

School/Department:	<i>Erasmus School of Behavioral Sciences (ESSB), Department of Psychology, Education and Child Studies (DPECS)</i>
Project Title:	<i>Depletion of Working Memory Resource as an Explanation for Cognitive Load Effects on Learning of Complex Cognitive Tasks</i>
Abstract:	<p>Depletion of limited working memory (WM) resources may occur following extensive mental effort resulting in decreased performance compared to conditions requiring less extensive mental effort. This “depletion effect” can be incorporated into cognitive load theory that is concerned with using the properties of human cognitive architecture, especially working memory, when designing instruction. In this project several experiments will be carried out to investigate whether positive effects on learning through spaced practice is caused by a cognitive load effect that can be explained by working memory resource depletion during cognitive effort with recovery during rest.</p> <p>Previous studies on this topic: Chen, O., Castro-Alonso, J. C., Paas, F., & Sweller, J. (2018). Extending cognitive load theory to incorporate working memory resource depletion: Evidence from the spacing effect. <i>Educational Psychology Review</i>, 30, 483-501.</p>
Requirements of candidate:	<p>Background: Educational sciences, educational psychology, cognitive psychology or similar domains; preferably skilled in quantitative research methods, academic writing, SPSS and/or R statistical software packages, programming skills (e.g. python)</p> <p>Master’s degree: Yes</p> <p>EUR requirement: IELTS: 7.5 (min. 6.0 for all subs.) Or TOEFL: 100 (min. 20 for all subs.)</p>
Supervisor information:	<p><i>Prof. dr. Fred Paas</i> <i>Paas@essb.eur.nl</i> http://scholar.google.nl/citations/FredPaas http://www.egs3h.eur.nl/people/fred-paas/ <i>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 learning environments. He has</i></p>

	<p>(co-) authored over 300 publications in (S)SCI listed journals, which been cited over 36.000 times.</p> <p>See below for list of recent publications:</p> <p>Ayres, P., Castro-Alonso, J. C., Wong, M., Marcus, N., & Paas, F. (2020). Factors that impact on the effectiveness of instructional animations. In S. Tindall-Ford, S. Agostinho, & J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 180-193). London: Routledge.</p> <p>Baars, M., Wijnia, L., De Bruin, A., & Paas, F. (in press). The relation between student's effort and monitoring judgments during learning: A meta-analysis. <i>Educational Psychology Review</i>.</p> <p>Baars, M., Wijnia, L., De Bruin, A., & Paas, F. (2020). Sharing the load: A strategy to improve self-regulated learning. D. Dinsmore, L. Fryer, & M. Parkinson, <i>Handbook of strategies and strategic processing</i>. (pp. 234-247). New York: Routledge</p> <p>Castro-Alonso, J. C., Ayres, P., Wong, M., & Paas, F. (2020). Visuospatial tests and multimedia learning: The importance of employing relevant instruments. In S. Tindall-Ford, S. Agostinho, & J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 89-100). London: Routledge.</p> <p>De Koning, B., Rop. G., & Paas, F. (2020). Learning from split-attention materials: Evidence for a mental self-managed integration effect. <i>Computers in Human Behavior</i>, 110, 106379.</p> <p>De Koning, B., Rop. G., & Paas, F. (2020). The self-management effect in learning from split-attention materials: Mental versus physical integration. <i>Contemporary Educational Psychology</i>, 61, 101873.</p> <p>Duchi, L., Lombardi, D., Paas, F., & 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.</p> <p>Eielts, C., Pouw, W., Ouwehand, K., Van Gog, T., Zwaan, R., & 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.</p> <p>Es-Sajjade, A., & 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>.</p> <p>Leppink, J., Paas, F., Van Gog, T., & 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, & J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 66-79). London: Routledge.</p> <p>Liu, T. C., Lin, Y. C., Hsu, C. Y., & Paas, F. (in press). Learning from animations and computer simulations: Modality and reverse modality effects. <i>British Journal of Educational Technology</i>.</p> <p>Mavilidi, M., Ouwehand, K., Okely, A. D., Chandler, P., & Paas, F. (2020). Embodying learning through physical activity and gestures in preschool children. In S. Tindall-Ford, S. Agostinho, & J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp.103-118). London: Routledge.</p> <p>Mavilidi, M., Ouwehand, K., Riley, N., Chandler, P., & 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.</p> <p>Mavilidi, M., Xu, M. K., Marsh, H., Jansen, P., & Paas, F. (in press). The relative age effect and academic achievement in primary and secondary school children. <i>Journal of Educational Psychology</i>.</p> <p>Mirza, F. Agostinho, S., Tindall-Ford, S., Paas, F., & Chandler, P. (2020). Self-management of cognitive load: Potential and challenges. In S. Tindall-Ford, S. Agostinho, & J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 157-167). London: Routledge.</p> <p>Nazlieva, N., Mavilidi, M. F., Baars, M., & Paas, F. (2020). Establishing the scientific consensus on cognitive benefits of physical activity. <i>International Journal of</i></p>
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	<p><i>Environmental Research and Public Health</i>, 17, 29.</p> <p>Paas, F., & Sweller, J. (in press). Implications of cognitive load theory for multimedia learning. In R. Mayer & L. Fiorella (Eds.), <i>The Cambridge handbook of multimedia learning 2nd edition</i>. New York: Cambridge University Press.</p> <p>Paas, F., & 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.</p> <p>Pouw, W., Wassenburg, S., Hostetter, A. B., De Koning, B. B., & Paas, F. (2020). Does gesture strengthen sensorimotor knowledge of objects? The case of the size-weight illusion. <i>Psychological Research</i>, 84, 966-980.</p> <p>Sepp, S., Howard, S., Tindall-Ford, S., Agostinho, S., & Paas, F. (in press). Working memory: Models and applications. <i>Oxford Research Encyclopedia of Educational Psychology</i>.</p> <p>Sepp, S., Agostinho, S., Tindall-Ford, S., & Paas, F. (2020). Gesture-based learning with ICT: Recent developments, opportunities and considerations. In S. Tindall-Ford, S. Agostinho, & J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 130-141). London: Routledge.</p> <p>Van Brussel, S., Verkoeijen, P., Timmermans, M., & 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.</p> <p>Weijers, R., De Koning, B. B., & Paas, F. (in press). Nudging in education: towards successful and responsible implication. <i>European Journal of Psychology of Education</i>.</p> <p>Wong, M., Castro-Alonso, J. C., Ayres, P., & Paas, F. (2020). The effects of transient information and element interactivity on learning from instructional animations. In S. Tindall-Ford, S. Agostinho, & J. Sweller (Eds.), <i>Advances in cognitive load theory: Rethinking teaching</i> (pp. 80-88). New York: Routledge.</p> <p>Xu, M. K., Koorn, P., De Koning, B., Skuballa, I., Lin, L., Henderikx, M., H. W. Marsh, Sweller, J., & 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>Castro-Alonso, J. C., Ayres, P., & Paas, F. (2019). A battery of computer tests to measure visuospatial processing. In J. C. Castro-Alonso (Ed.), <i>Visuospatial processing for education in health and natural sciences</i> (pp.207-229). Cham, Switzerland: Springer.</p> <p>Castro-Alonso, J. C., Paas, F., & Ginns, P. (2019). Embodied cognition, science education, and visuospatial processing. In J. C. Castro-Alonso (Ed.), <i>Visuospatial processing for education in health and natural sciences</i> (175-205). Cham, Switzerland: Springer.</p> <p>Castro-Alonso, J. C., Wong, A., Adesope, O. O., Ayres, P., & Paas, F. (2019). Gender imbalance in instructional dynamic versus static visualizations: A meta-analysis. <i>Educational Psychology Review</i>, 31, 361-388.</p> <p>Hoogerheide, V., Renkl, A., Fiorella, L., Paas, F., & Van Gog, T. (2019). Enhancing example-based learning: Teaching on video increases arousal and improves retention and transfer test performance. <i>Journal of Educational Psychology</i>, 111, 45-56.</p> <p>Kamermans, K. L., Pouw, W., Fassi, L., Aslanidou, A., Paas, F., & Hostetter, A. B. (2019). The role of gesture as simulated action in reinterpretation of mental imagery. <i>Acta Psychologica</i>, 197, 131-142.</p> <p>Kamermans, K. L., Pouw, W. T. J. L., Mast, F. W., & Paas, F. (2019). Reinterpretation in visual imagery is possible without visual cues: A validation of previous research. <i>Psychological Research</i>, 83, 1237-1250.</p> <p>Liu, T. C., Lin, Y. C., Gao, Y., & Paas, F. (2019). The modality effect in a mobile learning environment: Learning from spoken text and real objects. <i>British Journal of Educational Technology</i>, 50, 574-586.</p> <p>Ouwehand, K., Dijkstra, K., Van Gog, T., & Paas, F. (2019). Effects of semantic congruency and pointing gestures on item and source memory in children and</p>
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	<p>young adults. <i>Mind, Brain, and Education</i>, 13, 92-99.</p> <p>Pouw, W. T. L. J., Rop, G., De Koning, B. B., & Paas, F. (2019). The cognitive basis of the split-attention effect. <i>Journal of Experimental Psychology: General</i>, 148, 2058-2075.</p> <p>Raaijmakers, S. F., Baars, M., Paas, F., Van Merriënboer, J. J. G., & Van Gog, T. (2019). Effects of self-assessment feedback on self-assessment and task-selection accuracy. <i>Metacognition and Learning</i>, 14, 21-42.</p> <p>Ruiter, M., Eielts, C., Loyens, S., & Paas, F. (2019). Comparing cognitive control performance during seated rest and self-paced cycling on a desk bike in preadolescent children. <i>Journal of Physical Activity & Health</i>, 16, 533-539.</p> <p>Schmidt, M., Benzing, V., Wallman-Jones, A. R., Mavilidi, M., Lubans, D., & Paas, F. (2019). Embodied learning in the classroom: Effects on primary school children's attention and foreign language vocabulary learning. <i>Psychology of Sport & Exercise</i>, 43, 45-54.</p> <p>Sepp, S., Howard, S., Tindall-Ford, S., Agostinho, S. & Paas, F. (2019). Cognitive load theory and human movement: Towards an integrated model of working memory. <i>Educational Psychology Review</i>, 31, 293-318.</p> <p>Sweller, J., Van Merriënboer, J. J. G., & Paas, F. (2019). Cognitive architecture and instructional design: 20 years later. <i>Educational Psychology Review</i>, 31, 261-292.</p> <p>Wong, J., Baars, M., Davis, D., Van der Zee, T., Houben, G. J., & Paas, F. (2019). Supporting self-regulated learning in online learning environments and MOOCs: A systematic review. <i>International Journal of Human-Computer Interaction</i>, 35(4-5), 356-373.</p> <p>Wong J., Baars, M., De Koning, B. B., Van der Zee, T., Davis, D., Khalil, M., Houben, G. J., & Paas, F. (2019) Educational theories and learning analytics: From data to knowledge. In: Ifenthaler D., Mah DK., Yau JK. (eds) <i>Utilizing learning analytics to support study success</i> (pp.3-25). Springer, Cham</p> <p>Wong, J., Khalil, M., Baars, M., De Koning, B., & Paas, F. (2019). Exploring sequences of learner activities in relation to self-regulated learning in a massive open online course. <i>Computers & Education</i>, 140, 103595.</p>
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