NEUROSCIENCE AND EDUCATION: IMPLICATIONS FOR EDUCATIONAL SETTINGS

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HOW THE BRAIN CHANGES WHEN CHILDREN LEARN TO READ

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Learning to read involves exposure to large amounts of print in a focused period of time during childhood. How does this environmental transition affect cortical circuits for visual perception and language processing? I will present data from a three-year-long longitudinal study, examining the relation between reading-related skills, cortical function and white matter properties in school age children. Functional measurements show that a region in the left occipitotemporal sulcus increases its sensitivity to visual words over time. This cortical change correlates with change in sight word efficiency, a measure of speeded visual word naming. On the other hand, phonological awareness and non-timed reading measures correlate with white matter properties in pathways connecting lateral temporal regions through the corpus callosum, as well as in the arcuate fasciculus. These results will be discussed within the framework of current models for reading and learning in the brain.

RECONSOLIDATION OF MEMORY: CAN RESEARCH FROM THE LABORATORY BE APPLIED IN AN EDUCATIONAL SETTING?

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Neuroscience, the study of how the brain functions, provides knowledge and conceptual frameworks. However, despite significant advances in the field, the data generated does not specify exactly how this knowledge can be transferred to the classroom.

This study attempts to answer several questions. First, can findings from neuroscience research on long term memory be transferred to the educational setting? Second, which form of intervention, based on evidence from neuroscience, facilitates optimal learning? Declarative long-term memory of an experience is dependent on a consolidation process that follows the experience. Consolidation theory assumes that memories are labile during a limited window after encoding, but as time passes, memories are consolidated and become resistant to change. The discovery of reactivation-induced reconsolidation has challenged this view. In contrast to the consolidation account, reactivation is thought to return memories to a labile state, which allows them to change. In the normal course of events, reactivated memories are retained though a process similar to initial consolidation, i.e. reconsolidation. This view of memory formation as a dynamic process rather than a static one has important implications for teaching in the way the brain learns generally and understanding optimal conditions for retaining and retrieving facts specifically.

In this research, the process of reconsolidation is examined in the classroom at the junior high school level. The subject chosen is history as this is one of the subjects where the pupils have to remember many facts and is suitable for researching the application of declarative memory. In this research the influence of revision under different conditions of reactivation of declarative memory is examined to research the application of data from the laboratory to the classroom.

The results of this research will be presented in addition to a discussion of the challenges involved in translating scientific research into educational practice.

COMPUTERIZED PROGRESSIVE ATTENTION TRAINING (CPAT) IN ADULTS WITH ADHD – A RANDOMIZED CONTROLLED TRIAL

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Deficits in sustained attention and in executive attention have been demonstrated to be important in both children- and adult-ADHD. In the present study we investigated whether the computerized progressive attention training (CPAT) is an effective intervention for adults with ADHD. The CPAT is composed of four sets of structured tasks that uniquely activate sustained attention, selective attention, orienting of attention and executive attention. Performance was driven by tight schedules of feedback and participants automatically advanced in ordered levels of difficulty contingent upon performance. Fifteen adults with ADHD were assigned to the experimental group and received the CPAT sessions twice a week over an 8-week period. Fifteen age-matched control adults with ADHD were assigned to the control group and participated in sessions of the same frequency, length and format except that instead of performing the attention training tasks they played four standard video games (Glufo, Filler, String avoider and Tetris) during the session. There was a significant treatment effect for the sustained attention task, both post-intervention and at follow-up (2-3 months after the end of training). In addition, attention training improved reaction times in the selective- and executive attention tasks, an improvement that was evident right after the intervention as well as at follow-up. This study showed that sustained-, selective- and executive-attention can be improved in adults with ADHD. Most importantly, we found significant correlations between the magnitude of improvement in attention and between several unique characteristics of the training sessions. We concluded that attention improvements were primarily due to the CPAT.

CURRICULUM-BASED MEASUREMENT IN MATHEMATICS: A TOOL FOR ASSESSING DEVELOPMENTAL DYSCALCULIA

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Developmental dyscalculia (DD) is a disorder of numerical abilities in children of normal intelligence in the absence of other cognitive impairments. It is still unclear whether DD is domain-specific, that is, a pure disorder related to a core number representation in the intraparietal sulcus (IPS) of the parietal lobes, or a domain-general system that supports a wide range of cognitive deficits. Despite multiple diagnostic criteria suggested for defining DD, the general consensus is that DD can be diagnosed when the arithmetical achievements of the child are at least two grades below the current grade. In the present study, we developed a Curriculum-Based Measurement in Mathematics (CBM-M). Its purpose was to describe DD children's mathematical knowledge compared to normal achievers (NA). The questions addressed in the research were: (1) in which sub-subjects can differences between DD and NA be seen? (2) Does the profile of the child with DD stay stable throughout three grade levels?

In general, the results show that the NA succeeded in most of the tasks. Their error rates were much lower (less than 20%) than those with DD (above 50%). The difference in the results between the two groups supports our decision to build a discriminative tool which is based on the CBM-M principles. With respect to the second question, it seems that the profile difficulties in DD children were dependent on the sub-subject content and the number range of tasks. Moreover, domain-general factors modulated math performance of DD.