

<b>School/Department:</b>	<i>Erasmus School of Behavioral Sciences (ESSB), Department of Psychology, Education and Child Studies (DPECS)</i>
<b>Project Title:</b>	Multimodal Mobile Learning Experience (M <sup>2</sup> oLe)
<b>Abstract:</b>	<p>The M<sup>2</sup>oLe project aims to leverage multimodality to enhance and to enrich mobile and seamless learning experience in the age of Covid and digital learning. Notwithstanding, educational innovations in the context of mobile learning is not novel, M<sup>2</sup>oLe envisions to push the frontiers of mobile and seamless learning; advocating a paradigm shift from the analysis of mobile learning premising on multimodal tools to the analysis of mobile learning as a multimodal activity – an entity in its own right. In a nutshell, M<sup>2</sup>oLe conceives of multimodality as a learning methodology,</p> <p>M<sup>2</sup>oLe (a new project) will build on past and present ongoing projects e.g., Computer-supported collaborative learning using multimodal learning analytics to explore multimodal interface and online learning environment integrating PCs, handheld devices and smart phones to foster mobile and seamless collaborative learning: indoor (lab) and outdoor (situated) collaborative learning. More importantly, M<sup>2</sup>oLe not only enhances the multimodal accessibility to learning resources to empower learners to move beyond consumers of content to creators of learning content, but also to obtain real-time feedback/ intervention (e.g., via push notification) for actionable feedback from virtual facilitators.</p> <p>Applying multimodality to mobile learning, M<sup>2</sup>oLe will leverage affordances of multimodal learning analytics, artificial intelligence and data science to support the complexity of open-ended learning scenarios to enhance learning and teaching practices.</p>
<b>Requirements of candidate:</b>	<p>Background: The M<sup>2</sup>oLe project adopts a learning sciences approach harnessing interdisciplinary expertise. As such, we look for candidates with background in either multimodal learning analytic, artificial intelligence and/ or machine learning. Preferably, a candidate with some experience in mobile and ubiquitous learning and knowledge in designing mobile apps.</p> <p>Master's degree: Yes</p> <p>EUR requirement: IELTS: 7.5 (min. 6.0 for all subs.)</p>

	Or TOEFL: 100 (min. 20 for all subs.)
<b>Supervisor information:</b>	<p>The supervisory team will consist of Prof. dr. Marcus Specht, (promotor), Prof. dr. Fred Paas (promotor), and Dr. Esther Tan (co-promotor)</p> <p>Promotor          Prof. Dr. Marcus Specht          Email: <a href="mailto:specht@essb.eur.nl">specht@essb.eur.nl</a>          Prof. Dr. Marcus Specht is Professor for Digital Education at the Technical University of Delft and Director of the Leiden-Delft-Erasmus Center for Education and Learning. He received his Diploma in Psychology in 1995 and a Dissertation from the University of Trier in 1998 on adaptive information technology. From 2001 he headed the department "Mobile Knowledge" at the Fraunhofer Institute for Applied Information Technology (FIT). From 2005 to 2018 he was Professor for Learning Technologies at the Open Universiteit Nederland and head of the Learning Innovation Lab. His research focus is on Computational Thinking, Learning Analytics, AI in Education, and Virtual and Augmented Reality for Education. Prof. Specht is an Apple Distinguished Educator and was President (2013-2015) of the International Association of Mobile Learning.</p> <p><b>Mobile and Inquiry-Based Learning</b>          Suárez, Á., Specht, M., Prinsen, F., Kalz, M., &amp; Ternier, S. (2018). A review of the types of mobile activities in mobile inquiry-based learning. <i>Computers &amp; Education</i>, 118, 38-55.</p> <p>Specht, M., &amp; Suarez, A. (2018). Eine Analyse von Interaktionsmustern für mobiles forschendes Lernen. In <i>Handbuch Mobile Learning</i> (pp. 345-363). Springer VS, Wiesbaden.</p> <p>Rusman, E., Ternier, S., &amp; Specht, M. (2018). Early Second Language Learning and Adult Involvement in a Real-World Context: Design and Evaluation of the "ELENA Goes Shopping" Mobile Game. <i>Journal of Educational Technology &amp; Society</i>, 21(3).</p> <p><b>Learning Analytics</b>          Jivet, I., Scheffel, M., Specht, M., &amp; Drachsler, H. (2018, March). License to evaluate: Preparing learning analytics dashboards for educational practice. In <i>Proceedings of the 8th International Conference on Learning Analytics and Knowledge</i> (pp. 31-40). ACM.</p> <p>Di Mitri, D., Schneider, J., Specht, M., &amp; Drachsler, H. (2018). From signals to knowledge: A conceptual model for multimodal learning analytics. <i>Journal of Computer Assisted Learning</i>, 34(4), 338-349.</p> <p>Di Mitri, D., Schneider, J., Specht, M., &amp; Drachsler, H. (2018) Multimodal Challenge: Analytics Beyond User-computer Interaction Data. In Pardo, A., Bartimote, K., Lynch, G., Buckingham Shum, S., Ferguson, R., Merceron, A., &amp; Ochoa, X. (Eds.). (2018). <i>Companion Proceedings of the 8th International Conference on Learning Analytics and Knowledge</i> (pp. 362-365). Sydney, Australia: Society for Learning Analytics Research</p> <p><b>Augmented Reality and Sensor Technology</b>          Specht, M., Hang, L. B., &amp; Barnes, J. S. (2019). Sensors for Seamless Learning. In <i>Seamless Learning</i> (pp. 141-152). Springer, Singapore.</p>

	<p>Limbu, B. H., Jarodzka, H., Klemke, R., &amp; Specht, M. (2018). Using sensors and augmented reality to train apprentices using recorded expert performance: A systematic literature review. <i>Educational Research Review</i>.</p> <p>Limbu, B. H., Jarodzka, H., Klemke, R., Wild, F., &amp; Specht, M. (2018). From AR to expertise: A user study of an augmented reality training to support expertise development. <i>Journal of Universal Computer Science</i>, 24(2), 108-128.</p> <p>Praharaj, S., Scheffel, M., Drachsler, H., &amp; Specht, M. (2018, September). Multimodal Analytics for Real-Time Feedback in Co-located Collaboration. In <i>European Conference on Technology Enhanced Learning</i> (pp. 187-201). Springer, Cham.</p> <p>Schneider, J., Börner, D., van Rosmalen, P., &amp; Specht, M. (2018). Do you Want to be a Superhero? Boosting Emotional States with the Booth. <i>J. UCS</i>, 24(2), 85-107.</p> <p><b>Adoption of ICT in Higher Education</b></p> <p>Jokiaho, A., May, B., Specht, M., &amp; Stoyanov, S. (2018). Obstacles to using E-Learning in an Advanced Way. In <i>The International Conference on E-Learning in the Workplace</i>.</p> <p>Jokiaho, A., May, B., Specht, M., &amp; Stoyanov, S. (2018). Barriers to using E Learning in an Advanced Way. <i>International Journal of Advanced Corporate Learning (iJAC)</i>, 11(1), 17-22.</p> <p>Promotor        Prof. Dr. Fred Paas        Email address: <a href="mailto:paas@essb.eur.nl">paas@essb.eur.nl</a>        Fred Paas is a Professor of Educational Psychology at Erasmus University Rotterdam in the Netherlands and a Visiting Professorial Fellow at the University of Wollongong in Australia. His main research interest is in using knowledge about the human cognitive and motor system in the design of instruction for complex learning environments. He has (co-) authored over 300 publications in (S)SCI listed journals, which been cited over 36.000 times.  <a href="https://www.eur.nl/people/fred-paas">https://www.eur.nl/people/fred-paas</a>        Selected publications 2020</p> <ol style="list-style-type: none"> <li>1. Ayres, P., Castro-Alonso, J. C., Wong, M., Marcus, N., &amp; Paas, F. (2020). Factors that impact on the effectiveness of instructional animations. In S. Tindall-Ford, S. Agostinho, &amp; J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 180-193). London: Routledge.</li> <li>2. Baars, M., Wijnia, L., De Bruin, A., &amp; Paas, F. (2020). The relation between student's effort and monitoring judgments during learning: A meta-analysis. <i>Educational Psychology Review</i>.</li> <li>3. Baars, M., Wijnia, L., De Bruin, A., &amp; Paas, F. (2020). Sharing the load: A strategy to improve self-regulated learning. D. Dinsmore, L. Fryer, &amp; M. Parkinson, <i>Handbook of strategies and strategic processing</i>. (pp. 234-247). New York: Routledge</li> <li>4. Castro-Alonso, J. C., Ayres, P., Wong, M., &amp; Paas, F. (2020). Visuospatial tests and multimedia learning: The importance of employing relevant instruments. In S. Tindall-Ford, S. Agostinho, &amp; J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 89-100). London: Routledge.</li> <li>5. De Koning, B., Rop, G., &amp; Paas, F. (2020). Learning from split-attention materials: Evidence for a mental self-managed integration effect. <i>Computers in Human Behavior</i>, 110, 106379.</li> </ol>
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	<ol style="list-style-type: none"> <li>6. De Koning, B., Rop, G., &amp; Paas, F. (2020). The self-management effect in learning from split-attention materials: Mental versus physical integration. <i>Contemporary Educational Psychology</i>, 61, 101873.</li> <li>7. Duchi, L., Lombardi, D., Paas, F., &amp; Loyens, S. (2020). How a growth mindset can change the climate: The power of implicit beliefs in influencing people's thoughts and actions. <i>Journal of Environmental Psychology</i>, 70, 101461.</li> <li>8. Eielts, C., Pouw, W., Ouwehand, K., Van Gog, T., Zwaan, R., &amp; Paas, F. (2020). Co-thought gesturing supports more complex problem solving in subjects with lower visual working-memory capacity. <i>Psychological Research</i>, 84, 502-513.</li> <li>9. Es-Sajjade, A., &amp; Paas, F. (in press). Educational theories and computer game design: Lessons from an experiment in elementary mathematics education. <i>Educational Technology Research and Development</i>.</li> <li>10. Leppink, J., Paas, F., Van Gog, T., &amp; Van Merriënboer, J. J. G. (2020). How to measure effects of self-regulated learning with checklists on the acquisition of task selection skills. In S. Tindall-Ford, S. Agostinho, &amp; J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 66-79). London: Routledge.</li> <li>11. Liu, T. C., Lin, Y. C., Hsu, C. Y., &amp; Paas, F. (in press). Learning from animations and computer simulations: Modality and reverse modality effects. <i>British Journal of Educational Technology</i>.</li> <li>12. Mavilidi, M., Ouwehand, K., Okely, A. D., Chandler, P., &amp; Paas, F. (2020). Embodying learning through physical activity and gestures in preschool children. In S. Tindall-Ford, S. Agostinho, &amp; J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp.103-118). London: Routledge.</li> <li>13. Mavilidi, M., Ouwehand, K., Riley, N., Chandler, P., &amp; Paas, F. (2020). The effects of an acute physical activity break on test anxiety and math test performance. <i>International Journal of Environmental Research and Public Health</i>, 17: 1523.</li> <li>14. Nazlieva, N., Mavilidi, M. F., Baars, M., &amp; Paas, F. (2020). Establishing the scientific consensus on cognitive benefits of physical activity. <i>International Journal of Environmental Research and Public Health</i>, 17, 29.</li> <li>15. Paas, F., &amp; Sweller, J. (in press). Implications of cognitive load theory for multimedia learning. In R. Mayer &amp; L. Fiorella (Eds.), <i>The Cambridge handbook of multimedia learning</i> 2nd edition. New York: Cambridge University Press.</li> <li>16. Paas, F., &amp; Van Merriënboer, J. J. G. (2020). Cognitive load theory: Methods to manage cognitive load in the learning of complex tasks. <i>Current Directions in Psychological Science</i>, 29, 394-398.</li> <li>17. Pouw, W., Wassenburg, S., Hostetter, A. B., De Koning, B. B., &amp; Paas, F. (2020). Does gesture strengthen sensorimotor knowledge of objects? The case of the size-weight illusion. <i>Psychological Research</i>, 84, 966-980.</li> <li>18. Sepp, S., Howard, S., Tindall-Ford, S., Agostinho, S., &amp; Paas, F. (in press). Working memory: Models and applications. <i>Oxford Research Encyclopedia of Educational Psychology</i>.</li> <li>19. Sepp, S., Agostinho, S., Tindall-Ford, S., &amp; Paas, F. (2020). Gesture-based learning with ICT: Recent developments, opportunities and considerations. In S. Tindall-Ford, S. Agostinho, &amp; J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 130-141). London: Routledge.</li> <li>20. Van Brussel, S., Verkoeijen, P., Timmermans, M., &amp; Paas, F. (2020). "Consider the opposite" – Effects of elaborative feedback and correct answer feedback on reducing confirmation bias – a pre-registered study. <i>Contemporary Educational Psychology</i>, 61, 101844.</li> <li>21. Weijers, R., De Koning, B. B., &amp; Paas, F. (in press). Nudging in education: towards successful and responsible implication. <i>European Journal of Psychology of Education</i>.</li> </ol>
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	<p>22. Wong, M., Castro-Alonso, J. C., Ayres, P., &amp; Paas, F. (2020). The effects of transient information and element interactivity on learning from instructional animations. In S. Tindall-Ford, S. Agostinho, &amp; J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 80-88). New York: Routledge.</p> <p>23. Xu, M. K., Koorn, P., De Koning, B., Skuballa, I., Lin, L., Henderikx, M., H. W. Marsh, Sweller, J., &amp; Paas, F. (in press). A growth mindset leads to reduced cognitive load and improved learning: Integrating motivation and cognitive load theory. <i>Journal of Educational Psychology</i>.</p> <p>24. Zhang, S., De Koning, B. B., Agostinho, S., Tindall-Ford, S., Chandler, P., &amp; Paas, F. (in press). The cognitive load self-management principle. In R. Mayer &amp; L. Fiorella (Eds.), <i>The Cambridge handbook of multimedia learning</i> 2nd edition. New York: Cambridge University Press.</p> <p>Co-Supervisor:        Dr. Esther Tan, Senior Researcher        Leiden-Delft-Erasmus Centre for Education and Learning (LDE-CEL)        Delft University of Technology        e.b.k.tan@tudelft.nl  <a href="https://www.educationandlearning.nl/people/dr-esther-tan">https://www.educationandlearning.nl/people/dr-esther-tan</a></p> <p>Publications</p> <p>Chen, H.Y., Tan, E., Lee, Y., Praharaj, S., Specht, M., &amp; Zhao, G.Y. (2020). Developing AI into Explanatory Supporting Models: An Explanation-visualized Deep Learning Prototype for Computer Supported Collaborative Learning. In the proceedings of the International Conference of the Learning Sciences (ICLS) 2020. Nashville: International Society of the Learning Sciences.</p> <p>Xiao, J., Tan, E., Li, X. J., Cao, M. Y., &amp; Specht, M. (2019). Using Social Media in Mobile MOOC for Teacher Professional Development. <i>International Journal of Mobile Learning and Organization</i>.</p> <p>Tan, E. &amp; So, H. J. (2018). Role of Environmental Interaction in Interdisciplinary Thinking: from Knowledge Resources Perspectives. <i>The Journal of Environmental Education</i>. DOI: 10.1080/00958964.2018.1531280</p> <p>Tan, E. (2018). Effects of two differently sequenced classroom scripts on common ground in collaborative inquiry learning. <i>Instructional Science</i>, 1-27.</p> <p>Tan, E., Rusman, E., Firssova, O., Ternier, S., Specht, M., Klemke, R., &amp; So, H. J. (2018). Mobile Inquiry-based Learning: Relationship among levels of inquiry, learners' autonomy and environmental interaction. In D. Parsons, R. Power, A. Palalas, H. Hambrock &amp; K. MacCallum (Eds.), <i>Proceedings of 17th World Conference on Mobile and Contextual Learning</i> (pp. 22-29). Concordia University Chicago, Chicago, IL, USA. Retrieved November 30, 2018 from <a href="https://www.learntechlib.org/p/184919/">https://www.learntechlib.org/p/184919/</a>.</p> <p>Tan, E., Stracke, C. M., Prokopowicz, M., Kővári, E., Kigyós, T., Csizmadia, T., &amp; Erdős, K. (2017). Learning to learn: Beyond 2020. In Stracke, M. C., Tveiten, O., &amp; Shanks, M. (Eds.). <i>Smart Universities: Education's Digital Future: proceedings of the International WLS and LINQ Conference</i> (pp. 13-20). Norway: Logos.</p>
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	<p>Tan, E., &amp; So, H. J. (2016). Students' Use of Knowledge Resources in Environmental Interaction on an Outdoor Learning Trail. In Looi, C. K., Polman, J. L., Cress, U., and Reimann, P. (Eds.) (2016). Transforming Learning, Empowering Learners: The International Conference of the Learning Sciences (ICLS) 2016, Volume 2, (pp. 745-752). Singapore: International Society of the Learning Sciences.</p> <p>So, H. J., Zhang, X. J. &amp; Tan, E. (2016). Learning about Collaborative Knowledge Building: A Case of Future School in Singapore. Journal of Learner-Centered Curriculum and Instruction. 16 (10), 565 – 591.</p> <p>Tan, E. &amp; So, H. J. (2015). Rethinking the impact of activity design on a mobile learning trail: The missing dimension of the physical affordances. IEEE Transactions on Learning Technologies. DOI: 10.1109/TLT.2014.2376951</p> <p>So, H. J., Tan, E., Y. Wei., &amp; Zhang, X. J. (2015). What makes the design of mobile learning trails effective: A retrospective analysis (pp. 335-352). In L. S. Wong., M. Milard., &amp; M. Specht. (Eds.), Seamless learning in the age of mobile connectivity, (pp.335 – 352). Singapore: Springer.</p>
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