

DAFTAR PUSTAKA

- [1] Satria, A. N. “Pentingnya Masa Golden Age Anak”. Available: <https://ugm.ac.id/id/berita/21802-pentingnya-masa-golden-age-anak/> [Diakses: 18 Desember 2025].
- [2] FKM UI, “Doktor FKM UI Teliti: Kejar Tumbuh dan Kemampuan Kognitif Anak Indonesia (Analisis Data Longitudinal IFLS 1997, 2000, 2007, dan 2014)”. Available: <https://fkm.ui.ac.id/doktor-fkm-ui-teliti-kejar-tumbuh-dan-kemampuanhttps://fkm.ui.ac.id/doktor-fkm-ui-teliti-kejar-tumbuh-dan-kemampuan-kognitif-anak-indonesia-analisis-data-longitudinal-ifls-1997-2000-2007-dan-2014/kognitif-anak-indonesia-analisis-data-longitudinal-ifls-1997-2000-2007-dan-2014/> [Diakses: 18 Desember 2025]
- [3] S. Liana, “Studi Tentang Kesulitan Fokus Anak dalam Pembelajaran : Tinjauan Psikologis dan Edukatif,” vol. 3, no. 1, pp. 26–33, 2024, doi: 10.58540/pijar.v3i1.646.
- [4] Kids Medic. “*Concentration in children – the key to effective learning*” [Online]. Available: <https://kidsmedic.pl/en/articles/childrens-concentration-the-key-to-successful-learning/> [Diakses: 30 September 2025].
- [5] U. F. F. M. Rulianto, H. Hasanah, and I. Zahro, “JKIP : Jurnal Kajian Ilmu Pendidikan The Effect of Smart Finger Board Media on the Basic Numeracy Skills of 5 – 6Year-Old Children at Anisa Kindergarten , Kebonsari , Jember Pengaruh Media Papan Jari Pintar Terhadap Kemampuan Numerasi Dasar Anak Usia 5-6,” vol. 6, no. 2, pp. 652–664, 2025.
- [6] S. Wijaya, S. Utari Batamata, D. Mei Wulandari, M. Farlan, P. Guru Madrasah Ibtidaiyah, and I. Agama Islam Negeri Sorong, “Pengaruh Kurangnya Media Terhadap Hasil Belajar siswa di MI Al-Ishlah kota sorong,” *J. Pendidik. Dasar*, vol. 7, no. 1, pp. 31–36, 2025, [Online]. Available:

<https://ejurnal.iainsorong.ac.id/index.php/Misooljurnal.iainsorong.ac.id/index.php/Misool>

[7] I. Pendidikan *et al.*, “Pengaruh Penggunaan Media Pembelajaran Interaktif terhadap Minat Belajar Anak Usia 4-5 Tahun di TK Negeri Pembina Kec . Duingi , Kota Gorontalo Penggunaan media pembelajaran pada Pendidikan Anak Usia Dini sangat penting karena membantu guru dalam menyampaikan materi dengan lebih mudah serta membuat anak menarik , suara yang menyenangkan , dan aktivitas yang dapat direspon langsung oleh anak .,” no. November 2025, 2026.

[8] R. W. Syafitri, “Meningkatkan Perhatian Siswa Dengan Menggunakan Pengajaran Savi (Somatic, Auditory, Visualization, Intellectually) Pada Siswa Kelas 1 Sd Negeri Sidokare I Sidoarjo,” PTK A1 2018 PGSD FKIP Univ. Muhammadiyah ..., pp. 1–10, 2018, [Online]. Available: <http://eprints.umsida.ac.id/id/eprint/3001>

[9] R. S. Hessels and I. T. C. Hooge, “Eye tracking in developmental cognitive neuroscience – The good, the bad and the ugly,” *Dev. Cogn. Neurosci.*, vol. 40, no. September, p. 100710, 2019, doi: 10.1016/j.dcn.2019.100710.

[10] A. Rebreikina, D. Zakharchenko, A. Shaposhnikova, N. Korotkov, Y. Klimov, and T. Batysheva, “Voluntary Attention Assessing Tests in Children with Neurodevelopmental Disorders Using Eye Tracking,” *Children*, vol. 11, no. 11, pp. 1–13, 2024, doi: 10.3390/children11111333.

[11] M. Lee and C. Lai, “Integrasi konsep dan teori beban kognitif dalam pendidikan kejuruteraan di Malaysia: satu kajian literatur,” *Geogr. - Malaysian J. Soc. Sp.*, vol. 12, no. 3, pp. 46–57, 2016.

[12] G. Santoso and A. H. Putri, “Jurnal Pendidikan Transformatif (JPT) Efektivitas Metode Pembelajaran Berbasis Game dalam Meningkatkan

Keterampilan Pecahan Pada Siswa Kelas 5 Sekolah Dasar Jurnal Pendidikan Transformatif (JPT),” vol. 03, no. 01, pp. 1–9, 2024.

[13] P. Buono, B. De Carolis, F. D. Errico, N. Macchiarulo, and G. Palestra, “Assessing student engagement from facial behavior in on-line learning,” pp. 12859–12877, 2023.

[14] A. Nurhidayah, S. Suyoto, S. Suwarni, and A. A. Nugroho, “Peningkatan Hasil Belajar Matematika melalui Model Problem Based Learning di Sekolah Dasar,” *J. Basicedu*, vol. 8, no. 4, pp. 3271–3278, 2024, doi: 10.31004/basicedu.v8i4.8484.

[15] M. R. Nayla, K. Nurhayati, U. Islam, and N. Sunan, “*Exploring the Role of GameBased Learning in Early Childhood Cognitive Development : Perspectives from Teachers and Parents*,” vol. 9, no. December, pp. 733–745, 2024.

[16] T. A. Palintan, Nurul Asqia, and Hariska, —Meningkatkan Kemampuan Konsentrasi Anak Melalui Media Puzzle Pada Anak Kelompok B Di Ra Umdil Ihsan Parepare, *Anakta J. Pendidik. Islam Anak Usia Dini*, vol. 1, no. 2, pp. 87–92, 2023, doi: 10.35905/anakta.v1i2.4474.

[17] Lasmana, F.H. “Kenali Beda Smart TV dan Papan Interaktif Digital (IFP) Langsung dari Kemendikdasmen!” 24 September 2025, [Online]. Available: https://www.melintas.id/pendidikan/346613295/kenali-beda-smart-tv-dan-papanhttps://www.melintas.id/pendidikan/346613295/kenali-beda-smart-tv-dan-papan-interaktif-digital-ifp-langsung-dari-kemendikdasmeninteraktif-digital-ifp-langsung-dari-kemendikdasmen#goog_rewarded [Diakses: 25 September 2025].

[18] M. Deja, L. Zajac-Lamparska, and J. Trempala, "Executive attention training effects in children aged 4 and 6 years: improvement in the trained task greater for 6-year-olds, but far transfer greater for 4-year-olds," *Front. Public Health*, vol. 13, Art. no. 1499924, May 2025. doi: 10.3389/fpubh.2025.1499924.

- [19] A. Gulz and M. Haake, "Scaffolding attention and perseverance skills in a diverse population of preschool children in Sweden," *Learn. Individ. Differ.*, vol. 113, Art. no. 102488, 2024. doi: 10.1016/j.lindif.2024.102488.
- [20] I. T. Husain, D. A. Nggai, S. M. P. Tanti, and F. Lomuli, "Analisis faktor penyebab kurangnya fokus pada anak usia dini dan strategi penanganannya," *Jurnal Pendidikan Bahasa dan Anak Usia Dini (JUPENBAUD)*, vol. 1, no. 4, pp. 30–36, Jun. 2025, doi: 10.61132/jupenbaud.v1i4.59.
- [21] E. M. Mahone and H. E. Schneider, "Assessment of attention in preschoolers," *Neuropsychology Review*, vol. 22, no. 4, pp. 361–383, Dec. 2012, doi: 10.1007/s11065-012-9217-y.
- [22] Y. Chen, J. Zhou, Q. Gao, J. Gao, and W. Zhang, "MDNN : Predicting Student Engagement via Gaze Direction and Facial Expression in Collaborative Learning," 2023, doi: 10.32604/cmcs.2023.023234.
- [23] X. Hu dan J. Gao, "Facial expression recognition reveals students' engagement in online class: Correlations with six engagement measurements," *PLOS ONE*, vol. 20, no. 10, Art. no. e0334232, 2025, doi: 10.1371/journal.pone.0334232. [Online]. Available: <https://doi.org/10.1371/journal.pone.0334232>. [Diakses: 29 Des. 2025].
- [24] I. Qarbal, N. Sael, and S. Ouahabi, "Student's Engagement Detection Based on Computer Vision: A Systematic Literature Review," *IEEE Access*, vol. 13, pp. 140519–140545, 2025.
- [25] S. M. Kolk and P. Rakic, "Development of prefrontal cortex," *Neuropsychopharmacology*, vol. 47, no. 1, pp. 41–57, 2022, doi: 10.1038/s41386-021-01137-9.

- [26] D. Lee et al., "Attention and executive delays in early childhood: a meta-analysis of neurodevelopmental conditions," *Mol. Psychiatry*, vol. 30, no. 5, pp. 1906–1914, 2025, doi: 10.1038/s41380-024-02802-3.
- [27] N. M. A. Sukmandari, N. W. Septarini, and G. N. I. Pinatih, "Association between breakfast-eating habit and attention-concentration in primary school children: a cross-sectional study in Badung District," *Public Heal. Prev. Med. Arch.*, vol. 6, no. 1, pp. 55–60, 2018, doi: 10.53638/phpma.2018.v6.i1.p10.
- [28] N. C. Alter, E. M. Whitman, D. C. Bellinger, and P. J. Landrigan, "Quantifying the association between PM2.5 air pollution and IQ loss in children: a systematic review and meta-analysis," *Environ. Heal. A Glob. Access Sci. Source*, vol. 23, no. 1, 2024, doi: 10.1186/s12940-024-01122-x.
- [29] M. Vedeckina and F. Borgonovi, "A Review of Evidence on the Role of Digital Technology in Shaping Attention and Cognitive Control in Children," *Front. Psychol.*, vol. 12, no. February, pp. 1–22, 2021, doi: 10.3389/fpsyg.2021.611155.
- [30] S. Hutt, A. Wong, A. Papoutsaki, R. S. Baker, J. I. Gold, and C. Mills, "Webcam - based eye tracking to detect mind wandering and comprehension errors," *Behav. Res. Methods*, vol. 56, no. 1, pp. 1–17, 2024, doi: 10.3758/s13428-022-02040-x
- [31] L. Corbett, P. Phongsavan, A. D. Okely, A. Bauman, and L. R. Peralta, "Teachers' experience, needs and recommendations for promoting their health and wellbeing in Australia: A reflexive thematic analysis," *Teach. Teach. Educ.*, vol. 155, 2025, doi: 10.1016/j.tate.2024.104897.
- [32] N. Ali et al., "Optimizing an eHealth insomnia intervention for children with neurodevelopmental disorders: a Delphi study," *Sleep Heal.*, vol. 4, no. 2, pp. 224–234, 2018, doi: 10.1016/j.sleh.2017.12.008.

[33] H. H. Salma and F. Kurniawati, "Upaya Meningkatkan Kapasitas Atensi Anak Usia Dini untuk Siap Sekolah dengan Teknik Shaping," vol. 7, no. 2, pp. 1651–1663, 2023, doi: 10.31004/obsesi.v7i2.4157.

[34] bikinidcard.com. "Pengertian Kartu RFID" [Online]. Available: Pengertian Kartu RFID - Harga, Jenis, Fungsi dan Contohnya [Diakses: 30 September 2025].

[35] Vindiasari, Y. "Adaptive Learning: Proses Pelatihan dan Pembelajaran Adaptif Berbasis Kecerdasan Buatan dan Data Besar". Available: <https://www.ruangkerja.id/blog/adaptive-learning-proses-pelatihan-dan-pembelajaran-adaptif-berbasis-kecerdasan-buatan-dan-data-besar> [Diakses: 13 Oktober 2025].

[36] Dicoding. "Apa Itu Machine Learning? Beserta Pengertian dan Cara Kerjanya" [Online]. Available: <https://www.dicoding.com/blog/machine-learning-adalah/> [Diakses: 30 September 2025].

[37] Rita, P.S. "Apa itu *Reinforcement Learning*? Cara Kerja & Contohnya". Available: <https://aihub.id/pengetahuan-dasar/reinforcement-learning> [Diakses: 13 Oktober 2025].

[38] Irhan, H. D. N. "*Reinforcement Learning* adalah: Konsep, Komponen, dan Contoh". Available: <https://dibimbing.id/blog/detail/reinforcement-learning-adalah> [Diakses: 13 Oktober 2025].

[39] edukasikini.com "Sensor Berat (Load Cell): Prinsip Kerja dan Jenisnya" [Online]. Available: Sensor Berat (Load Cell): Prinsip Kerja dan Jenisnya - EDUKASIKINI.COM [Diakses: 30 September 2025].

- [40] Rita, P.S. “Apa itu *Convolutional Neural Network*? Pengertian & Cara Kerja”. Available: <https://aihub.id/pengetahuan-dasar/apa-itu-cnn> [Diakses: 13 Oktober 2025].
- [41] IBM. “Apa itu *Convolutional Neural Network*?”. Available: <https://www.ibm.com/id-id/think/topics/convolutional-neural-networks> [Diakses: 13 Oktober 2025].
- [42] K. Azmi, S. Defit, and S. Sumijan, “Implementasi *Convolutional Neural Network* (CNN) Untuk Klasifikasi Batik Tanah Liat Sumatera Barat,” *J. Unitek*, vol. 16, no. 1, pp. 28–40, 2023, doi: 10.52072/unitek.v16i1.504.
- [43] R. Szeliski, *Computer Vision: Algorithms and Applications*, Texts in Computer Science, Springer London, 2011, doi: 10.1007/978-1-84882-935-0.
- [44] J.-W. Kim, J.-Y. Choi, E.-J. Ha, and J. Choi, “Human Pose Estimation Using MediaPipe Pose and Optimization Method Based on a Humanoid Model,” *Applied sciences*, vol. 13, no. 4, pp. 2700–2700, Feb. 2023, doi: <https://doi.org/10.3390/app13042700>.
- [45] B. Elbaum, L. Perry, and D. Messinger, "Investigating Children's Interactions in Preschool Classrooms: An Overview of Research Using Automated Sensing Technologies," *Early Child. Res. Q.*, vol. 66, pp. 147–156, 2024. doi: 10.1016/j.ecresq.2023.10.005.
- [46] R. Hayami, J. A. Amien, and D. N. Ichsan, "Implementasi Metode Fuzzy Sugeno pada Sistem Keamanan Ruangan Menggunakan Sensor Ultrasonik Berbasis Mikrokontroler," *Jurnal INTEK*, vol. 4, no. 1, pp.

[47] I. P. Harahap and A. Muliantara, *Deteksi objek pada citra menggunakan model YOLO*, Jurnal Nasional Teknologi Informasi dan Aplikasinya, vol. 2, no. 3, pp. 469–474, May 2024, doi:10.24843/JNATIA.2024.v02.i03.p03.

[48] A. Raza, F. Hanif, and H. Mohammed, "Analyzing the enhancement of CNN-YOLO and transformer based architectures for real-time animal detection in complex ecological environments," *Sci. Rep.*, vol. 15, Art. no. 26645, 2025. doi: 10.1038/s41598-025-26645-2.

[49] R. S. I. Sihombing, R. N. T. Siregar, V. Sitorus, and T. S. Sitompul, "Pengenalan Ekspresi Wajah Menggunakan Convolutional Neural Network (CNN)," *Journal of Creative Student Research (JCSR)*, vol. 1, no. 6, pp. 89–97, Dec. 2023, doi: 10.55606/jcsrpolutama.v1i6.3046.

[50] T. Srikaewsiew dan S. Kanjanawattana, "Comparative Analysis of Facial Expression Recognition Using Image-Based and Landmark-Based Methods," *Advances in Technology Innovation*, vol. 10, no. 4, hlm.395-406, 2025, doi: 10.46604/aiti.2025.14589.

[51] IBM, "Apa itu support vector machines (SVM)?," Dec. 2023. [Online]. Available: <https://www.ibm.com/id-id/think/topics/support-vector-machine>

[52] A. Mehta dan W. Yang, "NAC-TCN: Temporal Convolutional Networks with Causal Dilated Neighborhood Attention for Emotion Understanding," arXiv:2312.07507v2 [cs.CV], Jan. 2024. [Online]. Available: <https://arxiv.org/abs/2312.07507>

[53] S. K. B. Sangeetha et al., "Spatiotemporal multimodal emotion recognition using Temporal Convolutional Network for children," *Sci. Rep.*, vol. 15, Art. no. 25813, Nov. 2025, doi: 10.1038/s41598-025-25813-8

[54] D. Arnita, F. Marpaung, F. Aulia, N. Suryani, dan R. C. Nabila, *Computer Vision dan Pengolahan Citra Digital*. Surabaya, Indonesia: Pustaka Aksara, 2022. ISBN 978-623-8230-27-3.

[55] S. Wazir, H. A. Imran, U. Latif, U. Mujahid, dan M. Bilal, "Single Board Computers (SBC): The Future of Next Generation Pedagogies in Pakistan," *CoRR*, vol. abs/2008.06576, Aug. 2020. [Online]. Available: <https://arxiv.org/abs/2008.06576>.

[56] F. Khan, I. Garcia, F. Mota, M. Saleem, et al., "Highly Tunable, Low-g MEMS Inertial Switch for Power-Efficient IoT Wake-Up Functions," *IEEE Sensors Journal*, pp. 1–1, Aug. 2025, doi:10.1109/JSEN.2025.3578656.

[57] A. Saleh, *Mikrokontroler, materi kuliah, Politeknik Elektronika Negeri Surabaya, Surabaya, Indonesia, 2022*. Available: <https://akuwan.lecturer.pens.ac.id/Mikrokontroler/Buku%20MK.pdf>.

[58] A. Rahman, P. Afrinasari, H. Azzahra, R. Adawwiyah, S. Angraini, N. Amanda, L. Efriyanti, Melisa, B. Aryahiyah, M. M. Rizal, M. I. D. Maulana, dan Y. Madela, *Fuzzy Logic*. Padang, Indonesia: CV Luminary Press Indonesia, 2025, ISBN 978-634-7304-34-6.

[59] Shenzhen Sinoseen Technology Co., Ltd., "Apa itu sensorToF? Kelebihan dan kekurangannya," *Sinoseen*, 18 Okt. 2024. [Online]. Available: <https://www.sinoseen.com/id/what-is-a-tof-sensorits-advantages-andhttps://www.sinoseen.com/id/what-is-a-tof-sensorits-advantages-anddisadvantagesdisadvantages>.

[60] E. Efyian, "Understanding IR Sensors and IR LEDs: Functions, Differences, and Applications," *Electronics For You*, Aug. 28, 2024. [Online]. Available: <https://www.electronicsforu.com/technology-trends/learn-electronics/ir->

led<https://www.electronicsforu.com/technology-trends/learn-electronics/ir-led-infrared-sensor-basics>infrared-sensor-basics. [Accessed: Jan. 4, 2026].

[61] J. Crouzet. “ESP32-WROOM-32 Datasheet Version3.6”. Available:https://www.espressif.com/sites/default/files/documentation/esp32-wroom-32_datasheet_en.pdf [Diakses: 28 Oktober 2025].

[62] Raspberry Pi. “Raspberry Pi 4”. Available: <https://www.raspberrypi.com/products/raspberry-pi-4-model-b/specifications/> [Diakses: 28 Oktober 2025].

[63] Raspberry Pi. “Raspberry Pi Zero 2 W”. Available: <https://datasheets.raspberrypi.com/rpizero2/raspberry-pi-zero-2-w-product-brief.pdf> [Diakses: 28 Oktober 2025].

[64] Y. V. S. Bharadwaj, S. B. Yarrapatruni, and D. P. Rao YVSSSV, “SQLite Database and its Application on Embedded Platform,” *Int. J. Comput. Trends Technol.*, vol. 67, no. 2, pp. 1–6, 2019, doi: 10.14445/22312803/ijctt-v67i2p101.

[65] Z. Aini, Mulyadi, and Azhar, “Sistem Absensi Pengenalan Wajah Menggunakan Algoritma Local Binary Patterns Histogram (LBPH) dan Haar Cascade : Studi Kasus Pada Lab InPro,” *J. Teknol. Rekayasa Inf. Dan Komput.*, vol. 7, no. 2, pp. 25–33, 2025, doi: 10.30811/jtrik.v7i2.7270.

[66] Logitech, *Logitech HD Webcam C270 – Technical Specifications*, Logitech Inc. [Online]. Available: <https://support.logi.com>. Accessed: Jan. 2026.

[67] Raspberry Pi Foundation, *Raspberry Pi Camera Module V2 Datasheet (Sony IMX219)*, Raspberry Pi Trading Ltd., 2018. [Online]. Available: <https://www.raspberrypi.com/documentation/>. Accessed: Jan. 2026.

[68] Intel Corporation, *Intel® RealSense™ D400 Series Product Family Datasheet*, Intel Corp., 2023. [Online]. Available: <https://www.intel.com>. Accessed: Jan. 2026.

[69] Raspberry Pi Foundation, *Raspberry Pi 5 Product Brief*, Raspberry Pi Ltd., 2025. [Online]. Available: https://datasheets.raspberrypi.com/rpi5/raspberry-pi-5https://datasheets.raspberrypi.com/rpi5/raspberry-pi-5-product-brief.pdf?utm_source=chatgpt.comproduct-brief.pdf. Accessed: Jan. 2026.

[70] NVIDIA Corporation, *NVIDIA Jetson Nano Developer Kit Datasheet*, NVIDIA Developer.[Online]: Available: https://cdn.sparkfun.com/assets/0/7/f/9/d/jetsonhttps://cdn.sparkfun.com/assets/0/7/f/9/d/jetson-nano-devkit-datasheet-updates-us-v3.pdf?utm_source=chatgpt.comnano-devkit-datasheet-updates-us-v3.pdf. Accessed: Jan. 2026.

[71] Beelink, *Beelink Mini PC Product Specifications*, Bee-Link.com. [Online]. Available: <https://www.bee-link.com/collections/product>. Accessed: Jan. 2026.

