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What we know about human cognition must inform educational practice, but we've lots to learn.

Working memory and academic learning.

Milton J. Dehn


Reviewed by Catherine Scott

Dr Catherine Scott, Swinburne Professional Learning, Swinburne University of Technology, Po Box 218, Hawthorn Vic. 3122 Australia E-mail: clscott@swin.edu.au
The tribes and clans who work within universities have been classified in a number of different ways but one that has wide acceptance is Biglan’s typology (1973). Academic groupings, by this system can pure or applied; life-based or non life-based, and hard or soft. Engineering is non-life based and ‘hard’, while education is life-based and ‘soft’. However, they are both applied fields and this confers some important similarities.

Practitioners in both fields are heavily dependent on the integrity of the basic research on which they rely, and regrettably here the similarity ends. Engineering’s foundation disciplines, chemistry and physics, have a robust record of producing reliable research that can be safely utilised as the basis for developing engineering practice. Education’s situation is less happy in this respect.

Those of us who hail from the educational psychology tradition hold the strong opinion that there is a great deal of very useful basic and applied research that offers practitioners important guides to professional decision-making and activities. This belief has informed the search for ‘what works’ in education and the production of some extremely useful guides, such as those published by the National Research Council (2000). There is still a great deal to learn, however.

Dehn’s book is a scrupulously-researched compendium of what works (and why) in the area of the relationship between working memory and academic learning or its absence. As such it is a gold mine of useful and interesting information for anyone who works with children experiencing academic difficulties, including specific learning disabilities involving oral language, reading and mathematics.
The book presents a good summary of current models of working memory and its relationship to other cognitive systems, including long term memory. It also provides a good coverage of controversies in the field of diagnosing and treating learning disability. Until recently, diagnosis depended on a discrepancy between full scale scores on IQ tests, for example the various Wechsler instruments, and academic attainment. Recent alterations to the Wechsler (WISC-IV) to include more measures of working memory and processing speed have resulted in the full scale scores of children with learning disabilities being ‘dragged down’, often removing the diagnostic discrepancy necessary to access to learning disability services. That model has since been replaced and the role played by working memory impairment in learning disability is now widely accepted, however, as Dehn notes, many practitioners do not see a place in educational plans for treatment for these impairments, given that these are wisely regarded as due to irremediable processing deficits. Given the weight of empirical evidence, however, Dehn mounts a strong case for the inclusion of such strategies in education plans.

With this in mind practitioners will find the chapters on strategies to assess working memory very useful, particularly the chapter devoted to an up-to-date evaluation of standardized tests. Given the lack of a US-normed test, or test battery, to assess working memory, practitioners need knowledge of the range of tests available and the aspects of working memory they tap. Dehn provides a valuable survey of the available tests. For each of the tests and their subtests discussed, Dehn offers information on the tests’ contents; their unique features in comparison with other similar tests; the research on their validity as measures of
working memory; interpretation of scores on memory subtests, and their strengths and weaknesses as measures of working memory.

Once a battery of judiciously chosen tests has been administered the practitioner can turn to Dehn’s book for assistance in analyzing the scores obtained, using the ‘Working Memory Analysis Worksheet’, which as Dehn notes (p. 161) ‘provides consistent structure and guidelines for analyzing nearly every set of test scores’. Dehn also suggests a set of pairwise comparisons of short-term and working memory components and of memory components and related processing scores. As someone who has, on occasions, been charged with interpreting test scores in an attempt to get to the bottom of a student’s educational difficulties, I am happy to declare this tool a God-send.

It is all very well to gather the intricate and sophisticated information on the processing deficits that afflict the learning disabled client but the next step is what practical use to make of it. As Dehn notes ‘… most psychologists believe that capacity is primarily innate’ (p. 258) with the result that remediation is thought by many to consist of improving the use of ‘what’s there’ rather than increasing it. This simple observation opens the proverbial can of worms. Undoubtedly Western psychology is prone to models and explanations that posit important explanatory variables as fixed and innate entities rather than processes that are influenced by experience and learning opportunities. Lurking in Dehn’s chapter on what is known about the relationship between working memory and academic learning are some nuggets of information that encourage a process rather than entity model of human capacity, however.
The typical school classroom is an environment that taxes the cognitive processing limits of even the ablest child. As research into the development of expertise has demonstrated, much more working memory capacity is required in the early stages of learning any task, compared to the later stages, when key components have become automatised. A child’s school career is a long series of encounters with new bodies of knowledge and skills in which he or she is a novice. In addition, the classroom itself provides a full array of ‘secondary tasks’ – for example, noise and distractions from other students, calls from the teacher to attend to her and listen to extra instructions or information - that compete for working memory space with the task at hand. It is no surprise that learning in such an environment can be inefficient, even for children advantaged by natural endowment or family environments that encourage the sort of ‘mental discipline’ called for by academic learning. It is also no surprise, then, that capacity deficits, whatever their origins, are most tellingly exposed in the context of academic learning.

A strong case can also be made that the learning required of children in schools is not ‘natural learning’ but highly artificial. That is, it is a process of internalisation of cultural tools and products, in the Vygotskyian sense (Rogoff, 2003), for which there are no innate structures or processes that smooth their acquisition, as there are for ‘hard-wired’ human basics, such as language acquisition. Instead, success at academic learning involves the development a range of key strategies and skills.

Although academic learning requires the development of a range of cognitive strategies these are by and large never explicitly taught but left to develop in an
ad hoc manner. The development of inefficient or ineffective strategies can have profound long term consequences, ones that lead to the diagnosis of ‘learning disability’. In the area of reading, for example, evidence exists that inappropriate or inadequate instruction in the early stages of literacy learning results in the development of ineffective strategies that not only reduce attainment in reading but interfere with the later development or acquisition of more effective strategies (McGuinness, 2004).

Research reported by McGuinness on reading deficits and their remediation, especially proposed difficulties with ‘phonemic awareness’, strongly suggest that these are not necessarily the result of processing problems but of insufficient training on what to listen for or how hard to listen. Properly targeted interventions can and do result in measurable improvement. As McGuinness states: “Research has failed to demonstrate that there is anything wrong with poor readers’ speech perception, certainly nothing that can’t be fixed with a little training’ (2005, p. 236). We are beholden to treat all proposed cognitive deficits in a similar fashion, rather than dismiss any child as ‘incurable’.

On the above grounds, Dehn’s contention that intervention can not only result in children with learning disabilities being able to make better use of their existing capacities but to increase these as well is well-supported. Dehn is able to offer the practitioner a good summary of ‘what works’ that has a considerable evidence base supporting it. He is also particularly insistent on the necessity for early intervention on the grounds that maturation in relevant brain regions makes later remediation more difficult and less likely to be successful. Another, cultural skills-based, explanation arising from research on reading strategies and in the
Vygostkyian tradition cited above, might be that the longer a strategy is employed the more entrenched it becomes and the more it interferes with the acquisition of more effective strategies, even where these are explicitly taught and deliberately practiced.

While Dehn's scholarship is by and large scrupulous one omission from the book is reference to the considerable body of research arising from cognitive load theory (Sweller, 1988), although this may be because the work is not specifically clinical in its focus. Sweller and his colleagues have explored the effects of working memory 'load' on learning and the results have included many findings of great practical utility for instruction. Probably of most significance has been the application by Sweller and his colleagues (Kirschner, Sweller and Clark, 2006) of cognitive load theory to settle the question of whether it is more educationally sound for students to 'construct' their own learning via various techniques such as problem-based or discovery learning, or for teachers to use more explicit instructional techniques. Cognitive load theory suggests that the load imposed on novice learners' working memory by having to learn novel problems solving and information search strategies at the same time as applying these to acquiring new knowledge ensures that little of the new information is transferred to long term memory, that is, learned. It is certainly an extreme case of allowing key skills to develop 'by accident' rather deliberately and mindfully.

While Dehn’s book contains plenty of practical utility to practitioners, it also unintentionally provides evidence for the contention that psychology does not yet provide the infallible underpinnings for educational practice that chemistry and physics provide for engineering. To a very great extent we still do not really know
what is occurring in children’s heads as they encounter the demands and complexities of the average classroom. A great deal of extremely important learning, for example the development of the sorts of cognitive strategies that underpin competent academic performance, proceeds largely unobserved and ‘by accident’. Mostly this all turns out reasonably well but for a substantial number of children it does not. This may be particularly so for those children whose families have not been able to provide them with an adequate apprenticeship in ‘school thinking’ before they arrive in their first classroom.

Classroom practice will remain more art than science until we truly understand what school learning entails and have techniques at our disposal that are aimed at explicitly teaching those skills that are presently ‘flying under the radar’ and being learned, or not, unobserved by teachers or other specialists. When that day dawns we will undoubtedly find ourselves in the blessed situation of being able ensure the greatest learning for the greatest number.

References


