

Facilitators or suppressors: Effects of experimentally induced emotions on multimedia learning



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ABSTRACT

The present study investigated the influence of experimentally induced emotions (positive, neutral, negative) on learning with multimedia instruction with $N = 75$ university students. In order to provide sound explanations about how emotional state might impact learning, measures of motivation, cognitive load, and attentional processes (eye tracking) were integrated. Results showed that while emotions did not influence retention, emotions did influence outcomes of the comprehension and transfer test. Specifically, a facilitating effect of an induced negative emotional state on learning outcomes was observed, which could be attributed to a more focused and detailed information processing. In contrast, an induced positive emotional state had a suppressing effect on learning outcomes since learners were distracted from the learning materials by their emotions. Motivational measures were not influenced by learners' different emotional states, but overall, controlled motivation increased and autonomous motivation decreased during learning. In sum, the learners' emotional state should be considered in learning research as an important predictor for learning success.

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1. Introduction

Do emotions suppress or facilitate successful learning? Even though there is a consensus that emotions do influence learning (e.g., Pekrun & Linnenbrink-Garcia, 2014), there are inconsistent findings on the direction of effects (e.g., Um, Plass, Hayward, & Homer, 2012). Thus, two contrasting hypotheses can be derived: The *emotions-as-suppressor-of-learning hypothesis* postulates that emotions may impair learning, while the *emotions-as-facilitator-of-learning hypothesis* assumes that emotions lead to better learning outcomes (Um et al., 2012). The validity of both hypotheses is supported by further theoretical considerations explaining how emotions influence cognitive processes and learning outcomes (e.g., Pekrun, 2006).

There is a lack of studies investigating the role of the learners' emotional state and its impact on learning outcomes, particularly in multimedia research (Park, Plass, & Brünken, 2014). In the last decade, an expansion of theoretical assumptions in multimedia learning has initiated studies which also include affective measures (Moreno, 2006; Moreno & Mayer, 2007). A body of studies now

exists on the influence of an emotionally appealing design on learning (Mayer & Estrella, 2014; Park, Knörzer, Plass, & Brünken, 2015; Plass, Heidig, Hayward, Homer, & Um, 2014; Um et al., 2012) and affective measures (Heidig, Müller, & Reichelt, 2015). While some multi-factorial studies have examined the effects of experimentally-induced positive emotions on learning (e.g., Park, Knörzer, et al., 2015), there has been no research to-date on the effects of experimentally-induced negative emotions on learning (Park, Flowerday, & Brünken, 2015).

In the present study, learners were exposed to a positive, neutral or negative emotion-induction procedure with the intent to investigate the impact of different emotional states on learning outcomes. Measures of motivation, cognitive load and attentional processes (eye tracking) were used in order to provide sound explanations about how emotional state might impact learning.

2. Theoretical framework

2.1. Emotions

The present study refers to the construct of emotion as a multifaceted phenomenon through which affective, cognitive, physiological, motivational, and expressive processes combine into an emotional episode (Pekrun, 2006; Pekrun & Linnenbrink-Garcia,

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2014; Russell, 2003; Shuman & Scherer, 2014). Although some authors have distinguished between the concepts of affect, emotion, and mood in terms of their intensity and duration (e.g., Sokolowski, 2008) affect can be understood as a broader category subsuming emotion and mood (Shuman & Scherer, 2014). Following this assumption, the differentiation regarding intensity and duration classifies mood to be a more prolonged affective state of low intensity whereas an emotion is more intense and of rather short duration (Shuman & Scherer, 2014). The assumed short duration of emotions can lead to short-term changes of emotional state (e.g., during a learning phase; D'Mello & Graesser, 2012) whereas the overall mood state might stay the same (c.f. Russell, 2003).

As proposed in Russell's Circumplex Model of Affect emotions are arranged with respect to the two orthogonal dimensions activation, activating – deactivating, and valence, positive – negative, (Russell, 2003; see also; Pekrun, 2006). As an example, happiness is an activating and positive emotion and satisfaction is classified as deactivating and positive. For emotions with a negative valence, sadness is a deactivating whereas anger is an activating emotion. A further, modified version of Russell's model differentiates between positive and negative activation (instead of activation and valence). The authors argue that these dimensions allow a better classification of emotions within empirically stable dimensions (Tellegen, Watson, & Clark, 1999; Watson, Clark, & Tellegen, 1988). However, in line with the theoretical assumptions of the primary model by Russell (2003), and for reasons of face validity, recently, the valence dimension was reinstated in emotion assessment measures (Schallberger, 2005; see Fig. 1).

2.2. Multimedia learning

The Cognitive-Affective Theory of Learning with Media (CATLM) integrates cognitive and affective aspects of learning with respect to multimedia research (Moreno, 2006; Moreno & Mayer, 2007). Within CATLM, cognitive processes are initiated via verbal and non-verbal elements of a multimedia instruction. Learning content is selected, then organized and integrated with prior knowledge in order to build a coherent mental model. According to the assumptions of the CATLM, these cognitive processes take place within two independent information processing channels in

working memory (Baddeley, 1986) where verbal and non-verbal information can be processed simultaneously and coded dually (Paivio, 1986). As working memory capacity has been shown to be limited active processing of the whole learning content is only possible when learning environments are designed in an optimal way to minimize extraneous challenges to working memory processes (Mayer, 2005). CATLM also states that three factors have an additional impact on multimedia learning: The affective mediation construct postulates that affective and motivational factors influence learning. The meta-cognitive mediation construct assumes that meta-cognitive and self-regulatory skills mediate learning by regulating cognitive and affective processes. The individual differences assumption indicates that learners' prior knowledge, cognitive styles, abilities, and personality traits affect the efficiency of multimedia instructions (see Fig. 2).

2.3. Emotions and learning

Um et al. (2012) introduced the emotions-as-facilitator-of-learning and the emotions-as-suppressor-of-learning hypotheses highlighting that there are different underlying assumptions and inconsistent findings regarding the impact of emotions on learning. Many studies report beneficial effects of positive emotions and detrimental effects of negative emotions on cognitive processes (Isen, Daubmann, & Nowicki, 1987). However, results of studies incorporating valence-congruent effects are not consistent and sometimes neglect variables that may significantly influence the interplay of emotions and learning (e.g., Ellis, Thomas, & Rodriguez, 1984; Isen et al., 1987; Oaksford, Morris, Grainger, & Williams, 1996). Further, there are other studies reporting negative effects of positive emotional states (e.g., Seibert & Ellis, 1991) or positive effects of negative emotional states (e.g., Sinclair & Marks, 1992) on cognitive processes. Four different assumptions, that support either the facilitating or suppressing hypothesis, can be derived, which help explaining how emotions influence learning.

2.3.1. Extraneous load assumption

Contributing to the emotions-as-suppressor-of-learning hypothesis, this assumption postulates that both positive and negative emotions impair learning via consumption of working memory capacity compared to a neutral or balanced emotional state. Remembering the cognitive component of emotions, being in a positive or negative emotional state means that additional (emotional) cognitions are to be held in working memory beside a primary activity, e.g., learning. In terms of Cognitive Load Theory (Plass, Moreno, & Brünken, 2010; Sweller, Ayres, & Kalyuga, 2011), emotions impose extraneous cognitive load because they do not contribute to the generative learning processes associated with germane load. Studies supporting this assumption demonstrated a detrimental effect of experimentally induced positive and negative emotions on information processing (e.g., Ellis et al., 1984). In other research, emotions were found to hinder deductive reasoning processes (Oaksford et al. 1996).

2.3.2. Motivation assumption

The motivation assumption primarily contributes to the emotions-as-facilitator-of-learning hypothesis. It hypothesizes that emotions of positive or negative valence will foster motivation which will lead to better learning outcomes (Pekrun, 2006). For positive emotions, which are assumed to increase intrinsic motivation, this is a plausible construct. The assumption concerning negative emotions can be explained by the mood repair principle (Bless & Fiedler, 2006). The mood repair principle states that humans in negative emotional states seek to improve their affect, which can be regarded as an evolutionary motivational tendency.

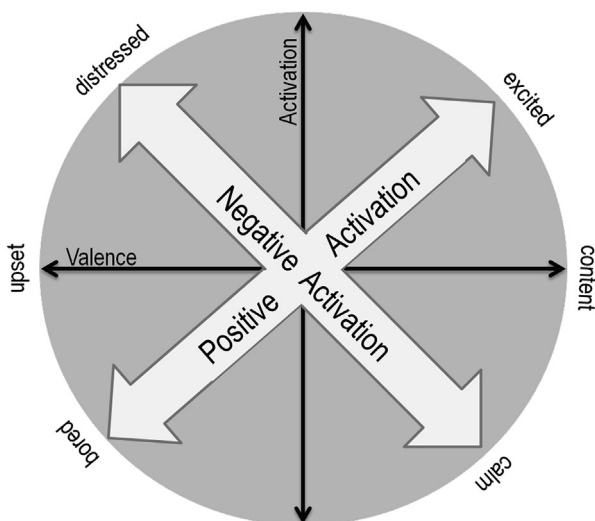


Fig. 1. Circumplex model of affect (adapted from Schallberger, 2005; Watson & Tellegen, 1985).

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