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Outcomes from a self-generated utility value intervention on fifth and sixth-grade students' value and interest in science

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ABSTRACT

The purpose of this field experiment was to understand whether fifth and sixth-grade students were able to write about the usefulness and relevance of what they were learning in their science class through self-generated reflections and to examine the impacts of this activity on students' value, utility value, and interest for science. Analysis of students' essays revealed in the self-generated reflection condition students connected what they were learning to their lives significantly more than the control condition. Linguistically, student essays did not differ between the two conditions, except for cognitive processing. Self-reflecting increased students' utility value but not value nor interest. Self-efficacy did not moderate these relations. Implications for extending self-generated utility value and broader social-psychological interventions for early adolescent students are discussed.

1. Introduction

Promoting student retention, performance, and careers in science, technology, engineering, and mathematics (STEM) is becoming increasingly important due to the national and international need for STEM workforce (National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2005; National Academy of Engineering & National Research Council, 2014; OECD, 2016). A key antecedent for these attainments is student motivation (Anderman & Young, 1994; Linnenbrink-Garcia, Pugh, Koskey, & Stewart, 2012; Simpkins, Davis-Kean, & Eccles, 2006).

Research (e.g., Hulleman, Godes, Hendricks, & Harackiewicz, 2010) suggests that interventions can be successful in getting students to be more interested in or find more value in certain school subjects. One type of intervention that produced promising results in formal school settings is social-psychological interventions (e.g., Haynes, Perry, Stupnisky, & Daniels, 2009; Hulleman et al., 2010; Lazowski & Hulleman, 2016; Yaeger, Walton, & Cohen, 2013). The present study focuses on a self-generated written reflection activity (i.e., a utility value intervention), which have demonstrated efficacy in enhancing students' interest, value, and performance in a variety of STEM disciplines (e.g., biology, mathematics, science) in high school and undergraduate contexts (e.g., Hulleman et al., 2010; Hulleman & Harackiewicz, 2009).

One area where the effectiveness of these interventions has not yet been explored is among middle school students. This is an especially sensitive period where students' intrinsic motivation is beginning to decrease (e.g., Lepper, Corpus, & Iyengar, 2005). This

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problem is salient with concern to science content areas (Anderman & Young, 1994; Lee & Anderson,1993; National Research Council [NRC], 2007; Vedder-Weiss and Fortus, 2011, 2012). Notably, despite the sensitive academic period, little research has examined the benefits of administering a utility value intervention with children. As such, the purpose of this study is to investigate the effectiveness of a utility-value intervention with fifth and sixth-grade students in science.

2. Theoretical framework

There are numerous theoretical frameworks that can be used to situate and explain the role of motivation in students' learning and achievement in STEM domains. The present study focuses on the expectancy-value theory (Eccles & Wigfield, 1995), and Hidi and Renninger's (2006) model of interest development primarily because of the alignment between these theoretical perspectives and the social-psychological intervention employed, namely a utility value intervention.

2.1. Expectancy-value theory

The expectancy-value theory posits that an individual's perception of expectancy for success (e.g., "Can I do this?") and their subjective task value (e.g., "Do I want to do this?") are proximal antecedents of achievement-related outcomes and choices (Eccles & Wigfield, 1995; Eccles et al., 1983; Wigfield & Eccles, 2000). Within this theoretical framework, expectancy beliefs are defined as an individual's judgment of their anticipated level of achievement on an upcoming task. In addition to expectancy for success, four types of task values are proposed: attainment, intrinsic, cost, and utility value. Since the present study focuses on the latter, only utility values will be discussed (for a more comprehensive review of task values see Eccles et al., 1983; Flake, Barron, Hulleman, McCoach, & Welsh, 2015; Wigfield & Eccles, 1992).

Utility value refers to the perceived usefulness or relevance of the task or activity for one's future plans and, consequently, involves a focus on the desired end state. For example, learning about the skeletal system should be perceived as especially useful for a student who is planning on becoming an x-ray technician. Together, students' expectancy for success and task-values predict important learning related outcomes, including achievement emotions, academic achievement, and interest (Bieg, Goetz, & Hubbard, 2013; Hulleman, Durik, Schweiger, & Harackiewicz, 2008).

2.2. Interest and interest development

In addition to the expectancy-value theory, theories of interest and interest development are also relevant in guiding the present study. Interest can be defined as the psychological state and a tendency to continue engagement with tasks (Hidi & Renninger, 2006). Interest predicts a variety of adaptive learning related outcomes, including, for instance, students' attention, goals, and academic achievement (e.g., Hidi & Renninger, 2006; Hulleman et al., 2010; Mitchell, 1993), and, therefore, is a critical component of students' motivation to learn (Brophy, 1999).

According to Hidi and Renninger's (2006) model of interest development, interest develops in four distinct and sequential phases: *triggered situational interest, maintained situational interest*, *emerging individual interest*, and *well-developed individual interest*. A crucial component in the development of interest from initial situational interest to well-developed individual interest is finding personal meaning and relevance with a task (Hidi & Renninger, 2006; Hulleman et al., 2008; Hulleman & Harackiewicz, 2009). The four-phase model of interest development and the expectancy-value theory offer complementary explanations for how generating utility rationales relate to persistence, learning, and achievement in academic domains and have consequently been critical in the design of utility value interventions.

2.3. Utility value interventions

Over the past ten years, there has been substantial interest in the design and implementation of brief social-psychological interventions in education as tools to target important psychological processes (Yeager & Walton, 2011). These interventions are designed to change how students (or parents) think or feel in relation to academically relevant concepts. The effectiveness of social-psychological interventions in education relate to the psychological precision and theoretical grounding of the targeted process, the ease of administering the intervention material, and the extent to which the focal construct is a recursive process (Paunesku et al., 2015; Yeager & Walton, 2011). One commonly investigated brief social-psychological intervention is utility value interventions.

Utility value interventions consist of either directly telling, or having students generate their own reasons for why the learning content is relevant or useful in their lives (e.g., Kale & Akcaoglu, accepted; Durik & Harackiewicz, 2007; Durik, Shechter, Noh, Rozek, & Harackiewicz, 2015; Godes, Hulleman, & Harackiewicz, 2007; Hulleman et al., 2010; Hulleman & Harackiewicz, 2009). These interventions are situated within the expectancy-value theory (Eccles & Wigfield, 1995) and the four-phase model of interest development (Hidi & Renninger, 2006). According to these theoretical perspectives, having students reflect on the usefulness of learning the content should increase the perceived utility value and should initiate situational interest, which in turn should lead to an increase in maintained interest, effort, and learning. The self-generated approach to manipulating students' utility value involves asking students to identify reasons why the learning content is useful in their lives, often in a writing task (e.g., Hulleman et al., 2010). This intervention is particularly effective at increasing interest and achievement of students with low perceived competence. The directly-communicated utility value intervention entails directly telling students why the learning content will be useful (e.g., Durik et al., 2015). In contrast to the self-generated version, this intervention is especially effective at increasing interest and