Making 'working memory' work in the classroom

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What is 'working memory'?

Psychologists use the term 'working memory' to refer to the ability we have to hold and manipulate information in the mind over short periods of time. Working memory is important because it provides a mental workspace in which we can hold information whilst mentally engaged in other relevant activities. The capacity to do this is crucial to many learning activities in the classroom. Children often have to hold information in mind whilst engaged in an effortful activity. The information to be remembered may, for example, be the sentence that they intend to write while trying to spell the individual words. It could also be the list of instructions given by the teacher while carrying out individual steps in the task.

Children with small working memory capacities will struggle in these activities, simply because they are unable to hold in mind sufficient information to allow them to complete the task. Losing crucial information from working memory will cause them to forget many things: instructions they are attempting to follow, the details of what they are doing, where they have got to in a complicated task, and so on. It is suggested that because low working memory children often fail to meet working memory demands of individual learning episodes, the incremental process of acquiring skill and knowledge over the school years is disrupted.

What can be done to minimise the learning difficulties resulting from working memory impairments? While the ideal solution would be to remediate these memory impairments directly, there is little evidence that training working memory in children with low working memory skills leads to substantial gains in academic attainments. Thus, our favoured approach is to use effective classroom management to minimise memory-related failures in

classroom-based learning activities. Here are some examples of useful strategies between teacher and child using the working memory intervention for young children.

Example 1

In class, Nathan often struggled with keep up with classroom activities. For example, when the teacher wrote on the board Monday 11th November and, underneath, The Market, which was the title of the piece of work, he lost his place in the laborious attempt to copy the words down letter by letter, writing *moNemarket.* It appeared that he had begun to write the date, forgot what he was doing and began writing the title instead.

Place-keeping errors such as repeating and/or skipping letters and words during sentence writing, or missing out large chunks of a task are common features of working memory overload. The first step for the teacher is to recognise this error as a working memory failure. The next step is to evaluate the working demands of learning activities. In particular, activities such as keeping track of the place reached in the course of multi-level tasks (e.g., writing a sentence down either from memory or from the white board) impose heavy storage demands on working memory.

An effective strategy for the teacher to use in order to avoid working memory-related failures is to reduce working memory loads in structured activities. This can be achieved in a number of ways, including breaking down tasks and instructions into smaller components. Specifically, it would be useful to write the instructions in different coloured ink in order to create a visual cue for the child to keep track of their place. This way, the child can see that the red ink represents the day of the week and the blue ink represents the activity title. By

using visual cues to support working memory, the child has external supports to help him/her achieve success in these individual learning activities.

Example 2

An activity in Jay's class involved the teacher writing number sequences on the white board with some numbers missing. She counted the numbers aloud and asked the class what numbers she had missed out. In each case, there was more than one number missing (e.g., 0, 1, 2, 4, 5, 7, 8). In this activity, the child has to use his/her number knowledge to identify each missing number, and store them. On all occasions, Jay was unable to identify the missing numbers.

This is an example of an activity that imposes heavy storage demands involving the retention of significant amounts of verbal material with a relatively arbitrary content. The first step for the teacher is to monitor the child's working memory regularly in the course of such demanding activities. This includes looking for warning signs of memory overload such as incomplete recall and task abandonment. As children are often aware of when they forget information, the teacher should also ask the child directly for details of what s/he is doing and intends to do next.

In order to reduce the storage loads of such activities, the teacher can employ two strategies. The first which is in line with good teaching practice when working with children with working memory deficits is to regularly repeat information that is crucial to ongoing activities. A second approach is to use a variety of tools that support memory that are in common use in classrooms. For this particular activity, the use of a number line will reduce the storage load of the task and so help the child keep their place in a sequence of number. It

is important to note, however, that children with working memory deficits are often unwilling to use such tools spontaneously, possibly because of the initial cost of mastering the new skill. It is therefore recommended that the teacher provide the child with an opportunity to practice the use of memory aids in situations with minimal working memory demands in order to establish mastery of the basic skill, before their use in more complex activities with higher working memory loads.

Example 3

On one occasion, the teacher gave the following instruction to John: “Put your sheets on the green table, put your arrow cards in the packet, put your pencil away and come and sit on the carpet”. John failed to put his sheet on the green table. The teacher asked John if he could remember where he was supposed to put it; he couldn’t, and needed reminding.

First, it is important for the teacher to ensure that the child can remember what he or she is doing. On many occasions, children with low working memory simply forget what they had to do next, leading to failure to complete many learning activities. Children’s memory for instructions will be improved by using the instructions that are as brief and simple as possible. Instructions should be broken down into individual steps where possible. One effective strategy for improving the child’s memory for the task is frequent repetition of instructions. For tasks that take place over an extended period of time, reminding the child of crucial information for that particular phase of the task rather than repetition of the original instruction is likely to be most useful. Finally, one of the best ways to ensure that the child has not forgotten crucial information is to ask them to repeat it back. Our observations indicate that the children themselves have good insight into their working memory failures.

A general recommendation for improving the learning successes of children with poor working memory skills is to develop in the children effective strategies for coping with situations in which they experience working memory failures. Strategies may include encouraging the child to ask for forgotten information where necessary, training in the use of memory aids, and encouragement to continue with complex tasks rather than abandoning them even if some of the steps are not completed due to memory failure. Arming the child with such self-help strategies will promote their development as independent learners able to identify and support their own learning needs.

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