Although the authors address a number of topics that have relevance for medical education, the story line is missing - topics are presented more or less as encyclopedic bullet points while each topic in itself could fill a review – and vital elements and key references are missing in various parts. I would advise Major Compulsory Revisions and motivate that advise in the following.

A clear central question or couple of central questions seems missing. The authors have used a number of useful keywords in their search, but these keywords are still very broad and it is unclear which questions and criteria have resulted in these 51 articles and why not other articles or book chapters appeared as well. In other words, the methods section – one small paragraph – is not any clearer than the central question(s) addressed in the manuscript.

Cognitive load theory forms an important topic in the manuscript. While the 51 articles selected do include some key research and review papers from well-known researchers, a number of important key references are missing. Because the search method is not described well, the reader cannot come to understand whether these references were not selected for a reason or whether these references simply did not show up in the search due to a lack of appropriate keywords.

The authors present intrinsic and extraneous cognitive load in a way that is hardly (if at all) understandable to people who are not familiar with this theory. Further, decreasing cognitive load in learning materials is presented as a solution; it is of course much more elaborate than this. Some intrinsic load may be very desirable, because otherwise learners will not learn anything new and all load they invest in studying the material may be extraneous. Finally, the authors forgot to include one type of cognitive load in their review: germane cognitive load. Although the status of this type of load in the literature is somewhat ambiguous, not mentioning this perhaps crucial type of cognitive load at all is unfortunate.

The debate about whether we should see germane cognitive load as third additive type of load or as subtype of intrinsic cognitive load has been studied especially in the past ten years from a measurement point of view. For a review of validation research on measurements for overall cognitive load as well as for different types of cognitive load as well as a review of the current state of affairs with regard to germane cognitive load, the authors might want to have a look at:


The Learning and Instruction paper is a follow-up on the Behavior Research Methods paper, but both papers provide numerous references to papers on key topics that deserve more detailed and structured attention in a review attempted by the authors: split attention effect, worked examples effect, problem completion effect, expertise reversal effect, scaffolding. Taken both papers together, the authors agree with a recent reconceptualization of germane cognitive load as germane resources for dealing with intrinsic cognitive load as suggested by Sweller (2010), Kalyuga (2011), and in a book by Sweller, Ayres, and Kalyuga (2011).

The need to better define search criteria for problem-based learning seems as evident as that need in the context of cognitive load theory. There is a boom of literature, including some extensive reviews, on problem-based learning in medical education, and it is unclear for what reasons the papers used now by the authors were included in the review and not other papers.

Level of interest: An article of importance in its field

Quality of written English: Needs some language corrections before being published

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests: I declare that I have no competing interests