

Literature

- [1] “Harvard LIT (Learning, Innovation and Technology) lab.” <https://lit.gse.harvard.edu/overview> (accessed Apr. 18, 2020).
- [2] S. K. Shankar, L. P. Prieto, M. J. Rodríguez-Triana, and A. Ruiz-Calleja, “A Review of Multimodal Learning Analytics Architectures,” in *2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT)*, Jul. 2018, pp. 212–214, doi: 10.1109/ICALT.2018.00057.
- [3] “Multimodal Learning Analytics,” *edX*, Aug. 02, 2017. </course/multimodal-learning-analytics-utarlingtonx-link-la-mmx> (accessed Apr. 19, 2020).
- [4] “Introduction to Multimodal Learning Analytics – LearnAITech.” <http://learnaitech.com/introduction-to-multimodal-learning-analytics/> (accessed Apr. 19, 2020).
- [5] P. Blikstein, “Multimodal learning analytics,” Apr. 2013, doi: 10.1145/2460296.2460316.
- [6] M. Worsley, “Multimodal Learning Analytics’ Past, Present, and, Potential Futures,” p. 16.
- [7] M. Worsley, D. Abrahamson, P. Blikstein, S. Grover, B. Schneider, and M. Tissenbaum, “Situating Multimodal Learning Analytics,” p. 4, 2016.
- [8] “Lowering Barriers for Accessing Sensor Data in Education: Lessons Learned from Teaching Multimodal Learning Analytics to Educators,” *Google Docs*. https://drive.google.com/file/d/1BVT2s8LD-Zyudc5qh25v6-QxKj6KYMMB/view?usp=sharing&usp=embed_facebook (accessed Apr. 26, 2020).
- [9] “Assessing Collaboration Using Motion Sensors and Multi-Modal Learning Analytics,” *Google Docs*. https://drive.google.com/file/d/1ZYQCgMECc-o8VynBxXCNs1Oxaa9k1JCC/view?usp=sharing&usp=embed_facebook (accessed Apr. 26, 2020).
- [10] “BIGDATA: EAGER: Catalyzing Research in Multimodal Learning Analytics,” *Northwestern Scholars*. <https://www.scholars.northwestern.edu/en/projects/bigdata-eager-catalyzing-research-in-multimodal-learning-analytic-3> (accessed Apr. 26, 2020).
- [11] “Marcelo Worsley.” <http://marceloworsley.com/projects.html> (accessed Apr. 26, 2020).
- [12] X. Ochoa and M. Worsley, “Augmenting Learning Analytics with Multimodal Sensory Data,” *JLA*, vol. 3, no. 2, pp. 213–219, Sep. 2016, doi: 10.18608/jla.2016.32.10.
- [13] M. Worsley, “Multimodal learning analytics: enabling the future of learning through multimodal data analysis and interfaces,” in *Proceedings of the 14th ACM international conference on Multimodal interaction*, Santa Monica, California, USA, Oct. 2012, pp. 353–356, doi: 10.1145/2388676.2388755.
- [14] P. Blikstein and M. Worsley, “Multimodal Learning Analytics and Education Data Mining: using computational technologies to measure complex learning tasks,” *Journal of Learning Analytics*, vol. 3, no. 2, Art. no. 2, Sep. 2016, doi: 10.18608/jla.2016.32.11.
- [15] M. Raca, R. Tormey, and P. Dillenbourg, “Sleepers’ lag - study on motion and attention,” in *Proceedings of the Fourth International Conference on Learning Analytics And Knowledge*, Indianapolis, Indiana, USA, Mar. 2014, pp. 36–43, doi: 10.1145/2567574.2567581.
- [16] A. Andrade, G. Delandshere, and J. A. Danish, “Using Multimodal Learning Analytics to Model Student Behaviour: A Systematic Analysis of Behavioural Framing,” *JLA*, vol. 3, no. 2, pp. 282–306, Sep. 2016, doi: 10.18608/jla.2016.32.14.

- [17] “A Wide Lens: Combining Embodied, Enactive, Extended, and Embedded Learning in Collaborative Settings.”
- [18] Schneider, Romano, and Drachsler, “Beyond Reality—Extending a Presentation Trainer with an Immersive VR Module,” *Sensors*, vol. 19, no. 16, p. 3457, Aug. 2019, doi: 10.3390/s19163457.
- [19] F. Roque *et al.*, “Using Depth Cameras to Detect Patterns in Oral Presentations: A Case Study Comparing Two Generations of Computer Engineering Students,” *Sensors*, vol. 19, no. 16, p. 3493, Aug. 2019, doi: 10.3390/s19163493.
- [20] K. Sharma, I. Leftheriotis, and M. Giannakos, “Utilizing Interactive Surfaces to Enhance Learning, Collaboration and Engagement: Insights from Learners’ Gaze and Speech,” *Sensors*, vol. 20, no. 7, p. 1964, Mar. 2020, doi: 10.3390/s20071964.
- [21] I. Brishtel, A. A. Khan, T. Schmidt, T. Dingler, S. Ishimaru, and A. Dengel, “Mind Wandering in a Multimodal Reading Setting: Behavior Analysis & Automatic Detection Using Eye-Tracking and an EDA Sensor,” *Sensors*, vol. 20, no. 9, Art. no. 9, Jan. 2020, doi: 10.3390/s20092546.
- [22] X. Li, R. Younes, D. Bairaktarova, and Q. Guo, “Predicting Spatial Visualization Problems’ Difficulty Level from Eye-Tracking Data,” *Sensors*, vol. 20, no. 7, Art. no. 7, Jan. 2020, doi: 10.3390/s20071949.
- [23] R. Martinez-Maldonado, J. Kay, A. Clayphan, and C. Ackad, “Multi-touch Technology in a Higher-Education Classroom: Lessons In-The-Wild,” Dec. 2014, doi: 10.1145/2686612.2686647.
- [24] X. Tu, J. Danish, C. Georgen, M. Humburg, B. Davis, and N. Enyedy, “Examining How Scientific Modeling Emerges Through Collective Embodied Play,” p. 4, 2019.
- [25] F. Ke, X. Yuan, M. Pachman, Z. Dai, R. Naglieri, and X. Xu, “Perspective Taking in Participatory Simulation-based Collaborative Learning,” p. 4, 2019.
- [26] A. C. Evans, K. Davis, and J. O. Wobbrock, “Adaptive Support for Collaboration on Tabletop Computers,” p. 8, 2019.
- [27] R. Martinez-Maldonado, A. Collins, J. Kay, and K. Yacef, “Who did what? Who said that? Collaid: An environment for capturing traces of collaborative learning at the tabletop,” Nov. 2011, pp. 172–181, doi: 10.1145/2076354.2076387.
- [28] “Augmented Electronic Sensing and Robotics.” <https://lit.gse.harvard.edu/augmented-robotics> (accessed Jun. 13, 2020).
- [29] “Kinect Learning Analytics.” <https://lit.gse.harvard.edu/kinect-learning-analytics> (accessed Jun. 13, 2020).
- [30] M. Worsley, M. Johnston, and P. Blikstein, “OpenGesture: a low-cost authoring framework for gesture and speech based application development and learning analytics,” in *Proceedings of the 10th International Conference on Interaction Design and Children - IDC ’11*, Ann Arbor, Michigan, 2011, pp. 254–256, doi: 10.1145/1999030.1999075.
- [31] “Projects | LIT Laboratory.” <https://lit.gse.harvard.edu/projects> (accessed Jun. 14, 2020).
- [32] I. Bratoev, C. Bonnet, A. Chokhachian, G. Schubert, F. Petzold, and T. Auer, “Designing and Evaluating District Heating Networks with Simulation Based Urban Planning,” Sep. 2017.
- [33] “Using Kinect to turn any surface into a multi-user, multi-finger touchscreen - ExtremeTech.” <https://www.extremetech.com/computing/137630-using-kinect-to-turn-any-surface-into-a-multi-user-multi-finger-touchscreen> (accessed Jun. 15, 2020).

- [34] A. Abro, S. Sulaiman, A. K. Mahmood, M. Khan, and M. Madni, "Applications of multi-touch tabletop displays and their challenging issues: An overview," *International Journal on Smart Sensing and Intelligent Systems*, vol. 8, pp. 966–991, Jan. 2015, doi: 10.21307/ijssis-2017-791.
- [35] A. N. Antle, A. Bevans, J. Tanenbaum, K. Seaborn, and S. Wang, "Futura: design for collaborative learning and game play on a multi-touch digital tabletop," in *Proceedings of the fifth international conference on Tangible, embedded, and embodied interaction - TEI '11*, Funchal, Portugal, 2011, p. 93, doi: 10.1145/1935701.1935721.
- [36] "Multi-touch tables for the classroom of the future - waack.org," *Sebastian Waack*. <https://waack.org/2012/12/03/multi-touch-tables-in-the-classroom/> (accessed Aug. 08, 2020).
- [37] R. C. T. P. Ltd, "Augmented Reality Company for Education & Classroom | AR Education Agency," *Augmented Reality Technology Solutions| AR Mobile App Development Services*. <https://yeppar.com/> (accessed Aug. 08, 2020).
- [38] "Learn how VR is being used in the classroom for education," *VR Vision Group*, Oct. 21, 2017. <https://vrvisiongroup.com/virtual-reality-classroom-extracurricular-vs-curriculum/> (accessed Aug. 08, 2020).
- [39] "Tobii Pro Eye-Tracking-Brille 2," Sep. 28, 2015. <https://www.tobii.com/de/produkte/tobii-pro-glasses-2/> (accessed Aug. 08, 2020).
- [40] "Hand Gesture Datasets." <https://lstm.dei.unipd.it/downloads/gesture/> (accessed Aug. 08, 2020).
- [41] "Motion Detection Lamp," *Arduino Project Hub*. <https://create.arduino.cc/projecthub/izzati-azryna/motion-detection-lamp-1a22d6> (accessed Aug. 08, 2020).
- [42] "3 in 1 Webcam - eMeet C980 Pro HD Webcam, 2 Speakers and 4 Built-in Omnidirectional Microphones arrays, HD 1080P Webcam for Video Conferencing, Streaming, Noise Reduction, Plug & Play, w/Webcam Cover: Amazon.ca: Camera & Photo." <https://www.amazon.ca/Webcam-Built-Omnidirectional-Microphones-Conferencing/dp/B07SK6SCKC> (accessed Aug. 08, 2020).
- [43] "Tiny people scientists identify womans emotions from voice and face. Emotion detection, emotional state recognizing, emo sensor technology concept. Header or footer banner template with copy space. – kaufen Sie diese Vektorgrafik und finden Sie ähnliche Vektorgrafiken auf Adobe Stock," *Adobe Stock*. <https://stock.adobe.com/de/images/tiny-people-scientists-identify-womans-emotions-from-voice-and-face-emotion-detection-emotional-state-recognizing-emo-sensor-technology-concept-header-or-footer-banner-template-with-copy-space/257790794> (accessed Aug. 08, 2020).
- [44] "Microsoft: Kinect für Windows ab 1. Februar erhältlich - Golem.de." <https://www.golem.de/1201/88925.html> (accessed Aug. 08, 2020).
- [45] "The emerging role of Microsoft Kinect in physiotherapy rehabilitation for stroke patients," *Physiopedia*. https://www.physio-pedia.com/The_emerging_role_of_Microsoft_Kinect_in_physiotherapy_rehabilitation_for_stroke_patients (accessed Aug. 08, 2020).
- [46] M. Basher, L. Burd, and N. Baghaei, "Collaborative software design using multi-touch tables," *2012 4th International Congress on Engineering Education*, 2012, doi: 10.1109/ICEED.2012.6779276.

- [47] “Figure 1: The sPeAK-MAN demo setup, which simply consist of a laptop...,” *ResearchGate*.
https://www.researchgate.net/figure/The-sPeAK-MAN-demo-setup-which-simply-consist-of-a-laptop-connected-to-a-Kinect-sensor_fig1_260480268 (accessed Aug. 08, 2020).
- [48] “Kinect,” *X-TECH CREATIVE STUDIO BLOG, Development news, kinect, Leap Motion, Web, Mobile, Game and more Development company*. <https://x-tech.am/kinect/> (accessed Aug. 08, 2020).
- [49] *Real-time Mixed Reality - Proof of concept: Kinect v2 + VR (HTC Vive) + Unity*. 2016.
- [50] “Figure 1: Hardware concept: Multi touch table in combination with...,” *ResearchGate*.
https://www.researchgate.net/figure/Hardware-concept-Multi-touch-table-in-combination-with-Microsoft-Kinect-3D-camera-and_fig1_320285900 (accessed Aug. 08, 2020).
- [51] “Fig. 4a) Virtual environment generated by Kinect Avatar ProjectFig. 4b)...,” *ResearchGate*.
https://www.researchgate.net/figure/a-Virtual-environment-generated-by-Kinect-Avatar-Projectb-Immersive-Telepresence_fig4_259561507 (accessed Aug. 08, 2020).