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Procedural and conceptual knowledge of expert and novice students for the solving of a basic problem in chemistry

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Abstract

Procedural and conceptual knowledge for solving a basic quantitative problem in chemistry by expert and novice secondary school students is reported. Experts use a known qualitative procedure with a working forwards strategy to obtain a numerical solution. Novices attempt a means-ends analysis strategy which is often unsuccessful, so switch to a simple formula-driven working forwards strategy to obtain a numerical solution, the qualitative procedure being either omitted or only partially formed. A gradual shift in strategies and representations used as expertise increases was observed. Differences with findings for problem solving in physics were also found. Experts' conceptual knowledge is accurate and linked to underlying procedural knowledge, whereas novices have misconceptions and a poor understanding of formulae. Conceptual understanding, use of a qualitative procedure, and the type of strategy used, are major differences between experts and novices. Instructional techniques are suggested in these areas to enhance problem solving and teaching.



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