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Age differences in effects of self-generated utility among Black and Hispanic adolescents

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ABSTRACT

This study tested the effects on interest and achievement of a classroom intervention in which students wrote about the utility of science. Participants were predominantly Black and Hispanic students in 7th and 9th grade ($N = 268$). The results suggest that the self-generated utility intervention may be fairly robust to differences in students' backgrounds, but is sensitive to age. Among seventh graders, the intervention promoted interest in science for students with high success expectancies. This is in contrast to prior research with high school students, and the pattern among ninth grade students in this study, showing somewhat more positive effects among students with low expectancies. Writing content varied by students' grade level and success expectancies in terms of focus (e.g. self) and temporality (e.g. future).

The belief that academic content is valuable can establish an enduring link between a person and a content domain and can contribute to the experience and development of interest (Renninger, 2000). Although value can take different forms (Eccles et al., 1983; Eccles & Wigfield, 2002), utility value describes the extent to which a task or domain is relevant for achieving personal goals. In this sense, perceived utility value can provide a bridge between individuals, their goals, and learning content. Adolescent students who perceive utility value in an academic domain are more likely to identify that domain as a personal interest and demonstrate commitment to learning in that domain (e.g., Eccles & Wigfield, 1995; Hulleman, Durik, Schweigert, & Harackiewicz, 2008; Simpkins, Davis-Kean, & Eccles, 2006). Utility value has also been shown to correlate with task performance, which may be a consequence of increased effort and sustained commitment to tasks that are perceived as personally useful (Bong, 2001; Hulleman et al., 2008; Simons, Dewitte, & Lens, 2000, 2004).

Given that perceived utility value is related to important positive outcomes, interventions have been developed to foster students' perceptions of utility value. One approach prompts learners to self-generate utility value for what they are learning. In one experiment, ninth-grade, predominantly White science students were asked to generate descriptions of how learning about science was personally useful to them or someone they know (Hulleman & Harackiewicz, 2009). Compared with students in the control group who were asked to summarize course-related content, the students that self-generated utility showed higher interest and performance, and these effects were strongest among students who initially had low expectancies for success. The self-generated utility prompts may have helped ninth graders who did not expect to do well to perceive greater value in what they were learning, which in turn may have led to higher interest and greater effort to perform well. Subsequent studies have replicated this effect on interest in a sample of predominantly White college students, again suggesting that self-generated utility is uniquely helpful for individuals who have low expectancies for success (Hulleman, Godes, Hendricks, & Harackiewicz, 2010). This research suggests that utility interventions hold promise, although expectancies for success moderate the effects. It is also worth noting that prior research has also shown effects that are not moderated by expectancies. One study showed that prompting ninth graders to either self-generate utility for math or to evaluate peer quotations regarding the utility of math promoted task values in math for students in general (i.e., not moderated by expectancies; Gaspard et al., 2015).

These promising results may inspire educators to insert self-generated utility interventions into classrooms, with a particular focus on being able to shape students' identities with regard to science, and to do so early in students' schooling. However, before introducing self-generated utility interventions on a broader scale it is prudent to examine the effects of this intervention among populations that are more diverse in terms of age and background.

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1. Considering the process

The process by which self-generated utility interventions work is not entirely clear, but needs to be considered, and might even be illuminated by testing the generalizability of the effects. Self-generated utility is theorized to allow learners to draw on personal experiences to forge a connection between themselves and a domain (Hulleman et al., 2010). As such, students who might not otherwise consider the utility of a learning activity can draw on what they know of the world and themselves in order to find utility and purpose in what they are learning in school. For example, students in a science class who are studying the laws of motion might be able to identify a link between themselves and the course content to the extent that they perceive the content related to personal activities (e.g., driving a car, playing soccer).

As this example suggests, self-generated utility interventions ask students to select a topic that they are studying in science class and to consider how the topic is useful to themselves or to someone they know for purposes beyond the current class. Importantly, this task requires students to connect at least three elements: science content, what they know about the world, and how they perceive themselves in the present and/or in the future. As to the question of whether age, socioeconomic status and race/ethnicity might play a role in the process of individuals connecting these three elements, we consider several different theoretical lenses that guide our thinking. The pattern that emerges might provide insight into how self-generated utility interventions influence outcomes.

2. Self-generated utility among seventh- versus ninth-grade students

The initial work examining the effects of self-generated utility interventions was conducted on samples of students who were predominately mid-adolescent high-school students or late-adolescent undergraduate students and that were predominately White (Hulleman et al., 2010; Hulleman & Harackiewicz, 2009). That said, educators of younger students might be drawn to self-generated utility interventions because students' interest in science and mathematics begins to decline during the middle school years (Fredricks & Eccles, 2002; George, 2000; Gottfried, Fleming, & Gottfried, 2001), and there is some evidence that by the time students enter ninth grade their science interests are already formed (Sadler, Sonnert, Hazari, & Tai, 2012). These findings suggest that interventions targeting interest should be done early, while students' interests may be more malleable. No previous studies were found that targeted self-generated utility for science during the middle school years, but given research suggesting that important developmental changes occur in this time period regarding cognitive capacity, career interest, and curricular focus, it is important to examine whether self-generated utility interventions will be effective among younger adolescents.

Relative to older adolescents, younger adolescents have less developed cognitive capacities that may limit their ability to think about the future (Greene, 1986; Nurmi, 1991; Steinberg et al., 2009; Trommsdorff, Lamm, & Schmidt, 1979). Consistent with this, younger learners have been found to think about themselves and their lives on a much shorter time scale than older learners (Husman & Lens, 1999). In a study of future orientation across age levels, Steinberg et al. (2009) found that young adolescents between the ages of 10–13 years old were less future-oriented than were 15–30-year-olds. Although the researchers did not report differences between smaller age ranges, visual inspection of their plotted data (p. 37) indicates that future orientation may change between the 12 to 13-year-old group (typical middle school age range) and the 14 to 15-year-old group (typical 9th grade age range).

If younger students are less capable than older students of engaging in abstract thinking and planning, both of which are implicated in utility value, then thinking about utility value may not be as meaningful for younger learners. The abstract nature of utility value may mute the effectiveness of self-generated utility interventions. In line with this reasoning, relative to older learners, younger learners are less likely to mention meaning and purpose in the context of a domain they find interesting, and instead focus more on feelings of enjoyment and excitement (Frenzel, Pekrun, Dicke, & Goetz, 2012). These cognitive changes suggest that a utility value intervention might be more beneficial for learners toward the end of early adolescence.

Alternatively, there may be reasons to expect other patterns as well. First, middle school and high school students may not differ from one another in terms of the types of utility value they can generate or in the effects of doing so because the ability to articulate career interests tends to be quite stable across the transition from middle school to high school (Low, Yoon, Roberts, & Rounds, 2005). If students identify utility value through the link between a science course topic and a career interest, there would be no differences between seventh and ninth graders in terms of either the utility value they generate or the effects of doing so. Second, generating utility for science content might be easier for adolescents in middle school than those in high school because the content taught in middle school science classes tends to be more concrete and connected to daily life, relative to content taught in high school (Yager, Ali, & Hacieminoglu, 2010). Therefore, ninth grade students may find it more difficult to make connections between the more abstract content presented in science class and their lives.

Given these various developmental considerations, we consider the question of whether middle and high school students experience similar effects of self-generated utility interventions. Moreover, the patterns of effects that are observed on various outcomes (i.e., interest, perceptions of utility, and performance) may provide insight into the underlying processes.

3. Self-generated utility among students from groups underrepresented in science

Utility interventions are designed to promote interest in science and motivate individuals to enter into science-related careers. Self-generated utility then, may provide a vehicle for encouraging participation in science among groups of individuals who are historically underrepresented in the field. Consistent with this, positive effects of a self-generated utility intervention were found among a sample of college students from racial and ethnic groups that are underrepresented in science. The sample of students, who were of Hispanic, African, or Native American descent (i.e., members of groups underrepresented in science, URM; National Science Foundation, 2008) and also first-generation college students (i.e., those whose parents were not college graduates), earned better grades and were more likely to continue on to a second semester of biology if they had been randomly assigned to the self-generated utility value condition rather than a control condition (Harackiewicz, Canning, Tibbetts, Priniski, & Hyde, 2016). These positive effects suggest that students from historically underrepresented groups who have the academic backgrounds to be admitted to an elite university benefit from connecting course material to their future endeavors. However, because science has broad value in our society, it is also important to examine whether similar effects are observed among younger adolescents from similar racial, ethnic, and socioeconomic groups who are not necessarily on the trajectory to attend an elite university.

The effects of self-generating utility may be similar across racial and socioeconomic lines because learners can draw primarily on knowledge and observations about the world that are shared by people in general. Students may begin the task by focusing first on their knowledge of the world and everyday life (e.g., weather-related events that can pose a threat to humans), and then considering the value of science within that context. Ethnic differences in beliefs about the general importance of math and science are not large, and the desire for achievement tends to be similar across ethnic groups (Bouchey & Harter, 2005; Halfond,