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Reflecting on multimedia design principles in medical education

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Issa *et al.*[1] have shown that multimedia design principles, when applied to the preparation of lecture slides, can afford enhanced knowledge retention in medical learners. In doing so, they ground their ideas in the work of Richard Mayer[2] (a co-author of this paper[1]) and colleagues,[3] who, in turn, developed their work from cognitive load theory (developed by Sweller[3] and others[3]). Mayer's seven basic and nine advanced principles of multimedia learning cover a range of issues around the appropriate use of text, still and moving images, and audio material for instructional purposes.[2] Examples from the redesigned slide deck described by Issa *et al.*[1] show some of the changes that were made and how they relate to different principles. It is hoped that these techniques, supported by a well-established body of research, can be more fully applied within medical education.

Multimedia design principles, when applied to the preparation of lecture slides, can afford enhanced knowledge retention in medical learners

However, it would be useful to enquire more about the primary intervention: was it, as the paper[1] emphasises, the administration of the redesigned slide deck or was it the process of redesign? Multimedia design principles are intrinsically about 'design' and yet the design aspects of the intervention are regularly downplayed in research papers. Establishing a causal relationship between the redesign of an educational tool and its effectiveness in use is quite understandable, but it is interesting to observe that the description given by Issa *et al.*[1] of the multimedia principles and the pre- and post-tests administered occupy rather more space than the description of how the redesign was undertaken. This is not intended as a particular criticism of Issa *et al.*'s work,[1] but, rather, a more general call to researchers to discuss their interventions more fully and what their development or preparation involved. For instance, it would be interesting to know what the easy and difficult design decisions were for Issa *et al.*[1] and whether the redesign was conducted on a per slide basis or whether it included changing the sequencing and numbers of slides involved. It would also be useful to know how much effort was involved in the redevelopment, how long it took, who did it and how much and what forms of validation were required to ensure the principles had been followed appropriately. Follow-up studies by Issa *et al.*[1] (or other authors) might therefore focus more on the process and experience of design than on the subsequent application.

Was the primary intervention the administration of the redesigned slide deck or was it the process of redesign?

The idea of cognitive load is based on minimizing the effort required for learning. The abiding popularity of the lecture format can perhaps be explained in similar terms. Lectures demand relatively little effort of learners other than to attend, watch and listen, take notes and perhaps ask questions. The pooling of notes among learners can further reduce the effort

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doi: 10.1111/j.1365-2923.2011.04064.x

required in the room. The work conducted by Issa *et al.*[1] may therefore be providing ways to make an already lean but reasonably effective educational activity yet more efficient for learners. Compare this, for instance, with problem-based learning (PBL), which generally requires more effort from learners (although possibly less from the tutor), and simulation-based learning, which is particularly labour-intensive for everyone involved. The differences among these modalities do not just refer to effort; they are intended to support quite different cognitive models. Very broadly, lecturing is used for knowledge transfer, PBL for problem solving, and simulation for rehearsing practical skills and behaviours. Comparator learning activities for lectures should therefore address similar objectives. For example, designing multimedia instructional materials as lecture alternatives in which both instructor and content are reified in software or in print involves significantly more effort than lecturing, at least in terms of creating the materials.[4] The effort invested in preparing educational materials therefore depends on (among other factors) how much these materials require educational activities to be constructed around them (such as a slide deck's requirement that it be delivered live or as a recording) and how much they can support autonomous learning activities (such as in individual, computer-based learning). The video capture of lectures (which would theoretically preserve the benefits of optimised slide design) adds the convenience of on-demand access, but it perhaps loses the sense of participation and immersion that come from a live lecture performance. The impact of a lecturer's performance, although controlled for in this study,[1] is another area that would benefit from additional research.

The effort invested in preparing educational materials depends on how much they require educational activities to be constructed around them

More than four decades have elapsed since computers were first used in medical education,[5] yet it would seem sometimes that we have done little more than alter the medium through which lectures are delivered. However, although the appropriate juxtaposition of text and images for instructional purposes have been considered by others,[6] the empirical development of multimedia design principles, which have largely flowed from the use of computers in education, can inform much more than the design of slides. The impact of educational technologies has therefore been as much (if not more) about reflecting on general educational issues as it is about the economic advantages and convenience of using digital media.

The empirical development of multimedia design principles can inform much more than the design of slides

It is Mayer's assertion that education should be based on evidence and grounded in theory.[2] Issa *et al.*[1] have shown that multimedia design principles can contribute to the design of lecture materials that can, in turn, afford improved learning outcomes. Having established the relevance of these principles to medical education, more work is now needed to unpack and understand what lecturers should do, both in preparing and presenting slide decks using these principles. To what extent these principles can also be applied to the design of other educational media, such as examination papers, textbooks and virtual worlds, also warrants further exploration. Given that lecturing has become largely synonymous with delivering a PowerPoint presentation, it is hoped that academic conferences will also be improved by following these guidelines and that scholarship in medical education as a whole will be the better for it.

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