



Measuring cost: The forgotten component of expectancy-value theory

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ARTICLE INFO

Article history:

Available online 9 March 2015

Keywords:

Cost
Expectancy-value model
Scale development
Motivation
Measurement

ABSTRACT

Although the Expectancy-Value Model offers one of the most influential models for understanding motivation, one component of this model, cost, has been largely ignored in empirical research. Fortunately, recent research is emerging on cost, but no clear consensus has emerged for operationalizing and measuring it. To address this shortcoming, we outline a comprehensive scale development process that builds and extends on prior work. We conducted a literature review of theory and existing measurement, a qualitative study with students, a content alignment with experts, exploratory and confirmatory factor analysis, and a correlational study. In the literature and across our studies, we found that cost was salient to students, separate from expectancy and value components, contained multiple dimensions, and related to student outcomes. This work led to proposing a new, 19 item cost scale with four dimensions: task effort cost, outside effort cost, loss of valued alternatives cost, and emotional cost. In addition, to extend existing cost measures, careful attention was taken to operationalize the cost dimensions such that the scale could be easily used with a wide variety of students in various contexts. Directions for future research and the implications for the study of motivation are discussed.

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1. Introduction

When we asked students to describe characteristics of the class in which they were the least motivated, we heard the following responses: “It was just so much, I couldn’t cram everything into my head”, “Studied so much for this class that I had to sacrifice work for other classes”, “It was really stressful with all the work we had to do.”

What is it that these students are describing? Can it be measured systematically? How is it related to students’ motivation and academic performance? And, what could teachers do to optimize student motivation if they knew students were experiencing it?

Motivation science offers a number of different options for understanding student motivation (Pintrich, 2003). In the current paper, we turn to expectancy-value models (Eccles et al., 1983) to understand what the students quoted above have expressed. In particular, one component within the expectancy-value model, known as cost, captures what the students are describing. Eccles (2005) defined cost as “what an individual has to give up to do a task, as well as the anticipated effort one will need to put into task completion.” Although cost has been theorized as an important component of

the expectancy-value model, empirical work within the expectancy-value framework has historically neglected it (Wigfield & Cambria, 2010). Fortunately, a growing body of work is beginning to emerge (Barron & Hulleman, 2015; Chen & Liu, 2009; Chiang, Byrd, & Molin, 2011; Conley, 2012; Perez, Cromley, & Kaplan, 2014; Trautwein et al., 2012; Watkinson, Dwyer, & Nielsen, 2005). In the current paper, we review what is currently known about cost and explore how it is experienced by undergraduate students using qualitative methods. We then use this theoretical foundation to develop a new measure of cost and present initial validity evidence for the scale.

2. Review of the cost literature

Over thirty years ago, Eccles et al. (1983) were the first to translate expectancy-value models of motivation into educational research. This framework proposes that motivation is a function of expectancy (i.e., students’ perceived judgments of their ability to succeed) and task value (i.e., students’ perceived level of task importance) components. Cost was first introduced by Eccles et al. (1983) as a mediator that would impact an individual’s overall value for an activity. Specifically, cost was hypothesized to be influenced by three dimensions: perceived effort, loss of valued alternatives, and the psychological cost of failure. Perceived effort was described as students’ perception of how much effort is needed to be successful at the task, stating that cost will be high if that effort is not perceived to be worth the benefit. Loss of valued alternatives was hypothesized to occur

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when engaging in one activity prevents an individual from being able to participate in other valued activities. Finally, the psychological cost of failure was described as the anxiety related to the potential of failure at the task. This initial conceptualization implies that cost is a negative motivational component that subtracts from the overall level of value a student has for the task.

The first attempts to measure cost are summarized in a 1980 grant report authored under Eccles's maiden name (see Parsons et al., 1980). In particular, in the subscale "Cost of Effort to Do Well in Math," items assessing whether the amount of effort is worthwhile and loss of valued alternatives were included (see Table 1 for items), representing two of the three dimensions that Eccles et al. (1983) theorized as cost. However, subscales to measure task effort and task difficulty were also included that were theorized to impact a student's expectancy (see Table 1 for items). Thus, in this initial work, it was difficult to disentangle the different appraisals of effort to distinguish one as cost (a component of value), one as difficulty (a component of expectancy), or one as general effort (separate from expectancy and value).

Eccles and colleagues used the Parsons et al. (1980) expectancy-value scale, or an adaptation of it, for years. Their published work focused on the predictive power of the expectancy and value subscales (but not the cost subscales), contributing greatly to what we know about student motivation. Then, in 1995, Eccles and Wigfield formally revisited the measurement properties of the scale by investigating the structure of expectancy and value, as well as the task difficulty items. The authors used exploratory factor analyses to refine the item pool and confirmatory factor analyses to investigate the structure of the different expectancy-value components. Although expectancy, value, and task difficulty were included in the analysis, the original cost subscale was not. Only one item from the cost subscale was featured in the analysis, but was included as an item on the attainment value subscale.

The results of Eccles and Wigfield (1995) provided evidence that: (a) expectancy and value components are distinct, though positively related, and (b) task difficulty is both separate from and differentially related to expectancy and value. Because the effort component of task difficulty is similar in content to the Parsons et al. (1980) "Cost of Effort to do Well in Math" items, cost might also be distinct from expectancy and value and differentially relate to them. Although Eccles and Wigfield offered an important and rigorous test of the factor structure of their scale and the interrelations between components, the relationship between cost and other constructs was not formally evaluated.

In 2000, Wigfield and Eccles offered additional clarification about the constructs of their expectancy-value model in a special issue of *Contemporary Educational Psychology* focused on clarifying motivation constructs. For cost, they continued to define the effort and loss of valued alternatives dimensions similarly to Eccles et al. (1983);

but rather than focusing on just psychological cost of failure or success, they offered a broader definition of "emotional cost" suggesting emotional costs could encompass other mood states. Further, rather than referring to cost as a mediator of value, as was done in Eccles et al. (1983), they present cost as a type of value, as was done in most writing on cost after 1983.

Over the past ten years, other educational psychologists have been inspired by Eccles's model to explore cost both qualitatively and quantitatively and its effects on student outcomes (Battle & Wigfield, 2003; Chen & Liu, 2009; Chiang et al., 2011; Conley, 2012; Perez et al., 2014; Trautwein et al., 2012; Watkinson et al., 2005). The surge of cost-related work emphasizes the interest and need in the field for theoretical and measurement clarification. This emerging research also suggests that cost does contribute to student motivation and is separate from other value components. For example, Watkinson et al. (2005) conducted a qualitative study of elementary students' motivation to be physically active during recess. Students discussed the cost of engaging in activities without being prompted, including both the physical costs of engaging in an activity (fatigue or being cold) and also psychological or emotional costs (being teased by friends or facing scrutiny).

Chen and Liu (2009) also qualitatively studied cost, noting the lack of a psychometrically sound measure and deep understanding of cost. For example, they asked students the open ended question, "If you have a choice whether to take physical education, would you rather not take it or [would] you still want to take it, and why?" Those who responded that they would not take physical education cited other demands on their time and heavy workload as contributing factors. Interestingly, this highlights a new dimension of cost. While the amount of effort required by a given task has always been recognized as a dimension of cost, educational psychologists have not considered how effort needed for other tasks can increase feelings of cost. For example, students may experience higher levels of cost in a particular class because of the time and energy they need to spend on another class, or other activities. Having other competing demands and how it impacts human behavior is more widely discussed in other literatures such as behavioral economics (for review, see Madden, 2000).

Building from Watkinson et al.'s (2005) qualitative work, Chiang et al. (2011) studied the cost of engaging in physical activity quantitatively. They included one item to assess each of the cost dimensions proposed by Eccles, Wigfield, and their colleagues (see Table 2 for items), along with items to measure expectancy and value. Exploratory factor analysis revealed that a two-factor structure best fits the data, with one factor including the three cost items, and the other including the items for expectancy, interest value, and importance value (which they labeled as "beliefs"). Students who reported higher levels of cost reported less exercise, whereas students who reported higher levels on the beliefs subscale reported

Table 1
Cost and effort scale items from Parsons et al. (1980).

Cost of effort to do well in math	Effort	Difficulty of current math
1. Is the amount of effort it will take to do well in your math course this year worthwhile to you?	1. How hard to do you have to try get good grades in math?	1. In general, how hard is math for you?
2. Is the amount of effort it would take to do well in advanced high school math courses worthwhile to you?	2. How hard do you have to study for math tests to get a good grade?	2. Compared to most other students in your class, how hard is math for you?
3. How much does the amount of time you spend on math keep you from doing other things you would like to do?	3. To do well in math, I have to work: much harder in math than in other subjects to much harder in other subjects than in math	3. Compared to most other school subjects that you have taken or are taking, how hard is math for you?
	4. How much time do you spend on home work?: an hour or more to I rarely do any math homework	
	5. How hard do you try in math?	
	6. Compared to most other students you know, how much time do you have to spend working on your math assignments?	

Note: Response options for items were on a 7-point scale with anchors at the low and high extreme (e.g., 1 (not at all) to 7 (very much) for Cost of Effort to do Well in Math, 1 (very easy) to 7 (very hard) for Effort, and 1(very worthwhile) to 7 (not at all worthwhile) for Difficulty of Current Math.

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