

DAFTAR PUSTAKA

- [1] X. Wang, W. Chen, H. Qiu, A. Eldurssi, F. Xie, and J. Shen, "A survey on the e-learning platforms used during COVID-19," in Proc. 11th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), Vancouver, BC, Canada, 2020, pp. 808–814, doi: 10.1109/IEMCON51383.2020.9284840
- [2] V. Chuwkory, G. Nanuck, and R. K. Sungkur, "The future of continuous learning–digital badge and micro-credential system using blockchain," *Global Transitions Proc.*, vol. 2, 2021, doi: 10.1016/j.glt.2021.08.026
- [3] Moodle, "Registered Moodle sites," Feb. 10, 2024. [Online]. Available: <https://stats.moodle.org/sites/> [Accessed: Feb. 10, 2024]
- [4] E-Learning Industry, "Learning Management Systems," Feb. 6, 2024. [Online]. Available: <https://elearningindustry.com/directory/software-categories/learning-management-systems/features/survey-engine> [Accessed: Feb. 6, 2024]
- [5] Statcounter, "Desktop vs Mobile Market Share Worldwide," Feb. 7, 2024. [Online]. Available: <https://gs.statcounter.com/platform-market-share/desktop-mobile/worldwide> [Accessed: Feb. 7, 2024]
- [6] Moodle, "Moodle core features," Feb. 10, 2024. [Online]. Available: <https://docs.moodle.org/38/en/Features> [Accessed: Feb. 10, 2024]
- [7] S. R. Hasan, "Potential of blockchain technology to solve fake diploma problem," M.S. thesis, Dept. Computer Science and Information Systems, Univ. of Jyväskylä, Finland, 2019
- [8] N. Pal, "The emergence of decentralized web in the education field," M.S. thesis, Dept. of Informatics and Media, Uppsala Universitet, Sweden, 2020
- [9] E. Elrom, *The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchain-based Projects*. New York, NY, USA: Apress Media, 2019
- [10] Y. Zou, T. Meng, P. Zhang, W. Zhang, and H. Li, "Focus on blockchain: A comprehensive survey on academic and application," *IEEE Access*, vol. 8, pp. 187182–187201, 2020, doi: 10.1109/ACCESS.2020.3030491
- [11] S. Islam, M. J. Islam, M. Hossain, S. Noor, K.-S. Kwak, and S. M. R. Islam, "A survey on consensus algorithms in blockchain-based applications: Architecture, taxonomy, and operational issues," *IEEE Access*, vol. 11, pp. 39066–39082, 2023, doi: 10.1109/ACCESS.2023.3267047
- [12] M. Turkanović, M. Hölbl, K. Košič, M. Heričko, and A. Kamišalić, "EduCTX: A blockchain-based higher education credit platform," *IEEE Access*, vol. 6, pp. 5112–5127, 2018, doi: 10.1109/ACCESS.2018.2789929
- [13] S. Guerreiro, J. F. Ferreira, T. Fonseca, and M. Correia, "Integrating an academic management system with blockchain: A case study," *Blockchain: Research and Applications*, vol. 3, 23 June 2022, doi: 10.1116/j.bcra.2020.100099

- [14] H. A. Alshobi, R. A. Alakhtar, A. Ubaid, O. K. Hussain, and F. K. Hussain, "Blockchain-based micro-credentialing system in higher education institutions: A systematic literature review," *Knowledge-Based Systems*, vol. 265, 2023, doi: 10.1016/j.knosys.2022.110238
- [15] A. Kamišalić, M. Turkanović, S. Mrdović, and M. Heričko, "A preliminary review of blockchain-based solutions in higher education," in **Learning Technology for Education Challenges**, 2019, pp. 114–124, doi: 10.1007/978-3-030-20798-4_11
- [16] M. Turkanović and B. Podgorelec, "Signing blockchain transactions using qualified certificates," in *Proc. IEEE Computer Society MIC*, 2020, doi: 10.1109/MIC.2020.3026182
- [17] P. K. Paul, P. S. Aithal, and R. Saavedra, "Blockchain in educational development: Potentialities and issues—towards sophisticated digital education systems," Jan. 2023, doi: 10.2139/ssrn.4400249
- [18] E. Karataş, "Developing Ethereum blockchain-based document verification smart contract for Moodle Learning Management System," vol. 11, no. 4, Oct. 2018, doi: 10.17671/GAZIBTD.452686
- [19] H. An and J. Chen, "ElearnChain: A privacy-preserving consortium blockchain system for e-learning educational records," vol. 63, Dec. 2021, doi: 10.1016/j.jisa.2021.103013
- [20] M. Tanriverdi, "PublicEduChain: A framework for sharing student-owned educational data on public blockchain network," *IEEE Access*, vol. 12, pp. 51772–51785, 2024, doi: 10.1109/ACCESS.2024.3385660
- [21] W. Gräther, S. Kolvenbach, R. Ruland, J. Schütte, C. F. Torres, and F. Wendland, "Blockchain for education: Lifelong learning passport," in *Proc. EUSSET 2018 – European Society for Socially Embedded Technologies*, 2018, doi: 10.18420/BLOCKCHAIN2018_07
- [22] E. Leka and B. Selimi, "Development and evaluation of blockchain-based secure application for verification and validation of academic certificates," 2021 IAER Int. Conf., vol. 5, no. 2, Apr. 2021, doi: 10.33166/AETIC.2021.02.003
- [23] E. Leka and B. Selimi, "BCERT - a decentralized academic certificate system distribution using blockchain technology," *Int. J. Inf. Technol. & Secur.*, vol. 12, no. 4, pp. 103–118, Nov. 2020
- [24] M. Baldi, F. Chiaraluce, M. Kodra, and L. Spalazzi, "Security analysis of a blockchain-based protocol for the certification of academic credentials," *arXiv preprint arXiv:1910.04622v1*, 2019, doi: 10.48550/arXiv.1910.04622
- [25] S. Nikolić, S. Matić, D. Čapko, S. Vukmirović, and N. Nedić, "Development of a blockchain-based application for digital certificates in education," in *Proc. 2022 30th Telecommunications Forum (TELFOR)*, Belgrade, Serbia, 2022, pp. 1–4, doi: 10.1109/TELFOR56187.2022.9983672
- [26] A. Tariq, H. Binte Haq, and S. T. Ali, "Cerberus: A blockchain-based accreditation and degree verification system," *IEEE Trans. Comput. Social Syst.*, vol. 10, no. 4, pp. 1503–1514, Aug. 2023, doi:

10.1109/TCSS.2022.3188453

- [27] I. Bashir, *Mastering Blockchain: Deeper Insight into Decentralization, Cryptography, Bitcoin, and Popular Blockchain Frameworks*. Birmingham, UK: Packt Publishing Ltd, 2017
- [28] M. N. M. Bhutta et al., "A survey on blockchain technology: Evolution, architecture and security," *IEEE Access*, vol. 9, pp. 61048–61073, 2021, doi: 10.1109/ACCESS.2021.3072849
- [29] S. M. Jain, *A Brief Introduction to Web3: Decentralized Web Fundamentals for App Development*. New York, NY, USA: Apress Media, LLC, 2023
- [30] L. K. Ramasamy and F. Khan, *Blockchain for Global Education*. Gewerbestrasse, Switzerland: Springer, 2024
- [31] Z. Yun, C. Chao, W. Haoling, L. Tao, and J. Hefang, "Decentralized identity and password authentication system based on blockchain," in *Proc. 2022 IEEE 4th Int. Conf. Power, Intelligent Computing and Systems (ICPICS)*, Shenyang, China, 2022, pp. 481–485, doi: 10.1109/ICPICS55264.2022.9873634
- [32] A. R. Hevner, S. T. March, J. Park, and S. Ram, "Design science in information systems research," *MIS Quarterly*, vol. 28, no. 1, pp. 75–105, Mar. 2004
- [33] A. R. Hevner, "A three-cycle view of design science research," *Scandinavian J. Inf. Syst.*, vol. 19, no. 2, pp. 87–92, 2007
- [34] M. N. Ubaka-Okoye et al., "Blockchain framework for securing e-learning system," *IJATCSE*, vol. 9, no. 2, pp. 1256–1263, 2020
- [35] I. R. Lakshmi and S. V. F. Rani, "Securing digital wallets: Threats and countermeasures," *MJACS*, vol. 2, no. 4, pp. 25–32, Dec. 2024
- [36] N. Mittal and A. Rajput, "Analysis of blockchain technology for business authentication," in *Proc. 2023 5th Int. Conf. Inventive Res. Comput. Appl. (ICIRCA)*, Aug. 2023, doi: 10.1109/ICIRCA57980.2023.10220882
- [37] N. Masla, V. Vyas, J. Gautam, R. N. Shaw, and A. Ghosh, "Reduction in gas cost for blockchain-enabled smart contract," in *Proc. 2021 IEEE 4th Int. Conf. Computing, Power and Communication Technologies (GUCON)*, Kuala Lumpur, Malaysia, 2021, pp. 1–6, doi: 10.1109/GUCON50781.2021.9573701
- [38] H. S. Kartiko, T. Rismawan, and I. Ruslianto, "Implementasi IPFS untuk mengurangi gas fee smart contract Ethereum pada aplikasi penggalangan dana," *J. Edukasi dan Penelitian Informatika (JEPIN)*, vol. 9, no. 2, p. 195, Aug. 2023, doi: 10.26418/jp.v9i2.61876
- [39] D. Menaga, S. Karthick M., and V. P., "Integration of blockchain in learning management system (LMS): A secure software for learning platform in education and technology," in *Proc. 2024 7th Int. Conf. Circuit Power and Computing Technologies (ICCPCT)*, Kollam, India, 2024, pp. 1637–1644, doi: 10.1109/ICCPCT61902.2024.10672974
- [40] I. Riadi, A. Z. Ifani, and R. S. Kusuma, "Optimization and evaluation of authentication system using blockchain technology," *Emerg. Sci. J.*, vol. 4,

pp. 225–240, Feb. 2022, doi: 10.28991/esj-2021-SP1-015

- [41] Ethereum Foundation, "Gas and Fees Documentation," 2024. [Online]. Available: <https://ethereum.org/en/developers/docs/gas/> [Accessed: Jun. 25, 2025]
- [42] MetaMask, MetaMask Documentation. [Online]. Available: <https://docs.metamask.io/> [Accessed: Jun. 25, 2025]
- [43] W3Schools, "HTTP response status codes," W3Schools. [Online]. Available: https://www.w3schools.com/tags/ref_httpmessages.asp [Accessed: Jul. 7, 2025]
- [44] Etherscan, "eth_getTransactionByHash – Geth/Parity Proxy API," Etherscan Documentation. [Online]. Available: https://docs.etherscan.io/etherscan-v2/api-endpoints/geth-parity-proxy#eth_gettransactionbyhash [Accessed: Jul. 7, 2025]
- [45] Telerik, "Capturing Modes in Fiddler Everywhere," Telerik Fiddler Documentation. [Online]. Available: <https://docs.telerik.com/fiddler-everywhere/capture-traffic/capturing-modes> [Accessed: Jul. 7, 2025]