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Jeroen J. G. van Merriënboer talks with *ScienceWatch.com* and answers a few questions about this month's Emerging Research Front Paper in the field of Psychiatry/Psychology.

Article: Cognitive load theory and complex learning: Recent developments and future directions
Authors: van Merrienboer, JJG;Sweller, J
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SW: Why do you think your paper is highly cited?

I think the main reason is that it appeals to a broad scientific audience. My co-author, John Sweller, from the University of New South Wales in Sydney, Australia, is the founder of cognitive load theory. This popular theory has a strong basis in cognitive and evolutionary psychology and provides guidelines for the design of instruction, but it is primarily applied to teaching simple skills in well-structured domains.

I am interested in teaching highly complex skills in ill-structured domains, such as medical diagnosis, air traffic control, software engineering, and so forth. I developed the four-component instructional design model (4C/ID-model; van Merriënboer, 1997; van Merriënboer & Kirschner, 2007) for complex learning, which is popular in vocational and higher professional education.

This article brings the two perspectives together. For cognitive load researchers, it opens up new roads for doing research on teaching complex skills; for researchers in complex learning, it provides a new theoretical perspective strongly grounded in cognitive and evolutionary psychology.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

The focus of the article is clearly on a synthesis of knowledge and the creation of a new, promising research line. On the one hand, there is cognitive load theory with a strong basis in cognitive and evolutionary psychology. Learning is described as the construction and automation of cognitive schemas in long-term memory. Experiments use laboratory tasks and simple school tasks.

On the other hand, there are models of complex learning with a strong basis in instructional design and professional training. Learning is described as the integration of knowledge, routine, and non-routine skills—e.g., problem solving, reasoning—and attitudes. Experiments use real-life tasks as well as professional ones. This article builds a strong bridge between these two theoretical frameworks and research traditions. It also sets out a future research agenda with clear theoretical and practical implications.

SW: Would you summarize the significance of your paper in layman's terms?

The teaching of highly complex and critical skills (e.g., medical diagnosis, air traffic control, fault management in the chemical industry) is typically based on common sense, intuition, and anecdotic evidence. As a result, teaching methods are often far from optimal.

For example, novice students are expected to learn from independently solving problems, while there is convincing scientific evidence that they learn much more from studying worked examples. Or students are required to study equivalent information presented in different ways, while there is strong scientific evidence that such redundant information hampers rather than helps learning.

This paper discusses evidence-based guidelines for complex learning and, more importantly, sets out a research agenda which should eventually help to improve the teaching of complex, critical skills based on sound scientific evidence.

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SW: How did you become involved in this research and were any particular problems encountered along the way?

Since the 1980s, when I conducted my Ph.D. research on teaching computer programming, I have been interested in complex learning and the teaching of complex skills. In 1996, John Sweller spent his sabbatical leave at the University of Twente in the Netherlands, where I was working by that time. We became interested in each other's work and started our cooperation, which resulted in a first influential article linking cognitive load theory to instructional design (Sweller, van Merriënboer, & Paas, 1998). I also used cognitive load theory as one of the cornerstones of my 4C/ID model for training complex cognitive skills (van Merriënboer, 1997).

In 2003/2004, I spent my own sabbatical leave with John Sweller's research group in Sydney. This resulted in the 2005 article in *Educational Psychology Review* and also contributed to a more refined approach to teaching complex skills called the "ten steps to complex learning" (van Merriënboer & Kirschner, 2007).

John and I encountered many problems in bringing cognitive load theory and models for complex learning together, because they are rooted in very different traditions. But problems are there to be solved and we always have a lot of fun doing so.

SW: Where do you see your research leading in the future?

Currently, my research mainly focuses on complex learning in the health professions, such as medicine, life sciences, nursing, physiotherapy etc. Technological developments in these fields are extremely fast and acquired knowledge quickly becomes obsolete because the state-of-the-art changes so quickly.

In such domains, teaching complex skills is a necessary but not a sufficient condition for training professionals. They should also be prepared to deal with continuously rapid changes in their working environment and be able to direct their own learning. Thus, lifelong learning is an emerging topic and my recent work on complex learning is moving in this direction.

SW: Do you foresee any social or political implications for your research?

Not directly, but I hope that my work contributes to an awareness that research on human factors and training is critical to reach pleasant and safe working environments. Too often, innovations in professions and in training are purely driven by the upsurge of new technologies, with the risk that employees are left with tasks that are hard to train for and tedious to perform.

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Sources:

- Sweller, J, van Merriënboer, JJG, & Paas, F, "Cognitive architecture and instructional design," *Educational Psychology Review* 10 (3), 251-96, 1998.
- Van Merriënboer, JJG, *Training complex cognitive skills*, Englewood Cliffs, NJ: Educational Technology

Publications, 1997.
- Van Merriënboer, JJG, & Kirschner, PA, *Ten steps to complex learning*, Mahwah, NJ: Lawrence Erlbaum Associates, 2007.

KEYWORDS: COGNITIVE ARCHITECTURE; BIOLOGICAL EVOLUTION; COMPLEX LEARNING; COGNITIVE LOAD; INSTRUCTIONAL DESIGN; EXPERTISE; ADAPTIVE INSTRUCTION.

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