

***NON-PLAYABLE CHARACTER BERBASIS
LARGE LANGUAGE MODEL UNTUK GAME ROLE PLAYING GAME***

SKRIPSI

Diajukan Untuk Memenuhi Sebagian dari Syarat Memperoleh Gelar Sarjana
Komputer Program Studi Ilmu Komputer



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ALAM
UNIVERSITAS PENDIDIKAN INDONESIA
2025**

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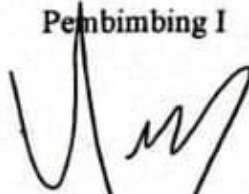
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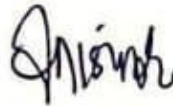
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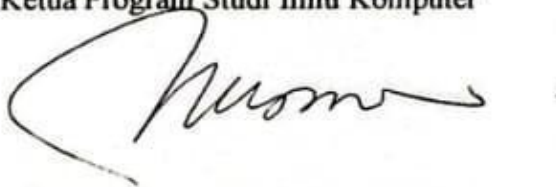


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PERNYATAAN

Dengan ini saya menyatakan bahwa skripsi berjudul “*Non-playable Character* berbasis *large language model* untuk *game role playing game*” sepenuhnya merupakan hasil karya asli saya. Segala bentuk kutipan atau rujukan yang digunakan telah dicantumkan sesuai dengan kaidah penulisan ilmiah yang berlaku. Apabila di kemudian hari terbukti terdapat pelanggaran terhadap etika akademik atau klaim dari pihak lain mengenai keaslian karya ini, saya bersedia menerima konsekuensi sesuai aturan yang berlaku.

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KATA PENGANTAR

Puji syukur penulis panjatkan ke hadirat Allah SWT atas segala rahmat, karunia, dan kemudahan yang diberikan sehingga penulis dapat menyelesaikan penyusunan skripsi dengan judul "*Non-playable Character* berbasis *large language model* untuk *game role playing game*" dengan baik.

Skripsi ini disusun untuk memenuhi salah satu syarat untuk mendapatkan gelar sarjana pada program studi Ilmu Komputer, Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam, Universitas Pendidikan Indonesia.

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**NON-PLAYABLE CHARACTER BERBASIS
LARGE LANGUAGE MODEL UNTUK GAME ROLE PLAYING GAME**

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ABSTRAK

Game RPG sering menghadirkan dialog NPC yang statis dan kurang kontekstual, sehingga mengurangi imersi pemain terhadap alur cerita. Penelitian ini mengembangkan sistem dialog NPC dinamis berbasis *Large Language Model* (LLM) dengan pendekatan *Retrieval-Augmented Generation* (RAG) dan *prompt engineering*, diimplementasikan pada prototipe game *Kage no Meiyaku: Shinobi no Michi*. Sistem dirancang agar NPC merespons input pemain secara adaptif dengan merujuk pada lore cerita, riwayat percakapan serta menjaga konsistensi persona karakter. Evaluasi menggunakan kuesioner skala Likert mencakup lima aspek kualitas dialog: relevansi cerita, koherensi naratif, konsistensi persona, kealamian bahasa, dan keterlibatan emosional. Hasil pengujian terhadap 13 responden menunjukkan skor rata-rata 4,07–4,46, menandakan respons positif. Meskipun masih terdapat keterbatasan, seperti kesalahan ejaan pada response, dan fitur game sederhana, sistem terbukti meningkatkan kualitas interaksi dalam game naratif. Penelitian ini tidak hanya menghasilkan prototipe NPC yang lebih interaktif, tetapi juga mengeksplorasi potensi teknologi LLM dalam pengembangan game, khususnya NPC berbasis percakapan yang lebih kontekstual dan imersif.

Kata Kunci: *Non-Playable Characters, Large Language Models, Retrieval Augmented Generation, Role-Playing Game, prompt engineering*

**NON-PLAYABLE CHARACTERS BASED ON LARGE LANGUAGE
MODELS FOR ROLE PLAYING GAMES**

by

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ABSTRACT

Role-Playing Games (RPGs) often feature static and less contextual NPC dialogues, which can reduce player immersion in the storyline. This study develops a dynamic NPC dialogue system based on Large Language Models (LLMs) using a Retrieval-Augmented Generation (RAG) approach and prompt engineering, implemented in the prototype game Kage no Meiyaku: Shinobi no Michi. The system is designed to enable NPCs to respond adaptively to player input by referencing game lore, conversation history, and maintaining consistent character personas. Evaluation was conducted using a Likert-scale questionnaire covering five dialogue quality aspects: story relevance, narrative coherence, persona consistency, language naturalness, and emotional engagement. Testing with 13 participants showed positive responses, with average scores ranging from 4.07 to 4.46. Despite limitations such as typos in NPC responses and the simplicity of the prototype features, the system proved to enhance interaction quality in narrative-driven games. This research not only delivers a more interactive NPC prototype but also explores the potential of LLM technology in game development, particularly for creating more contextual and immersive conversational NPCs.

Keywords: *Non-Playable Characters, Large Language Models, Retrieval Augmented Generation, Role-Playing Game, prompt engineering*

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DAFTAR PUSTAKA

- Bethesda Game Studios. (2011). The Elder Scrolls V: Skyrim [Video game]. Bethesda Softworks.
- Gao, J., Liu, Z., Wang, Z., & Zhang, Y. (2023). PeaCoK: Persona commonsense knowledge for consistent and engaging narratives. *arXiv*. <https://doi.org/10.48550/arXiv.2305.02364>
- Lewis, P., Perez, E., Piktus, A., Petroni, F., Karpukhin, V., Goyal, N., Küttler, H., Lewis, M., Yih, W.t., Rocktäschel, T., Riedel, S., & Kiela, D. (2020). Retrieval-augmented generation for knowledge-intensive NLP tasks. *Advances in Neural Information Processing Systems*, 33, 9459–9474. <https://papers.nips.cc/paper/2020/file/6b493230205f780e1bc26945df7481e5-Paper.pdf>
- Xi, Y., Chen, Z., Wang, G., Liu, Z., & Zhang, Y. (2023). The rise and potential of large language model based agents: A survey. *arXiv*. <https://doi.org/10.48550/arXiv.2309.07864>
- Jennett, C., Cox, A. L., Cairns, P., Dhoparee, S., Epps, A., Tijs, T., & Walton, A. (2008). Measuring and defining the experience of immersion in games. *International Journal of Human-Computer Studies*, 66(9), 641–661. <https://doi.org/10.1016/j.ijhcs.2008.04.004>
- Newzoo. (2021). RPGs are mobile's biggest genre by revenues: How do gamers across East and West engage with the genre? <https://newzoo.com/insights/articles/rpgs-are-mobiles-biggest-genre-by-revenues-how-do-gamers-across-east-and-west-engage-with-the-genre>
- Xu, Z., Jain, S., & Kankanhalli, M. (2024). Hallucination is inevitable: An innate limitation of large language models. *arXiv preprint arXiv:2401.11817*.
- Lewis, P., Perez, E., Piktus, A., Petroni, F., Karpukhin, V., Goyal, N., ... & Kiela, D. (2021). Retrieval-augmented generation for knowledge-intensive NLP tasks. *Advances in Neural Information Processing Systems*, 33, 9459–9474. <https://papers.nips.cc/paper/2020/file/6b493230205f780e1bc26945df7481e5-Paper.pdf>
- Treanor, M., McCoy, J., & Sullivan, A. (2021). Social Play in Non-Player Character Dialog. *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, 11(4), 99–101. <https://doi.org/10.1609/aiide.v11i4.12838>
- Treanor, M., Zook, A., Eladhari, M. P., Togelius, J., Smith, G., Cook, M., Thompson, T., Magerko, B., Levine, J., & Smith, A. (2015, December). AI-based game design patterns. *Proceedings of the 10th International Conference on the Foundations of Digital Games 2015 (FDG 2015)*. <http://www.fdg2015.org/>
- Reynolds, L., & McDonell, K. (2021). Prompt Programming for Large Language Models: Beyond the Few-Shot Paradigm. <https://arxiv.org/abs/2102.07350>
- Ouyang, L., Wu, J., Jiang, X., Almeida, D., Wainwright, C. L., Mishkin, P., Zhang, C., Agarwal, S., Slama, K., Ray, A., Schulman, J., Hilton, J., Kelton, F., Miller, L., Simens, M., Askeel, A., Welinder, P., Christiano, P., Leike, J., & Lowe, R. (2022). Training language models to follow instructions with human feedback. <https://arxiv.org/abs/2203.02155>

- Isbister, K. (2006). *Better Game Characters by Design: A Psychological Approach*. <https://doi.org/10.1201/9780367807641>
- Ou, J., Lu, J., Liu, C., Tang, Y., Zhang, F., Zhang, D., & Gai, K. (2024). *DialogBench: Evaluating LLMs as Human-like Dialogue Systems*. <https://arxiv.org/abs/2311.01677>
- Mateas, M., & Stern, A. (2005). Interaction and narrative. In K. Salen & E. Zimmerman (Eds.), *The game design reader: A rules of play anthology*. MIT Press.
- Preece, J., Sharp, H., & Rogers, Y. (2015). *Interaction design: Beyond human-computer interaction* (4th ed.). Wiley.
- Watkiss, S. (2020). *Beginning Game Programming with Pygame Zero: Coding Interactive Games on Raspberry Pi Using Python*. Apress. <https://doi.org/10.1007/978-1-4842-5650-3>
- Reynolds, L., & McDonell, K. (2021). *Prompt Programming for Large Language Models: Beyond the Few-Shot Paradigm*. <https://arxiv.org/abs/2102.07350>
- Ji, K., Lian, Y., Li, L., Gao, J., Li, W., & Dai, B. (2025). *Enhancing Persona Consistency for LLMs' Role-Playing using Persona-Aware Contrastive Learning*. <https://arxiv.org/abs/2503.17662>
- Gallotta, R., Todd, G., Zammit, M., Earle, S., Liapis, A., Togelius, J., & Yannakakis, G. N. (2024). *Large Language Models and Games: A Survey and Roadmap*. 1–19. <https://doi.org/10.1109/TG.2024.3461510>
- Warpefelt, H., & Verhagen, H. (2016). *A model of non-player character believability*. *Keywords*.
- Radež, G., & Bohak, C. (2024). *Integrating Environmental Awareness Into NPCs : Contextual Conversational Interaction in Games*.
- Collins, J., Hirst, W., Tang, W., Luu, C., Smith, P., Watson, A., & Sahandi, R. (2016). *EDTree: Emotional dialogue trees for game based training*.
- Gao, Q., Isaac, S., Way, B., Catharines, S., Emami, A., & Catharines, S. (2023). *The Turing Quest : Can Transformers Make Good NPCs ?* 93–103.
- Shahsavari, Y., & Choudhury, A. (2023). User Intentions to Use ChatGPT for Self-Diagnosis and Health-Related Purposes: Cross-sectional Survey Study. *JMIR Hum Factors*, 10, e47564. <https://doi.org/10.2196/47564>
- Zhang, Q., Wen, R., Hendra, L. B., Ding, Z., & LC, R. (2025). Can AI Prompt Humans? Multimodal Agents Prompt Players' Game Actions and Show Consequences to Raise Sustainability Awareness. <https://arxiv.org/abs/2409.08486>
- Wibawanto, W. (2020). Game Edukasi RPG (Role Playing Game). In *Lppm Unnes* (Issue July).
- Greco, M. (2009). The Use of Role-Playing in Learning. *Games-Based Learning Advancements for Multi-Sensory Human Computer Interfaces: Techniques and Effective Practices*, 157–173. <https://doi.org/10.4018/978-1-60566-360-9.ch010>
- Kirk, W. J. (2009). *Design patterns of successful role-playing games* [Draft]. Internet Archive. <https://archive.org/details/RPGDesignPatterns91309>
- Purnomo, S. L. A. (2020). *Narrative Junction: Revisiting Branching Narrative Design Approach for Role Playing Video Games from the Perspectives of Cognitive Linguistics* (pp. 76–111).

- Dale, G., & Shawn Green, C. (2017). The Changing Face of Video Games and Video Gamers: Future Directions in the Scientific Study of Video Game Play and Cognitive Performance. *Journal of Cognitive Enhancement*, 1(3), 280–294. <https://doi.org/10.1007/s41465-017-0015-6>
- Zong, Y., Lin, L., Wang, S., Cui, Z., & Chen, Y. (2023). Improvements and Challenges in StarCraft II Macro-Management A Study on the MSC Dataset. *Journal of Theory and Practice of Engineering Science*, 3(12), 29–35. [https://doi.org/10.53469/jtpes.2023.03\(12\).05](https://doi.org/10.53469/jtpes.2023.03(12).05)
- Jenkins, H. (2003). Game Design as Narrative Architecture. *Response*, 44(3), 118–130. <http://web.mit.edu/cms/People/henry3/games&narrative.html>
- Koenitz, H. (2010). Towards a theoretical framework for interactive digital narrative. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 6432 LNCS(October), 176–185. https://doi.org/10.1007/978-3-642-16638-9_22
- Hämäläinen, M., & Alnajjar, K. (2019). Creative contextual dialog adaptation in an open world RPG. *FDG '19: Proceedings of the 14th International Conference on the Foundations of Digital Games*, 1–7. <https://doi.org/10.1145/3337722.3341865>
- Hitchens, M., & Drachen, A. (2008). The Many Faces of Role-Playing Games. *International Journal of Role-Playing*, (1), 3–21. <https://doi.org/10.33063/ijrp.vi1.185>
- Montola, M. (2008). The Invisible Rules of Role-Playing The Social Framework of Role-Playing Process. *International Journal of Role-Playing*, (1), 22–36. <https://doi.org/10.33063/ijrp.vi1.184>
- Kim, J. H. (1998). *The Threefold Model FAQ*. Retrieved from http://www.darkshire.net/~jhkim/rpg/theory/threefold/faq_v1.html
- Edwards, R. (2001). *GNS and Other Matters of Role-Playing Theory*. Retrieved from <https://web.archive.org/web/20040603205053/http://www.indie-rpgs.com/articles/1/>
- Silva, G. A. da, & Souza Ribeiro, M. W. de. (2022). *Development of Non-Player Character with Believable Behavior: a systematic literature review*. 319–323. https://doi.org/10.5753/sbgames_estendido.2021.19660
- Bailey, C., & Katchabaw, M. (2008). An emergent framework for realistic psychosocial behaviour in non player characters. *ACM Future Play 2008 International Academic Conference on the Future of Game Design and Technology, Future Play: Research, Play, Share*, 17–24. <https://doi.org/10.1145/1496984.1496988>
- Reynolds, C. (2002). *Steering Behaviors For Autonomous Characters*.
- Warpefelt, H., & Verhagen, H. (2015). Towards an updated typology of non-player character roles. *Proceedings of the International Conferences on Interfaces and Human Computer Interaction 2015, IHCI 2015, Game and Entertainment Technologies 2015, GET 2015 and Computer Graphics, Visualization, Computer Vision and Image Processing 2015, CGVCVIP 2015 - Part of the Multi Conference on Computer Science and Information Systems 2015*, 131–139.

- Nendya, M. B., Gandang, S., Santosa, R. G., Elekto, J. T., & Industri, F. T. (2015). Pemetaan Perilaku Non-Playable Character Pada Permainan Berbasis Role Playing Game Menggunakan Metode Finite State Machine. *Journal of Animation and Games Studies*, 1(2), 185–202. <https://doi.org/10.24821/jags.v1i2.1304>
- Fraser, J., Papaioannou, I., & Lemon, O. (2018). Spoken conversational AI in video games – Emotional dialogue management increases user engagement. *Proceedings of the 18th International Conference on Intelligent Virtual Agents, IVA 2018, October*, 179–184. <https://doi.org/10.1145/3267851.3267896>
- Naveed, H., Khan, A. U., Qiu, S., Saqib, M., Anwar, S., Usman, M., Akhtar, N., Barnes, N., & Mian, A. (2024). *A Comprehensive Overview of Large Language Models*. <https://arxiv.org/abs/2307.06435>
- Almarie, B., Teixeira, P. E. P., Pacheco-Barrios, K., Rossetti, C. A., & Fregni, F. (2023). Editorial - The Use of Large Language Models in Science: Opportunities and Challenges. *Principles and Practice of Clinical Research Journal*, 9(1), 1–4. <https://doi.org/10.21801/ppcrj.2023.91.1>
- Ren, M. (2024). *Advancements and Applications of Large Language Models in Natural Language Processing: A Comprehensive Review*. 0, 55–63. <https://doi.org/10.54254/2755-2721/97/20241406>
- Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, Ł., & Polosukhin, I. (2017). Attention is all you need. *Advances in Neural Information Processing Systems*, 30.
- Gao, Y., Xiong, Y., Gao, X., Jia, K., Pan, J., Bi, Y., Dai, Y., Sun, J., Wang, M., & Wang, H. (2023). *Retrieval-Augmented Generation for Large Language Models: A Survey*. 1–21. <http://arxiv.org/abs/2312.10997>
- Karpukhin, V., Oguz, B., Min, S., Lewis, P. S. H., Wu, L., Edunov, S., Chen, D., & Yih, W. (2020). Dense Passage Retrieval for Open-Domain Question Answering. *EMNLP (1)*, 6769–6781.
- Izcard, G., & Grave, E. (2021). Leveraging passage retrieval with generative models for open domain question answering. *EACL 2021 - 16th Conference of the European Chapter of the Association for Computational Linguistics, Proceedings of the Conference*, 874–880. <https://doi.org/10.18653/v1/2021.eacl-main.74>
- Aslan, P. (2024). *Understanding LLMs for Game NPCs: Vol. TRITA-EECS* (Issue 2023:0000). KTH Royal Institute of Technology.
- Mao, Y., Ge, Y., Fan, Y., Xu, W., Mi, Y., Hu, Z., & Gao, Y. (2024). *A Survey on LoRA of Large Language Models*. 1–144. <https://doi.org/10.1007/s11704-024-40663-9>
- Li, Y. (2023). *A Practical Survey on Zero-shot Prompt Design for In-context Learning*. https://doi.org/10.26615/978-954-452-092-2_069
- Sahoo, P., Singh, A. K., Saha, S., Jain, V., Mondal, S., & Chadha, A. (2024). *A Systematic Survey of Prompt Engineering in Large Language Models: Techniques and Applications*. <http://arxiv.org/abs/2402.07927>
- Ma, L., Zhang, R., Han, Y., Yu, S., Wang, Z., Ning, Z., Zhang, J., Xu, P., Li, P., Ju, W., Chen, C., Wang, D., Liu, K., Wang, P., Wang, P., Fu, Y., Liu, C., Zhou, Y.,

- & Lu, C.-T. (2025). *A Comprehensive Survey on Vector Database: Storage and Retrieval Technique, Challenge*. <https://arxiv.org/abs/2310.11703>
- Nangunori, S. K. (2024). *VECTOR DATABASES: A PARADIGM SHIFT IN HIGH-DIMENSIONAL DATA MANAGEMENT*. 15(6), 566–577.
- Ashby, T., Webb, B. K., Knapp, G., Searle, J., & Fulda, N. (2023). Personalized Quest and Dialogue Generation in Role-Playing Games: A Knowledge Graph- and Language Model-based Approach. In *Conference on Human Factors in Computing Systems - Proceedings* (Vol. 1, Issue 1). Association for Computing Machinery. <https://doi.org/10.1145/3544548.3581441>
- Kleinerman, D. (2022). *Playing or Being Played? Choice and Agency in The Witcher III: Wild Hunt (2016)*. 2016.
- Ji, K., Lian, Y., Li, L., Gao, J., Li, W., & Dai, B. (2025). Enhancing Persona Consistency for LLMs' Role-Playing using Persona-Aware Contrastive Learning. <http://arxiv.org/abs/2503.17662>
- Chen, J., Lin, H., Han, X., & Sun, L. (2024). Benchmarking Large Language Models in Retrieval-Augmented Generation. *Proceedings of the AAAI Conference on Artificial Intelligence*, 38(16), 17754–17762. <https://doi.org/10.1609/aaai.v38i16.29728>
- Zhao, W. X., Zhou, K., Li, J., Tang, T., Wang, X., Hou, Y., Min, Y., Zhang, B., Zhang, J., Dong, Z., Du, Y., Yang, C., Chen, Y., Chen, Z., Jiang, J., Ren, R., Li, Y., Tang, X., Liu, Z., ... Wen, J.-R. (2025). *A Survey of Large Language Models*. <https://arxiv.org/abs/2303.18223>
- Chen, J., Lin, H., Han, X., & Sun, L. (2024). Benchmarking Large Language Models in Retrieval-Augmented Generation. *Proceedings of the AAAI Conference on Artificial Intelligence*, 38(16), 17754–17762. <https://doi.org/10.1609/aaai.v38i16.29728>
- Es, S., James, J., Anke, L. E., & Schockaert, S. (2024). Ragas: Automated evaluation of retrieval augmented generation. *Proceedings of the 18th Conference of the European Chapter of the Association for Computational Linguistics: System Demonstrations*, 150–158.
- Thiel, D. V. (2014). *Research methods for engineers*. Cambridge University Press. <https://www.cambridge.org/us/universitypress/subjects/engineering/engineering-general-interest/research-methods-engineers?format=HB&isbn=9781107034884>
- Shao, Y., Li, L., Dai, J., & Qiu, X. (2023). *Character-LLM: A Trainable Agent for Role-Playing*. <https://arxiv.org/abs/2310.10158>
- Topsakal, O., & Akinci, T. C. (2023). Creating Large Language Model Applications Utilizing LangChain: A Primer on Developing LLM Apps Fast. *International Conference on Applied Engineering and Natural Sciences*. <https://api.semanticscholar.org/CorpusID:260223847>
- Douze, M., Guzhva, A., Deng, C., Johnson, J., Szilvasy, G., Mazaré, P.-E., Lomeli, M., Hosseini, L., & Jégou, H. (2025). *The Faiss library*. <http://arxiv.org/abs/2401.08281>
- Touvron, H., Lavril, T., Izacard, G., Martinet, X., Lachaux, M.-A., Lacroix, T., Rozière, B., Goyal, N., Hambro, E., Azhar, F., Rodriguez, A., Joulin, A., Grave,

- E., & Lample, G. (2023). *LLaMA: Open and Efficient Foundation Language Models*. <https://arxiv.org/abs/2302.13971>
- Huang, W., Zheng, X., Ma, X., Qin, H., Lv, C., Chen, H., Luo, J., Qi, X., Liu, X., & Magno, M. (2024). An empirical study of LLaMA3 quantization: from LLMs to MLLMs. *Visual Intelligence*, 2(1). <https://doi.org/10.1007/s44267-024-00070-x>
- Consalvo, M. (2007). *Cheating: Gaining Advantage in Videogames*. MIT Press.
- Edwards, K. (2015). *Narrative and Game Worlds*. New York: Palgrave Macmillan.
- Jenkins, H. (2004). Game Design as Narrative Architecture. In N. Wardrip-Fruin & P. Harrigan (Eds.), *First Person: New Media as Story, Performance, and Game* (pp. 118-130). MIT Press.
- Calleja, G. (2011). *In-Game: From Immersion to Incorporation*. MIT Press.
- Barton, M. (2008). *Dungeons and Desktops: The History of Computer Role-Playing Games*. A K Peters/CRC Press.
- Bowman, S. L. (2010). *The Functions of Role-Playing Games: How Participants Create Community, Solve Problems and Explore Identity*. McFarland.
- McDonald, P. (2013). *Lore and Worldbuilding*. In J. Dovey & H. Kennedy (Eds.), *Game Cultures: Computer Games as New Media*.
- Sweetser, P., & Wyeth, P. (2005). GameFlow: A Model for Evaluating Player Enjoyment in Games. *Computers in Entertainment*, 3(3).
- Rouse, R. (2001). *Game Design: Theory and Practice*. Wordware Publishing.
- Kumaran, V., Rowe, J., Mott, B., & Lester, J. (2023). SCENECRAFT: Automating Interactive Narrative Scene Generation in Digital Games with Large Language Models. *Proceedings - AAAI Artificial Intelligence and Interactive Digital Entertainment Conference, AIIDE*, 19(1), 86–96. <https://doi.org/10.1609/aiide.v19i1.27504>
- Adams, E. (2014). *Fundamentals of game design* (3rd ed.). New Riders.
- Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- Barton, M. (2021). *Dungeons and desktops: The history of computer role-playing games* (2nd ed.). CRC Press. <https://doi.org/10.1201/9781003098249>
- Hitchens, M., & Drachen, A. (2009). The many faces of role-playing games. *International Journal of Role-Playing*, 1(1), 3–21. <http://www.ijrp.subcultures.nl/wp-content/issue1/IJRPissue1-Article1.pdf>
- Hunicke, R., LeBlanc, M., & Zubek, R. (2004). MDA: A formal approach to game design and game research. *Proceedings of the AAAI Workshop on Challenges in Game AI*, 1–5. <https://www.aaai.org/Papers/Workshops/2004/WS-04-04/WS04-04-001.pdf>
- Boone, H. N., & Boone, D. A. (2012). Analyzing Likert data. *Journal of Extension*, 50(2). <https://doi.org/10.34068/joe.50.02.48>
- Newman, J. (2023). *The future of gaming: Trends in interactive entertainment*. Routledge. <https://doi.org/10.4324/9781003273493>
- Peterson, J. (2012). *Playing at the world: A history of simulating wars, people and fantastic adventures, from chess to role-playing games*. Unreason Press.
- Salen, K., & Zimmerman, E. (2003). *Rules of play: Game design fundamentals*. MIT Press.

- Schreier, J. (2021). *Press reset: Ruin and recovery in the video game industry*. Grand Central Publishing.
- Duan, J., Cheng, H., Wang, S., Zavalny, A., Wang, C., Xu, R., Kailkhura, B., & Xu, K. (2023). Shifting attention to relevance: Towards the predictive uncertainty quantification of free-form large language models. *ArXiv Preprint ArXiv:2307.01379*.
- Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, Ł., & Polosukhin, I. (2017). Attention is all you need. *Advances in Neural Information Processing Systems*, 30.
- Grattafiori, A., Dubey, A., Jauhri, A., Pandey, A., Kadian, A., Al-Dahle, A., Letman, A., Mathur, A., Schelten, A., Vaughan, A., Yang, A., Fan, A., Goyal, A., Hartshorn, A., Yang, A., Mitra, A., Sravankumar, A., Korenev, A., Hinsvark, A., ... Ma, Z. (2024). *The Llama 3 Herd of Models*. <https://arxiv.org/abs/2407.21783>
- Mitchell, M. (2024). Large Language Models. In M. C. Frank & A. Majid (Eds.), *Open Encyclopedia of Cognitive Science*. MIT Press. <https://doi.org/10.21428/e2759450.2bb20e3c>
- Meskó, B. (2023). Prompt Engineering as an Important Emerging Skill for Medical Professionals: Tutorial. *J Med Internet Res*, 25, e50638. <https://doi.org/10.2196/50638>
- Nidhra, S. (2012). Black Box and White Box Testing Techniques - A Literature Review. *International Journal of Embedded Systems and Applications*, 2, 29–50. <https://doi.org/10.5121/ijesa.2012.2204>
- Brown, E., & Cairns, P. (2004). A grounded investigation of game immersion. *CHI '04 Extended Abstracts on Human Factors in Computing Systems*, 1297–1300. <https://doi.org/10.1145/985921.986048>
- Elizabeth, E., Mutiaz, I. R., & Santosa, I. (2015). Kajian Interaksi dan Persepsi Visual pada Game Cut The Rope dan Angry Birds untuk Mengetahui Challenge Based Immersion. *Wimba : Jurnal Komunikasi Visual*, 5(1). <https://doi.org/10.5614/jkvw.2013.5.1.6>
- Sweetser, P., & Wyeth, P. (2005). GameFlow: a model for evaluating player enjoyment in games. *Comput. Entertain.*, 3(3), 3. <https://doi.org/10.1145/1077246.1077253>
- Groq. (2025). Whitepapers | Groq is fast inference for AI builders. Groq. <https://groq.com/whitepapers>