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Developing Automatic Recall of Basic Skills in Mathematics

In "A Case for Automatic Recall", forthcoming in *The International Journal of Science, Mathematics and Technology Learning*, I describe the need for the learning of basic skills in mathematics in terms of research results from cognitive and developmental psychology. In this presentation, I will describe some psychological principles governing the structure of the type of practice required to develop automatic recall in the manner required to enable the learner to consistently apply correct rules when engaged in problem-solving activities. The sources for the applicable research results have not illustrated applications of their results in the learning of mathematics, but rather, in the context of attaining levels of expert performance in sports, and more recently, in financial management under conditions of exigency and music, for example. A cogent point to be made here is that in mathematics, the level of complexity of the integration of component skills exceeds that generally required in athleticism, even at an expert level, because the number of component skills is much larger. This aspect in the learning of mathematics also complicates the design of appropriate practice because of the intertwining of component skills as more advanced topics are introduced. In my presentation, I will specifically demonstrate this point for order of operations, beginning with primary level addition and subtraction of whole numbers, through elementary level arithmetic of numeric fractions, junior high level arithmetic incorporating negative numbers and exponents, and finally, senior high algebra with variables and functional expressions incorporating trigonometry and logarithms.