



Empirical study

Assessing task values in five subjects during secondary school: Measurement structure and mean level differences across grade level, gender, and academic subject[☆]



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ABSTRACT

Students' value beliefs tend to decrease across secondary school (Wigfield et al., 2015). However, previous studies did not differentiate between all the dimensions of task values defined by expectancy-value theory (Eccles et al., 1983). Therefore, this study evaluated an instrument for assessing multiple value dimensions across grade level and academic subjects and tested for differences between grade levels in these subjects. A total of 830 students from Grades 5 to 12 completed a questionnaire assessing their value beliefs in German, English, math, biology, and physics with 37 items each. The factor structure was shown to be invariant across academic subjects, grade levels, and gender. Generally, students in higher grades showed lower means on positive value facets and higher means on cost facets. However, the results varied substantially by facet and subject. Furthermore, stereotypical gender differences in value beliefs were found, and some of these differences increased with students' grade level. The findings indicate that examining multiple dimensions and subjects is crucial for developing a complete understanding of the development of students' value beliefs.

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1. Introduction

Students' value beliefs in different academic domains are crucial predictors of students' effort and persistence in these domains as well as of their long-term academic choices (Eccles, 2005, 2009). One well-established finding in research on students' value beliefs and related motivational constructs is the tendency for the levels of these constructs to decline during secondary school (e.g., Frenzel, Goetz, Pekrun, & Watt, 2010; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Watt, 2004). This decline has been explained by an interaction between natural developmental factors and school context factors (Wigfield et al., 2015). However,

measures that can capture differences across age groups and academic subjects are needed to paint a realistic picture of this development.

Although many previous studies have examined how students' value beliefs develop across secondary school, these studies have also suffered from a number of limitations. Typically, such studies have investigated how task values or related constructs (e.g., interest) develop in one subject (e.g., math) over several years using short scales (e.g., Frenzel et al., 2010; Trautwein, Lüdtke, Kastens, & Köller, 2006). However, expectancy-value theory (EVT; Eccles et al., 1983) conceives of subjective task value as a multidimensional construct. Different types of value beliefs about one domain can be differentiated, including intrinsic value, attainment value, utility value, and cost. These aspects have not always been measured separately, and previous research has tended to neglect cost (for a review, see Wigfield & Cambria, 2010). Moreover, the choices that individuals make are driven by intraindividual hierarchies of subjective task values across domains (Eccles, 2009), a process that highlights the importance of assessing task values in multiple subjects (for an exemplary study, see Jacobs et al., 2002). To be able to draw valid conclusions about hierarchies across domains as well as about mean level changes that are associated with students' age, measurement instruments need to reflect strong measurement invariance across subjects and age groups (Meredith, 1993).

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Whereas many earlier studies simply ignored these assumptions, recent studies have shown that establishing measurement invariance can be difficult across academic subjects (Nagengast, Trautwein, Lüdtke, & Kelava, 2013) and over time (Frenzel, Pekrun, Dicke, & Goetz, 2012).

In an attempt to address these problems, the current study evaluates an instrument that measures a differentiated set of value beliefs across academic subjects. The instrument was originally developed to measure ninth-grade students' value beliefs in math (Gaspard, Dicke, Flunger, Schreier, et al., 2015). It covers all four value components and additionally includes subfacets of some of these components. Administering this instrument to students of different ages and in several academic subjects can yield insight into the strength of age differences across value facets in these subjects. To this end, a sample of students from Grades 5 to 12 were asked about their value beliefs in five academic subjects. Our study had two major aims: First, we tested whether the instrument could be used across grade levels and academic subjects with rigorous tests of measurement invariance. Second, we examined how mean levels of value beliefs in these subjects were associated with students' grade level. As potential moderators of these grade level differences, we investigated students' gender and the facet and academic subject under consideration.

1.1. Theoretical conceptualization and empirical operationalization of task values

EVT by Eccles et al. (1983) postulates that academic performance and choices are predicted by two kinds of subjective beliefs: expectancies (i.e., the perceived ability to succeed on a task) and value beliefs (i.e., reasons for engaging in a task). Research has shown that expectancy and value beliefs are highly domain-specific, with beliefs in different school subjects such as math and English showing only low correlations (e.g., Bong, 2001; Eccles, Wigfield, Harold, & Blumenfeld, 1993; Trautwein et al., 2012). Another core assumption of EVT is that values regarding a particular task are comprised of multiple components: intrinsic value, attainment value, utility value, and cost (for more detailed discussions of these components, see Eccles, 2005; Eccles et al., 1983; Wigfield & Eccles, 1992). Intrinsic value is defined as the enjoyment a person derives from engaging in a task and has been linked to individual interest. Attainment value indicates the importance that individuals attach to doing well on a given task and is related to the relevance of a task for a person's identity. Utility value describes the perceived usefulness of engaging in a task for short- as well as long-term goals. Cost refers to the perception of negative consequences of engaging in a task.

Although EVT thus describes four theoretically distinct components, previous research on students' value beliefs usually did not measure these aspects separately (for exceptions, see Conley, 2012; Trautwein et al., 2012). Rather, previous studies tended to incorporate positive value aspects (i.e., attainment, intrinsic, and utility value) into a global value scale and usually neglected to include measures of cost altogether (Trautwein et al., 2013; Wigfield & Cambria, 2010). With this approach, information about the differential predictive validity of the four components is missing. So far, all four components have been found to be associated with important student outcomes when assessed separately (e.g., Durik, Vida, & Eccles, 2006; Perez, Cromley, & Kaplan, 2014; Watt et al., 2012). To investigate their differential predictiveness, Guo et al. (2016) used a hierarchical representation of task values that specified a global value factor as well as four component-specific factors. By doing so, they were able to show that—beyond global value—attainment value uniquely contributed to self- and teacher-rated engagement, and low cost contributed uniquely to achievement.

Adding to the complexity of task values, the definition of the EVT value components is rather broad and relatively unspecific. Thus, previous studies have often relied on different operationalizations of the same value components. To offer some clarity, Gaspard, Dicke, Flunger, Schreier, et al. (2015) tested whether several facets of the attainment value, utility value, and cost components could be empirically distinguished. Using data from a large sample of German ninth-grade students and focusing on value beliefs in math, they found that attainment value could be divided into the importance of achievement and personal importance, utility value could be separated into facets tapping different life domains in the short as well as in the long term (e.g., school, daily life, social life, job), and cost could be differentiated into effort required, emotional cost, and opportunity cost (for a representation of these facets, see Fig. 1). Although the facets within each of the three components (i.e., attainment value, utility value, and cost) were highly correlated—a finding that was in line with a higher order model—distinguishing between these facets was useful as gender differences in math depended on the specific facet under consideration. In addition, recent studies focusing on cost found that cost facets were differentially related to students' outcomes (Flake, Barron, Hulleman, McCoach, & Welsh, 2015; Perez et al., 2014). Although there is thus some initial evidence for the separability of facets of value components and their differential validity, further research is still needed to examine whether these facets can be generalized across age groups and academic subjects.

1.2. Development of task values during secondary school

Most research on the development of task values has addressed changes in mean levels, although some insight into the development of the structure of task values has also been obtained (Wigfield et al., 2015). Confirmatory factor analyses suggest that expectancy and value beliefs within one domain form distinct factors from the first grade and beyond (Eccles, Wigfield, et al., 1993). With respect to the distinction of value components, it has been found that three to four items assessing intrinsic, attainment, and utility value form one value factor for elementary school students (Eccles, Wigfield, et al., 1993). Applying a confirmatory factor analysis to students' responses to seven value items, Eccles and Wigfield (1995) found that factors indicating intrinsic, attainment, and utility value could be separated for students in Grades 5–12. These results can be interpreted to mean that the components of task values within subjects become more differentiated with increasing student age. Wigfield and Eccles (1992) argued that children's understanding of the usefulness of different activities for their future goals develops at a later age than the intrinsic enjoyment of a task. However, studies have yet to explicitly compare how the correlational structure of these components within domains changes with age.

Regarding changes in mean levels, a large number of studies conducted in different countries have shown that task values for different academic subjects decrease with students' age (e.g., Jacobs et al., 2002; Trautwein, Lüdtke, Schnyder, & Niggli, 2006; Watt, 2004). This decrease appears to begin in elementary school (Spinath & Steinmayr, 2008; Wigfield et al., 1997) and continues into secondary school (Trautwein, Lüdtke, Kastens, et al., 2006; Watt, 2004). However, declines have been found to be curvilinear with stronger declines occurring in earlier years, and a leveling off of task values occurring in late adolescence (Jacobs et al., 2002; Watt, 2004). Several explanations have been proposed for these declines in value and related beliefs (see Schiefele, 2009; Wigfield et al., 2015). Focusing on age-related changes, a differentiation of interests has been described with young children having quite general interests that become more specific as they mature (Krapp, 2002). Also, children's competence appraisals become

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