

Learner Expertise and Emotional Design in Multimedia Learning

Thomas K.F. Chiu, The University of Hong Kong, thomas.kf.chiu@gmail.com

Abstract: Literature shows that learners' emotions affect the effectiveness of multimedia learning, which is explained by Cognitive-Affective Theory of Learning with Media (CATLM). An emotional design that changes learners' emotional status can facilitate or suppress multimedia learning. In CATLM individual difference is an assumption. How learner expertise affects the effectiveness of emotional designs remains unclear. This study comprising 122 K12 students aims to investigate the effect of learner expertise (novice vs advanced) and emotional design—face-shape like and warm colors—(with vs without) on developing remembering and understanding. These results showed that (1) in remembering the emotional design group performed better, and (2) in understanding the design benefited the advanced group, but not the novice group. A plausible explanation is the benefits of the emotional design do not outweigh its drawback in the novice group when developing understanding. Further analysis reveals that learner expertise and learning outcomes aid to determine the designs' effects.

Keywords: emotional design, learner expertise, CATLM, multimedia learning

Introduction

Recent research on multimedia learning has been focusing on the influence of affective processes such as emotions and motivations (Ng & Chiu, 2017; Park, Knörzer, Plass, & Brünken, 2015). Multimedia design elements that can change learners' emotional status (Heidig, Müller, & Reichelt, 2015) may affect working memory capacities during learning, which is supported by many empirical studies (Knörzer, Brünken, & Park, 2016). These studies showed that learners' emotions can facilitate or suppress their learning processes, for example, Knörzer and colleagues (2016) provided evidence that there are differential effects of diverse emotional status on multimedia learning—a facilitating effect of induced positive emotions and a suppressive effect of induced negative emotions occurred on learning outcomes. These empirical evidences can be explained by Moreno's Cognitive-Affective Theory of Learning with Media (CATLM) (Moreno, 2009). CATLM suggests that individual difference includes learner expertise affects multimedia learning, which is supported by studies of Chiu and Mok (2017), Kalyuga (2007, 2014) and his colleagues (2012). However, how learner expertise affects the effectiveness of emotional design remains unclear. The present study aims to investigate the effects of learner expertise and emotional design on learning outcomes—remembering and understanding. The rest of the paper is organized as follows: we first present the theoretical framework of this study, and previous studies on emotional design in multimedia learning, followed by the purpose and methodology of the study. Then we describe the results of our analyses, followed by discussing the results and concluding the study.

The present study

This study investigates how different learner expertise levels affect an emotional design on multimedia learning and attempts to understand how the design affects cognitive capacities available for learning. We expected that the design would place extraneous cognitive load on both learners, but have larger facilitating effects on novice learners in developing understanding due to the expertise reversal effect (Kalyuga, 2007, 2014).

The participants comprised 122 primary 1 and 2 students, (5-9 years old, around 52% is boy), and an experienced mathematics teacher in Hong Kong. A 2 x 2 between subjects factorial design with the factors learner expertise (primary 1, P1 vs primary 2, P2) and emotional design (with an emotional design, ED vs without, ND) was used. This resulted in the four experimental conditions. Materials were written in Chinese (Cantonese style) included learning materials, a post-test and a questionnaire. The learning materials were 5-minute videos; the topic was understanding geometrical patterns. In the experimental group, face-like shape and warm colors were used in the design. The post-test was in form of multiple choice questions with 4 answers assessed remembering and understanding. The questions were used in the experiments of Ng and Chiu (2017) and modified from the studies of Chiu (2016, 2017), Chiu and Mok (2017), and Chiu and Churchill (2015). The remembering measured learning outcomes by means of recall questions, as same as that presented in the videos from the control group; that of understanding were new. Each measure had 10 questions and scored 1. The questionnaire includes a 5-scale likert question measuring intrinsic motivation—I find learning the material is fun. This question was used in the study of Plass and colleagues (2014).

Discussions and conclusions

There are three major empirical implications. First, the emotional design “face-shape like and warm colors” had main effects when developing remembering. Second, the design benefited the advanced group, but not the novice group when developing understanding. Final the emotional design derived more fun (instinct motivation) from the learning process. In term of theoretical contribution, the results contribute to CATLM, more specifically, how the emotional design affects cognitive processes through emotion, motivation and attention in multimedia learning. Most previous relevant studies did not take learner expertise / order thinking skill into account when studying the emotional designs (see Park et al., 2015, Plass et al., 2014; Knörzer, et al., 2016; Schneider et al., 2016; Um et al., 2012). In their studies, the authors advocated that an appropriate emotional design can facilitate cognitive processing during learning even though it may place extraneous cognitive load on the learners. The learners would invest more effort in their cognitive processing to integrate their prior knowledge from long term memory and organized knowledge from the multimedia presentations into new knowledge. Moreover, this study affords two practical suggestions. First, it is more effective to use the face-shape like and warm colors for all learners in developing lower order thinking skills. The human-like pictures are recommended to be included in multimedia presentations when the learning tasks are not too complicated. Second, we suggest that teachers should be very careful when they design activities for drawing interests and fostering motivation because those activities may not lead to better learning outcomes. Multimedia presentation designers are suggested to use learner expertise and learning outcomes to determine whether to include emotional design offered to learners. Overall, future research on adaptive learning environments should focus on cognitive processing, and interactions among learner prerequisites, emotions and multimedia presentations.

References

- Chiu, T.K.F. (2016). Prior knowledge and mathematics order thinking skill in multimedia learning. In *Proceedings of The International Conference of Learning Sciences*, June 20-24, 2016, Singapore.
- Chiu, T.K.F. (2017). Effects and Contributions of External Presentation Comprising Prior Knowledge during Multimedia Learning. *AERA Annual Meeting*, April 27-May 1, 2017, San Antonio, Texas.
- Chiu, T.K.F., & Churchill, D. (2015). Exploring the characteristics of an optimal design of digital materials for concept learning in mathematics: Multimedia learning and variation theory. *Computers & Education*, 82, 280-291. <https://doi.org/10.1016/j.compedu.2014.12.001>
- Chiu, T.K.F., & Mok, I.A.C. (2017). Learner expertise and mathematics different order thinking skills in multimedia learning. *Computers & Education*, 107, 147-164. <https://doi.org/10.1016/j.compedu.2017.01.008>
- Heidig, S., Müller, J., & Reichelt, M. (2015). Emotional design in multimedia learning: Differentiation on relevant design features and their effects on emotions and learning. *Computers in Human Behavior*, 44, 81-95.
- Kalyuga, S. (2007). Expertise reversal effect and its implications for learner-tailored instruction. *Educational Psychology Review*, 19(4), 509-539. DOI:10.1007/s10648-007-9054-3
- Kalyuga, S. (2014). The expertise reversal principle in multimedia learning. In R.E. Mayer (Ed.), *The cambridge handbook of multimedia learning*, (pp. 576-597). New York, NY: Cambridge university press.
- Knörzer, L., Brünken, R., & Park, B. (2016). Facilitators or suppressors: Effects of experimentally induced emotions on multimedia learning. *Learning and Instruction*, 44, 97-107.
- Moreno, R. (2009). Learning from animated classroom exemplars: the case for guiding student teachers' observations with metacognitive prompts. *Journal of Educational Research and Evaluation*, 15, 487-501.
- Ng, K.H., & Chiu, T.K.F. (2017). Emotional Multimedia design for Developing Mathematical Problem solving Skills. *HKAECT x AECT 2017 Summer International Research Symposium*, June 15-17, 2017, Hong Kong.
- Park, B., Knörzer, L., Plass, J. L., & Brünken, R. (2015). Emotional design and positive emotions in multimedia learning: An eyetracking study on the use of anthropomorphisms. *Computers & Education*, 86, 30-42.
- Plass, J. L., Heidig, S., Hayward, E. O., Homer, B. D., & Um, E. (2014). Emotional design in multimedia learning: Effects of shape and color on affect and learning. *Learning and Instruction*, 29, 128-140.

Acknowledgements

Thank the schools and the University of Hong Kong for the support of this work through a research fund.