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Cognitive architecture and the learning of language knowledge

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ABSTRACT

In a recent study of trends in language teaching pedagogy, I identified a major professional dichotomy regarding preferred approaches to the teaching of 'language knowledge'. In general, it was shown that the theoretical discourse of language teaching favoured a 'communicating-to-learn' approach in the matter (e.g., task-based learning), whereas the practitioner 'world' leaned more towards a 'learning-to-communicate' approach (e.g., Presentation–Practice–Production). The purpose of this paper is to build on these findings by attempting to determine to what extent either of these pedagogic stances can be justified. In doing so, recent research and theorising on the workings of memory in relation to the learning of factual information is reviewed. On the basis of the characteristics of cognitive architecture that this literature describes, it is taken to indicate that i), long-term memorisation of knowledge is the key to skilled performance, and ii), guided or 'direct' instruction is superior to problem-solving or discovery-oriented forms of pedagogy in facilitating the long-term learning of factual information. Following this, the implications of these findings for language teaching pedagogy are discussed. In particular, they are seen to provide a rationale for current professional perspectives concerning the teaching of language knowledge to be re-conceptualised.

The teaching of language knowledge[1] is obviously one of the most important aspects of language teaching pedagogy. However, in a study of trends in language teaching methodology of the last 20 years or so (Waters, 2012), I identified a fundamental dichotomy with respect to this area: in general, the language teaching 'professional discourse' (i.e., the 'voice' of most leading theoreticians) was found to favour a 'communicating-to-learn' approach in the matter (in which learners solve communicative problems in order to acquire language knowledge, as in, e.g., 'task-based learning'), whereas most language teaching practitioners were seen to prefer a 'learning-to-communicate'-oriented approach (in which learners focus primarily on acquiring language knowledge via a series of graded exercises, which may or may not be followed by communication work, as in, e.g., 'Presentation–Practice–Production').

In the article in question the evidence for the existence of this division was described, but there was insufficient scope to also address the important related issue of which – if either – of the two approaches can, in reality, be regarded as efficacious. Such a concern is therefore the purpose of this paper. In other words, it asks if the views which lend support to a 'communicating-to-learn' approach do or do not really hold water, on the one hand, and whether there is or is not more than meets the

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[1] 'Language knowledge' in this context means 'language input' in the form of vocabulary, grammar, and so on, as well as information about such language (e.g., explanations of grammatical rules).

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eye to the 'learning-to-communicate' approach on the other. To this end, the remainder of this paper attempts to build on and extend existing work in this area (see, e.g., Swan, 2005; Johnson, 1996; Littlewood, 1992) by drawing on recent research and theorising concerning the role of memory in the learning of factual information – a literature which, so far, does not seem to have received the attention it deserves within language teaching circles – and then goes on to consider the related pedagogical implications. A major part of the ensuing argument is that the body of work reviewed points to the need for a reprioritising and better integration of theoretical perspectives about the teaching of language knowledge, in order to attempt to resolve the deep – and potentially damaging – division of views currently at the heart of this area of language teaching pedagogy.

1. Memorisation of factual information

Firstly, thus, what are the main overall 'messages' in the literature just referred to, i.e., in recent studies concerning the workings of memory in relation to the retention of factual information? There appear to be two main aspects to the matter. These are to do with, firstly, the importance for skilled performance of the long-term memorisation of knowledge, and, secondly, the way in which memory conditions operate in the process of learning such information. Each of these facets is therefore dealt with in turn in what follows.

1.1. The importance of long-term memorisation for skilled performance

Various types of memory exist, of course, but here we are concerned with only 'working' or 'short-term' memory, on the one hand, and long-term memory on the other. As is well-known (see, e.g., Stevick, 1996), short-term memory acts as a kind of mental 'scratch-pad', enabling us to remember particular items of information for a relatively brief period of time before they are 'overwritten' or forgotten. As such, the chief characteristic of short-term memory is its limited storage capacity. In a well-known paper, Miller (1956) estimated this to be around seven items of information at any one time. However, as Sweller, van Merrienboer, and Paas (1998: p. 252) point out, the storage capacity of short-term memory is even more limited when (as is usually the case) information processing is also involved. This is because space is also needed within short-term memory for the processing operations, thus making less of it available for retention of items of information. As a result, as Sweller et al. (1998) go on to say:

> All conscious cognitive activity learners engage in occurs in a structure whose limitations seem to preclude all but the most basic processes. Anything beyond the simplest cognitive activities appear to overwhelm working memory. (pp. 252–3).

It is therefore obvious that for learning to occur, apart from the kind which involves only 'the most basic processes', other forms of cognitive activity have to also be involved. The role of long-term memory is crucial in this respect, since information stored in this way can be accessed without time restrictions, thereby obviating the temporal restrictions of short-term memory (Kirschner, Sweller, & Clark, 2006: p. 77).

Thus, long-term memorisation of factual information is vital in order to overcome the limits of short-term memory. But the importance of long-term memory for learning is not simply because it acts as a large-scale repository for the accumulation of items of knowledge. Rather, it is the effects on learning and performance of the build-up of information of this kind which is equally or more important.

Firstly, information stored in long-term memory operates in a manner akin to the 'Matthew effect' (Merton, 1968), whereby pre-existing 'capital' is the primary factor in the potential for further capital to be acquired. In other words, because of the well-established principle that the key to learning new information is for connections to be formed between it and existing knowledge, the greater the amount of pre-existing information stored in long-term memory, the greater the potential for additional knowledge to be acquired (Hutchinson & Waters, 1987: pp. 49–51). Secondly, when knowledge acquired in this manner accumulates in sufficient quantities, there is evidence that it provides the primary basis for skilled performance.

This effect of the large-scale accumulation of factual information in long-term memory is demonstrated very tellingly in research reported in Sweller et al. (1998: pp. 253–5; cf. Kirschner et al., 2006: pp. 76–77), involving expert versus less-expert chess players. When the two kinds of players were shown real-life chess board configurations for a period of a few seconds, the experts could subsequently reproduce the layout of most of the pieces, whereas the less expert players were able to replicate far fewer of them. These results were not due to differences in individuals' short-term memory capabilities, since, when both groups of subjects were also shown randomly-configured chess boards, neither performed better than the other. Rather, these findings were therefore taken to indicate that the main factor involved in the different performances was the very large number of chess-board configurations which the experts had learned during their many years of playing chess. Because their long-term memories contained thousands of examples of real-life games, such players were already familiar with the configurations of this kind that they were exposed to in the research, and could therefore easily recall them from memory. However, by the same token, they were unable to process randomly-configured boards in a similar way, because of their lack of familiarity with them, thus accounting for the lack of difference between the performance of the two groups when exposed to such layouts.

As Sweller et al. (1998: p. 254) also explain, this means that expert players can use their long-term memory of multiple chess-board configurations to determine appropriate board moves, rather than having to rely on short-term memory for this