., Harlita, H., & Karyanto, P. (2022). Validity and Practicality of Discovery Learning E-Modules on environmental change material to Empower Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, *8*(3), 1593–1598. https://doi.org/10.29303/jppipa.v8i3.1726

Uygarer, R., & Uzunboylu, H. (2017). An investigation of the digital teaching book compared to traditional books in distance education of teacher education programs. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(8), 5365–5377. https://doi.org/10.12973/eurasia .2017.00830a

Vassilikopoulou, M., Retalisa, S., Nezi, M., & Boloudakis, M. (2011). Pilot use of digital educational comics in language teaching. *Educational Media International*, *48*(2), 115–126. https://doi.org/10.1080/09523987.2011. 576522

Venkatesan, S., & Murali, C. (2019). Graphic Medicine and the Critique of Contemporary U.S. Healthcare. *Journal of Medical Humanities*, *8*(1), 1–16. https://doi.org/10.1007/s10912-019-09571-z

Venkatesan, S., & Murali, C. (2020). "It just went wrong, as bodies are prone to do": Graphic Medicine and the Trauma of Miscarriage. *Journal of Medical Humanities*, *10*(2), 1–13. https://doi.org/10.1007/s10912-020-09666-y

Visnovska, J., & Cobb, P. (2019). Supporting shifts in teachers' views of a classroom statistical activity: problem context in teaching statistics. *Mathematical Thinking and Learning*, *21*(4), 285–305. https://doi.org/10. 1080/10986065.2019.1576003

Voinov, V., M. Nikulin, & N. Balakrishnan. (2019). Chi-Squared Goodness of Fit Tests with Applications. In *Sustainability (Switzerland)*, (Vol. 11, Issue 1). http://scioteca.caf.com/bitstream/handle/123456789/1091/RED2017-Eng-8ene.pdf?sequence=12&isAllowed=y%0Ahttp://dx.doi.org/10.1016/j.regsciurbeco.2008.06.005%0Ahttps://www.researchgate.net/publication/305320484_SISTEM_PEMBETUNGAN_TERPUSAT_STRATEGI_MELESTARI

Wale, B. D., & Bishaw, K. S. (2020). Effects of using inquiry-based learning on EFL students' critical thinking skills. *Asian-Pacific Journal of Second and Foreign Language Education*, *5*(1), 1–15. https://doi.org/10.1186/s40862-020-00090-2

Wershler, D., Sinervo, K., & Tien, S. (2021). 17. Digital Comics. *Comics Studies*, *1*(2), 253–266. https://doi.org/10.36019/9780813591452-018

Winaryati, E., Munsarif, M., & Mardiana. (2021). *Cercular Model of RD&D (Model RD&D Pendidikan dan Sosial)*. http://repository.unimus.ac.id/5142/1/E-Book%20Cercular%20Model%20RD%26D%20%28RD%26D%20Pendidikan%20dan%20Sosial%29.pdf

Wong, S. L., & Wong, S. L. (2019). Relationship between interest and mathematics performance in a technology-enhanced learning context in Malaysia.

Research and Practice in Technology Enhanced Learning, *14*(1), 1–13. https://doi.org/10.1186/s41039-019-0114-3

Yang, L., Weng, T., Yang, D., & Wu, P. (2014). The Effectiveness of Digital Teaching Materials on Introduction Statistics. *Proceedings of the 2014 International Conference on Education Reform and Modern Management*, *75*(1), 267–270. https://doi.org/10.2991/ermm-14.2014.73

Yeh, C. Y. C., Cheng, H. N. H., Chen, Z. H., Liao, C. C. Y., & Chan, T. W. (2019). Enhancing achievement and interest in mathematics learning through Math-Island. *Research and Practice in Technology Enhanced Learning*, *14*(1), 1–19. https://doi.org/10.1186/s41039-019-0100-9

Yu, J. (2023). Digital teaching and learning resources. *OECD*. https://www.oecd.org/en/publications/oecd-digital-education-outlook-2023_c74f03de-en/full-report/digital-teaching-and-learning-resources_5651654d.html?utm_source=chatgpt.co

Yulianti, D., & Herpratiwi. (2024). Development of a science, environment, technology, and society-based learning module to foster critical thinking in elementary students. *Journal of Education and Learning*, *18*(4), 1372–1384. https://doi.org/10.11591/edulearn.v18i4.21713

Zajda, D. (2021). Constructivist learning theory and creating effective learning environments. *Globalisation and education reforms 30*(4), 35–50. https://link.springer.com/chapter/10.1007/978-3-030-71575-5_3

Zhao, Y. (2014). On How to Arouse the Students' Learning Interest in Foreign Language Teaching. *Proceedings of the 2014 International Conference on Education, Management and Computing Technology*, *100*(Icemct), 308–312. https://doi.org/10.2991/icemct-14.2014.71

Zipkin, E. F., Zylstra, E. R., Wright, A. D., Saunders, S. P., Finley, A. O., Dietze, M. C., Itter, M. S., & Tingley, M. W. (2021). Addressing data integration challenges to link ecological processes across scales. *Frontiers in Ecology and the Environment*, *19*(1), 30–38. https://doi.org/ 10.1002/fee.2290