



Human-Computer Interaction Institute
School of Computer Science
Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh, Pennsylvania 15213-3890 USA
Fax: (412) 268-1266

December 5, 2017

To Cyril Brom's Habilitation Thesis Committee,

I have read Cyril Brom's Habilitation Thesis ("Learning with Digital Technologies: the Role of Positive Affect and Motivation"), and this letter provides my review of his work. Let me start by saying that I believe Dr. Brom's work merits a full passing grade. I will start my review by stating my reasons for this positive assessment.

First, I am impressed with the number and breadth of educational technology studies that Dr. Brom and his colleagues have conducted and published. The reported experiments in Tables 7 and 8 (pages 28 and 29) cover a wide range of target areas, including personalized feedback, games, and gamification. The results add to the important body of scientific knowledge about learning with technology. The publications are also presented in strong venues, reputable peer-reviewed journals (e.g., *Computers & Education*, the *International Journal of Computer-Supported Collaborative Learning*).

Second, the summary of Brom's body of work – his research agenda and its main results – is excellent. Figure 1 is a clear and succinct summary of the agenda. Across the range of articles included in the habilitation thesis, Dr. Brom generalizes and connects his various studies through two key research questions that are at the heart of the work.

Third, the work of the thesis is framed and supported by learning theory, which is carefully and thoroughly described by Dr. Brom. The Cognitive-Affective Theory of Learning from Media (CATLM) provides the framework for Brom's research. This theory is well established and widely recognized, as specified primarily by Richard E. Mayer and Roxana Moreno and has close connections to cognitive load theory (specified by Sweller, Paas, Van Merriënboer, Van Gog, & others). Brom does an excellent job of describing and referencing this theory.

Finally, Dr. Brom writes with lucidity and depth that is unusual for scientific papers. His writing contains just the right amount of technical detail, while at the same time being clear and imminently readable. A very strong aspect of the thesis is that Brom is clear up front about the objectives of the thesis, the unit of analysis, the expected outcomes, the context of learning, and the measures.

Of course, the thesis is not without flaws or issues that could be mentioned. In the following, I cite some of the issues that I identified. Note that many of these issues could be more properly called suggestions and should not be seen as detracting (at least not much) from the overall quality of the thesis.

First, there could be somewhat more emphasis on the findings that show that motivation doesn't always lead to learning. Dr. Brom admits of this finding in the thesis, but doesn't say quite enough about it, given that his work primarily follows the model that motivation leads to engagement which leads to learning. There is some evidence, uncovered in the meta-analysis by Wouters et al (2013), that motivation does not lead to learning. A more thorough coverage of that body of work would be valuable.

Second, Dr. Brom claims that his thesis is "primarily about computerized games, simulations, and animations" (page 3). However, some of the learning technologies studied and reported on by Brom do not appear to be precisely in this category. In any case, I would have characterized the technologies Dr. Brom studies more broadly as instructional or educational technologies.

Third, I was intrigued as to why Dr. Brom focuses on positive incentives and affect. While this choice follows the theory that he subscribes to for learning, it would have been useful for his research to have focused, at least to an extent, on negative incentives and affect. I would have also liked to have seen more discussion of negative incentive and affect.

Fourth, with respect to measures, I wondered whether Dr. Brom considered using (potentially more) objective and accurate measurements of affect (e.g., machine-learned classifiers, eye tracking, etc.) in his research studies. While the surveys he has used and cites in the thesis are commonly used, there is also much debate in research about the accuracy of self-report measures such as these. Also, with respect to measurements, I would have liked to see more justification for why Brom chose the particular measures he uses for enjoyment, positive and negative affect, and flow.

Fifth, I was intrigued by the claims that some findings were not confirmed in the Czech context due to cultural and social differences between the U.S. (or English speaking countries more generally) and the Czech Republic. A study of this in the context of the politeness principle would also be very intriguing. Related to the politeness principle: Amy Ogan and colleagues have gotten some interesting results that show that politeness can actually depress learning between friends, where rudeness and bluntness might be more appreciated.

Finally, Brom could have cited some of the worked examples literature when he discusses the study in which students observe game play, rather than actually playing the game.

In closing, I would like to emphasize the quality of the work that Dr. Cyril Brom does. I highly respect his work and urge you to grant him a passing grade for his habilitation thesis.

Yours sincerely,

Dr. Bruce M. McLaren
Associate Research Professor
Human-Computer Interaction Institute
Carnegie Mellon University