Self-Generated Utility Among a Diverse Sample of Adolescent Students: An Analysis of Grade Level and Gender

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Abstract

Perceived utility value has been related to students’ motivation in academic domains, and a self-generated utility intervention has been found to promote academic interest and performance among students with low expectancies for success. This study tested the effects of a self-generated utility intervention among 7th and 9th grade science students. Students given the intervention wrote essays about how the material in their science course was useful whereas students given the control task were prompted to summarize a course topic. The results showed that the utility value intervention promoted interest in science for 9th grade girls with low expectancies for success but undermined interest for girls with high expectancies for success. The effects were not strong among 9th grade boys overall, and the data for 7th graders showed effects in the opposite direction. An analysis of a subset of the utility essays suggested considerable variability in how students self-generated utility value for science, which may affect subsequent interest.
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Interest involves an enduring link between a person and a content domain that includes appreciation for the domain content as valuable (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 is a form of personal relevance, and students who perceive utility value in an academic domain may identify that domain as a personal interest. Consistent with this, the extent to which learners perceive utility value in what they are learning is typically strongly and positively correlated with interest in the material (e.g., Eccles & Wigfield, 1995; Hulleman, Durik, Schweigert, & Harackiewicz, 2008; Simkins, Davis-Kean, & Eccles, 2006). Utility value has also been shown to correlate with task performance, which is likely a consequence of increased effort and commitment to tasks that are perceived as 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 that has been tested prompts learners to self-generate utility value for what they are learning. In one study, 9th grade science students were asked to self-generate descriptions of how learning about science was personally useful to them (Hulleman & Harackiewicz, 2009). Compared with a control group that was asked to summarize course-related content, the group that received the prompts to self-generate utility showed higher interest and performance, but only if they initially had low expectancies for success. The self-generated utility prompts helped individuals with low expectancies for success perceive value in what they were learning and to put effort into
performing well. Subsequent studies replicated the effect found on interest among college students, again suggesting that self-generated utility is more helpful for individuals who have low expectancies for success (Hulleman et al., 2010).

The current research aimed to extend this line of research by examining a similar intervention introduced to 7th as well as 9th graders from a racially and ethnically diverse population of students. We also tested how gender might influence the unfolding processes initiated by prompts to self-generate utility value.

We reasoned that it may be especially revealing to test the effects of self-generated utility value within a younger sample and within gender because of the link between utility value and learners’ futures (Husman & Lens, 1999). Utility value is personally meaningful because it is conceptualized in the context of individuals’ short- or long-term goals. As such, when individuals recognize utility value in tasks, they must conceptualize the task not only in the present, but also in the context of a hypothetical future. In other words, utility value requires that learners consider the task at a more abstract level, and apply the knowledge or skills to some other time and/or situation. The effects of perceived utility value may be potent because it holds the potential to connect the present learning context to individuals’ developing sense of self.

However, this feature of utility value may have implications for learners of different ages. As adolescents develop, they are in a better position to engage in abstract thinking and planning, both of which are implicated in perceived utility value in tasks. In other words, utility value may not be as meaningful for younger learners if they are still struggling to think abstractly in general. Younger learners may be thinking about themselves and their lives on a much short time scale (Husman & Lens, 1999). This developmental change across adolescence may limit the effectiveness of a utility value intervention on interest and performance.
Second, the connection between utility value and personal goals also suggests that gender may play a role in how individuals think about domains and how those domains fit with their developing identities. Given that science is often thought of as a domain that is more consistent with the male stereotype (Francis, 2000; Lightbody & Durndell, 1996; Whitehead, 1996), girls’ and boys’ sense of utility value within science may differ. Even if girls and boys self-generate utility value for science, the effects of doing so may vary depending on the extent to which they perceive their developing identities fitting with the goals implied by the utility of various academic domains.

These open questions regarding the processes initiated by utility interventions and how these might play out for individuals of different ages and gender, prompted us to examine the effects of self-generated utility for 7th and 9th grade students, across gender.

Method

Participants

The participants were 7th (N=192) and 9th (N=123) graders enrolled in science classes in a single school district. Seventh grade participants were drawn from 9 different classes taught by 2 teachers. Ninth grade participants were drawn from 6 different classes taught by 2 teachers. The participation rate was over 90% in each classroom, with some classrooms having a 100% participation rate. The sample was half male and half female. The student sample was 18% White, 49% Latino, 12% African American, 2% Asian, 1% Native American, and 18% multi-racial. According to school records, 61% of students in the sample were eligible to receive free or reduced lunch.

Procedure
Treatment and control groups were assigned to naturally-occurring sections of regular-track 7th grade life science classes and 9th grade general science classes. Each teacher had multiple class sections participating in the study so specific sections within teacher were randomly assigned as treatment and control. Teachers were not aware of which sections were the treatment and control groups, and were not present when the study intervention was described to their students. During each of the six intervention weeks, students wrote briefly about a topic they were studying in class. Participants in the utility condition wrote about how the topic was relevant or useful to them or to someone they knew. Participants in the control condition instead wrote a summary of the topic (Hulleman & Harackiewicz, 2009). Participants reported their interest and expectancies for success in science before and after the intervention. All essays (utility and summary) were coded along a number of dimensions including: whether the essay actually referred to utility value on some level; whether any utility statement referred to utility for self, other or people in general; whether the time frame for the utility statement was the present, the immediate future, long term future, or unspecified; and what type of utility was specified (e.g., useful for future education, for future career, for hobbies or interest).

Measures

Science interest. A science interest variable was created from student ratings of the importance of science, their excitement about learning science and their intrinsic interest (items used in Harackiewicz et al, 2008). Interest data were gathered both prior to the intervention and then following the intervention. Cronbach’s alphas were .92 and .90 for the initial and post surveys, respectively. Initial interest was used as a covariate in the analysis, and post-intervention interest was used as the outcome variable.
Initial success expectancies. Students were asked about how well they expected to do in science class and how capable they were of learning new things in science (items from Eccles et al, 1993). These questions were combined to create a measure of success expectancies. Cronbach’s alpha for initial success expectancies was .74.

Science Performance. Students’ fourth quarter science grades were obtained from school records and used as the measure of science performance. First quarter science grades were used as a covariate in analyses predicting science performance.

Perceived Utility. To assess students’ utility value beliefs, participants were asked three questions about the usefulness of their science learning and their ability to apply that learning to their life outside of school (items from Eccles et al, 1993). They answered using a seven point Likert scale from 1 = strongly disagree to 7 = strongly agree. Cronbach’s alpha for this composite variable was .81.

Achievement goals. Students’ adoption of mastery goals (“My goal in science class is to learn as much as possible.”) and performance goals “My goal in science class is to perform better than the other students.” were each measured with a single item.

Results

Multiple regression was used to examine the effects of the intervention, expectancies for success, and gender on science interest and performance. Several variables that were measured prior to the intervention were used as covariates, including initial interest, perceived utility, achievement goals, teacher, and initial science grades (for analyses predicting post-intervention science grades). The intervention was contrast coded such that students in the utility condition (+1) were compared with those in the control condition (-1). A contrast code for gender compared boys (+1) with girls (-1). Expectancies for success was mean centered, and all two-
and three-way interactions among the intervention, gender, and expectancies for success were tested. The degrees of freedom fluctuate slightly across the analyses due to missing data.

**9th graders.** When the model was used to predict interest in science among 9th graders at the end of the intervention, several effects emerged. In addition to a main effect of initial interest, \( t(110) = 7.95, p < .01, \beta = .72 \), and initial mastery goals, \( t(110) = 2.56, p < .05, \beta = .19 \), a significant three-way interaction of the intervention, expectancies, and gender emerged, \( t(110) = 3.78, p < .01, \beta = .23 \). Simple effects tests were conducted comparing the utility and control conditions at each level of expectancy and gender. The intervention promoted interest for 9th grade girls with low expectancies, \( t(110) = 2.71, p < .01, \beta = .33 \), but undermined interest for girls with high expectancies, \( t(110) = -2.55, p < .01, \beta = -.34 \). When these analyses were conducted for boys, neither of the comparisons was statistically significant (see Figure 1).

In the ninth grade model used to predict science grades, no significant effects of the intervention emerged. However, not surprisingly, expectancies for success positively predicted grades, \( t(110) = 2.97, p < .01, \beta = .38 \).

Given the discrepant effects of the intervention for 9th grade girls with initially low versus high expectancies of success, we wanted to explore further how the content of the self-generated utility essays varied across these different students.

Of the girls with low initial expectancies for success, five cases that showed positive change from pre- to post-interest were compared with 3 cases that showed essentially no change in interest. In many ways the essays were similar in terms of the number of sentences and the extent to which students referred to themselves versus a general other in their statements of utility. However, students who showed positive change in interest were more likely to mention how science contributed to their understanding of natural phenomena (e.g., earthquakes,
tornadoes). In contrast, the girls who showed no change focused exclusively on how information from science class contributed to their understanding of routine activities (e.g., driving a car, cooking).

Of the girls with high initial expectancies of success, the utility essays of five cases that showed decreases from pre- to post-interest and three cases that showed essentially no change were identified for analysis of content. In their essays, girls who showed a decrease in interest were more likely to refer to themselves in the statement of utility. In contrast, girls who showed no change were more likely to describe the utility at a more general level, applicable to people more broadly. Moreover, although a minority of essays referred to the utility of science for careers overall, the girls who showed decreases in interest were somewhat more likely to refer to science as being useful for a career.

7th graders. When the model was used to predict science interest among 7th graders, initial interest, $t(179) = 8.26, p = .05, \beta = .60$, and initial perceived utility, $t(179) = 1.98, p = .05, \beta = .14$, both positively predicted post-intervention interest in science. Moreover, a two-way interaction between the utility intervention and expectancies for success emerged, $t(179) = 1.94, p = .05, \beta = .10$. The interaction pattern was opposite to that seen among 9th grade girls and in research with older samples. The simple effects tests showed a marginally significant positive effect of the utility intervention among 7th graders with high expectancies for success, $t(179) = 1.73, p = .08, \beta = .13$, but no affect among those with low expectancies for success. Within the 7th grade sample, there were no interactions with gender.

When the model was used to predict science grades, four effects emerged. Most importantly, the interaction of the utility intervention and expectancies emerged, $t(165) = 2.11, p < .05, \beta = .10$. Simple effect tests revealed that the intervention did not affect performance for
those with high initial expectancies, $t(165) = 0.61, p = .54, \beta = .04$, but it decreased performance for those with low initial expectancies for success, $t(165) = -2.37, p < .05, \beta = -.16$. There was also a positive effect of pre-intervention science grades, $t(165) = 12.83, p < .05, \beta = .72$, an effect of gender that favored girls, $t(165) = -3.19, p < .05, \beta = -.16$, and an effect teacher, $t(165) = -3.58, p < .05, \beta = -.17$.

Essays from the 7th grade sample are in the process of being analyzed in a similar fashion as those from the 9th grade sample, with a focus on students’ reports of utility for low versus high expectancies of success.

**Discussion**

The results of these analyses reveal some similarities with past research and some differences. In terms of similarities, the positive effect of self-generated utility found in prior research among 9th grade science students with low initially expectancies of success also emerged in this study; however, only among girls. For 9th grade girls with low expectancies of success, the intervention helped them perceive the importance of science and find the subject interesting. These students came to value the domain more to the extent that they considered how the material they were learning in science class was relevant to them. In contrast to prior research, the same effect was not statistically significant among 9th grade boys with low expectancies for success.

Although girls tend to perform better than boys in school, girls often report lower expectancies for success. To the extent that lower expectancies for success are a barrier for girls to become interested in some academic domains, this intervention may provide a corrective. Girls with lower expectancies for success who generated utility for science content benefited from doing so. The analyses of the content of these girls’ essays may suggest that self-generated
utility may promote interest among this group to the extent that the utility is focused on natural phenomena. One possibility is that the girls who showed positive gains in interest may have used the utility statements to help them realize the wonder and complexity that exists in the natural world.

In contrast, for girls with high expectancies in science, the prompt to generate utility actually undermined their interest in science. This is not consistent with prior research that simply showed no effect of self-generated utility on interest for those with high expectancies of success. This pattern is somewhat difficult to understand, but may be related to beliefs about science being more consistent with the male versus female stereotype (Francis, 2000; Lightbody & Durndell, 1996; Whitehead, 1996). The prompt to generate utility may have highlighted to these girls the extent to which they see themselves fitting (or not) into a science career. Ironically, girls with high expectancies for success in science may have talked themselves out of their interest in science by self-generating utility statements if those statements reified gender stereotypes. The analyses of utility essays for this subset of girls who showed decreases in pre-to post-interest is consistent with this analysis, given that these students were more likely to write about utility of science for careers, and to refer to themselves rather than to a more general other.

The effects of the utility manipulation among 7th graders also varied from previous research testing the effects of self-generated utility. In this age group, the utility manipulation slightly promoted interest only among those with high expectancies for success and decreased performance among those with low expectancies for success. Although not expected with self-generated utility, this pattern of results has been observed with another type of intervention designed to increase utility value. In research testing the effects of directly-communicated utility value (i.e., when the utility of a task is explained to learners), the effects have been shown to be
positive for those with higher expectancies of success (Durik, Shechter, Noh, Rozek, & Harackiewicz, 2014). The explanation that has been put forth for this pattern of results has hinged on the idea that directly-communicated utility value may add information to the situation that the learner has not already considered, thereby adding value to the situation for those who feel confident in the domain already. However, this information may threaten those with lower expectancies for success if they are not convinced of their competence in the domain. Given that utility value implicates future time perspective, and that 7th graders are less likely to be thinking about the future, the prompt to self-generate utility value information may have added information and knowledge to the situation that otherwise would not have been there. In other words, because 7th graders are less likely to think about how school connects to their future, the prompt to consider utility value contributed added value to the situation, and those with high expectancies for success were in the best position for this to translate to their interest in science. Unfortunately, this also undermined the performance of students with low expectancies of success.

Although the utility intervention affected school grades among the 7th grade sample, there were no effects of the utility value intervention on school grades for 9th graders. Research has been mixed in terms of whether self-generated utility value can promote performance. Although it has been demonstrated once among 9th grade science students (Hulleman & Harackiewicz, 2009), it was not found within college student samples (Hulleman et al., 2010). That said, many variables contribute to achievement effects, especially in classrooms. One possibility is that self-generated utility can promote classroom performance, but only in combination with another contextual variable that was not at play in the current study. An alternative explanation is that fourth quarter science grades may not be an accurate assessment of classroom performance in
this particular study. Our results indicate that there were teacher effects in the prediction of grades: That is to say, teachers in the study had tendencies to assign either higher or lower grades. Each teacher was assigned both the utility and control conditions. Thus, teacher effects on grade assignment may have washed out any possible treatment effects. Further research needs to be done to better understand the relationship between utility value and aspects of task engagement that affect performance, whether the mediating variable may be effort, commitment, or some other variable.

Although the prompt given to students was to self-generate utility for the activity, an important aspect of the self-generated nature of the task is that students engaged in the writing activity however they chose. Moreover, rarely did student essays reflect a very specific connection between something they learned in science class and a future goal. Given this, it is important to recognize that students may have defined utility more broadly, as relevance to the self more generally. In other words, some students’ essays reflected how science was related to their life rather than how science was useful to their lives. Although a subtle distinction, this may be important for interpreting the results.

Overall, these findings highlight the importance of gender and grade level in utility value interventions in science. The data reported here suggest that care should be taken in how students are prompted to self-generate utility value. One possibility is that self-generated utility that focuses on the appreciation of the natural world may help cultivate interest for girls in science, rather than a more open-ended utility that might foster thoughts about careers. For those with high expectancies of success, considering the utility value of science for careers may accentuate rather than downplay the fit between girls and the value and enjoyment of science. Finally, the effects of self-generated utility value on 7th graders’ science interest was more
muted, although seventh graders with low expectancies for success may be too young to appreciate this type of manipulation. An important idea that is imbedded in the utility construct is the aspect of time and future. These data are consistent with theorizing that utility value may become a more important determinant of achievement behavior as students mature ().
References


Figure 1. Predicted values for the effect of self-generated utility on science interest, by gender and low versus high expectancies for success.