Learning and Instruction 40 (2015) 9–20

Contents lists available at ScienceDirect

Learning and Instruction

journal homepage: www.elsevier.com/locate/learninstruc

The influence of consequence value and text difficulty on affect, attention, and learning while reading instructional texts

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ARTICLE INFO

Article history:
Received 29 October 2014
Received in revised form
14 July 2015
Accepted 16 July 2015
Available online xxx

Keywords:
Affect
Attention
Learning
Motivation
Consequence value

ABSTRACT

The present study investigated how consequence value influences affect, attention, and learning while reading instructional texts, and if text difficulty moderates these effects. Participants studied four instructional texts on research methods in a 2 × 2 consequence value (high vs. low) × text difficulty (easy vs. difficult) within-subjects experiment. Consequence value was manipulated by assigning two of the four texts as having high value and the other two as having low value with respect to a performance goal on a subsequent test, while text difficulty was manipulated via experimenter-created easy and difficult versions of the texts. We hypothesized that consequence value would induce mild anxiety, which would focus attention and facilitate learning, and that text difficulty would moderate the influence of consequence value. Partially consistent with the predictions, high consequence value led to lower valence, higher arousal, longer reading times, and positively predicted knowledge transfer. Arousal mediated the relationship between consequence value and knowledge transfer, but only when the texts were difficult, thereby suggesting moderated mediation.

1. Introduction

Educators are often faced with the challenge of motivating students to learn. This can be particularly difficult, especially when students are unmotivated and uninterested in the subject itself. In these cases, extrinsically-valued rewards are a commonly-used motivational strategy. Extrinsic value refers to students' perceptions of the value of a learning activity as it relates to goals unrelated to the activity itself (Pekrun, Goetz, Titz, & Perry, 2002). These goals can be in the form of receiving a reward as well as avoiding a consequence.

The effects of extrinsic value have received considerable attention, particularly with respect to the influence of rewards on task performance and intrinsic motivation (Deci & Ryan, 1985; Eisenberger, Pierce, & Cameron, 1999; Fryer, 2011; Pierce, Cameron, Banko, & So, 2012). Meta-reviews on the relationship between rewards and task performance have reported mixed findings, including positive, negative, and null effects (Deci, Koestner, & Ryan, 2001; Pierce et al., 2012). For example, monetary incentives have been both positively and negatively related to performance (Bettinger, 2012; Fryer, 2011). The effects of extrinsic rewards on intrinsic motivation have also been a topic of debate. Self-determination theory posits that rewards decrease intrinsic motivation because they undermine students' sense of autonomy (Deci, Koestner, & Ryan, 1999; Deci et al., 2001; Deci & Ryan, 2012), a claim that has received empirical support (see Deci et al., 1999 for a review). However, conflicting evidence suggests that rewards can also have positive effects on intrinsic motivation (Cameron, Pierce, Banko, & Gear, 2005; Hagger & Chatzisarantis, 2011; Pierce et al., 2012). It might be the case that rewards can be effective in appropriate situations, such as when the material is uninteresting or the reward is unexpected (Cordova & Lepper, 1996; Sansone, 2000).

In many real-world situations, negative consequences accompany extrinsic rewards upon failure to reach a goal (e.g., reward of getting a passing grade vs. consequences of failing, such as having to attend summer school). Self-determination theory (SDT) predicts that negative consequences should also lower intrinsic motivation (Roth, Assor, Niemiec, Ryan, & Deci, 2009). Research in support of this hypothesis has indicated that students perceive lower autonomy and intrinsic motivation when they feel pressure

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http://dx.doi.org/10.1016/j.learninstruc.2015.07.003
0959-4752/

to perform an activity in order to avoid a negative consequence (Assor, Roth, & Deci, 2004; Hancock, 2001; Roth et al., 2009). However, contrasting evidence also suggests that negative consequences can be linked to increased motivation for achievement as well as performance during learning (Miller, Greene, Montalvo, Ravindran, & Nichols, 1996; Smith & Smith, 2002). It might be the case that, similar to extrinsic rewards, negative consequences can also be effective in specific situations, although existing research does little to reconcile the conflicting findings.

Previous research on the effects of rewards and negative consequences[1] has focused on motivation and performance as outcome variables (Bettinger, 2012; Cameron et al., 2005; Hagger & Chatzisarantis, 2011). *Affect* and *attention* are equally important, yet often overlooked, processes to consider as they have been shown to play critical roles during learning (Pekrun & Linnenbrink-Garcia, 2014; Sweller, 1988). Affect and attention are conceptually distinct from motivation, as motivation is more closely related to students' goals prior to a learning activity, while affect and attention occur *during* a learning activity and are influenced by a multitude of factors beyond motivation (Anderman & Patrick, 2012). Moreover, models of motivation do not typically place a primary focus on relatively short-term states, such as affect and attention (Deci & Ryan, 2012; Eccles & Wigfield, 2002). Thus, a focus on affect and attention might offer an alternative explanation for how consequence value influences learning. We consider this possibility in the present research.

The primary goal of the current experiment was to investigate the influence of negative consequence value on affect, attention, and learning and to assess if difficulty moderated this effect. Students read four instructional texts on scientific research methods. Affect was measured via self-reports of valence and arousal at multiple points during reading. Attention was primarily measured via periodic self-reports of mind wandering and secondarily via overall reading time. Learning was measured with knowledge tests after the learning session. Negative consequence value (referred to as *consequence value*) was manipulated by assigning two of the four texts as having *high consequence value* and two as having *low consequence value* with respect to a performance goal on a subsequent test. Failure to meet the performance goal resulted in an undesirable penalty (having to read more texts). This manipulation attempted to mirror a real-world situation where, in addition to potentially being rewarded for achievement (e.g., free time on the computer), failure itself has negative consequences (e.g., having to re-take a test). Text difficulty was manipulated via experimenter-created easy and difficult versions of the texts.

We test two specific hypotheses grounded in the control-value theory (CVT) of academic emotions. CVT posits that the affective states that arise during learning are based on appraisals of *subjective control* and *subjective value* (Pekrun, 2006; Pekrun & Stephens, 2010). Subjective control refers to students' appraisals of their own abilities to take action in order to achieve a desirable outcome (Pekrun & Stephens, 2010). When a task is difficult relative to a student's ability, the student will perceive having lower subjective control towards achieving the desired outcome, and vice versa for easy tasks (Pekrun, 2006). Subjective value pertains to the perceived interest/importance of the activity and can be either negative or positive, depending on students' object of focus (Pekrun, 2006), which can be the activity itself (e.g., enjoyment or dislike) or the outcome (e.g., success or failure). Positive subjective value results when the focus is on enjoyment of the activity or the reward of a successful outcome. Alternatively, negative subjective value occurs when the focus is on negative feelings associated with the activity or if the consequences of failure are aversive.

Consistent with circumplex models of affect (Pekrun & Linnenbrink-Garcia, 2012; Russell, 2009), CVT posits that both valence (i.e., positive and negative feelings) and arousal (i.e., level of activation) are the basic components of affect. As depicted in Table 1, discrete affective states arise from different combinations of valence and arousal. In particular, positive subjective value, when combined with low arousal, is associated with a state of relaxation or calmness, but is more akin to state of engagement (Pekrun et al., 2002; Pekrun & Linnenbrink-Garcia, 2012) when paired with high arousal. Negative subjective value can lead to boredom and disengagement when combined with low levels of arousal. However, negative subjective value can lead to mild anxiety when arousal is moderate. Importantly, this form of mild anxiety is expected to be facilitative rather than harmful to learning, as elaborated in Hypothesis 1 (the *consequence value hypothesis*).

The *consequence value hypothesis* is multicomponential in that it includes affect, attention, and learning. The first component is a derivation from CVT in that the consequence value manipulation will be subjectively appraised as being negative due to undesirable consequences of failure. Focus on the threat of failure will increase arousal, thereby resulting in a state of anxiety (Pekrun et al., 2002), which should be reflected in our measures via lower valence and higher arousal for the high vs. low consequence value texts.

It is widely known that anxiety focuses attention in order to identify, avoid, or eliminate potential threats in the environment (Fielder & Beier, 2014). In addition to influencing affect, consequence value is also expected to influence attention, measured in the present study via attentional lapses (or *mind wandering*) and reading time. Mind wandering is an unintentional shift of attention from task-related thoughts to task-unrelated thoughts, and has been linked to negative performance outcomes (Randall, Oswald, & Beier, 2014; Smallwood & Schooler, 2015). We predict mind wandering will occur less frequently during high consequence value texts due to attentional focus associated with anxiety. We also predict that consequence value will influence reading time, which is taken as an indicator of attention and effort (Guthrie, Wigfield, & You, 2012; Ponitz, Rimm-Kaufman, Grimm, & Curby, 2009). Participants should spend more time reading the high consequence value texts because of increased pressure to comprehend those texts.

Finally, with respect to learning, it is hypothesized that high consequence value texts should facilitate learning compared to low value texts. This is because the anxiety triggered by the threat of a negative outcome can motivate performance (in part via focused attention) due to a desire to avoid the negative outcome (Martin & Marsh, 2003; Pekrun et al., 2002; Smith & Smith, 2002).

In summary, the *consequence value hypothesis* posits that consequence value will be subjectively appraised as negative and will be associated with an affective state akin to mild anxiety (lower valence and higher arousal), more attention (less mind wandering and longer reading times), and increased learning for the high vs. low value texts. Since affect and attention are expected to influence learning, we also posit that the effect of consequence value on learning will be mediated through affect and attention. This prediction is based on the notion that increased levels of arousal

Table 1
Example 2 × 2 Overview of Subject Value and Levels of Arousal based on CVT.

Arousal	Negative subjective value	Positive subjective value
Moderate arousal	**Mild Anxiety**	Engagement
Low arousal	Boredom/Disengagement	Relaxation/Calmness

[1] Henceforth, negative consequences are referred to simply as consequences. Positive outcomes are called rewards.