Reviewer's report

Title: Using a conceptual framework during learning attenuates the loss of expert-type knowledge structure.

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Reviewer: William D Wattenmaker

Reviewer's report:

General
This study was designed to determine if there is a relationship between the use of diagnostic, conceptually-based frameworks during learning and the type of knowledge structures that exist a year later. The authors compared medical students who used a diagnostic, conceptually-based scheme while learning a specific clinical domain, with medical students who used a non-diagnostic approach during learning. The medical students were studied a year after initial learning to determine if there was a difference in the knowledge structures that the two group of students developed about the initial clinical domain. The results indicated that the medical students who used a diagnostic, conceptually-based framework during learning were more likely to exhibit expert-type knowledge structures than those who used a non-diagnostic approach. The authors conclude that students who developed diagnostic, conceptually-based schemes during instruction are more likely to exhibit expert-type knowledge structures even a year after the initial clinical domain was learned.

There are many positive aspects to this study. The attempt to discover cognitive strategies that will facilitate learning, memory, and the development of expert knowledge structures in medical students is clearly important. This study suggests that the use of diagnostic schemes or frameworks during learning might be a valuable strategy to use in medical education. Another interesting aspect of this study was that the authors examined the type of knowledge that the students maintained a year after the initial problem domain was learned, with no further formal instruction occurring during this year. The long lasting advantage of using diagnostic schemes that was observed is an interesting and potentially significant result. In summary, on the positive side, the authors are examining an important topic, and they found potentially interesting results of great relevance to medical education and to learning in general. On the negative side, there are a number of concerns related to the description of the experiment, the methodology that was used, the design of the experiment, and the interpretation of the results. Some of these concerns are listed below.

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Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)

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Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

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Discretionary Revisions (which the author can choose to ignore)
A. One of the major problems was that the use of a diagnostic or non-diagnostic framework during learning was a strategy that was self-selected by the students. The students were not randomly assigned to “diagnostic” or “non-diagnostic” conditions but instead spontaneously adopted these strategies on their own. This leads to the possibility that the greater frequency of expert knowledge in the diagnostic group over time reflects individual differences in cognitive functioning rather than an influence of the diagnostic scheme that was employed during learning. This would be an interesting finding, but it is not the question that the authors are attempting to answer. An additional study is needed to answer this question conclusively.

B. The authors need to provide more details and examples of the sorting task that was used. They should provide details such as instructions and specific examples of patterns of sorting behavior that would or would not constitute expert sorts. It seems there is also a lot more information (e.g., the average number of categories formed) that could be observed from the sorting task, but that was not presented.

C. The distinction between “novice” and “expert” sorts in the experiment was not very sharp. For example, if a student shared two of four concepts with experts, then they were labeled as “expert” sorts, but if they shared one of four concepts with experts, they were labeled as “novice” sorts. This seems like a small difference to use as a basis for such a significant classification.

D. A sorting strategy that the authors should consider using in a subsequent study is one in which participants are required to form a specific number of categories with a specific number of examples or diagnoses in each category. The researchers could select the 20 examples/diagnoses so that they fit clearly into a specific number of categories with a specific number of examples belonging to each of the categories (based on expert sorts of the same information). This more constrained type of sorting task would provide much more specific and detailed information, and provide for much clearer differentiation between expert and novice sorts.

E. The original learning task had 81 students but only 34 of these 81 students were examined a year later. Why was the number of students who were re-examined so small? The results would be more convincing if a greater number of students participated in both the original learning phase and the subsequent sorting task, and if overall, the number of students in the second phase of the experiment was greater.

F. Some of the statistical differences were not particularly strong, although I think this has to do with the small number of subjects in the second phase of the experiment.

G. As used in the present manuscript, is a diagnostic framework the same as expert knowledge structures? Is it possible for students to use the diagnostic framework as defined in the manuscript but not have expert knowledge structures?
H. Examples of “expert” vs. “novice” sorts or “deep” vs. “surface” knowledge would improve clarity.

I. The authors argue that the development of expertise is based upon the formation of higher order concepts. Although this is true, doesn’t the development of expertise also involve learning a lot of specific information that is needed to differentiate specific diagnoses?

In summary, the main result of this study is potentially very interesting: the use of conceptual structures and diagnostic schemes during learning increases the likelihood that medical students will exhibit expert knowledge structures even a year after learning has occurred. Although the problems detailed above limit the confidence we can have in the results of this particular study, a case can be made for publishing these interesting and potentially important results in the hope that the experiment will inspire further research on this topic that will provide more definitive results.

What next?: Accept after discretionary revisions

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable

Statistical review: No

Declaration of competing interests:

I declare that I have no competing interests