A student who repeatedly gives up e-clinical reasoning exercises at the first mistake, or tries to skip post-patient encounter discussions, certainly needs a closer look …

We thought that the review by Richmond et al offered good insights into teaching of clinical reasoning.[1] As Richmond et al acknowledge, however, they were forced to build their conclusions combining incomplete empirical evidence, theories of learning and inferences from the reviewed studies because students' characteristics varied amongst experiments and consistent outcomes were not always explicitly measured.[1] We look forward to seeing further assessment of some of their reasonable assumptions in future experimental and/or observational studies.

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A plea for contrastive instructions

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'Hatala and colleagues claimed: 'to many, the design of medical curricula appears the reverse of common sense,'[1] with reference to an education that starts with the basic sciences and only at the very end presents students with signs and symptoms of actual patients. Indeed, students 'may well discover that their knowledge is organised inadequately'[1] if they are confronted with a patient with ventricular tachycardia only late in their education and then have to use knowledge acquired long ago in such distant disciplines as physiology, clinical chemistry, pharmacology and internal medicine. Instead, the reverse order - starting from real patient problems and working out the necessary basics from there, so-called problem-based learning - would seem to better result in a medical curriculum informed by common sense.

We have learned time and time again in education, however, that common sense is insufficient. In the interest of reducing cognitive load, it would seem advisable to learn about heart conditions by fully immersing oneself in the systematic study of characteristic features (including causes, pathomechanisms and therapies) of a particular disease, and mastering it, before moving onto the next one. Indeed, this seems to be the most common approach, as textbooks and lessons are routinely organised by the features of individual conditions. Less frequent is the strategy of learning disease categories primarily by working out the differences between similar looking conditions. Thankfully, Thach et al questioned common sense here.[2] They investigated the effectiveness of training based on characteristic features versus training based on discriminating features. In their randomised crossover study, they compared the effectiveness of worked examples, highlighting salient features of cardiac dysrhythmias compared to discriminating features.[2] Of note, the authors further compared both instructional formats to historical controls.[3] Students in the control groups either learned from expert-generated schemas or from a table listing features of dysrhythmias (the type of table you would encounter in many medical textbooks). In immediate post-training assessments, students' diagnostic accuracy was worst when they had studied with traditional tables (29% correct), better when instruction was based on expert schemas (40%) and best when studying with worked examples (56% for salient and 60% for discriminating features). In sum, all of the instructional formats investigated outperformed the traditionally used table of disease characteristics - Why?

In the interest of reducing cognitive load, it would seem advisable to learn about heart conditions by fully immersing oneself in the systematic study of characteristic features ... of a particular disease, and mastering it, before moving onto the next one

We would suggest that, with the exception of table-based instruction, all other formats actually focus learners on the discriminating features of dysrhythmias; they just do so to varying degrees. Although the table used exhaustively characterises all taught dysrhythmias along nine different variables, both the expert-generated schemas and the (expert-derived) salient features reduce this complexity substantially (down to five variables in the schema and only three salient features). The three salient features, however, constitute the majority of information in the schema and are the exact same as the features used to distinguish between dysrhythmias in the worked examples based on discriminating features. The additional information in the latter condition is that different diagnoses are contrasted directly, a task left to the student in the other formats. Apparently, the features experts deem salient for a given diagnosis are those that help them most to distinguish the diagnosis from possible differential diagnoses Admittedly, this conclusion relies on the examples given in a pair of publications,[2,3] but we expect this phenomenon to occur quite regularly in training materials and think it plausibly explains why so little difference was seen between training materials built on salient and those built on discriminating features in the study by Thach and colleagues.[2]

Apparently, the features experts deem salient for a given diagnosis are those that help them most to distinguish the diagnosis from possible differential diagnoses

Their proposition that an instructional focus on discriminating features should be preferred over disease-oriented formats aligns well with the literature. For example, Hatala and colleagues demonstrated that students contrasting electrocardiograms (ECGs) from different diagnostic categories during learning achieved a 50% higher diagnostic accuracy in subsequent testing than those seeing ECGs ordered by category.[1] Further evidence for the importance of discriminating features in diagnostic tasks comes from the following research: Mamede and colleagues demonstrated that residents can be biased towards a diagnosis by recent exposure to either a similar looking case,[4]and Schmidt and colleagues demonstrated that residents can be biased towards a diagnosis by exposure to Wikipedia information on a disease that is phenomenologically similar to the to-be-diagnosed disease.[5] Mamede et al further demonstrated that physicians can be 'immunised' against such bias by contrasting possible differential diagnoses with similar looking diseases prior to exposure to a biased vignette.[6] If you only master hepatitis, apparently every case of jaundice looks like hepatitis However, to correctly categorise (or diagnose) most cases of jaundice, one would need to know how to distinguish hepatitis from other, similar looking, diseases.

If you only master hepatitis, apparently every case of jaundice looks like hepatitis

The critical question, then, becomes why are so many teaching units and textbooks organised by disease rather than offering a juxtaposition of different causes of similar presentations? One potential cause may be that teachers mistake performance during training for actual learning, although many studies find a disconnect or even reverse relationship between the two.[7] Indeed, the study contrasting table-organised disease presentation versus schema-based ECG training (discussed earlier) found no differences in performance during learning, but a substantial difference in subsequent testing.[3] If the structure of our teaching is informed predominantly by the performance gains we concurrently observe, we are likely to choose methods with short-term effects at the expense of actual learning - yet another example where 'common sense' can fool us.

> *... why are so many teaching units and textbooks organised by disease rather than offering a juxtaposition of different causes of similar presentations?*

In summary, although common sense may be a reliable advisor on some educational issues, it misleads us on others. This is the very justification for the field of medical education research, and the study by Thach et al[2] is a prime example of the value of empirical research that helps to overcome our mislaid intuitions with imminent implications for educational practice. Let's move from disease-oriented training towards contrasting diseases with similar presenting complaints.

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How to conceptualise self-regulated learning: Implications for measurement

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Self-regulated, lifelong learning is considered a key competence in the health professions and, obviously, fostering development of self-regulated learning (SRL) skills is high on the agenda in health professions education worldwide. Monitoring and providing students with meaningful feedback on their SRL development as well as assessing whether our graduates are actually well prepared for lifelong learning calls for appropriate measures that provide valid indicators of SRL behaviours.