ABSTRACT

Title of dissertation: Uncovering the Relations Among College Students' Expectancies, Task Values, Engagement, and STEM Course Outcomes

Jessica R. Gladstone, Doctor of Philosophy, 2020

Dissertation directed by: Professor Allan Wigfield
Department of Human Development and Quantitative Methodology

In the last thirty years, student engagement has received much attention as an important contributor to students' school success. One major limitation of the research on student engagement is that there is not a widely accepted theory regarding what constitutes it and how it relates to motivation. In the present study I examined relations of college students' motivational beliefs and task values (as defined in Eccles and colleagues' expectancy-value theory, EVT) to proposed dimensions of their engagement: behavioral, cognitive, social, agentic, and behavioral and emotional disaffection. In particular, I examined: (1) empirical overlap among certain dimensions of engagement and task value constructs; (2) which EVT constructs are associated with which dimensions of engagement; (3) how motivational beliefs, values, and engagement dimensions relate over time; and (4) whether engagement dimensions mediate the relationship between motivational beliefs, values, and math and science grades. Students (N_{time1} = 486, N_{time2} = 516) were recruited from a large public university and then completed surveys about their motivation and engagement in their introductory math or science course twice, at the beginning of the semester and again after mid-terms examinations. Findings indicated that although there were strong associations among certain engagement dimensions and task value constructs, structural equation model fit indices indicated that these should be treated as separate constructs. Regression analyses showed that in general, students' competence beliefs and values were associated with behavioral, cognitive, and emotional engagement and behavioral and emotional disaffection dimensions. However, the relations between the motivational variables and social and agentic engagement were weak or non-significant. Cross-lagged panel analyses indicated that some relations among task values and engagement dimensions were reciprocal over time, but more often motivation predicted engagement rather than the reverse. Students' behavioral and cognitive engagement were strong mediators of the relations between their task values and domain-specific grades in math and science. I conclude from these results that (at least for college-aged students) certain engagement constructs should be integrated more fully into the well-established expectancy-value model; however, future research is needed to ensure that these relations hold across different domains.

Uncovering the Relations Among College Students' Expectancies, Task Values, Engagement, and STEM Course Outcomes

by

Jessica R. Gladstone

Dissertation to the Faculty of the Graduate School of the University of Maryland, College Park in partial fulfillment of the requirements for the degree of
Doctor of Philosophy
2020

Advisory Committee:

Professor Allan Wigfield, Chair
Professor Patricia Alexander
Professor Lucas Butler
Professor Mariam Jean Dreher
Professor Ji Seung Yang

Acknowledgements

I am so incredibly grateful to have had the support, encouragement and guidance from so many amazing and inspiring people throughout graduate school and during the completion of my dissertation. I would like to first thank my advisor and mentor, Dr. Allan Wigfield. Thank you for giving me the opportunity to come to the University of Maryland and for allowing me to work with such an amazing scholar and person. You have taught me so much and your passion for motivation research can clearly be seen in your work and in your mentoring. I am so grateful that I had such an encouraging, supportive, and engaged mentor.

I would also like to thank my amazing dissertation committee members, Drs. Patricia Alexander, Lucas Butler, Mariam Jean Dreher, and Ji Seung Yang, for not only providing me with thoughtful feedback but also for your guidance throughout my time at UMD. Patricia Alexander, you have been a role model and mentor to me since I arrived at Maryland. You challenged me, listened to me, and supported me. You are such an inspiration and I am so thankful to have had you on my committee. Lucas Butler, thank you for always being so thoughtful in your questions and comments. Ji Seung, you have been an amazing mentor for me, and your continual encouragement has really helped push my statistics knowledge to the next level. Additionally, I would like to thank my previous mentor, Dr. Sam Mathews. Sam, your encouragement throughout my undergraduate career is a huge part of why I am where I am today. I could not have done it without you!

Next, I would like to thank all of the math and science professors, as well as the Registrar's Office, for working with me to administer my dissertation study. I would like to also thank the University of Maryland College of Education for providing me with funding for this project. I am also thankful for the students who participated in my research. Additionally, I am forever grateful for the HDQM staff.

I also want to thank all of the current, former, and honorary members of the Motivation in Education Research Group, particularly Katie Muenks, Emily Rosenzweig, Lara Faust, Annette Ponnock, Monica Morell, and Marguerite Tom-Wigfield. Katie, Emily, Lara, and Annette, thank you all so much for your support and guidance! Monica, thank you for going through this dissertation phase with me and helping me with all my statistics questions! Marguerite, I will always be grateful to have had your constant love and support for all of us in MERG.

Finally, I would like to thank my amazing family and friends, I wouldn't be here without you! A special thank you to my incredible husband who has been my biggest supporter and a huge inspiration to me. Your constant love and encouragement mean the world to me. I am also thankful to our dogs, Yadi and Kona, who never fail to put a smile on my face. I would also like to give a huge thank you to my amazing mother who has always believed in me and has helped me reach each of my dreams. Thank you to my loving stepfather, Rob, and my brother and sister, whose hard work and tenacity has always been an inspiration. Finally, thank you to my late father, I know you would be proud of me.

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Chapter 1: Introduction

Statement of Problem

Students who are engaged in their schoolwork are likely to have high achievement and continue pursuing an education (Finn, 1989; Finn, 2006; Finn & Zimmer, 2012; Fredricks, Blumenfeld, & Paris, 2004; Wang & Eccles, 2013). But what do students look like when they are engaged? Are students engaged if they are raising their hands in class? If they are showing excitement over a new topic? If they are working quietly on an assignment? Are students engaged if they are only doing one of these things? Although many researchers over the last thirty years have attempted to answer questions such as these regarding what it means to be engaged, there are still many gaps in the literature.

A fundamental problem in the study of student engagement is the lack of definitional clarity. Although many researchers now agree that student engagement is a multifaceted construct that generally describes students who are actively involved and committed in school (Fredricks et al., 2004), there is still disagreement regarding how many dimensions make up student engagement and how those dimensions are defined. In the last decade, more scholars have come to agree that there are at least three dimensions that comprise student engagement: behavioral, cognitive, and emotional/affective engagement (See Christenson, Reschley, & Wylie, 2012; Fredricks et al., 2004). However, more recently Reeve (2012) and Wang, Fredricks, Ye, Hofkens and Schall Linn (2016) proposed two more dimensions of engagement, agentic and social. Although the inclusion of multiple dimensions of engagement adds to the overall understanding of the nature of engagement, the lack of agreement about how to define these multiple dimensions has led to difficulties in comparing findings across studies and inconsistencies about how many dimensions make up engagement. However, in the present study I operationalized student engagement in terms of these five proposed dimensions and two dimensions of behavioral and emotional disaffection.

Engagement's conceptual and empirical clarity is also muddled by the fact that some researchers' definitions of the different dimensions of engagement overlap with the definitions of some motivational constructs. For example, researchers including Eccles and Wang (2012) and Finn (2006) have described emotional engagement as being similar to subjective task values definitions from the Expectancy-Value theory of motivation. Further, this overlap between definitions of engagement and motivational constructs has led researchers to debate about how these constructs relate. Some researchers, such as Martin (2007) argue that motivation and engagement are interchangeable terms, some, including Fredricks and colleagues (2004) argue that motivation is inherently included in engagement, and some researchers such as Skinner, Kindermann, and Furrer (2009) and Wigfield and Guthrie (2010) argue that motivation and engagement are separate constructs and that motivation precedes engagement. In my dissertation study I addressed these empirical issues by examining the potential overlap among emotional engagement and components of subjective task value and by examining how motivational beliefs and values predict dimensions of engagement and whether this relationship is reciprocal.

How engagement is conceptualized is also highly dependent upon the domain or level at which engagement is being examined. Students' engagement can vary depending on whether students are asked to report their overall school engagement, their math engagement, or even their engagement in a particular math class. Many definitions of engagement and measures of it concern school in general (Christenson et al., 2012);

however, measuring student engagement at the domain or course-specific levels would allow for a deeper and clearer understanding of students' engagement in a specific course and how this engagement impacts their achievement in that course. Increasing student engagement in math and science classes has been at the forefront of much educational research as well as policy concerns in the last decade. However, in order to understand student engagement in math and science courses and then do interventions to increase it, we need to define and measure student engagement that is specific to these domains. Active engagement in math and science classes is considered a key contributing factor to students' academic success and likelihood of continuing majoring in science, technology, engineering and/or mathematics (STEM) and obtaining a career in STEM (Wang & Degol, 2014; Wang et al., 2016). Thus, in this dissertation study I focused on college students in the domains of math and science in order to help better understand how students' engagement may keep students in the STEM pipeline.

As will be discussed in more detail below, in this dissertation study, I examined math and science self-reported behavioral, emotional, cognitive, social and agentic engagement and behavioral and emotional disaffection in relation to constructs from one motivational theory, Expectancy-Value theory (EVT). EVT is a prominent motivation theory and some researchers (e.g., Wang & Eccles, 2013) have started to examine EVT variables and their relationship with engagement in math and science, but the work is still limited. By basing my study in this theory, I was able to address some of the empirical confusion in the literature concerning how distinct or similar engagement and motivation are and how they relate to one another.

Expectancy-Value Theory

As just discussed, the key variables in my dissertation are students' self-reported behavioral, emotional, cognitive, social and agentic engagement and behavioral and emotional disaffection. Given the lack of agreement on its definitions and how many dimensions make up engagement, there currently are not widely accepted theoretical frameworks for student engagement. So, although various definitions and measures of engagement are discussed, the only theory I present is the primary motivation theory grounding the study, Expectancy-Value Theory.

As noted in the overview, researchers studying engagement and motivation together have based their work in several different motivation theories to ground their work: Self-determination theory, achievement goal theory, and school identification are the main ones. Researchers have begun to use Expectancy-Value Theory (EVT), another major theory in the motivation field, as a basis for their work on how individuals' motivation predicts their engagement and achievement outcomes (Guo et al., 2016; Marchand & Gutierrez, 2016; Wang & Eccles, 2013). In this study I will continue to build on the EVT-based research on motivation and engagement.

As discussed in more detail in Chapter 2, Eccles-Parsons and colleagues (Eccles, 2005; Eccles-Parsons et al., 1983) proposed and developed an expectancy-value model of academic achievement-related choices and performance. They posited that students' motivation to pursue or engage in different achievement tasks is determined most directly by two beliefs: students' expectancies for success for a given task or set of activities and their valuing of them. Eccles-Parsons and colleagues defined expectancies for success as students' beliefs about how well they will do on an upcoming task. Students' beliefs about their self-concept of ability (or competence) in a domain is another key component of the expectancy-value model. Students' self-concept of ability beliefs is conceptually distinct from students' expectancies for success. Students' self-concept of ability beliefs refers to students' evaluations of their current competence, rather than their future performance. However, Eccles and her colleagues (Eccles & Wigfield, 1995; Eccles, Wigfield, Harold, & Blumenfeld, 1993; Wigfield et al., 1997) found that these two beliefs are strongly related empirically and so they often combine them. I will use the phrase competence-related beliefs throughout this paper when I am discussing the two together.

The second major construct is the extent to which students value an achievement task. Eccles-Parsons and colleagues (Eccles, 2005; Eccles-Parsons et al., 1983; Wigfield, Rosenzweig, & Eccles, 2017) posited that individuals' overall subjective task value for a task is determined by four things: Students' inherent enjoyment of a task (i.e., intrinsic value), students' beliefs about whether the task is important to their sense of self (i.e., attainment value), students' beliefs about whether the task is useful (i.e., utility value) and students' beliefs about what they may have to give up in order to do a task (cost). More recently, researchers such as Flake, Barron, Hulleman, McCoach and Welsh (2015) and Gaspard and colleagues (2015), have proposed additional sub-components of utility and cost in particular. These sub-components will be discussed in more detail in Chapter 2.

As noted above, EV theorists (Eccles & Wigfield, 1995; Eccles-Parsons et al., 1983; Wigfield et al., 2017) posited that students' competence-related beliefs and values directly predict their engagement in an academic activity. Recently, researchers have begun to examine how different-aged students' competence-related beliefs and values relate to student engagement and have found that students' competence-related beliefs and values predict different dimensions of their engagement (Guo et al., 2016; Marchand & Gutierrez, 2016; Wang & Eccles, 2013). As can be seen in the EVT model (see Figure 1), engagement is not explicitly included as an outcome; however, Eccles (personal communication) and Eccles and Wang (2012) stated that engagement can be an outcome of competence-related beliefs and values. Further, they also stated that there are reciprocal relations of students' engagement to their subsequent competence-related beliefs and values. Therefore, one major goal of the present study is to study both how competence-related beliefs and values are associated with students' self-reported engagement, and the possible reciprocal relations among them.

EVT-Based Research on the Relations of Motivation and Engagement

As just noted, in the past several years EVT researchers have begun to conduct empirical work on how individuals' competence-related beliefs, values, and cost predict the different dimensions of student engagement (I review this work in more detail in Chapter 2). Wang and Eccles (2013) found that adolescents who reported valuing school highly (measured as a combined score of attainment and intrinsic value), reported being more behaviorally, emotionally and cognitively engaged than students who valued school less. Further, they found that students' task value was a stronger predictor of emotional engagement than students' competence beliefs. However, students' competence-related beliefs were a stronger predictor of behavioral and cognitive engagement than their valuing of school. A limitation of this study is that Wang and Eccles did not examine the value components separately and rather combined items from attainment and intrinsic value to represent subjective task value. Therefore, their measure of subjective values did not include utility value and they also did not examine how cost relates to these three dimensions of engagement.

Marchand and Gutierrez (2016) extended Wang and Eccles (2013) study by examining the relations of graduate students' utility, attainment, and intrinsic value predicted their perceived cognitive and behavioral engagement in a research methods course. They found that students' utility, attainment, and intrinsic value later predicted their semester-end reports of behavioral and cognitive engagement. These results are important, but the study is limited by the fact that Marchand and Gutierrez only examined two dimensions of engagement, and also did not include either perceived cost or competence beliefs. Cost likely is a particularly worthwhile construct to assess in a college and graduate student samples because post-secondary students typically have to balance multiple responsibilities regarding school at the same time.

Guo and colleagues (2016) examined how students' cost, utility value, attainment value, and intrinsic value predicted teacher reported behavioral engagement of their ninth-grade students. They found that students' attainment and intrinsic value positively predicted and cost negatively predicted teacher-rated behavioral engagement. Students' utility value was not a significant predictor of teacher reported behavioral engagement. Again, these results add important information to the literature about how beliefs and values predict students' engagement, but the measure of engagement was limited in that it only included one dimension of engagement.

In the most recent study to date, Fredricks, Hofkens, Wang, Mortenson, and Scott (2018) found that that seventh to twelfth grade students' attainment value predicted their behavioral, cognitive, emotional and social engagement in both math and science classes.

Their utility value predicted math and science behavioral engagement, science cognitive engagement, and science social engagement. Expectancy beliefs predicted math and science behavioral engagement, math and science emotional engagement, and science cognitive engagement. Although Fredricks and colleagues included multiple dimensions of engagement, they did not include measures of cost or intrinsic value and they only assessed students' motivation and engagement at a single time-point, making it difficult to identify the exact predictive relationship.

In summary, researchers basing their studies in EVT have found that individuals' competence-related beliefs and values do predict different dimensions of their engagement. However, these studies have not examined all of the sub-components of the belief and value constructs in the model, or all the proposed dimensions of engagement, particularly the recently proposed social and agentic dimensions. Therefore, in this study I examined how students' competence related beliefs and values included in EVT (along with newly introduced sub-facets of these constructs) related to the five proposed dimensions of student engagement, using well-validated measures of each that have been reported in the literature.

Purpose of the Proposed Study and Research Hypotheses/Question

As just noted, the overarching purpose of this study was to examine the relations between different dimensions of student engagement and their competence-related beliefs and values. Prior to doing so I examined (using factor analysis) the potential empirical overlap of emotional engagement with aspects of task values, given the overlap in their definitions. To date such work has not been done. Following this I examined the different kinds of relations among students' self-reported competence-related beliefs, values, engagement dimensions, and domain-specific math and science grades. These include associative relationships, predictive relationships, reciprocal relationships, and relations with students' domain-specific grades. I also used measures of these constructs at the subject-specific level, thus examining their relations in math and science courses. This domain-specificity allowed for a deeper understanding of how engagement is manifested in different subject areas.

Factor analyses on similar EVT constructs and dimensions of engagement. The variables with the most definitional and measurement overlap are emotional disaffection and emotional cost along with emotional engagement and intrinsic value. My first set of hypotheses (labeled hypotheses 1A and 1B) regarding the factor analyses of these variables were[1]:

1A. Emotional disaffection and emotional cost will overlap empirically.

1B. Emotional engagement and intrinsic value will overlap empirically.

To address these hypotheses, I conducted a confirmatory factor analysis (CFA) on well-validated emotional engagement and disaffections scales and well validated expectancy-value scales assessing students' intrinsic value and emotional cost.

The rationale for these hypotheses were as follows: Both emotional disaffection and emotional cost emphasize students experiencing negative emotions such as stress and frustration. Because of this overlap in their definitions it was likely there would be cross-loadings among the items measuring these two constructs. Emotional engagement and

[1] The rationale for these hypotheses will be discussed more fully in Chapter 3 once I have thoroughly described the measures and the items of each measure.

intrinsic value were likely to overlap because they both were defined as including positive emotions such as valuing, showing interest and enjoying a subject.

Predictive relations among competence-related beliefs, values, and dimensions of engagement. My second set of hypotheses (labeled hypotheses 2A, 2B, and 2C) regarding which EVT constructs will predict which dimensions of engagement were as follows:

2A. Students' competence-related beliefs, attainment value, intrinsic value, and utility value would be positively associated with their engagement and cost negatively associated with engagement. Students' competence-related beliefs, attainment value, intrinsic value, and utility value would be negatively associated with behavioral and emotional disaffection and cost would be positively associated.

2B. Students' competence-related beliefs would be most strongly associated with behavioral and cognitive engagement than any of the task value variables.

2C. Students' attainment value, intrinsic value, and utility value would be most strongly associated with emotional engagement, social engagement and agentic engagement than students' competence-related beliefs. Students' cost would be most strongly associated with behavioral and emotional disaffection than students' competence-related beliefs, attainment value, intrinsic value, and utility value.

In addition, I included both unidimensional and correlated two-factor models of emotional disaffection and emotional cost and emotional engagement and intrinsic value as additional dimensions of engagement and as additional independent variables in the hypotheses above.

The rationale for these hypotheses were as follows: Previous research has demonstrated that competence-related beliefs and values predict the various dimensions of student engagement (Guo et al., 2016; Fredricks et al., 2018; Marchand & Guitierrez, 2016; Wang & Eccles, 2013). I hypothesized that competence-related beliefs would be a stronger predictor of behavioral and cognitive engagement because Eccles (2009) proposed that students' competence-related beliefs influence how they behave and how they think. Regarding the third hypothesis, values are more affective than competence-related beliefs and so one might expect that they would relate more strongly to emotional engagement than competence related beliefs. Further, Fredricks and colleagues (2018) demonstrated that values would be a stronger predictor of social engagement than students' competence-related beliefs. I also hypothesized that students' values would be a stronger predictor of agentic engagement than competence-related beliefs because Reeve (2012, 2013) emphasized that students who demonstrate agentic engagement make the learning environment personally relevant to themselves and make sure that the teacher knows what they are interested in.

Reciprocal relations among competence-related beliefs, values, and dimensions of engagement. As noted earlier, Eccles and colleagues (Eccles, personal communication; Eccles & Wang, 2012) proposed that students' competence-related beliefs, values, and engagement relate reciprocally. My hypothesis (labeled Hypothesis 3) regarding these proposed reciprocal relations was as follows:

3: Students' competence-related beliefs and values and engagement would have a reciprocal relationship.

The rationale for this hypothesis, was (as just noted) that Eccles proposes these reciprocal relationships, with motivational beliefs and values first leading to academic outcomes (including engagement), and these academic outcomes then leading to subsequent competence-related beliefs and values (see Figure 1; Eccles-Parsons et al., 1983).

As discussed in more detail in Chapter 2, motivation and engagement researchers have often debated about whether motivation precedes engagement (Eccles & Wang, 2012; Fredricks et al., 2004; Martin 2007; 2012; Reeve & Lee, 2014). Answering this research question will provide important information regarding this debate.

Predictive relations of competence-related beliefs, values, and dimensions of engagement to domain-specific grades. I had one research question regarding the relative strength of students' competence-related beliefs, values and dimensions of engagement in predicting their grades.

My research question (labeled RQ) was:

RQ. Would dimensions of engagement mediate the relationship between competence-related beliefs, values, and domain-specific grades?

In a personal communication, Eccles (September, 2018) stated that motivational beliefs and values are the driving force behind whether students start an activity, and that engagement is what students' experience while doing the task. Thus, how engaged students are in the task should predict their achievement, as long as students are also reporting that they feel competent and/or value the task. Therefore, although the leading expectancy-value theorist suggests that motivational beliefs and values drive engagement which then predicts achievement, I assessed a research question regarding whether there was a mediated relationship of motivation to achievement rather than proposing a hypothesis regarding mediation because of a lack of research on it.

Dissertation Contributions

This study was the first to explore whether there was empirical overlap in certain dimensions of engagement and value constructs defined in EVT. Factor analytic work has been done on students' competence-related beliefs and values, and also on the different dimensions of engagement; both sets of work shows that competence-related beliefs and values are distinct (Eccles et al., 1993; Eccles & Wigfield, 1995) and also that the different dimensions of engagement are distinct (Christenson et al., 2012; Skinner et al., 2009; Reeve, 2013; Wang et al., 2016). However, to the best of my knowledge there has been no factor analytic work examining whether certain of the motivational belief and value constructs are distinct from the engagement constructs. As I discuss in Chapter 2, the lack of conceptual and empirical clarity regarding engagement has to do with some researchers' definitions of the different dimensions of engagement overlapping with how certain motivational constructs are defined.

The major contribution of this study is its expansion of the extant literature on both motivation and engagement by examining how students' competence-related beliefs and multiple facets of students' values are associated with and predicted all five proposed dimensions of student engagement. As discussed in more detail in Chapter 2, there has not been a comprehensive study of the relations of competence-related beliefs, values and dimensions of engagement in domain-specific courses. Therefore, this was an important next step because the two new dimensions of engagement, social and agentic, have not been examined much and more research is needed on their relations and predictive validity. Additionally, the new aspects of utility value and perceptions of cost have not been examined as thoroughly, especially with respect to their relations with the dimensions of engagement.

This study also provided important information regarding the nature of the relations of competence beliefs, values and engagement; in particular, whether they related reciprocally or not. Researchers continue to debate about how motivation and engagement are related with some stating motivation and engagement are similar enough that they can be interchangeable terms (Martin, 2007), others saying that motivation is inherently included in engagement (Fredricks et al., 2004), and still others that motivation precedes engagement (Skinner et al., 2009). Thus, testing whether a reciprocal relationship exists would provide more information regarding the exact relationship between motivation defined under EVT and engagement.

Fourth, this study contributed to our understanding of how students' motivational beliefs, values and engagement predict students' domain-specific grades, and whether dimensions of engagement mediate the relationship between motivational beliefs, values, and domain-specific achievement. Understanding whether dimensions of engagement mediate the relationship between motivational beliefs and values and domain-specific achievement could have implications for the EVT model. Eccles has stated that engagement is considered an outcome; however, the model has not been changed to accommodate this addition (Eccles, personal communication, November 1, 2017; Eccles & Wang, 2012). Thus, if students' engagement mediates the relationship between motivational beliefs and values and achievement, then engagement should probably be placed in its own box appearing after expectations for success and subjective task values but before achievement-related choices (see Figure 1).

Finally, in this study students' competence-related beliefs, values, and engagement were assessed in domain-specific subject areas. Research on engagement has predominately examined students' engagement at the domain-general level (Christenson et al., 2012). However, it is likely that students' engagement differs from subject to subject. Thus, this study extended the current literature on student engagement by examining student engagement in two different domains: math and science.

Definition of Terms

As will be discussed in more detail in Chapter 2, there are various definitions of the different dimensions of engagement. The definitions I report below were chosen for this study because they produced the measures of the dimensions of engagement I used for the present study.

Engagement. Because there is no agreed upon definition of engagement, I have defined it here as a multifaceted construct that generally describes students who are actively involved and committed in school and in their schoolwork (Fredricks et al., 2004).

Behavioral engagement. Wang and colleagues (2016) adapted Fredricks and colleagues' (2004) definition of behavioral engagement and defined behavioral engagement as the involvement in academic and class-based activities, the presence of positive conduct and the absence of disruptive and negative behavior (Fredricks et a., 2004).

Behavioral disaffection. Skinner and colleagues (2009) defined this term as students giving up and withdrawing, being distracted, and generally unprepared for class.

Emotional engagement. Wang and colleagues (2016) adapted Finn (1989) and Voelkl's (1997) definition of emotional engagement and the definition used in the present study refers to the presence of positive emotional reactions to teachers, peers, and classroom activities, as well as valuing learning and displaying interest in the classroom.

Emotional disaffection. Skinner and colleagues (2009) defined emotional disaffection as students' demonstrating motivated withdrawal or alienation during learning activities which could be indicated by emotions such as boredom, frustration, anxiety and disinterest in school.

Cognitive engagement. Wang and colleagues (2016) adapted their definition of cognitive engagement from Zimmerman (1990) and cognitive engagement refers to students' use of self-regulated learning and deep cognitive learning strategies in order to understand what is being taught.

Social engagement. Fredricks and colleagues (2016) and Wang and colleagues (2016) defined social engagement as the quality of social interactions with peers and adults, as well the initiative to form and maintain relationships while learning.

Agentic engagement. Reeve and Tseng (2011) defined agentic engagements as individuals trying to actively enrich their learning experiences and to take responsibility for them.

Expectancies for success on a task. Eccles-Parsons and colleagues (1983) and Wigfield and Eccles (2000) defined this term to refer to how well students believe they will do on upcoming tasks in the future.

Self-Concept of Ability beliefs. Eccles-Parsons and colleagues (1983) and Wigfield and Eccles (2000) defined this term to refer to how competent students perceive they are to complete a certain task in the present.

Competence-related beliefs. This is an umbrella term referring to the combination of students' self-concept of ability beliefs and expectancies for success regarding a given task. I discuss this construct in more detail in Chapter 2.

Subjective task value. This construct refers to students' perceptions of how much they are interested in a task (intrinsic value), find a task to be useful (utility value), feel that a task is important to them (attainment value) or what an individual has to give up in order to do a task (cost; Eccles-Parsons et al., 1983; Eccles, 2005). Recently, Gaspard and colleagues (2015) differentiated utility value into five facets. However, only two facets were used for the current study. These include utility for job, referring to future career opportunities, and general utility for future life, relating to unspecified future life activities. These two facets were chosen because of their emphasis on the future which is likely to be an important concern for college undergrads.

Eccles-Parsons et al. (1983) originally posited three specific dimensions of cost: the effort one must put forth on a task (effort cost), the psychological ramifications of failure on a task (psychological cost), or the alternative valued activities students must give up to complete a task (loss of valued alternatives cost). Since then, Wigfield and colleagues have expanded the dimension of psychological cost to be called emotional cost, which refers to any negative emotional or psychological experiences students might have while completing a task (Wigfield et al., 2017). More recently, Flake and colleagues (2015) have posited an additional dimensional of cost, which is the effort one must put forth on other tasks that interferes with a given task (outside effort cost). I will discuss the definition and measurement of utility value and cost further in Chapter 2. For the present study all four facets of cost were used as they have been understudied in previous work on EVT and engagement and are likely to be particularly salient motivation constructs for young adults.

Chapter 2: Literature Review

As discussed in Chapter 1, students who are engaged in their schoolwork are likely to have high achievement and subsequently be more likely to continue pursuing an education Fredricks et al., 2004; Wang & Eccles, 2013). In my dissertation study I focused on clarifying measurement issues in the engagement constructs through factor analyses on emotional disaffection, emotional engagement, emotional cost, and intrinsic value. I also examined how engagement relates to key motivational beliefs and values in EVT. In this chapter I summarized the relevant research on student engagement, EVT, and how student engagement relates to constructs in EVT.

The chapter is organized as follows: First, I provided an overview of the study of student engagement and some of the gaps in the current literature that my dissertation addressed. Second, I discussed the various dimensions of student engagement and how researchers currently define these dimensions. I also discussed the recently proposed dimensions of social and agentic engagement. Third, I discussed the differing views about how distinct or similar motivation and engagement are. Fourth, I discussed more fully the motivation constructs (competence-related beliefs and task values) found within EVT that I examined. I further discussed the limited extant research on how students' competence-related beliefs and task values relate to the different dimensions of engagement, and the current limitations and gaps in these empirical studies. I next discussed the importance of considering the level of domain-specificity when assessing student engagement and conclude with the study's contributions.

Student Engagement

In the last thirty years student engagement has received much attention as a construct that can have an impact on student school success and failure. Student engagement was initially used as the primary model for understanding student achievement and dropout, in which engagement was defined as graduation from high school with the necessary skills to enter the workforce or postsecondary education (Christenson et al., 2008; Finn, 2006) However, there was no clear consensus on this definition and as one will see the definition of engagement has been expanded in a variety of ways.

Much empirical work has demonstrated that student engagement is critical to academic achievement (Wang & Eccles, 2013). Even when cognitive skills are controlled or equated, students who are engaged in the classroom are more likely to have high achievement and continue pursuing an education either at the college level or at a vocational school compared to students who are less engaged (Finn, 1989; Finn, 2006; Finn & Zimmer, 2012; Fredricks, Blumenfeld, & Paris, 2004). Students who are not engaged are at risk for a variety of negative outcomes, such as boredom and drop out (Finn, 1989; Reschly & Christenson, 2006).

Mosher and McGowan (1985) were the first to review the literature on engagement and developed a conceptual model of engagement and ways to measure engagement, which had not been done previously by other researchers. They did so because of their perception that the engagement construct lacked conceptual and operational clarity. Mosher and McGowan were later credited by Christenson and colleagues (2012) for sparking interest in and advancing the study of student engagement.

Research on student engagement has burgeoned since the 1980s. In fact, Sinatra, Heddy and Lombardi (2015) described student engagement as the holy grail of student learning and achievement because of its strong links to positive outcomes in and out of the classroom. A Psychinfo search of "student engagement" in the last 10 years yielded over 13,000 results and Fredricks and colleagues' (2004) seminal review article on engagement has been cited over 4,600 times.

Initially, many scholars posited that engagement is comprised and defined in terms of participatory behavior and an affective dimension (Reschly & Christenson, 2012). More recently, most scholars have come to agree that there are at least three dimensions: behavioral engagement, cognitive engagement, and emotional/affective engagement (see Christenson et al., 2012; Fredricks et al., 2004; for discussion; these terms will be defined below). Recently, Reeve (2012) and Wang and colleagues (2016) proposed two more dimensions of engagement, agentic and social. The inclusion of multiple dimensions of engagement has also contributed to the continued haziness of the definition of overall student engagement and its dimensions because of the lack of agreement about how to define these dimensions as well as the number of them. However, the inclusion of multiple dimensions adds to the overall richness of the findings concerning engagement and provides a more in-depth picture as to why some students are doing well in school and others are not.

Another concern regarding engagement's lack of definitional clarity is that some researchers' definitions of the different dimensions of engagement overlap with how certain motivational constructs are defined. For example, as mentioned in chapter 1, emotional engagement has been described to be conceptually similar to motivation constructs, such as task value components from the Expectancy-Value theory of motivation (Eccles & Wang, 2012; Finn, 2006; Wylie & Hodgen, 2012). As noted above one purpose of Mosher and McGowan's (1985) review was to define engagement more clearly; unfortunately, this has not occurred, and conceptual haziness limits the advancements that can be made in our understanding of student engagement. Therefore, one aim of the present dissertation study is to examine through factor analysis, potential empirical overlap among emotional engagement and disaffection and certain of the task value components in EVT.

Partly as a result of overlap of some definitions of engagement and motivation researchers continue to debate how the two constructs relate. Martin (2007) argued that motivation and engagement can be viewed as the same construct in certain situations and therefore uses the terms interchangeably in his work. Fredricks and colleagues (2004) stated that motivation is inherently included within engagement. Finally, some researchers argue that motivation precedes engagement and therefore motivation and engagement are separate constructs (Skinner et al., 2009; Wigfield & Guthrie, 2010). I take the later stance in which motivation is an individual characteristic that can influence engagement and will provide more rationale for this stance later on. In the present dissertation study, I explored the predictive relations among the central motivational beliefs and value constructs in EVT and dimensions of engagement. I explored which motivational beliefs and values were associated with the engagement dimensions, how they related over time and whether dimensions of engagement mediated the relationship of competence-related beliefs and task values and students' grades.

Another important issue is the level of specificity at which engagement is assessed. Researchers often have measured engagement at the general school level. However, students' motivation and engagement may look very different in their math class as compared to their English class or even to school in general; therefore, researchers should be cognizant of which domain, if any, they are researching and be sure to specify the level of specificity at which students were questioned about their engagement and motivation. In my dissertation study, I examined students' self-reported engagement and competence-related beliefs and task values at the domain-specific level, in particular in introductory math and science courses.

In the next section I discuss how various researchers define student engagement and its various dimensions. I also discuss the limitations of some of these definitions.

Defining Student Engagement and its Dimensions

Leading researchers studying engagement, such as Fredricks and colleagues (2004) and Skinner (2016), generally define student engagement in terms of students' involvement, participation, attention and connection to school. These and other researchers posit that student engagement is at a *minimum* comprised of two related but distinct dimensions, a behavioral and an affective dimension (Mosher & McGowan, 1985; Reschly & Christenson, 2012. Over the last decade a number of researchers added a third dimension, cognitive engagement (Skinner, 2016). As noted in the overview, recently some researchers have proposed two additional dimensions of engagement, social and agentic engagement (Reeve, 2012; Fredricks et al., 2016). Nevertheless, regardless of how many dimensions researchers include in their conceptualization of student engagement, researchers generally agree that an overall definition of student engagement includes students doing more than just performing academically or attending class; they are also putting forth extra effort and challenging themselves to excel past what is expected and required of them (Christenson et al., 2012).

Although there is broad agreement on the three dimensions of engagement, researchers are not yet in agreement on the specific definition of each. Thus, in this section, I will describe the different proposed dimensions of student engagement and how they are defined in the literature by various researchers; focusing on how the definitions both overlap and differ. I will discuss the following dimensions of student engagement: behavioral, emotional, cognitive, social and agentic.

Behavioral Engagement. Behavioral engagement is one of the most frequently studied dimensions of student engagement and has been defined in a variety of ways (see Fredricks et al., 2004 for a review of the earlier work on behavioral engagement). Finn (1989) originally defined behavioral engagement as “participation” in academic activities and broke that into four different aspects. These aspects include: 1) responding to requirements, such as the teacher’s instructions; 2) taking initiative in class-related activities; 3) participating in extracurricular activities; and 4) goal-setting and decision making. Appleton, Christenson, Kim and Reschly (2006) defined two subtypes of behavioral engagement in academic settings, academic and behavioral. They defined academic engagement as the amount of time students spent on a task and their homework completion. Behavioral engagement was defined as students’ attendance, voluntary classroom participation, their extracurricular participation, and their participation in extra credit opportunities.

Skinner and her colleagues took a somewhat different approach and derived their conceptualization of engagement from the self-system model of motivational development (Connell & Wellborn, 1991; Skinner & Wellborn, 1997). In this model, Skinner and colleagues contrast engagement versus disaffection as important mechanisms impacting student development. As such, Skinner and colleagues divide behavioral engagement into two dimensions, behavioral engagement and behavioral disaffection (Skinner & Belmont, 1993; Skinner, Furrer, Marchand, & Kinderman, 2008; Skinner et al., 2009). Skinner and colleagues defined behavioral engagement as students' positive effort, action, persistence, attention, and involvement in school. They defined behavioral disaffection as students giving up and withdrawing, being distracted, and unprepared for class; this dimension thus can be considered maladaptive with respect to healthy development.

Martin (2007), utilizing the Motivation and Engagement Wheel that he developed in order to integrate motivation and engagement, also divided behavioral engagement into adaptive and maladaptive dimensions. Martin described behavioral engagement as adaptive behavior, which is comprised of students being persistent, actively planning, and staying on task. On the other hand, maladaptive behavior is comprised of disengagement and self-handicapping, or students purposefully not putting forth effort.

As can be seen from the definitions, there is some overlap and some differences among these researchers' views on engagement. For example, Finn (1989) and Appleton and colleagues (2006) both place an emphasis on extracurricular activities whereas Skinner and colleagues (1993; 2008; 2009) and Martin (2007) do not. Further, Finn describes behavioral engagement predominately in terms of participation, whereas

Appleton and colleagues include participation in their definition but also focus on academic-related tasks such as homework completion. Skinner and colleagues and Martin are similar in their specification of positive and negative dimensions of behavioral engagement. Both place an emphasis on persistence in their positive behavioral engagement definitions and disengagement in their negative behavioral engagement definitions. Nevertheless, it is clear that despite differences in these models and definitions of behavioral engagement, they all describe behavioral engagement in terms of observable behaviors.

Overall, I think there are aspects of these definitions that make the most sense in terms of students' involvement in observable behaviors directly related to their learning and others that do not seem to fit within the scope of behavioral engagement. For example, Finn (1989), Appleton and colleagues (2006) and Skinner and colleagues (Skinner & Belmont, 1993; Skinner et al., 2008; Skinner et al., 2009) include indicators such as responding to requirements and attendance. In my opinion these are inherent rules concerned with attending school and thus may not help distinguish between students who are just following the rules and those who are actively engaged in the learning environment. On the other hand, indicators such as participating in extracurricular activities, initiating positive action in the classroom (e.g., engaging in discussion), and taking time to plan out their schedule for completing school work, are better indicators of behavioral engagement, especially as they are actions initiated by the student and not requirements of the teacher.

Emotional Engagement. In general, emotional or affective engagement, encompasses positive and negative feelings and reactions to school, teachers, and peers

(Fredricks et al., 2004). However, different researchers define this dimension of student engagement in a variety of ways. Both Appleton et al. (2006) and Finn (1989) defined emotional engagement as students' identification with school, teacher, peers, and/or academics. For instance, Finn (1989; 2006) uses the term identification instead of emotional or affective engagement and defines identification in terms of students' sense of belonging and perceived value of school. Finn argued that the term identification is an appropriate way to capture student's emotional engagement because if students feel they belong in the school and value it, they are much more likely to remain engaged when things do not go as planned. On the other hand, students who do not identify with the school are more likely be less successful and withdraw emotionally. Appleton and colleagues (2006) describe affective engagement in similar terms, as students' sense of belonging and identification with school.

By contrast, other researchers (Skinner et al., 2009; Stipek, 2002) define emotional engagement as students' affective reactions to their school, teacher, peers, and/or academic subjects. Skinner and colleagues (1993; 2008; 2009) include positive and negative dimensions of emotional engagement, as they did with behavioral engagement, within the self-system model of motivational development. They describe emotional engagement as students' enthusiasm, pride, interest, and enjoyment in school and emotional disaffection as students' boredom, frustration, anxiety and disinterest in school.

Although there is some overlap among these three definitions in terms of emotional reactions to school, Finn (1989; 2006) and Appleton et al.'s (2006) emotional engagement definitions are clearly more similar than they are to Skinner and colleagues' definition. This also was the case for these researchers' definitions of behavioral engagement. Further, in their definitions of emotional engagement, none of these researchers specify the exact source of identification or emotional reaction, so one cannot know whether students' emotional reactions are directed primarily towards school in general, their teachers, their peers, or other things such as their homework. Further, it is likely that a student's emotional reaction or identification with the school could differ by teacher, peer, or subject, particularly in middle and high school when students have many different teachers. Thus, all three of these definitions are not clear in their specification of levels of emotional engagement. Additionally, although these three definitions share some similarities and differences with each other, all three also share considerable overlap with motivation variables found in EVT, particularly students' achievement task values such as interest value. This point will be discussed in more detail later.

Further, both Appleton et al. (2006) and Martin's (2007) definitions of emotional engagement overlaps with other researchers' definitions of cognitive engagement. They consider valuing of school to be an indicator of cognitive engagement rather than part of emotional engagement; by contrast Finn (1989) has valuing of school as part of emotional engagement, as do Fredricks et al. (2004). Further, some argue that emotional engagement is an antecedent of behavioral and cognitive engagement (Eccles & Wang, 2012). These latter two points will be discussed in more detail later.

Cognitive Engagement. Researchers define cognitive engagement in three notably different ways. Some researchers define cognitive engagement in terms of beliefs and values about the importance of school and learning (Appleton et al., 2006; Martin, 2007), others define it as putting forth more effort than is required (Connell & Wellborn, 1991; Greene, 2015), and finally some describe it in terms of self-regulation, strategy use, and goals (Appleton et al., 2006; Corno & Mandinach, 1983; Greene, 2015; Martin, 2007; Meece, Blumenfeld, & Hoyle, 1988; Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1988). Interestingly, these different researchers rarely cite those whose definitions of cognitive engagement differ from their own.

Beginning with Appleton and colleagues (2006), as just noted they define cognitive engagement in terms of students' valuing of school, and also their self-regulation, and their goal setting. Their definition of students' valuing of school includes how important and relevant students think what they are learning is to their future. Self-regulation includes things such as whether or not students check over their homework, and the importance of school for achieving future goals as an indicator of goal setting. In his Motivation Engagement Wheel, Martin (2007) defines cognitive engagement in terms of what he calls adaptive and maladaptive cognition. He defined adaptive cognition in terms of students' valuing of academic tasks, having a mastery goal-orientation (focusing on learning or understanding the material), and high self-efficacy towards school and class. He defined maladaptive cognition as students' attempts to avoid failing by self-handicapping themselves and participating in maladaptive behaviors such as not studying until the last minute, so they have an excuse for why they did not perform well. There is some overlap between his conceptualization of cognitive engagement and that of Appleton and colleagues; they both believe students' valuing is a core component of cognitive engagement. As noted earlier, Finn (1989) views valuing as a part of emotional engagement. Placing the same construct (in this case valuing) in two different dimensions of engagement is an example of how different dimensions of engagement overlap in their definitions.

Greene (2015) defined cognitive engagement in terms of students' use of cognitive strategies, self-regulation, and amount of mental effort used. Further, she breaks cognitive engagement into deep versus shallow engagement, in which deep engagement involves using prior knowledge and strategies in order to learn new material and shallow engagement involves rote processing and more simple strategies, such as memorization. Greene's definition partially comes from Pintrich and De Groot's (1990) conceptualization of cognitive engagement, which they called self-regulated learning strategies, and from Zimmerman and Martinez-Pons' (1988) work on self-regulation and goal setting. In addition, it should be noted that Greene's emphasis on effort in her definition of cognitive engagement overlaps with Skinner and colleague's (1993; 2008; 2009) definition of behavioral engagement in which they also emphasize effort. Further both Greene and Connell and Wellborn (1991) include extra effort as part of cognitive engagement.

Again, although these researchers each developed their own definition of cognitive engagement, there is considerable overlap among them, perhaps indicating that there is at least some consensus about what cognitive engagement is. However, several of the definitions include constructs such as valuing of school that others view as motivation constructs (Wigfield, Tonks, & Klauda, 2016) and overlap with self-regulation constructs (Greene, 2015; Pintrich & De Groot, 1990) as well as with definitions of behavioral and emotional engagement.

Social Engagement. Recently some researchers have posited social engagement as another dimension of individuals' overall engagement. Finn and Zimmer (2012) defined social engagement in terms of the extent to which students follows classroom rules. Examples of social engagement include acting appropriately with the teacher and other students, arriving to class on time, and participating in group projects. Pekrun and Linnenbrink-Garcia (2012) noted that this definition of social engagement shares considerable overlap with behavioral engagement, and therefore referred to social engagement as social-behavioral engagement. Their definition of social-behavioral engagement includes students having high-quality social relationships with their peers; they noted that such relationships can directly impact students' learning in positive ways. These high-quality relationships include students working cohesively together and supporting one another.

Fredricks and colleagues (2016) defined social engagement in math and science classes as the quality of student's social interactions with peers and teachers. These interactions include students working with their peers and whether they enjoyed working with their peers. Although this definition has a clear focus on social interactions, Fredricks and colleagues' definition overlaps to an extent with affective, or emotional, engagement, given the inclusion of affective reactions to working with their peers.

Agentic Engagement. Based in Self-Determination Theory (Reeve & Tseng, 2011), agentic engagement is another recently developed and proposed dimension of student engagement that is just beginning to receive research attention. Reeve and colleagues defined agentic engagement as individuals trying to actively enrich their learning experiences and to take responsibility for them (Reeve, 2012; Reeve & Tseng, 2011). Specifically, Reeve and Tseng (2011) mean that students demonstrate agentic engagement when they are actively contributing to their learning by doing activities such as expressing their opinion, letting the teacher know when they find something interesting, or requesting clarification when they are confused by the material being presented. Reeve (2012) argued for the inclusion of agentic engagement as a core dimension of student engagement because students who are engaged do not only *react* to the learning activity, but they are also *proactiv*e with the learning activity. In this way, Reeve defines students' *reaction* to the learning activity as behavioral engagement (e.g., participating in the activity), emotional engagement as their expressed enjoyment of the activity and cognitive engagement as their strategies for completing the activity. Reeve differentiates students' reactions from their being proactive by stating that students who are proactive take agency over their learning by doing such things as making the activity more interesting and relevant for themselves or working with peers.

In general, my view is that Reeve and colleagues (Reeve, 2012; Reeve & Tseng, 2011) have clearly differentiated agentic engagement conceptually from behavioral, emotional, and cognitive engagement. However, they have not clearly specified how agentic engagement differs from or is similar to social engagement, particularly since they include working with peers as one indicator of agentic engagement. Research on agentic engagement is just beginning and findings from this work helped clarify whether agentic engagement is a unique and important dimension of student engagement. Thus, one of the broader aims of this study was to gain a better understanding of whether agentic engagement should be an additional engagement dimension and whether agentic engagement could be included into EVT, or if agentic engagement solely belongs within Self-Determination Theory.

Summary. Overall, it is clear that there is considerable overlap in definitions among and between the dimensions of student engagement. This overlap may be a basis for creating an agreed-upon definition of each. However, more problematic is the overlap among some definitions of dimensions of student engagement (particularly emotional and cognitive engagement) and motivation constructs, such as interest and value, and self-regulatory constructs such as strategy use. This overlap is the basis for my first set of research hypotheses regarding whether there is potential overlap among emotional engagement and disaffection and certain of the task value variables in EVT that were mentioned in Chapter 1.

It also is clear that researchers are still in disagreement about how many dimensions make up student engagement. Although a total of five dimensions have been proposed, to my knowledge there is not a researcher who currently posits in their overall definition of student engagement that it is comprised of all five dimensions. Thus, in my dissertation study I examined all five proposed dimensions, and how they related to and possibly overlapped with central EVT constructs. Before discussing these relations, I discuss the different views on how distinct motivation and engagement are.

Different Views on How Distinct Engagement and Motivation Are

There are two major positions regarding how related and distinct student engagement and motivation are. The first is that motivation and engagement are so similar that they can essentially be treated as the same thing and the second is that motivation and engagement are distinct.

Martin (2007, 2012) argued that motivation and engagement are in fact interchangeable and in his Motivation and Engagement Wheel, he attempts to integrate motivation and engagement. Martin's main argument for integrating motivation and engagement is that it makes it easier to communicate findings to practitioners, parents and students. Nevertheless, Martin (personal communication, November 1, 2017) more recently stated that whether motivation and engagement can be viewed as being interchangeable depends on the context in which they are studied:

> ..sometimes a study or a discussion or a narrative is at a very broad level and not granular with regards to motivation and engagement – then I may bundle them together because relative to the other issues at hand, they are actually quite closely aligned. Thus, a study on, for example, personality that is interested in a host of different outcome factors, I might collect motivation and engagement together as they represent a cognate academic construct relative to the other non-academic etc. measures. (Martin, personal communication, November 1, 2017).

In this same personal communication Martin further stated that fundamentally, engagement and motivation are distinct, and when that distinctiveness matters in operationalizing a study, he will model and treat them separately. For example, he stated that he believes motivation and engagement would be treated as distinct in a study in which one is interested in different outcomes predicted by motivation and engagement. In fact, Martin found through factor analysis that his adaptive and maladaptive motivation and engagement items from his Motivation Wheel do load onto separate factors (Martin, Ginns, Papworth, 2017; Martin, personal communication, November 1, 2017). Thus, whether Martin treats motivation and engagement as being interchangeable seems to depend on his specific research question(s) and his targeted audience.

However, taking the position that motivation and engagement are interchangeable in some situations but not others makes it difficult to understand the implications of findings from different studies for both the motivation and engagement fields. In addition, having some researchers use motivation and engagement interchangeably in some situations and other researchers treating them as separate constructs, makes it more difficult to compare findings across studies and understand more clearly when motivation is of interest and when engagement is of interest.

Fredricks and colleagues (2004) proposed that student engagement inherently includes some motivation constructs and thus may therefore be interchangeable in some contexts. They described in their review how several researchers' definitions of the different dimensions of student engagement include constructs found in the motivational literature. For example, Connell and Wellborn (1991) defined emotional engagement as students' affective reactions in the classroom, including interest, boredom, and anxiety and Finn (1989) refers to emotional engagement as students' sense of value for school. These emotions, such as interest and value, are constructs used frequently in motivation research. The inclusion of motivation constructs into definitions of engagement has led to some confusion about how separate these constructs are and how they should relate to one another. Such that the National Research Council and Institute of Medicine (2004) wrote a report on engaging schools in which the authors treated motivation and engagement as synonyms and used them interchangeably throughout the report.

When researchers studying engagement incorporate central motivation constructs from different theories into their definitions of student engagement and obtain similar findings as do motivation researchers who operationalize the same construct as solely a motivational construct, both fields are in danger of jingle-jangle fallacies. In addition, assuming engagement subsumes motivation makes it impossible to determine theoretically or empirically whether motivation precedes engagement or vice versa. It also makes it impossible to determine whether motivation and engagement predict the same or different outcomes, or whether they themselves are influenced by the same or different variables.

The second major viewpoint is that motivation and engagement are distinct constructs and motivation is the intent, drive, or energy that leads to engagement, which is the action resulting from the motivation, and that these constructs become reciprocal over time (Ainley, 2012; Appleton et al., 2006; Eccles & Wang, 2012; Russell, Ainley, & Frydenberg, 2005; Wigfield & Guthrie, 2010). For example, according to Eccles (personal communication, November 1, 2017), student engagement is one of the achievement outcomes that motivation constructs in her expectancy-value (EV) model, and other prominent motivational constructs, such as self-efficacy, predict. Although Eccles has not included engagement specifically in any of the visual depictions of her EV model (see Figure 1), she has stated that engagement is an outcome that is considered in this model (Eccles, 2007; Eccles & Wang, 2012; personal communication, November 1, 2017).

Despite these assertions, most of the work on what the central motivation constructs in expectancy-value theory (EVT) predict included academic performance, and choices regarding which classes to take, college major, or job, rather than engagement per se (Wigfield et al., 2016). Thus, there is less information in the current literature concerning how the central constructs in EVT predict the various dimensions of student engagement. This point will be discussed in more detail later. Overall, I took the stance that motivation and engagement are distinct constructs and that motivation is the driving force for subsequent engagement. I chose this stance because my review of the literature indicated that a variety of motivation constructs from various theoretical models lead to subsequent engagement. I empirically tested this issue by examining how the central constructs in EVT are associated with the various dimensions of engagement and how they related over time. In the next section I focus specifically on EVT and how constructs from this theoretical model relate to dimensions of student engagement.

Expectancy-Value Theory and Student Engagement

Eccles-Parsons and colleagues (Eccles, 2005; Eccles-Parsons et al., 1983) developed an expectancy-value model of performance, academic-related choices, and other outcomes such as persistence, that has guided much research (Eccles-Parsons et al., 1983; see also Wigfield & Eccles, 1992; Wigfield et al., 2016; see Figure 1 below). Eccles-Parsons et al. defined expectancies for success as students' beliefs about how well they will do on an upcoming task; thus, this belief focuses on future performance. A key component of the expectancy-value model is students' beliefs about their competence or self-concept of ability in a domain. Students' self-concept of ability beliefs is conceptually distinct from students' expectancies for success, with students' self-concept of ability beliefs referring to students' evaluations of their current competence. Although these two beliefs are conceptually distinct, they are strongly related empirically, and so usually are combined into a single scale (e.g., Eccles & Wigfield, 1995; Eccles et al., 1993; Wigfield et al., 1997). As mentioned in Chapter 1, when referring to the combined self-concept of ability belief and expectancy constructs, I use the term competence-related beliefs.

The other major motivation-related construct in Eccles-Parsons et al.'s model (1983) is subjective task value, that Eccles-Parsons et al. defined as individuals' incentives or reasons for doing different tasks or activities. They also discussed how individuals' overall valuing of any specific task is the function of four major facets: attainment value, intrinsic value, utility value and cost. They defined attainment value as the importance one places on doing well on a given task, with tasks viewed as more important when success on the task is tied to the individual's sense of self and identity. Intrinsic value is defined as the enjoyment one experiences from doing a particular task. They defined utility value as the usefulness one sees in completing a particular task or how that task is important for one's future. Cost is defined by a students' beliefs about what they may have to give up in order to do a task. Eccles and Wigfield (1995) and Gaspard et al. (2015) showed that the different aspects of value can be empirically distinguished, but they do relate to one another relatively strongly.

More recently, Gaspard and colleagues (2015) developed a new scale of task value for math, in which they added additional value facets in order to increase the predictive power of EVT. They believed that attainment value, utility value, and cost may be further differentiated into multiple facets and had 1,868 9th grade students in Germany complete a set of 37 items assessing their value beliefs in mathematics. Confirmatory factor analyses demonstrated that value beliefs could be differentiated into 11 value facets. They found that intrinsic value remained a single facet, but attainment value has two sub facets: *importance of achievement*, defined as students focusing on high performance, and *personal importance*, defined as students focusing on mastering the content and its relation to one's identity. Utility value was found to have five sub facets: *utility for school*, defined as relating to the usefulness for present and future education; *utility for daily life*, defined as relating to daily routines and leisure time activities; *social utility*, defined as the usefulness of subject knowledge of being accepted by peers; *utility for job*, referring to future career opportunities; and *general utility for future life*, referring to the unspecified future life activities. However, for the present study, I only focused on the last two sub facets of utility value because they have to do with more long-term goals that might be especially pertinent to college undergraduates. Cost was found to have three sub facets: *opportunity cost*, defined as time lost for other activities; *effort required*, defined as perceived exhaustion; and *emotional cost*, which is associated with negative emotions.

Flake and her colleagues (2015) have also extended the work done on cost by proposing some new dimensions of it and then developing a questionnaire to assess them. They demonstrated through exploratory and confirmatory analyses on data from college undergraduates that cost is comprised of four sub facets: *task effort cost*, defined as the negative appraisal of the amount of effort or time put forth to engage in a task; *outside effort cost*, defined as the negative appraisals of effort or time put forth on other tasks that interferes with a given task; *loss of valued alternatives cost*, defined as the negative appraisal of what is given up as a result of engaging in the task of interest; *emotional cost*, defined as the negative appraisals of a psychological state that results from exerting effort for the task. In my dissertation study, I used Flake and colleagues measure of cost because it represents the most thorough and up-to-date examination of the construct and its dimensions.

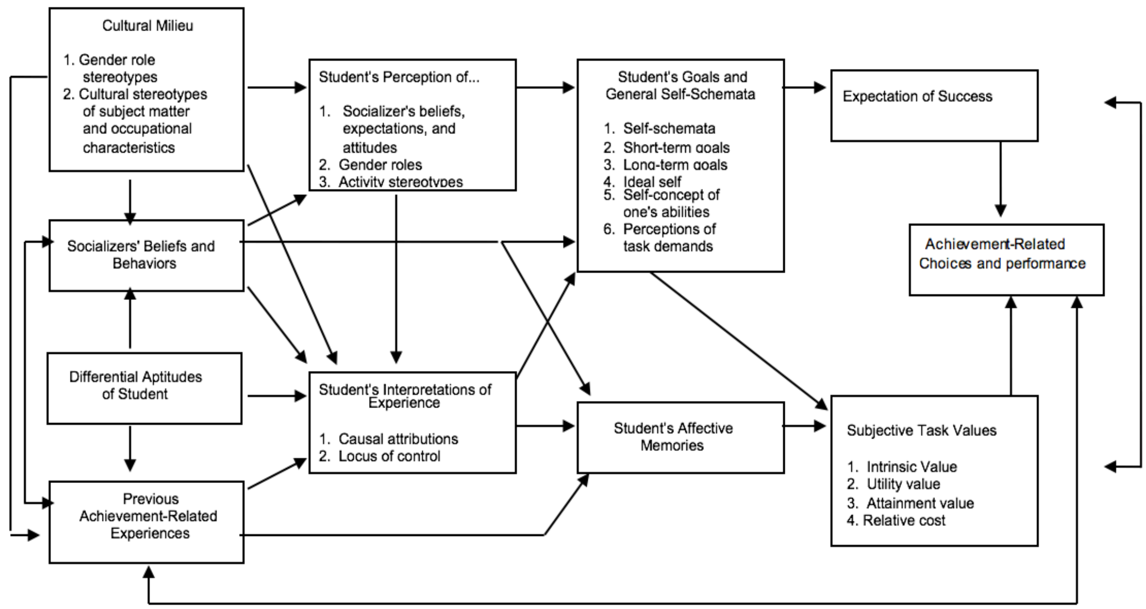


Figure 1. Eccles-Parsons et al. (1983) Expectancy-Value Theory Model

As can been seen in the model in Figure 1, Eccles-Parsons et al. (1983) posited that students' expectancies and values are the most proximal predictors of their performance on different activities and choices of which to pursue. More specifically, they proposed that self-concept of ability beliefs are stronger predictors of performance, and values are stronger predictors of activity choice. Various studies have supported these propositions (e.g., Meece, Wigfield, & Eccles, 1990; Musu-Gillette, Wigfield, Harring, & Eccles, 2015; Simpkins, Davis-Kean, & Eccles, 2006).

As noted earlier, Eccles (2007; personal communication, November 1, 2017) stated that students who are most likely to be engaged in learning and academic tasks have a positive self-concept of ability and positive expectancies for success and place more value on doing well on the tasks than do students who are not engaged. Wang & Eccles (2013) found support for these links of expectancies, values, and engagement. They found that among adolescents, self-concept of ability beliefs and subjective task values had significant positive direct effects on behavioral, emotional, and cognitive engagement. To date, Eccles and her colleagues primarily discussed behavioral and cognitive engagement, as defined by Fredricks et al. (2004) and Skinner and Pitzer (2012), in relation to the motivational beliefs and values in EVT (Eccles & Wang, 2012). More specifically, Eccles (personal communication, November 1, 2017) believes that behavioral engagement inherently includes cognitive engagement, as thinking is a behavior. Eccles and Wang (2012) also discussed emotional engagement as an antecedent of behavioral or cognitive engagement and have not discussed social and agentic engagement as either outcomes or antecedents in EVT. Therefore, in the present dissertation study, I examined the extent to which college students' competence-related beliefs and task values were associated with all of these dimensions of engagement.

Relations of Competence-Related Beliefs, Task Values and Engagement

Although Eccles and her colleagues posited that motivation leads to engagement, most EVT based studies have not included a separate measure of engagement, focusing instead on how competence-related beliefs and task values predict academic achievement, their choices regarding which classes to take, and their college major choice (Wigfield et al., 2016).

The few extant studies examining how students' competence-related beliefs and values and student engagement relate have found that students' competence-related beliefs and subjective task values are predictors of different dimensions of student engagement. For instance, Wang and Eccles (2013) found that adolescents who highly valued school, measured using items representing attainment and intrinsic value, also reported being behaviorally, emotionally and cognitively engaged, measured using scales adapted from Finn and Voelkl (1993), Pintrich (2000) and Skinner and Wellborn (1994), and that subjective task value was a stronger predictor of emotional engagement than students' self-concept of ability beliefs. However, students' self-concept of ability beliefs was a stronger predictor of behavioral and cognitive engagement than was their subjective task values. Although this study has the strength of examining three different dimensions of student engagement, the authors did not examine intrinsic, attainment, and utility value separately. Thus, their measure of subjective task value is limited because it does not include measures of utility value or cost.

Marchand and Gutierrez (2016) examined how graduate students' valuing (measured as utility, attainment, and intrinsic value) of their introductory research methods course predicted their perceived cognitive and behavioral engagement in the course. They used Greene, Miller, Crowson, Duke, and Akey's (2004) measure of meaningful strategy use as their measure of cognitive engagement, something many other many researchers have done (Greene, 2015). Results indicated that students' utility, attainment, and intrinsic value measured at mid-semester each predicted their semester-end reports of behavioral and cognitive engagement. However, the researchers examined each of the three value components in separate structural equation models. By not including the three value components in the same structural equation model, one cannot test for unique relations of the three components of subjective task values to cognitive and behavioral engagement. Additionally, the researchers did not include a scale measuring cost, which may be especially important to examine among graduate students as many have to juggle multiple responsibilities regarding courses and homework, research obligations, and families. Nevertheless, results of the study add to our understanding of relations of students' task values and their engagement.

Guo and colleagues (2016) extended Wang and Eccles (2013) and Marchand and Gutierrez's (2016) studies by examining how each of the four subjective task values facets predicted teacher reported behavioral engagement, in a sample of German 9th grade students from 82 different classes in 25 schools. Students' attainment value and intrinsic value positively and uniquely predicted teacher-rated behavioral engagement; utility value did not. Cost was a significant negative predictor. Students' self-concept of ability beliefs predicted their behavioral engagement when task value was controlled in the analyses. Although this study adds important information on the relations of the different aspects of task value to engagement, the teacher-reported engagement measure consisted of only two items which asked about students' homework completion and whether they participate in math lessons. One may argue that just because students are working on their homework doesn't mean they are engaged. The students may be working on their homework because this is expected of them and their grade is influenced by their homework completion. Future research should use a more complete measure of teacher-reported engagement.

More recently, Fredricks and colleagues (2018) conducted a mixed method exploratory study to examine motivational and contextual influences on seventh to twelfth graders engagement in math and science. They found that students' attainment value predicted their behavioral, cognitive, emotional and social engagement in both math and science classes. Their utility value predicted math and science behavioral engagement, science cognitive engagement, and science social engagement. Students' expectancies for success predicted their math and science behavioral engagement, math and science emotional engagement, and science cognitive engagement. They found through their qualitative interviews that participants reported feeling more engaged when they were able to demonstrate their ability to their teachers, when they perceived they had the skills to solve challenging problems, when they felt they could be successful in their math and science classes, and when they saw the relevance of what they were doing in their math and science class and how it could be applied to their lives outside of class. Although Fredricks and colleagues included multiple dimensions of engagement, they did not include measures of cost or intrinsic value and they only assessed students' motivation and engagement at a single time-point, making it difficult to identify the exact predictive relationship.

Relations of Competence-Related Beliefs, Values, and Engagement to Outcomes

As mentioned above, students' competence-related beliefs and values have been shown to be predictive of different dimensions of engagement. Research has also demonstrated that students' competence-related beliefs and values predict various other academic outcomes, such as students' performance, persistence, and choices of which activities to do (Wigfield et al., 2015). Empirical support for these predictive relations has been found consistently in the literature and has been found across a wide range of ages (Tonks, Wigfield, & Eccles, 2017). Even when level of previous performance is controlled, students' competence-related beliefs strongly predict their performance in academic domains and students' task values predict both intentions and actual decisions to keep taking courses in various academic domains.

Student engagement has been treated as both an academic outcome and a predictor of academic outcomes (see Christenson et al., 2012, for review). Next I discuss the research on how engagement relates to different academic outcomes. I focused on studies using the measures of engagement that I used for the proposed dissertation study.

Wang and colleagues (2016) tested in a series of regression analyses the predictive validity of the Math and Science Engagement Scale for math and science achievement and STEM career aspirations. They found that general engagement was the strongest positive predictor of these outcomes. However, each of the four engagement factors, behavioral, emotional, cognitive, and social engagement, differentially predicted achievement and STEM career aspirations. Behavioral engagement was the strongest predictor of math and science achievement. Interestingly, it was a statistically significant negative predictor of STEM career aspirations. Emotional engagement was found to be the only dimension that was a statistically significant positive predictor of STEM career aspirations. Cognitive engagement did not predict either math or science achievement and cognitive engagement was surprisingly a statistically significant negative predictor of students' math career aspirations. Students' social engagement was a statistically significant negative predictor of their math and science achievement and a non-significant negative predictor of STEM career aspirations.

Because the concept of agentic engagement is still relatively new, the extant literature examining the predictive reliability of the Agentic Engagement Scale is still fairly limited. However, Reeve (2013) found that Korean college students' agentic engagement predicted their course-specific grades when behavioral, emotional, and cognitive engagement were controlled for. Thus, suggesting that agentic engagement can be a unique predictor of students' academic achievement.

Emotional and behavioral disaffection have sometimes been treated as academic outcomes, primarily because Skinner and colleagues (2009) view engagement as the outward manifestation of motivation. However, Skinner and Pitzer (2012) further discuss how behavioral and emotional disaffection can lead to negative achievement outcomes. Thus, Skinner and Pitzer view engagement and disaffection as mediators of the relationship between student motivation and student learning and achievement.

Overall, students' competence-related beliefs and values predict the different dimensions of engagement and of academic outcomes and dimensions of engagement are oftentimes considered outcomes of motivation and predictors of academic achievement. The research reviewed provides support for my second set of hypotheses regarding the relations among students' competence-related beliefs, values, and dimensions of engagement and indicates a need for more research to be conducted examining whether dimensions of engagement mediate the relationship among students' competence-related beliefs, values, and academic achievement.

However, there are two other types of relationships among these constructs that have not been examined in the extant literature. The first is how competence-related beliefs, task values, and dimensions of engagement relate over time, and the second is how students' engagement may mediate the relationship between their competence-related beliefs, task values, and achievement.

Eccles and colleagues (Eccles, personal communication; Eccles & Wang, 2012) proposed that students' competence-related beliefs, values, and engagement relate reciprocally. Eccles proposes that competence-related beliefs and task values first lead to academic outcomes (including engagement), and these academic outcomes then lead to subsequent competence-related beliefs and values. One important contribution of this dissertation study is that I tested this hypothesis.

More recently, Eccles (personal communication, September 2018) stated that even though engagement can be considered an outcome, it can also potentially mediate the relationship between competence-related beliefs, values, and achievement outcomes. Eccles stated that how engaged students are in a task should predict their achievement, as long as students are also reporting that they feel competent or value the task. Because this proposed mediation is not demonstrated in the EVT model, I explored this as a research question rather than stating a hypothesis about the mediated relationship.

To date EVT-based research examining student engagement is limited in that researchers have (for the most part) only examined certain aspects of students' task values, and certain aspects of engagement. Thus, more research is needed on how the different value facets uniquely and in combination relate to the different dimensions of engagement. Further, researchers have predominately examined how competence-related beliefs and task values are associated with and predict dimensions of engagement and have not examined in much detail how these constructs relate over time. Additionally, research has not examined whether dimensions of engagement might mediate the relationship between competence-related beliefs, task values, and student achievement. EVT researchers have also not focused on social or agentic engagement and with the emerging literature supporting these constructs to be dimensions of engagement, it is a prime time to examine how students' competence-related beliefs and values relate to them. The present dissertation study addressed these various gaps in the literature.

Specificity of Measurement of Student Engagement

Student engagement was originally studied at the overall school level and findings from this work were used in discussions of how to understand and prevent student dropout (Finn, 1989). Although this work was important, examining student engagement at the school or even the general classroom level may not tell us much about students' engagement in different academic subject areas or specific academic activities. Since Finn's (1989) original work researchers have studied students' engagement in more specific contexts, first at the general classroom level and more recently students' engagement in specific subject areas (e.g., Fredricks et al., 2016; 2018). This work has shown that student engagement in these different domains predicts achievement outcomes in those domains, such as students' grades and career aspirations (Wang et al., 2016).

One important consideration with respect to which level researchers should assess is the level of the outcome variable in which they are interested. Bandura (1997) and others have argued convincingly that psychological variables (such as motivation or engagement) should be measured at the same level as the outcomes of interest. For example, if a researcher is interested in whether student engagement in high school predicts if students will become STEM majors in college, then the researcher should examine STEM specific student engagement rather than general engagement at school. If a researcher is interested in more "micro" level outcomes, such as engagement with social studies homework, then students' engagement with social studies homework should be assessed.

Recently, Fredricks and colleagues (2016, 2018; Wang, Fredricks, et al. 2016) have become strong advocates for assessing engagement at the domain-specific level. Thus, because they are interested in STEM outcomes they advocate for and measure students' engagement in STEM subject areas rather than overall engagement in school. In this dissertation study I extended the work done by Fredricks and colleagues on middle and high school students by examining college students' engagement and motivation in their math and science courses. I provide more insight into understanding why some students continue to pursue STEM majors and careers by investigating their engagement and motivation in their math and science courses.

Overall Summary and Contributions of the Present Study

In this chapter, I reviewed the extant literature on the different definitions and dimensions of engagement. I further discussed the different views on how distinct engagement and motivation are and then I focused specifically on how constructs found in EVT relate to the different dimensions of engagement. I chose EVT as my motivation theoretical framework because it is a major theory in the motivation field and researchers are beginning to use EVT as a basis for their work on how individuals' motivation predicts their engagement and achievement outcomes (Guo et al., 2016; Marchand & Guitierrez, 2016; Wang & Eccles, 2013). Additionally, the EVT framework is a popular framework for understanding math and science achievement motivation. Thus, this framework allowed me to better compare my findings across other studies. The present dissertation contributed to the current EVT-based research on motivation and engagement in several important ways that I discuss below.

In my review of the literature on the different definitions and dimensions of engagement, I found that there is still not agreed upon definitions of the different dimensions of engagement and some of these definitions overlap with definitions of popular motivation constructs. Thus, in my dissertation study, I examined potential overlap among emotional engagement and disaffection and aspects of task values as one way to help clarify how each is operationalized and measured.

There is considerable agreement across researchers that student engagement is comprised of different dimensions and researchers have clearly established at least three: behavioral, emotional, and cognitive engagement (Fredricks et al., 2004; Reschly & Christenson, 2012; Skinner, 2016). Some researchers have proposed that there are two additional dimensions of student engagement, social engagement (Wang et al., 2016) and agentic engagement (Reeve, 2012). However, to date no researcher has created a measure to assess all five dimensions or used individual measures of the five dimensions. In the present dissertation study, I included measures of these five dimensions in order to provide more information on what is associated with social and agentic engagement.

One key issue addressed in this chapter is how motivation and student engagement relate conceptually and empirically. Despite a fair amount of research on this topic there still is not agreement on how these constructs relate, in part because some definitions and measures of student engagement encompass well-known motivation constructs from theoretical frameworks such as self-determination theory, goal theory, social cognitive theory, and EVT and also because some researchers view motivation and engagement as interchangeable constructs (Martin 2007; 2012). However, I believe the research I reviewed here and other work (Eccles & Wang, 2012; Linnenbrink & Pintrich, 2003) supports the notion that these are separate constructs and that motivation leads to subsequent engagement and their relationship becomes reciprocal over time. Therefore, in my dissertation, I examined at two time points students' engagement, their competence-related beliefs, and their task values in order to determine whether motivation at time one predicted engagement at time two, or vice versa, and whether these relationships became reciprocal over time.

The extant research examining whether competence-related beliefs and task values predict different dimensions of engagement has found support for these predictive relationships. However, EVT-based research examining student engagement is limited in that researchers have (for the most part) only examined certain aspects of students' task values, and certain aspects of engagement. Thus, in this dissertation study, I included the newly proposed and validated sub-facets of utility value and cost and all five dimensions of student engagement and behavioral and emotional disaffection. Further, I included unidimensional and correlated two-factor models of emotional disaffection and emotional cost and of emotional engagement and intrinsic value as predictors and outcomes. I included these factors as both independent variables and outcomes because they are a combination of motivation and engagement constructs.

Additionally, research has not examined whether dimensions of engagement might mediate the relationship between competence-related beliefs, task values, and student achievement. Eccles (personal communication, September, 2018) stated that motivational beliefs and task values are the driving force behind whether students start an activity, and that engagement is what students experience while doing the task. Further, she stated that engagement is considered an outcome; however, the model has not been changed to accommodate this addition (Eccles, personal communication, November, 2017; Eccles & Wang, 2017). Thus, if students' engagement mediates the relationship between competence-related beliefs and task values and achievement, this would have implications for where engagement is placed into the EVT model.

Finally, with respect to the specificity of measurement issue, I examined student engagement, competence-related beliefs and task values in math and science courses. With educational policy makers interest in increasing the number of students who enroll and stay in STEM majors, it is important to understand how student motivation and engagement relate in math and science. Thus, the present study contributed to our understanding of how these constructs relate and predict math and science achievement.

Chapter 3: Methods

Participants

As discussed in Chapters 1 and 2, the main purpose of this study was to examine the relations between different dimensions of college students' engagement and their competence-related beliefs and values in introductory math and science courses. I therefore sampled college undergraduate students who were enrolled in introductory math and science courses at the University of Maryland, College Park. I used this method of non-probability sampling to recruit participants because I was generally interested in this population of students and many of these professors expressed interest in the study and these courses are generally required for a wide range of majors.

I emailed 59 professors teaching a 100 or 200 level math, statistics, chemistry, biology, or physics course asking if they would be interested in having their students participate in the study. Out of the 59 professors I contacted, 15 math, biology, and physics professors agreed to distribute my survey at two time points. Professors were asked if they would be willing to offer extra credit to their students for their participation, or, if not, whether they would be willing to send a link to the survey to their students for voluntary participation. In three courses instructors offered extra credit to their students for their participation during the first time point, and two additional courses offered extra credit for participation at the second time point. Fourteen courses were sent the volunteer link for participation during the first data collection time point and 12 courses were sent the volunteer link for participation during the second data collection timepoint (two of the courses offered extra credit during the second data collection time point). Overall, 50.6%

of students in time point one that participated were offered extra credit and 86.9% of students in time point two that participated were offered extra credit.

In the first time point, 66.46% of participating students came from introductory math courses, 11.67% came from introductory physics courses, and 21.04% came from introductory biology courses. In the second time point, 56.63% of participating students came from introductory math courses, 5.00% came from introductory physics courses, and 36.83% came from introductory biology courses. All students who participated in the study were entered into a raffle to win one of 19 $50 Amazon gift cards.

Students were asked at two separate times to participate. Students were first given the survey link on February 4, 2019 and had until March 18, 2019 to complete the survey at time point one. The second survey at time point two was sent out to students on April 23, 2019 (five weeks after the end of the first survey time point and after mid-terms) and students had until the last day of classes, May 15, 2019 to participate. There were 486 students that participated in the study at time point one, and 516 students participated at time point two, and a total of 240 students participated at both time points. Overall, there was a total of 741 subjects across the two time points. Consenting students at time point one were 51% female, 54.6% European American, 28% Asian or Asian American, 10.1% African American, 5.4% Hispanic or Latinx, 0.2% Pacific Islander and 1.6% other. Students' average age in time point one was 19.58 years old (*SD* = 2.59); 50.5% of students were in their first year of college, 26.1% were in their second year, 18.3% were in their third year, 3.5% were in their fourth, and 1.5% of participating students at time point one had been in college for five or more years. Most students (80.4%) were required to take the course they were recruited from for their major or intended majors.

Consenting students at time point two were 50.5% female, 46.4% European American, 27.3% Asian or Asian American, 10.6% African American, 8.3% Hispanic or Latinx, 0.5% Native American, 0.7% Pacific Islander and 1.8% other ethnicities. Students' average age in time point two was 20.16 years old (*SD* = 2.59); 39.7% of students were in their first year of college, 23.7% in their second year, 22.7% in their third year, 9.7% in their fourth year, and 4.3% of participating students at time point two had been in college for five or more years. Most students (71.6%) in time point two were required to take the course they were recruited from for their major or intended majors.

Before collecting data, I conducted an a priori power analysis using G*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007, 2009) to determine the size of effects I could observe using models with 17 or fewer predictor terms included. I conducted my power analyses within the *t* test family, because my hypotheses and research question were such that I wanted to detect the effects of a single regression coefficient. I determined that with at most 17 regression terms, a two-tailed test, $n = 403$, power = 0.80, and $\alpha = 0.05$, I could detect effects at a Cohen's $f^2 = .0196$ and thus I determined I would be able to detect at least small to medium effects using a sample size of 403.

Materials/Measures

The complete list of measures and the wording of self-report questionnaires administered in this study can be found in Appendix A. Students were asked to think about the specific math or science course from which they were recruited from when responding to items. I chose these measures because they are well-validated and widely used assessments of dimensions of engagement, competence-related beliefs and values. The Math and Science Engagement Scale by Wang and colleagues (2016) was chosen because it is a scale that was developed specifically for measuring dimensions of engagement in math and science classrooms. I chose two subscales from the Engagement versus Disaffection with Learning Scale by Skinner and colleagues (2009) because these subscales emphasize the opposite of engagement by focusing on disaffection. I chose the Agentic Engagement Scale by Reeve (2012) because it is currently the only validated measure used to assess agentic engagement as the development of the agentic engagement dimension is still relatively new. The questionnaires used to measure competence-related beliefs and facets of values were chosen because they are well validated and widely used among researchers studying EVT. Further I chose Gaspard and colleagues (2015) value facets questionnaire and Flake and colleagues (2015) perception of cost questionnaire because of the incorporation of sub-facets of utility value and the inclusion of four dimensions of perception of cost. All items on the questionnaire were randomized. The reliability coefficients reported in this study for all measures are marginal reliabilities, instead of cronbach's alpha, because I used item pattern scores (EAP scores) that can be obtained from flexMIRT software output (Thissen & Orlando, 2001). Marginal reliabilities are calculated by marginalizing (averaging out) latent trait density and scales are generally considered reliable if the marginal reliability is around 0.7 or higher (Green, Bock, Humphreys, Linn, & Reckase, 1984; Thissen & Orlando, 2001). Marginal reliabilities are the appropriate ones to use in this instance because I used EAP scores and treated some of the data as categorical (Thissen & Orlando, 2001).

Behavioral engagement. I assessed students' behavioral engagement, or their involvement in academic and class-based activities using a subscale of a questionnaire called the Math and Science Engagement Scale that is adapted from previous engagement research and open-ended responses by students and is well-validated for use in math and science courses (Wang et al., 2016). This subscale contained eight items (sample item: "I put effort into learning math/science."). Students responded to these items using a 5-point Likert scale from 1 (not at all like me) to 5 (very much like me). This subscale has demonstrated internal consistency in a previous study (α = .80-82; Fredricks et al., 2018) and was reliable in the present study ($\hat{\rho}^2$ = .80). Three of the items were negatively worded and reverse-coded.

Behavioral disaffection. I assessed students' behavioral disaffections, or students giving up and withdrawing, being distracted, and generally unprepared for class using a subscale of Skinner and colleagues (2009) Engagement versus Disaffection with Learning Scale. This subscale was adapted to be used in math and science courses. This subscale contained five items (sample item: "When I'm in class, I just act like I'm working."). Students responded to these items using a 4-point Likert scale from 1 (not at all true) to 4 (very true). This subscale has demonstrated internal consistency in a previous study (α = .71-78; Skinner et al., 2009) and was reliable in the present study ($\hat{\rho}^2$ = .85).

Emotional engagement. Students' emotional engagement, or their presence of positive emotional reactions, valuing of learning, and display of interest in the classroom, was assessed using a subscale of a questionnaire called the Math and Science Engagement Scale that is adapted from previous engagement research and open-ended responses by students and is well-validated for use in math and science courses (Wang et al., 2016). This subscale contained ten items (sample item: "I enjoy learning new things about math/science."). Students responded to these items using a 5-point Likert scale from 1 (not at all like me) to 5 (very much like me). This subscale has demonstrated internal consistency in a previous study (α = .88; Fredricks et al., 2018) and was reliable in the present study ($\hat{\rho}^2$ = .92). Five of the items were negatively worded and these were reverse-coded.

Emotional disaffection. I assessed students' emotional disaffections, or students demonstrating motivated withdrawal or alienation during learning activities which could be indicated by emotions such as boredom, frustration, anxiety and disinterest in school using a subscale of Skinner and colleagues (2009) Engagement versus Disaffection with Learning Scale. This subscale was adapted to be used in math and science courses. This subscale contained five items (sample item: "When I'm in class, I feel worried."). Students responded to these items using a 4-point Likert scale from 1 (not at all true) to 4 (very true). This subscale has demonstrated internal consistency in a previous study (α = .81-.85; Skinner et al., 2009) and was reliable in the present study ($\hat{\rho}^2$ = .84).

Cognitive engagement. I assessed students' cognitive engagement, or their self-regulated learning and deep cognitive learning strategies, using a subscale of a questionnaire called the Math and Science Engagement Scale that is adapted from previous engagement research and open-ended responses by students and is well-validated for use in math and science courses (Wang et al., 2016). This subscale contained eight items (sample item: "I try to connect what I am learning to things I have learned before."). Students respond to these items using a 5-point Likert scale from 1 (not at all like me) to 5 (very much like me). This subscale has demonstrated internal consistency in a previous study (α = .74-75; Fredricks et al., 2018) and was reliable in the present study ($\hat{\rho}^2$ = .79). I reverse coded four negatively worded items.

Social engagement. Students' social engagement, or the quality of students' social interactions with peers and adults as well as their initiative to form relationships while learning, was assessed using a subscale of a questionnaire called the Math and Science Engagement Scale that is adapted from previous engagement research and open-ended responses by students and is well-validated for use in math and science courses (Wang et al., 2016). This subscale contained seven items (sample item: "I try to understand other people's ideas in math/science class."). Students responded to these items using a 5-point Likert scale from 1 (not at all like me) to 5 (very much like me). This subscale has demonstrated internal consistency in a previous study (α = .73; Fredricks et al., 2018) and was reliable in the present study ($\hat{\rho}^2$ = .82). I reversed coded three items that were negatively worded.

Agentic engagement. I assessed students' agentic engagement, or students' trying to actively enrich their learning experiences and taking responsibility for their learning, using a newly validated scale by Reeve (2013) and Reeve and Tseng (2011). The Agentic Engagement Scale (AES) was adapted to be used in math and science courses. This scale contained five items (sample item: "During class, I ask questions."). Students responded to these items using a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). This scale has demonstrated internal consistency in previous studies (α = .81-.86; Reeve, 2013) and was reliable in the present study ($\hat{\rho}^2$ = .87).

Competence-related beliefs. I assessed students' beliefs related to their competence to learn in a specific domain (i.e., math or science) using a questionnaire that was adapted from previous EVT research and is well-validated in the field (Eccles & Wigfield, 1995). This questionnaire contained five items, three of which assessed students' current self-concept of ability beliefs (sample item: "How good in math/science are you?") and two of which assessed students' future expectations for success (sample item: "How well do you expect to do in math/science this year?"). Students responded to these items using a 7-ponit Likert scale with anchor items that differ for each question (see Appendix A). This scale has demonstrated internal consistency in previous studies (α = .88-.92; Eccles & Wigfield, 1995; Fredricks et al., 2018) and was reliable in the present study ($\hat{\rho}^2$ = .93).

Attainment Value. I assessed students' perceptions of how important math/science is to their sense of self using items from two questionnaires. One item was adapted from a questionnaire that is well-validated in the field by Eccles and Wigfield (1995). This item asked students to respond to the question "Compared to most of your other activities, how important is it for you to be good at math/science?" on a 7-point Likert scale from 1 (not at all important) to 7 (very important). This scale has demonstrated internal consistency in previous studies (α = .70-.85; Eccles & Wigfield, 1995; Fredricks et al., 2018). Four additional items came from the importance of achievement subscale of Gaspard and colleagues (2015) value facets questionnaire (sample item: "It is important to me to be good at math/science."). These four items were adapted from work by Steinmayr and Spinath (2010) and students responded to these items using a 4-point Likert scale from 1 (completely disagree) to 4 (completely agree). This scale has demonstrated internal consistency in previous studies using ρ, which is an estimator for reliability in latent variable modeling (ρ = .88; Gaspard et al., 2015) and was reliable in the present study ($\hat{\rho}^2$ = .93).

Intrinsic Value. I assessed students' perceptions of how much they are interested in math/science using four items from the intrinsic subscale of Gaspard and colleagues (2015) value facets questionnaire (sample item: "I like doing math/science."). Students responded to these items using a 4-point Likert scale from 1 (completely disagree) to 4 (completely agree). This scale has demonstrated internal consistency in previous studies using ρ, which is an estimator for reliability in latent variable modeling (ρ = .94; Gaspard et al., 2015) and was reliable in the present study ($\hat{\rho}^2$ = .90).

Utility Value. I assessed students' perceptions of utility value for learning math/science using a subscale from the Eccles and Wigfield (1995) questionnaire. Two items assessed how useful is what students are learning in math/science (sample item: "In general, how useful is what you learn in math/science?"). Students responded to these items using a 7-point Likert scale with anchor items differing depending on the questions (see Appendix A). This scale has demonstrated internal consistency in previous studies (α = .62-.77; Eccles & Wigfield, 1995; Fredricks et al., 2018) and was reliable in the present study ($\hat{\rho}^2$ = .89). In order to assess two additional sub-facets of utility value (utility for job and utility for future), I used two subscales from Gaspard and colleagues (2015) value facets questionnaire. Both of these sub-facets were answered using a 4-point Likert scale from 1 (completely disagree) to 4 (completely agree). I assessed students' utility for job, or their perceptions of how math/science will be useful for their job using two items (sample item: "Learning math/science is worthwhile, because it improves my job and career chances."). This subscale has been found to be reliable in previous studies (ρ = .68; Gaspard et al., 2015). However, this scale had low reliability ($\hat{\rho}^2$ = .50) and thus I did not include it in my analyses. I assessed students' general utility for future life, or their perceptions of how math/science will be useful for their future using two items (sample item: "I will often need math/science in my life."). This subscale has also been found to be reliable in previous studies (ρ = .79; Gaspard et al., 2015) and was reliable in the present study ($\hat{\rho}^2$ = .80).

Perceptions of cost. I assessed students' perceptions of cost in math/science class using a questionnaire developed and validated by Flake and colleagues (2015) with college students. This questionnaire assesses four dimensions of cost (task effort, outside effort, loss of valued alternatives, and emotional cost) with 4-6 items for each dimension (sample item for task effort cost: "This class demands too much of my time."). Students responded to all items using 7-point Likert scales ranging from 1 (strongly disagree) to 7 (strongly agree). Flake and colleagues (2015) found all subscales to be reliable (full cost scale: α = .97; task effort cost: α = .95; outside effort cost: α = .93; loss of valued alternatives: α = .89; emotional cost: α = .94). I computed the marginal reliability for the full cost scale ($\hat{\rho}^2$ = .97), as well as for each dimension of cost (task effort cost: $\hat{\rho}^2$ = .94; outside effort cost: $\hat{\rho}^2$ = .93; loss of valued alternatives: $\hat{\rho}^2$ = .90; and emotional cost: $\hat{\rho}^2$ = .94).

Grades. After the semester ended, students' grades were collected via school records for the class from which they were recruited, which is also the class they thought about when responding to the motivation and engagement scales. The grades were in the form of letters (e.g., A-, B+, etc.) and were re-coded on a scale from 1 to 13 where 1 = F and 13 = A+.

Demographics. At the end of the questionnaire, students were asked to report their gender, race/ethnicity, year in school, major or intended major, whether the course they were recruited from was a required course for them, their current overall GPA, their current major GPA, their SAT scores, and whether they were a first-generation university student.

Procedure

Instructors who agreed to have their class participate in the study were sent a Qualtrics survey link two times to their students through email at the beginning and end of the Spring semester. The students were able to complete the survey at home on their own during the two data collection time points. When students accessed the online survey, they were asked to give consent in order to participate in the study and to give permission to me to access their final grades in the course. After completing the consent form, students were given (in a randomized order) scales measuring competence-related beliefs, attainment value, intrinsic value, utility value, perceptions of cost, behavioral engagement and disaffection, emotional engagement and disaffection, cognitive engagement, social engagement, and agentic engagement. Items in scales were also randomized. Additionally, students were asked to respond to items thinking about a specific math or science class in which they were currently enrolled, and to type in the name of the course they were thinking about when responding to items. At the end of the survey, students were asked to report some additional information about the course and their educational background, as well as their demographics. At the end of the semester I collected students' grades from the registrar's office for all students with correctly entered UIDs and who gave consent.

Pre-Data Analytic Decisions

Likert scaled response data: Continuous vs. categorical. When researchers analyze data from Likert scaled surveys, attention should be paid to whether data should be treated as continuous (i.e., assuming equal intervals between each response option on the scale) or categorical (i.e., assuming unequal intervals between each response option on the scale). Rhemtulla, Brosseau-Laird, and Savalei (2012) have found that results may be unreliable if data are treated as continuous when they are actually categorical, especially with five or fewer categories on the answer scale (Rhemtulla et al., 2012). Therefore, all of my scales with five or fewer categories on the answer scale were treated as categorical. This includes all subscales from the Engagement vs. Disaffection with Learning Scale (Skinner et al., 2009), the Math and Science Engagement Scales (Wang et al., 2016), and the subscales from the Value Facets Questionnaire (Gaspard et al., 2015). Items from the Agentic Engagement Scale (Reeve, 2013), the Children's Ability Beliefs and Subjective Task Values Scales (Eccles & Wigfield, 1995), and the Perceptions of Cost Scale (Flake et al., 2015) were treated as continuous because they had more than five categories on the answer scale.

Structural equation estimation. It is also important to consider which estimator approach to use when conducting structural equation modeling. When using both categorical and continuous data, there are two different estimation approaches that can be used: Full information maximum likelihood (FIML) or limited information methods (e.g., weighted least squares estimation (WLS). Previous research has determined that FIML is best for smaller sample sizes (e.g., around 500 observations) and for samples with missing data (Forero & Maydeu-Olivares, 2009). Thus, I chose to use FIML estimation in the present study. However, it is important to note that FIML does not always provide model fit information when using both categorical and continuous variables. Therefore, I used model fit indices when provided and also relative model fit indices (AIC and BIC) when appropriate.

Data Analysis Plan for Testing the Hypotheses and Research Question

Hypotheses 1a and 1b. I used the multidimensional item response theory (MIRT) approach to confirmatory factor analyses (CFA; Wirth & Edwards, 2007) in order to address hypotheses 1A and 1B, regarding whether emotional disaffection and emotional cost overlap factorially and whether emotional engagement and intrinsic value overlap factorially. I hypothesized that emotional disaffection and emotional cost will overlap empirically, and that emotional engagement and intrinsic value will overlap empirically. I conducted confirmatory item factor analyses rather than an exploratory factor analyses (EFA) because the confirmatory item factor analysis approach allowed me to compare alternative theoretical models that were hypothesized a priori. Further, Fabrigar, Wegener, MacCallum and Strahan (1999) discussed how an optimal factor solution may not be found when using an EFA. Additionally, researchers have also used confirmatory item factor analysis to build evidence for convergent and discriminant validity, which are of particular interest because of the potential overlap among these constructs (Guo, Aveyard, Fielding, & Sutton, 2008; Marsh & Hocevar, 1983; Widaman, 1985).

I ran separate models with emotional disaffection and emotional cost together and models with emotional engagement and intrinsic value together and then assessed comparative model fit. The models I tested included specifying the constructs (i.e. emotional disaffection and emotional cost; emotional engagement and intrinsic value) as being quite distinct, to models specifying complete overlap in the constructs (see Figures

2 and 3). I tested these models because they would allow me to determine whether these constructs are empirically distinct or overlap. In the first model I assumed that emotional disaffection and emotional cost are empirically separate, but correlated, constructs and that emotional engagement and intrinsic value are empirically separate, but correlated constructs. In the second model I assumed that emotional disaffection and emotional cost make up a single construct and that emotional engagement and intrinsic value make up a single construct. Thus, these models assumed these constructs are not empirically separate. In order to test for the best fitting model in each set of analyses, I used comparative model fit indices, which included Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). I used AIC and BIC because these are the most well-accepted comparative model fit indices when using Full-Information Maximum Likelihood (FIML). The better fitting model will be the model with the smaller AIC and BIC values (Burnham & Anderson, 1998; Yang, 2005). I also used an absolute model fit index, the root mean squared error of approximation (RMSEA). If I find that Model 1 fits better than Model 2 for the particular set of constructs (based on the RMSEA, AIC and BIC fit indices), then I will have evidence that emotional disaffection is separate from emotional cost and that emotional engagement is separate from intrinsic value.

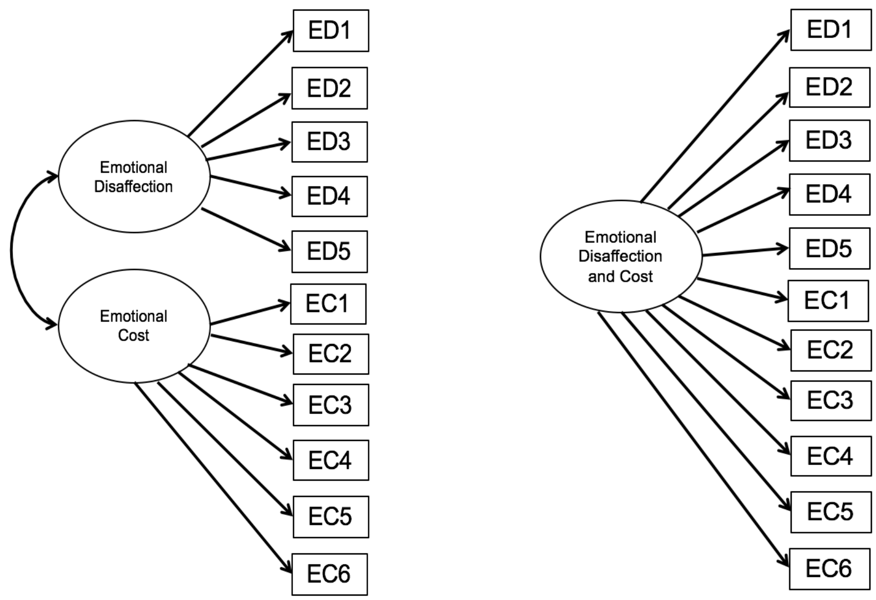


Figure 2. Graphical representation of proposed tested structural models for emotional disaffection and emotional cost (from left to right: two-correlated factor model, one-factor model).

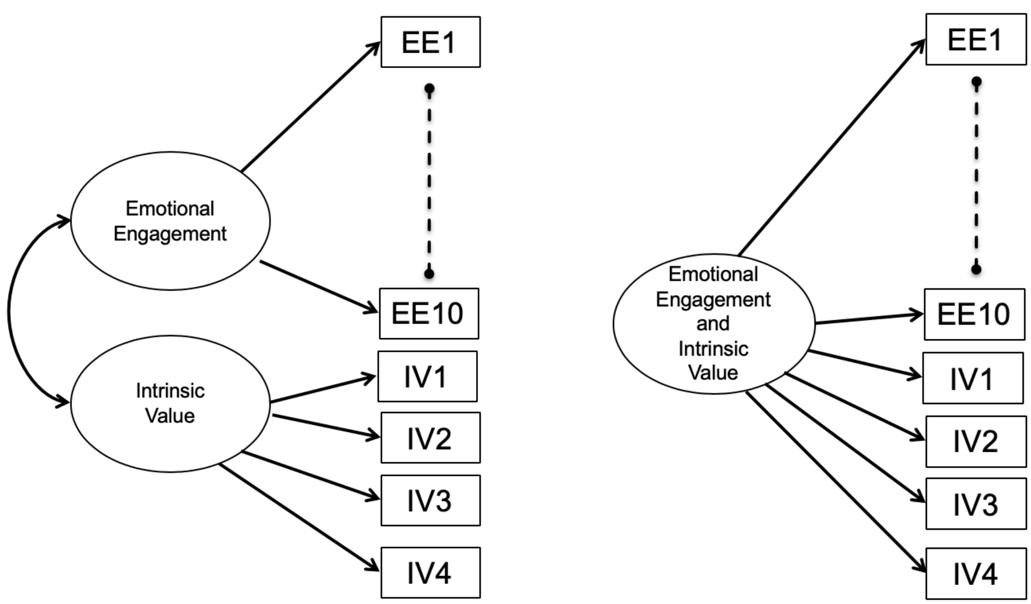


Figure 3. Graphical representation of proposed tested structural model for emotioanl engagement and intrinsic value (from left to right: two-correlated factor model, one-factor model).

Hypotheses 2a-2c. To address hypotheses 2A through 2C regarding the predictive relations among competence-related beliefs, values, and dimensions of engagement, I used a two-step approach in which I first obtained latent factor scores for each latent construct at time one and used them in subsequent multiple regression analyses. The factor scores for emotional disaffection, emotional cost, emotional engagement, and intrinsic value are based on the factor structure models in the figures above. Thus, factor scores were computed for the two-correlated factor models and the one-factor models. The latent factor scores from item factor analyses are often called item response pattern scores, or IRT scaled scores, because the mean and the standard deviation of the latent factor scores are scaled at 0 and 1, and only same item response patterns have the same level of scores. IRT scaled scores are known to contain more discriminating information of items than observed scores and tend to yield better estimates of the latent trait scores (Thissen & Wainer, 2001). Therefore, IRT scaled scores can be conceptually seen as weighted item scores. I specifically obtained expected a posteriori (EAP) scores that are the means of posterior distributions of the selected latent trait scores given the observed item response patterns (see Thissen & Wainer, 2001 for more details).

Some researchers have argued that structural equation modeling (SEM) approaches to assessing associative relations of constructs to outcomes are more desirable than multiple regression analyses conducted using observed variables because measurement models and the relations among latent variables are simultaneously estimated in SEM (e.g., Bollene, 1989; Skrondal & Laake, 2001). However, with respect to the constructs in this study, my sample size is not adequate to assess the full models

(Marsh, Balla, & McDonald, 1988). Because of this, I examined the associations of competence-related beliefs, values, engagement and disaffection using the IRT scaled scores (EAP) regression approach rather than using SEM.

I ran a series of regression analyses using the EAP scores for each construct in SPSS. Gender (male: 0, female: 1) and ethnicity (Black, Asian, Hispanic, Multiple ethnicity) dummy variables were included in all tested models as independent variables to statistically control for the effect of individual demographic information. The different dimensions of engagement were the outcome variables and separate regression models were run for each dimension of engagement. I additionally included the unidimensional and correlated two-factor models of emotional disaffection and emotional cost and of emotional engagement and intrinsic value as independent and dependent variables in the regression analyses.

First, I introduced each of the motivational beliefs and values constructs into the model one at a time to see the effect of each construct on a dimension of engagement, controlling for demographic variables, and compared the standardized betas. Second, I included all of the motivational beliefs and values constructs in one model to see which constructs were significantly related to the specific dimension of engagement while controlling for effects of other constructs; however, when introducing all of these variables simultaneously into one regression, multicollinearity becomes an issue (Cohen, Cohen, West, & Aiken, 2003; Gaspard et al., 2015). Multicollinearity occurs when an independent variable is highly correlated with one or more other independent variables. This becomes a problem because it undermines the statistical significance of an independent variable. The cost constructs indicated issues of multicollinearity and in the hierarchical regressions I included an overall cost score rather than the four sub-facets. These two steps allowed me to see which constructs remained significant when other constructs are controlled. Finally, I used an automated variable selection procedure, the stepwise method, to examine which motivational beliefs and values had the strongest associations with a specific dimension of engagement among the set of candidate predictors. This step helps with the multicollinearity issues experienced in step two. This final step was also used to address hypotheses 2b and 2c, regarding whether students' competence-related beliefs was more strongly associated with behavioral and cognitive engagement and whether students' task values was more strongly associated with emotional, social and agentic engagement.

Hypothesis 3. To address my third hypothesis regarding whether students' motivational beliefs and values and engagement had reciprocal relationships, I conducted cross-lagged panel analyses in a structural equation framework. Various researchers have stated that such models are the most appropriate way to assess reciprocal relationships among constructs at two time points (Laursen, Little, & Card, 2012; Soenens, Luyckx, Vansteekiste, Duriez, & Goossens, 2008; Tyagi & Singh, 2014). Although other modeling approaches exist, such as the random intercepts cross-lagged panel model, these approaches require data from at least three different time points (Hamaker, Kuiper, & Grasman, 2015). Thus, because I used data from only two time points, I used cross-lagged panel model analyses to address my third hypothesis.

Before I conducted the cross-lagged analyses, I first had to test for measurement invariance because I was using variables from time one and time two and it is important to ensure that these variables were invariant over time. I used two different methods to test for invariance because of the nature of the different Likert scales used: 1) Differential Item Functioning using FlexMIRT v.3.51 (Cai, 2012) software for scales with five or fewer Likert options; 2) Measurement invariance using M*plus* v.8.4 (Muthén & Muthén, 2012-2019) software for scales with more than five Likert options. Thus, if DIF is present, it means the assumption of measurement invariance with respect to metric or scalar equivalency has not been met. Therefore, any item exhibiting DIF, or lack of invariance, will not be constrained to be equal across the two time points.

As discussed earlier, for scales with five or fewer Likert options (i.e., Engagement vs. Disaffection with Learning Scale (Skinner et al., 2009), Math and Science Engagement Scales (Wang et al., 2016), and the Value Facets Questionnaire (Gaspard et al., 2015) the items were treated as categorical (Cohen, Manion, & Morrison, 2000; Rhemtulla et al., 2012). As such, for ordered categorical measures like Likert scale items with five or fewer categories, Millsap and Yun-Tein (2004) described how a test of measurement invariance can be conducted using the multigroup confirmatory item factor analysis framework (CIFA). In the framework of item response theory (IRT), this is oftentimes called differential item functioning (DIF). Testing differential item functioning within an IRT framework is equivalent to testing metric and scalar measurement invariance in CIFA. Thus, DIF is a way to test for measurement invariance among categorical variables. If DIF is detected, then the assumption that the item is the same across the two time points is not met and as such these items will be estimated freely.

I conducted the DIF analyses using FlexMIRT v.3.51 (Cai, 2012) software because this allowed me to conduct Item Response Model-Based Differential Item functioning analyses to test for invariance among my categorical data. I also used the graded response model (GRM; Samejima, 1969, 1997) because it characterizes items based on two psychometric properties: Item slopes (discrimination) and item thresholds (difficulty or intercept) parameters. DIF in IRT also refers to differences in items slopes and intercepts across subgroups (i.e., time one and time two), after accounting for the overall differences between the subgroups on the construct being measured (Holland & Wainer, 1993).

To determine whether DIF existed in the scales, I used the likelihood ratio test (LRT), which has been shown to be the most flexible and powerful model-based method (Teresi, Kleinman, & Ocepek-Welikson, 2000; Thissen, Steinberg, & Wainer, 1993; Wainer, 1995). In order to do this, I first fit a model with full invariance, i.e., slopes and thresholds for each item constrained to be equal between the two testing points. I then freed one item's slope and threshold at a time, allowing each group (i.e., time one participants and time two participants) to have its own slope and threshold estimates for that item. I then compared these models to the fully constrained model using the LRT to determine if the additional parameters estimated, when each time point group is allowed its own item parameters, significantly improved the fit of the model (Thissen et al., 1993; Wainer, Sireci, & Thissen, 1991). This approach allowed me to conduct a statistical test to identify any significant differences in the item parameters between time one and time two. I then made sure to control for the family wise Type I error rate by using the Bonferroni adjustment which is a preferred method of correction because it is conservative (Bland &Altman, 1995) Thus, any items with significant results were identified as having DIF, such that metric and scalar measurement invariance was not found. Further, I conducted post hoc analyses in order to determine whether the DIF was specifically in the slope parameters or just in the thresholds. In order to do this, I freed the slope for each item demonstrating DIF, one at a time, allowing both time one and time two groups to have their own slope estimates, then I compared these against the full measurement invariance model using LRT. If significant, this indicated that the DIF was in the slope parameters.

As discussed earlier, for scales with more than five Likert options (i.e., Agentic Engagement Scale (Reeve, 2013); Children's Ability Beliefs and Subjective Task Values (Eccles & Wigfield, 1995), and the Perceptions of Cost Scale (Flake et al., 2015), the items were treated as continuous. Specifically, I calculated whether weak (factor loadings equal across the two time points) and strong (loadings and intercepts equal across the two time points) measurement invariance was reasonable across the two time points. I used the MLR estimator in Mplus because it handles missing data and provides model fit information for continuous variables (Muthén & Muthén, 2012-2019). I also followed Chen (2012) and Cheung and Rensvold's (2005) recommendations, models were evaluated according to model fit: An increase in the model fit of the more restrictive model of around .01 for the CFI, a decrease around .015 for the RMSEA, and an increase in the SRMR around .030 would provide adequate support for the more constrained model and thus for measurement invariance. Measurement invariance was not tested for either utility value or utility value for future life because these scales only had two items each. Thus, the slopes and intercepts for items from these two scales were constrained to be equal across both time points.

After testing for measurement invariance (and DIF), I conducted separate cross-lagged models for competence-related beliefs and each dimension of engagement, and each component of task values in relation to each dimension of engagement. For example, I conducted a cross-lagged model for students' competence-related beliefs and behavioral engagement and a separate cross-lagged model for students' competence-related beliefs and cognitive engagement. I conducted these analyses using the structural equation framework in Mplus. I used the MLR estimator and Gauss-Hermite integration with five integration points because I only had four latent variables in each cross-lagged model (Muthén & Asparouhov, 2009) In each cross-lagged model there will be a total of four latent variables; X_1, X_2, Y_1, Y_2 (see Figure 4). The variables X_1 and X_2 represent one of the dimensions of engagement measured at time one and time two. either students' competence-related beliefs or a value component measured at time one and time two. The variables Y_1 and Y_2 represent either students' competence-related beliefs or a value component measured at time one and time two. Cross-lagged panel analyses are used to determine the directionality in the nature of the relations of the constructs (Laursen et al., 2012; Tyagi & Singh, 2014). Therefore, the cross-lagged panel design analysis could suggest that: if the correlation between X_1 and Y_2 is substantially different from zero, I can conclude that X (motivational beliefs or facets of values) predicts Y (a dimension of engagement); if the correlation between X_2 and Y_1 is substantially different from zero, I can conclude that Y predicts X; if both correlations are significantly different from zero, I can conclude that X predicts Y and Y predicts X; if both correlations are equal, I can conclude that they do not predict each other but are both predicted by a third variable.

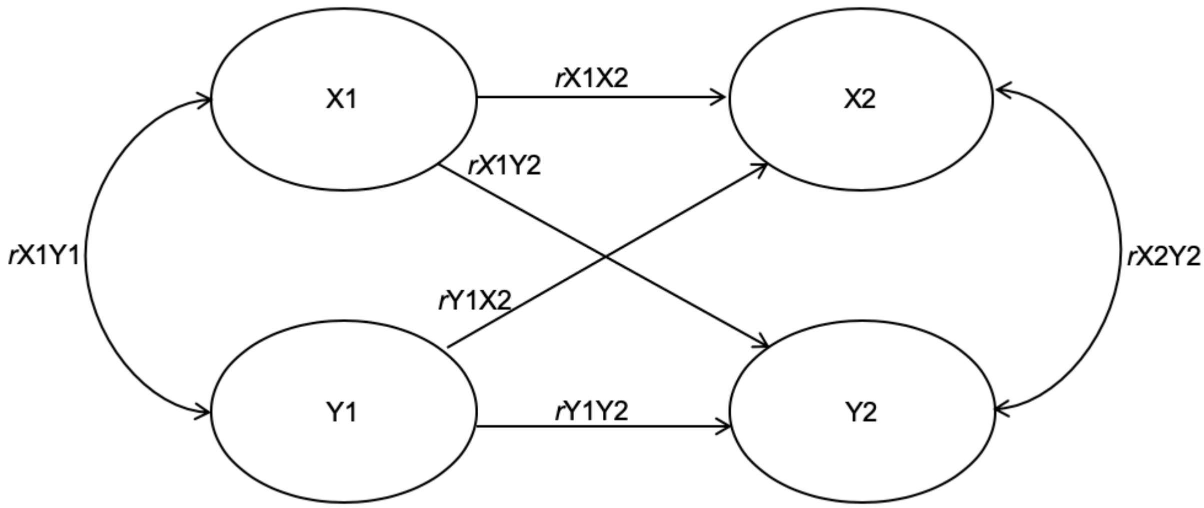


Figure 4. Graphical representation of proposed cross lagged model. Multiple models were ran for each EVT construct and engagement dimension. Here X represents an EVT construct at time 1 and time 2; Y represents engagement dimension at time 1 and time 2.

Research question. My research question concerns whether dimensions of engagement will mediate the relationship between competence-related beliefs, values, and domain-specific grades. As mentioned in Chapter 1, I assessed mediation in order to explore whether a specific dimension of engagement affected domain-specific grades via students' competence-related beliefs and values. There are different ways to assess mediation and indirect effects (Baron & Kenny, 1986; Shrout & Bolger, 2002; Williams & Mackinnon, 2008). The most parsimonious method is to explore indirect effects in a structural equation model. Thus, I conducted my mediation models using a structural equation framework in Mplus. Full information maximum likelihood (FIML) estimation was used to help account for missing data across the two time points. Competence-related beliefs and values from time one were treated as exogenous variables, dimensions of engagement from time two were treated as the endogenous mediating variables, and end of year domain-specific grades was the measured outcome. I ran multiple mediation models. Each model explored the relationship between a particular EVT construct, a specific dimension of engagement as a mediator, and students' end of year math or science grades (see Figure 5).

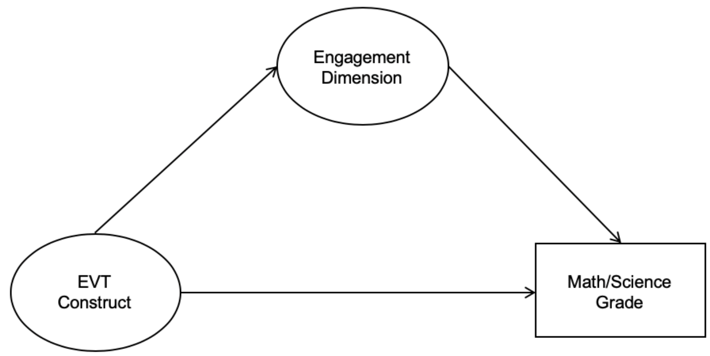


Figure 5. Graphical representation of proposed mediation model. Multiple mediation models will be run for each EVT construct and engagement dimension.

Addressing the potential for Type 1 Error. I ran multiple statistical analyses in this study because I had multiple outcome and mediating variables of interest. I acknowledged that there could be an increased risk of making Type I errors in interpreting my results due to running this amount of analyses (i.e., I might find a significant effect in my analyses that does not reflect an actual effect). To help alleviate this concern, I used an approach recommended by Nakagama (2004) in which I reported and interpreted effect sizes throughout my results rather than focusing solely on interpreting the exact *p* values of my effects. The effect sizes I reported and interpreted are the standardized beta values representing the regression coefficients of different terms in each model and estimates of the indirect effects in the mediation models. This approach is appropriate because all analyses are based in *a priori* theoretical reasoning (Christenson et al., 2012; Eccles & Wang, 2012) or are exploratory (i.e., my single research question). Even when I did not have specific hypotheses, as is this case for my mediation models, I planned to evaluate constructs that were reasonable given previous literature and theory. Additionally, I interpreted significant effects with particular attention paid towards the patterns of results rather than relying solely on each individual significant effect that I found.

Chapter 4: Results

Missing Data

There was less than 5% missing data for data collected at time one and time two. However, when these two data sets were merged the missingness increased between 31.20% - 32.70% for all variables (see Table 1). I used a modeling approach that uses full-information maximum likelihood (FIML; see Enders, 2010) estimation with the expectation-maximization computation algorithm (Bock & Aitkin, 1981) to test hypotheses 1a and 1b. I used data from just time one for these hypotheses, so missing data was not an issue. I used this same method when calculating the EAP scores I used in the regression analyses to address hypotheses 2a-2c. I additionally used the listwise deletion method once I entered the EAP scores into SPSS (version 25) for the regression analyses because the missing data at Time 1 was so minimal and this is the default when using SPSS. To test for differential item functioning and measurement invariance prior to doing the analyses for hypothesis 3, I used FIML with the expectation-maximiation computation to test for measurement invariance among my categorical variables using FlexMIRT v3.0 (Cai, 2012). I also used FIML when testing for invariance among my continuous variables in M*plus* v.8.4 (Muthén & Muthén, 2012-2019), when testing the full cross-lagged models and when conducting my mediation analyses. The cross-lagged models and mediation models used data from both time one and time two and FIML is the recommended method for handling large amounts of missing data (see Enders, 2010 and Graham, 2009). FIML works by using multiple imputations to estimate a likelihood function for each individual based on the variables that are present so that all of the available data are used (Enders, 2010).

Table 1

Missing Data Information for all Variables

T1/T2	N Valid T1/T2	N Missing T1/T2	% Missing
Time One: N = 486 Time Two: N = 512			
Behavioral Disaffection	486/512	0/0	0.00%
Emotional Disaffection	486/512	0/0	0.00%
Behavioral Engagement	483/506	3/6	0.60/1.19%
Cognitive Engagement	483/506	3/6	0.60/1.19%
Emotional Engagement	483/506	3/6	0.60/1.19%
Social Engagement	483/504	3/8	0.60/1.59%
Agentic Engagement	465/503	21/9	4.30/1.18%
Competence	465/502	21/10	4.30/1.99%
Attainment Value	465/500	21/12	4.30/2.40%
Utility Value	465/502	21/10	4.30/1.99%
Utility for Future Life	465/500	21/12	4.30/2.40%
Intrinsic Value	465/500	21/12	4.30/2.40%
Task Effort Cost	465/499	21/13	4.30/2.60%
Loss of Valued Alternatives	465/499	21/13	4.30/2.60%
Outside Effort Cost	465/499	21/13	4.30/2.60%
Emotional Cost	465/499	21/13	4.30/2.60%
Time One and Two Combined: N = 741	**N Valid**	**N Missing**	**% Missing**
Behavioral Disaffection	510	231	31.20%
Emotional Disaffection	510	231	31.20%
Behavioral Engagement	509	232	31.30%
Cognitive Engagement	509	232	31.30%
Emotional Engagement	509	232	31.30%
Social Engagement	509	232	31.30%

Agentic Engagement	501	240	32.40%
Competence	500	241	32.50%
Attainment Value	500	241	32.50%
Utility Value	500	241	32.50%
Utility for Future Life	498	243	32.80%
Intrinsic Value	498	243	32.80%
Task Effort Cost	499	242	32.70%
Loss of Valued Alternatives	499	242	32.70%
Outside Effort Cost	499	242	32.70%
Emotional Cost	499	242	32.70%
Grades	704	37	5.00%

Descriptive Statistics

The descriptive statistics for all variables in this study for time point one and two are reported in Table 2. Overall, students reported relatively high competence-related beliefs, task values and engagement as indicated by the averages being above the mid-point of the Likert scale and low disaffection and facets of cost as indicated by the averages being below the mid-point of the Likert scale, in their math or science course across the two time points. However, agentic engagement was particularly low across the two time points compared to the other variables. Students had an average final grade in the “B” range.

Correlations between all variables, using EAP scores, for time point one are reported in Table 3 and time point two correlations are reported in Table 4. Behavioral and emotional disaffection were significantly negatively correlated with the engagement dimensions (except for social engagement at time one), competence-related beliefs, and the value facets, and positively correlated with the four cost variables. All of the engagement dimensions were significantly positively correlated with one another. Social engagement was not significantly correlated with competence-related beliefs at time one, cost facets at time one, and grades but was significantly correlated with all other variables. Agentic engagement was not significantly correlated with attainment value or cost facets at time one or time two, or grades. Agentic engagement was however significantly correlated with all other variables.

Students' competence-related beliefs and the value facets were all significantly positively correlated with one another. Task effort cost, loss of valued alternatives, outside effort cost, and emotional cost at time one were significantly negatively correlated with the engagement dimensions excluding social and agentic engagement, and significantly negatively correlated with competence-related beliefs and value facets. However, emotional cost was not significantly correlated with attainment value at time one. Task effort cost, loss of valued alternatives, outside effort cost, and emotional cost at time two were significantly negatively correlated with all engagement dimensions, except for agentic engagement, and with competence-related beliefs and the value facets.

Students' grades were significantly negatively correlated with their reported emotional disaffection and perceptions of cost (all four components), positively correlated with behavioral, cognitive and emotional engagement, competence-related beliefs, intrinsic value at time one and time two. Students' competence beliefs correlated more strongly with their grades than did any of the other variables.

Table 2

Descriptive Statistics for all Variables

	N	M	SD
	W1/W2	**W1/W2**	**W1/W2**
Behavioral Disaffection	486/512	2.18/2.32	0.64/0.64
Emotional Disaffection	486/512	2.13/2.29	0.70/0.73
Behavioral Engagement	466/506	3.74/3.57	0.59/0.61
Cognitive Engagement	466/506	3.84/3.69	0.57/0.59
Emotional Engagement	466/506	3.61/3.40	0.77/0.79
Social Engagement	466/504	3.63/3.45	0.72/0.71
Agentic Engagement	465/503	2.73/2.75	1.27/1.33
Competence	464/502	4.84/4.64	1.17/1.32
Attainment Value (7-point)	465/502	5.70/5.40	1.46/1.51
Attainment Value (4-point)	465/500	3.63/3.45	0.47/0.58
Utility Value	465/502	4.52/4.33	1.67/1.71
Utility for Future Life	464/500	2.75/2.65	0.89/0.90
Intrinsic Value	465/500	2.58/2.44	0.81/0.82
Task Effort Cost	463/499	4.00/4.31	1.97/2.03
Loss of Valued Alternatives	463/499	3.49/3.89	1.90/1.97
Outside Effort Cost	463/499	3.91/4.54	2.05/2.18
Emotional Cost	463/499	4.11/4.49	2.26/2.30
Grades	704	9.06	3.13

Note. Attainment Value (7-point) is for the single attainment value item from the Children's Ability Beliefs and Subjective Task Values Scale (Eccles & Wigfield, 1995). Attainment Value (4-point) is for the four attainment value items from the Value Facets Questionnaire (Gaspard et al., 2015)

Table 3

Correlations between All Variables (EAP Scores) for Time Point One

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. BD																
2. ED	.39**															
3. BE	-.66**	-.33**														
4. CE	-.48**	-.38**	.74**													
5. EE	-.46**	-.78**	.47**	.44**												
6. SE	-.20**	-.08	.35**	.30**	.10*											
7. AE	-.25**	-.20**	.25**	.16**	.25**	.32**										
8. Comp	-.11*	-.59**	.23**	.38**	.57**	.00	.14**									
9. AV	-.26**	-.14**	.46**	.45**	.20**	.24**	.02	.14**								
10. UV	-.28**	-.37**	.38**	.39**	.55**	.11*	.23**	.34**	.38**							
11. UVFL	-.24**	-.32**	.29**	.30**	.48**	.15**	.23**	.33**	.30**	.73**						
12. IV	-.36**	-.67**	.39**	.39**	.84**	.13**	.28**	.53**	.25**	.62**	.55**					
13. TEC	.16**	.60**	-.21**	-.30**	-.62**	-.02	-.08	-.53**	-.09*	-.36**	-.31**	-.56**				
14. LVA	.11*	.49**	-.18**	-.26**	-.50**	-.03	.01	-.45**	-.11*	-.28**	-.23**	-.45**	.85**			
15. OEC	.14**	.48**	-.22**	-.25**	-.49**	-.02	-.02	-.50**	-.13**	-.27**	-.22**	-.44**	.78**	.82**		
16. EC	.13**	.71**	-.14**	-.25**	-.68**	.04	-.05	-.64**	.01	-.31**	-.29**	-.59**	.86**	.77**	.72**	
17. Grades	-.07	-.22**	.13**	.14**	.21**	.06	.07	.39**	-.01	.00	-.02	.16**	-.13**	-.13**	-.14**	-.24**

* $p < .05$. ** $p < .01$.

Note 1. BD = behavioral disaffection; ED = emotional disaffection; BE = behavioral engagement; CE = cognitive engagement; EE = emotional engagement; SE = social engagement; AE = agentic engagement; Comp = competence-related beliefs; AV = attainment value; UV = utility value; UVFL = utility value for future life; TEC = task effort cost; LVA = loss of valued alternatives; OEC = outside effort cost; EC = emotional cost

Table 4

Correlations between All Variables (EAP Scores) for Time Point Two

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. BD																
2. ED	.40**															
3. BE	-.66**	-.38**														
4. CE	-.53**	-.42**	.77**													
5. EE	-.51**	-.76**	.55**	.53**												
6. SE	-.33**	-.17**	.48**	.44**	.30**											
7. AE	-.27**	-.12**	.26**	.16**	.24**	.33**										
8. Comp	-.17**	-.61**	.36**	.38**	.56**	.14**	.21**									
9. AV	-.36**	-.23**	.56**	.57**	.37**	.31**	.06	.27**								
10. UV	-.36**	-.37**	.42**	.37**	.57**	.23**	.25**	.36**	.47**							
11. UVFL	-.34**	-.33**	.40**	.36**	.51**	.29**	.25**	.33**	.46**	.75**						
12. IV	-.44**	-.57**	.49**	.43**	.84**	.29**	.33**	.50**	.37**	.60**	.60**					
13. TEC	.18**	.62**	-.19**	-.24**	-.59**	-.09*	-.02	-.46**	-.11*	-.25**	-.26**	-.46**				
14. LVA	.18**	.55**	-.21**	-.26**	-.51**	-.12**	.03	-.40**	-.14**	-.21**	-.21**	-.39**	.89**			
15. OEC	.19**	.49**	-.25**	-.29**	-.46**	-.12**	-.06	-.41**	-.17**	-.20**	-.20**	-.37**	.75**	.79**		
16. EC	.20**	.74**	-.21**	-.26**	-.67**	-.10*	-.05	-.60**	-.10*	-.28**	-.29**	-.53**	.89**	.80**	.68**	
17. Grades	-.03	-.30**	.17**	.20**	.21**	.05	.07	.56**	.12**	.07	.06	.11*	-.19**	-.18**	-.24**	-.27**

* $p < .05$. ** $p < .01$.

Note 1. BD = behavioral disaffection; ED = emotional disaffection; BE = behavioral engagement; CE = cognitive engagement; EE = emotional engagement; SE = social engagement; AE = agentic engagement; Comp = competence-related beliefs; AV = attainment value; UV = utility value; UVFL = utility value for future life; TEC = task effort cost; LVA = loss of valued alternatives; OEC = outside effort cost; EC = emotional cost

Hypotheses 1A and 1B Results

Hypotheses 1A and B stated that emotional disaffection and emotional cost would overlap empirically, and that emotional engagement and intrinsic value would overlap empirically. To test them I ran the two MIRT based CFA models described previously for each pair of constructs (See Figures 2 and 3). I examined whether the one factor or correlated two-factor models fit best for each pair of constructs. I used the following set of goodness of model fit indices to assess the model fits: 1) relative model fit indices (observed log-liklihood, AIC, and BIC), and 2) an absolute model fit index (RMSEA calculated from M2). All of these are available from flexMIRT software output (Cai, 2012).

Emotional disaffection and emotional cost. Model one posited that emotional disaffection and emotional cost were separate but correlated latent variables. Thus, from this model I was able to obtain the correlation among the two latent variables, which was 0.80. Model two posited that emotional disaffection and emotional cost made up a single latent factor, which I will call EDEC. I compared model fit using AIC and BIC values (Burnham & Anderson, 1998) and the RMSEA value. The two models had the same RMSEA value of 0.06, which is close to the acceptable absolute model fit (0.05; e.g., Browne & Cudeck, 1993). The correlated two-factor model had lower AIC and BIC values than model two and so provided better fit for emotional disaffection and emotional cost (see Table 5). Therefore, I treated these variables as separate in my subsequent regression, cross-lagged, and mediation analyses. However, because the correlation between these two variables was so high, I also conducted subsequent analyses using the unidimensional model of emotional disaffection and emotional cost (EDEC). Thus, Hypothesis 1A was not supported because the model fit indices indicated that the correlated two-factor model was a better fit to the data.

Emotional engagement and intrinsic value. Model one posited that emotional engagement and intrinsic value were separate but correlated latent variables. Thus, from this model I was able to obtain the correlation among the two latent variables, which was 0.94. This high correlation suggests that these variables are essentially measuring the same thing. Model two posited that emotional engagement and intrinsic value made up a single latent factor, which I will call EEIV, and were not empirically separate. I compared model fit using AIC and BIC values (Burnham & Anderson, 1998) and the RMSEA value. The two models had the same RMSEA value of 0.05, which is an acceptable absolute model fit (0.05; e.g., Browne & Cudeck, 1993). I found that the correlated two-factor model (model one) had lower AIC and BIC values than model two and thus model one was a better fit for emotional engagement and intrinsic value (see Table 6). Thus, my hypothesis was not supported because the model fit indices indicated that the correlated two-factor model fit the data best. However, because the correlation between these two variables was so high, I also conducted analyses using the unidimensional model of emotional cost and intrinsic value (EEIV).

Table 5

Model Fit Indices for the Tested Structural Models of Emotional Disaffection and Emotional Cost

Models	1 factor	2 factors (SE)
Correlation	--------	0.80 (.02)
-2 log likelihood	13880.56	**13634.27**
AIC	14028.56	**13784.27**
BIC	14338.33	**14098.23**
# of parameters	74	75
RMSEA	0.06	0.06

Table 6

Model Fit Indices for the Tested Structural Models of Emotional Engagement and Intrinsic Value

Models	1 factor	2 factors (SE)
Correlation	--------	0.94 (.01)
-2 log likelihood	13832.79	**13758.53**
AIC	13964.79	**13892.53**
BIC	14241.08	**14173.00**
# of parameters	66	67
RMSEA	0.05	0.05

Hypotheses 2A-2C Results

Hypotheses 2A-2C concerned which EVT constructs would be associated with which dimensions of engagement and disaffection. Specifically, I hypothesized (2A) that students' competence-related beliefs, attainment value, intrinsic value, and utility value would be positively associated with their engagement and negatively associated with behavioral and emotional disaffection and cost constructs would negatively be associated with engagement and positively associated with disaffection. I further hypothesized (2B) that competence-related beliefs would be more strongly associated with behavioral and cognitive engagement than any of the task value constructs. Finally, I hypothesized (2C) that students' attainment value, intrinsic value, and utility value would more strongly associated with emotional, social and agentic engagement than students' competence related beliefs. Additionally, the cost constructs would be the variables most strongly associated with emotional disaffection.

To test Hypotheses 2A – 2C I conducted different kinds of multiple regression analyses. I started with individual regressions in which one of the motivational beliefs or values constructs was regressed on one of the engagement dimensions. Thus, separate regressions were conducted for each motivational belief and value variable. I then conducted a series of hierarchical regressions by including all of the motivational beliefs and values constructs regressed on one of the engagement dimensions in a single model. Finally, I used the stepwise method to examine which motivational beliefs and values were most strongly associated with a specific dimension of engagement and disaffection among the set of candidate independent variables. The stepwise method was used in addition to the hierarchical regressions because the stepwise method controls for issues of multicollinearity that can occur in hierarchical regressions. (McIntyre, Montgomery, Srinivasn, & Weitz, 1983).

Individual regressions. Tables 7-15 presents the results from the individual regressions of the dimensions of student engagement and disaffection on each motivational belief and value separately while controlling for gender and ethnicity. For students' behavioral engagement, all independent variables were significant. Students' competence-related beliefs, attainment value, utility value, utility for future, intrinsic value (correlated with emotional engagement) and EEIV were significantly positively associated with behavioral engagement. The four cost dimensions and EDEC were all significantly associated with behavioral engagement. The variable with the strongest association with behavioral engagement (based on adjusted R^2 values and standardized betas) was attainment value (adj. R^2 = 0.21, $*\hat{\beta} = 0.47, p < .001$) and EEIV (adj. R^2 = 0.21, $*\hat{\beta} = 0.48, p < .001$). Similar findings occurred when cognitive engagement was the outcome, as well as emotional engagement correlated with intrinsic value. Students' cognitive engagement was most strongly associated with (based on adjusted R^2 values and standardized betas) attainment value (adj. R^2 = 0.20, $*\hat{\beta} = 0.46, p < .001$) and EEIV (adj. R^2 = 0.20, $*\hat{\beta} = 0.46, p < .001$). Students' emotional engagement as a correlated factor with intrinsic value was most strongly associated with (based on adjusted R^2 values and standardized betas) EDEC (adj. R^2 = 0.51, $*\hat{\beta} = -0.69, p < .001$).

The results for social and agentic engagement showed a slightly different pattern. Attainment value, utility value, utility for future, intrinsic value correlated with emotional engagement and EEIV were all significantly positively associated with social engagement. Students' competence-related beliefs and the cost dimensions (including EDEC) were not significant. The strongest association (based on adjusted R^2 values and standardized betas) was attainment value (adj. R^2 = 0.06, $*\hat{\beta} = 0.24, p < .001$). Students' agentic engagement was found to be positively associated with competence-related beliefs, utility value, utility for future, intrinsic value correlated with emotional engagement, and EEIV.

Attainment value and the cost dimensions (including EDEC) were not significantly associated with agentic engagement. The strongest association with agentic engagement (based on adjusted R^2 values and standardized betas) was with intrinsic value correlated with emotional engagement (adj. R^2 = 0.08, $*\hat{\beta} = 0.27, p < .001$) and EEIV (adj. R^2 = 0.07, $*\hat{\beta} = 0.26, p < .001$)

Students' behavioral disaffection was significantly negatively associated with competence-related beliefs, attainment value, utility value, utility for future, intrinsic value correlated with emotional engagement and EEIV. Behavioral disaffection was significantly positively associated with the four dimensions of cost and EDEC. The strongest relationship (based on adjusted R^2 values and standardized betas) was with EEIV (adj. R^2 = 0.20, $*\hat{\beta} = -0.47, p < .001$). Emotional disaffection correlated with emotional cost had the same pattern of results and EEIV was again the strongest relationship (adj. R^2 = 0.59, $*\hat{\beta} = -0.74, p < .001$).

As mentioned previously, EDEC and EEIV were used as both independent variables and outcomes because they are a combination of motivation and engagement constructs. In these regression models, emotional cost correlated with emotional disaffection was not included as an independent variable for EDEC and intrinsic value correlated with emotional engagement was not included as an independent variable for EEIV because they are included in the unidimensional model. EDEC was significantly negatively associated with competence-related beliefs, utility value, utility for future, intrinsic value correlated with emotional engagement and EEIV. Task effort cost, outside effort cost, and loss of valued alternatives were significantly positively associated with EDEC. The strongest relationship (based on adjusted R^2 values and standardized betas) was task effort cost (adj. $R^2 = 0.69$, $*\hat{\beta} = 0.81, p < .001$). Students' competence-related beliefs, attainment value, utility value, and utility for future were significantly positively associated with EEIV. The four dimensions of cost were significantly negatively associated with EEIV. The strongest relationship of EEIV (based on adjusted R^2 values and standardized betas) was with EDEC (adj. $R^2 = 0.48$, $*\hat{\beta} = -0.68, p < .001$).

Summary. Overall, I found good support for hypothesis 2a. As predicted, students' competence-related beliefs, attainment value, utility value, utility for future and intrinsic value were all positively associated with behavioral, cognitive, and emotional engagement and negatively associated with behavioral and emotional disaffection. The four cost constructs were all significantly negatively associated with behavioral, cognitive, and emotional engagement and positively associated with behavioral and emotional disaffection. However, social engagement was not significantly associated with competence-related beliefs or any of the cost constructs and agentic engagement was not significantly associated with attainment value or any of the cost constructs.

Table 7

Associations with Behavioral Engagement by Each Construct Individually (Controlling for Gender and Ethnicity)

	B	*$\hat{\beta}$	SE	*p-value*	ΔR^2	Adj. R^2	df	F-change (*p* value)
Baseline model					0.01	-0.01	485	0.45 ($p = .815$)
Competence	0.21**	0.22**	0.04	< 0.001	0.05	0.04	480	23.88 ($p < .001$)
Attainment	0.48**	0.47**	0.04	< 0.001	0.21	0.21	480	130.21 ($p < .001$)
Utility Value	0.35**	0.37**	0.04	< 0.001	0.14	0.13	480	74.95 ($p < .001$)
Utility Future	0.28**	0.28**	0.05	< 0.001	0.08	0.07	480	40.34 ($p < .001$)
Intrinsic corr. with EE	0.42**	0.45**	0.04	< 0.001	0.19	0.19	480	115.32 ($p < .001$)
Task Effort Cost	-0.19**	-0.21**	0.04	< 0.001	0.04	0.03	480	19.61 ($p < .001$)
Outside Effort Cost	-0.20**	-0.22**	0.04	< 0.001	0.05	0.04	480	22.64 ($p < .001$)
Loss of Valued Alternatives	-.0.17**	-0.18**	0.04	< 0.001	0.03	0.02	480	15.14 ($p < .001$)
Emotional Cost corr. with ED	-0.15**	-0.17**	0.04	< 0.001	0.03	0.02	480	12.44 ($p < .001$)
EEIV	0.44**	0.48**	0.04	< 0.001	0.22	0.21	480	132.67 ($p < .001$)
EDEC	-0.17**	-0.18**	0.04	< 0.001	0.03	0.04	480	15.47 ($p < .001$)

*$p < .05$, **$p < .01$. N = 486.

Note 1. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; EEIV = Composite of emotional engagement and intrinsic value; EDEC = Composite of emotional disaffection and emotional cost.

Note 2. Each construct was alternately tested while gender and ethnicity are consistently remained in the regression model. The "baseline model" refers to a model with only gender and ethnicity entered; the change in R^2 is after each variable is entered above that baseline model.

Table 8

Associations with Cognitive Engagement by Each Construct Individually (Controlling for Gender and Ethnicity)

	B	*$\hat{\beta}$	SE	*p-value*	ΔR^2	Adj. R^2	df	F-change (*p* value)
Baseline model					0.01	0.00	485	0.64 ($p = .667$)
Competence	0.37**	0.39**	0.04	< 0.001	0.15	0.14	480	81.90 ($p < .001$)
Attainment	0.47**	0.46**	0.04	< 0.001	0.21	0.20	480	125.83 ($p < .001$)
Utility value	0.37**	0.40**	0.04	< 0.001	0.15	0.15	480	87.10 ($p < .001$)
Utility Future	0.30**	0.31**	0.04	< 0.001	0.09	0.09	480	47.74 ($p < .001$)
Intrinsic corr. with EE	0.40**	0.44**	0.04	< 0.001	0.18	0.18	480	107.75 ($p < .001$)
Task Effort Cost	-0.29**	-0.31**	0.04	< 0.001	0.09	0.08	480	46.85 ($p = .001$)
Outside Effort Cost	-0.24**	-0.26**	0.04	< 0.001	0.07	0.06	480	33.57 ($p < .001$)
Loss of Valued Alternatives	-.0.25**	-0.27**	0.04	< 0.001	0.07	0.07	480	36.08 ($p < .001$)
Emotional Cost corr. with ED	-0.27**	-0.29**	0.04	< 0.001	0.08	0.08	480	41.74 ($p < .001$)
EEIV	0.42**	0.46**	0.04	< 0.001	0.20	0.20	480	120.59 ($p < .001$)
EDEC	-0.28**	-0.31**	0.04	< 0.001	0.09	0.08	480	45.81 ($p < .001$)

*$p < .05$, **$p < .01$. N = 486.

Note 1. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; EEIV = Composite of emotional engagement and intrinsic value; EDEC = Composite of emotional disaffection and emotional cost.

Note 2. Each construct was alternately tested while gender and ethnicity are consistently remained in the regression model. The “baseline model” refers to a model with only gender and ethnicity entered; the change in R^2 is after each variable is entered above that baseline model.

Table 9

Associations with Emotional Engagement correlated with Intrinsic Value by Each Construct Individually (Controlling for Gender and Ethnicity)

	B	*$\hat{\beta}$	SE	*p-value*	ΔR^2	Adj. R^2	df	F-change (*p* value)
Baseline model					0.07	0.06	485	6.73 ($p < .001$)
Competence	0.54**	0.53**	0.04	< 0.001	0.27	0.32	480	190.54 ($p < .001$)
Attainment	0.26**	0.23**	0.05	< 0.001	0.05	0.11	480	29.43 ($p < .001$)
Utility value	0.57**	0.56**	0.04	< 0.001	0.30	0.36	480	225.15 ($p < .001$)
Utility Future	0.53**	0.48**	0.04	< 0.001	0.23	0.28	480	153.31 ($p < .001$)
Task Effort Cost	-0.59**	-0.58**	0.04	< 0.001	0.32	0.37	480	245.31 ($p < .001$)
Outside Effort Cost	-0.46**	-0.46**	0.04	< 0.001	0.20	0.26	480	127.65 ($p <.001$)
Loss of Valued Alternatives	-.0.48**	-0.47**	0.04	< 0.001	0.21	0.27	480	139.62 ($p < .001$)
Emotional Cost corr. with ED	-0.68**	-0.67**	0.03	< 0.001	0.42	0.48	480	390.40 ($p < .001$)
EDEC	-0.69**	-0.69**	0.03	< 0.001	0.44	0.51	480	433.95 ($p < .001$)

*$p < .05$, **$p < .01$. N = 486.
Note 1. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; EEIV = Composite of emotional engagement and intrinsic value; EDEC = Composite of emotional disaffection and emotional cost.
Note 2. Each construct was alternately tested while gender and ethnicity are consistently remained in the regression model. The "baseline model" refers to a model with only gender and ethnicity entered; the change in R^2 is after each variable is entered above that baseline model.

Table 10

Associations with Social Engagement by Each Construct Individually (Controlling for Gender and Ethnicity)

	B	*$\hat{\beta}$	SE	*p-value*	ΔR^2	Adj. R^2	df	F-change (*p* value)
Baseline model					0.01	0.00	485	1.27 (p = .274)
Competence	0.02	0.03	0.05	0.588	0.00	0.00	480	0.30 (p = .588)
Attainment	0.25**	0.24**	0.05	< 0.001	0.06	0.06	480	28.99 (p < .001)
Utility value	0.12**	0.12**	0.04	0.007	0.02	0.02	480	7.24 (p = .007)
Utility Future	0.17**	0.17**	0.05	< 0.001	0.03	0.03	480	13.77 (p < .001)
Intrinsic corr. with EE	0.15**	0.16**	0.04	0.001	0.03	0.03	480	12.21(p = .001)
Task Effort Cost	-0.04	-0.05	0.05	0.336	0.00	0.00	480	0.93 (p = .336)
Outside Effort Cost	-0.04	-0.04	0.04	0.369	0.00	0.00	480	0.81 (p =.369)
Loss of Valued Alternatives	-.0.05	-0.05	0.04	0.287	0.00	0.00	480	1.14 (p = .287)
Emotional Cost corr. with ED	0.01	0.01	0.04	0.878	0.00	0.00	480	0.02 (p = .878)
EEIV	0.15**	0.16**	0.04	0.001	0.02	0.03	480	12.08 (p = .001)
EDEC	0.00	0.00	0.04	0.996	0.00	0.00	480	0.00 (p = .996)

*p < .05, **p < .01. N = 486.

Note 1. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; EEIV = Composite of emotional engagement and intrinsic value; EDEC = Composite of emotional disaffection and emotional cost.

Note 2. Each construct was alternately tested while gender and ethnicity are consistently remained in the regression model. The "baseline model" refers to a model with only gender and ethnicity entered; the change in R^2 is after each variable is entered above that baseline model.

Table 11

Associations with Agentic Engagement by Each Construct Individually (Controlling for Gender and Ethnicity)

	B	*$\hat{\beta}$	SE	*p-value*	ΔR^2	Adj. R^2	df	F-change (*p* value)
Baseline model					0.02	0.01	485	1.97 (p = .082)
Competence	0.13**	0.13**	0.05	0.005	0.02	0.02	480	7.85 (p = .005)
Attainment	0.03	0.03	0.05	0.571	0.00	0.01	480	0.37 (p = .571)
Utility value	0.21**	0.22**	0.04	< 0.001	0.05	0.06	480	23.76 (p < .001)
Utility Future	0.23**	0.22**	0.05	< 0.001	0.05	0.06	480	24.26 (p < .001)
Intrinsic corr. with EE	0.25**	0.27**	0.04	< 0.001	0.07	0.08	480	34.78(p < .001)
Task Effort Cost	-0.07	-0.07	0.05	0.143	0.00	0.01	480	2.15 (p = .143)
Outside Effort Cost	-0.01	-0.01	0.05	0.862	0.00	0.01	480	0.03 (p =.862)
Loss of Valued Alternatives	0.03	0.03	0.05	0.569	0.00	0.01	480	0.37 (p = .542)
Emotional Cost corr. with ED	-0.04	-0.04	0.05	0.425	0.00	0.01	480	0.64 (p = .425)
EEIV	0.25**	0.26**	0.04	< 0.001	0.07	0.07	480	33.86 (p < .001)
EDEC	-0.05	-0.05	0.04	0.291	0.00	0.01	480	1.12 (p = .291)

*p < .05, **p < .01. N = 486.

Note 1. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; EEIV = Composite of emotional engagement and intrinsic value; EDEC = Composite of emotional disaffection and emotional cost.

Note 2. Each construct was alternately tested while gender and ethnicity are consistently remained in the regression model. The "baseline model" refers to a model with only gender and ethnicity entered; the change in R^2 is after each variable is entered above that baseline model.

Table 12

Associations with Behavioral Disaffection by Each Construct Individually (Controlling for Gender and Ethnicity)

	B	*$\hat{\beta}$	SE	*p-value*	ΔR^2	Adj. R^2	df	F-change (*p* value)
Baseline model					0.00	-0.01	485	0.43 (*p* = .831)
Competence	-0.12*	-0.12*	0.05	0.010	0.01	0.01	480	6.74 (*p* = .010)
Attainment	-0.28**	-0.26**	0.05	< 0.001	0.07	0.06	480	34.38 (*p* < .001)
Utility value	-0.29**	-0.29**	0.04	< 0.001	0.08	0.07	480	42.36 (*p* < .001)
Utility Future	-0.26**	-0.25**	0.05	< 0.001	0.06	0.05	480	30.22(*p* < .001)
Intrinsic corr. with EE	-0.42**	-0.44**	0.04	< 0.001	0.18	0.18	480	106.66 (*p* < .001)
Task Effort Cost	0.17**	0.17**	0.05	< 0.001	0.03	0.02	480	13.44 (*p* < .001)
Outside Effort Cost	0.15**	0.16**	0.05	0.001	0.02	0.02	480	11.19 (*p* =.001)
Loss of Valued Alternatives	0.12*	0.12*	0.05	0.011	0.01	0.01	480	6.52 (*p* = .011)
Emotional Cost corr. with ED	0.17**	0.18**	0.05	< 0.001	0.03	0.02	480	14.26 (*p* < .001)
EEIV	-0.45**	-0.47**	0.04	< 0.001	0.20	0.20	480	123.25 (*p* < .001)
EDEC	0.19**	0.20**	0.05	< 0.001	0.04	0.03	480	18.81 (*p* < .001)

*$p < .05$, **$p < .01$. N = 486.
Note 1. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; EEIV = Composite of emotional engagement and intrinsic value; EDEC = Composite of emotional disaffection and emotional cost.
Note 2. Each construct was alternately tested while gender and ethnicity are consistently remained in the regression model. The "baseline model" refers to a model with only gender and ethnicity entered; the change in R^2 is after each variable is entered above that baseline model.

Table 13

Associations with Emotional Disaffection correlated with Emotional Cost by Each Construct Individually (Controlling for Gender and Ethnicity)

	B	*$\hat{\beta}$	SE	*p-value*	ΔR^2	Adj. R^2	df	F-change (*p* value)
Baseline model					0.08	0.07	485	8.42 ($p < .001$)
Competence	-0.60**	-0.60**	0.04	< 0.001	0.34	0.41	480	281.90 ($p < .001$)
Attainment	-0.13**	-0.12**	0.05	0.009	0.01	0.08	480	6.90 ($p = .009$)
Utility value	-0.33**	-0.33**	0.04	< 0.001	0.10	0.17	480	59.82 ($p < .001$)
Utility Future	-0.30**	-0.28**	0.05	< 0.001	0.08	0.15	480	43.23 ($p < .001$)
Intrinsic corr. with EE	-0.69**	-0.71**	0.03	< 0.001	0.48	0.55	480	516.31($p < .001$)
Task Effort Cost	0.66**	0.67**	0.03	< 0.001	0.41	0.49	480	390.85 ($p < .001$)
Outside Effort Cost	0.52**	0.53**	0.04	< 0.001	0.27	0.34	480	196.99 ($p <.001$)
Loss of Valued Alternatives	0.55**	0.55**	0.04	< 0.001	0.30	0.37	480	227.35 ($p < .001$)
Emotional Cost corr. with ED	0.82**	0.85**	0.02	< 0.001	0.66	0.74	480	1235.87 ($p < .001$)
Overall Cost	0.69**	0.70**	0.03	< 0.001	0.46	0.54	480	483.43 ($p < .001$)
EEIV	-0.71**	-0.74**	0.03	< 0.001	0.51	0.59	480	605.93 ($p < .001$)

*$p < .05$, **$p < .01$. N = 486.
Note 1. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; EEIV = Composite of emotional engagement and intrinsic value; EDEC = Composite of emotional disaffection and emotional cost.
Note 2. Each construct was alternately tested while gender and ethnicity are consistently remained in the regression model. The "baseline model" refers to a model with only gender and ethnicity entered; the change in R^2 is after each variable is entered above that baseline model.

Table 14

Associations with EDEC by Each Construct Individually (Controlling for Gender and Ethnicity)

	B	*$\hat{\beta}$	SE	*p-value*	ΔR^2	Adj. R^2	df	F-change (*p* value)
Baseline model					0.08	0.07	485	8.03 ($p < .001$)
Competence	-0.63**	-0.62**	0.04	< 0.001	0.36	0.43	480	301.48 ($p < .001$)
Attainment	-0.03	-0.02	0.05	0.590	0.00	0.07	480	0.29 ($p = .590$)
Utility value	-0.30**	-0.29**	0.04	< 0.001	0.08	0.15	480	44.46 ($p < .001$)
Utility Future	-0.28**	-0.26**	0.05	< 0.001	0.06	0.13	480	34.95 ($p < .001$)
Intrinsic corr. with EE	-0.65**	-0.64**	0.04	< 0.001	0.39	0.46	480	346.92 ($p < .001$)
Task Effort Cost	0.83**	0.81**	0.03	< 0.001	0.62	0.69	480	961.03 ($p < .001$)
Outside Effort Cost	0.69**	0.67**	0.03	< 0.001	0.43	0.50	480	409.92 ($p < .001$)
Loss of Valued Alternatives	0.74**	0.71**	0.03	< 0.001	0.49	0.56	480	537.51 ($p < .001$)
EEIV	-0.67**	-0.67**	0.03	< 0.001	0.42	0.49	480	392.44 ($p < .001$)

*$p < .05$, **$p < .01$. N = 486.

Note 1. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; EEIV = Composite of emotional engagement and intrinsic value; EDEC = Composite of emotional disaffection and emotional cost.

Note 2. Each construct was alternately tested while gender and ethnicity are consistently remained in the regression model. The "baseline model" refers to a model with only gender and ethnicity entered; the change in R^2 is after each variable is entered above that baseline model.

Table 15

Associations with EEIV by Each Construct Individually (Controlling for Gender and Ethnicity)

	B	*$\hat{\beta}$	SE	*p-value*	ΔR^2	Adj. R^2	df	F-change (*p* value)
Baseline model					0.06	0.05	485	6.40 ($p < .001$)
Competence	0.54**	0.53**	0.04	< 0.001	0.26	0.31	480	183.82 ($p < .001$)
Attainment	0.28**	0.25**	0.05	< 0.001	0.06	0.11	480	33.06 ($p < .001$)
Utility value	0.60**	0.58**	0.04	< 0.001	0.32	0.38	480	252.61 ($p < .001$)
Utility Future	0.56**	0.51**	0.04	< 0.001	0.25	0.30	480	172.48 ($p < .001$)
Task Effort Cost	-0.59**	-0.57**	0.04	< 0.001	0.31	0.36	480	230.91 ($p < .001$)
Outside Effort Cost	-0.46**	-0.45**	0.04	< 0.001	0.19	0.24	480	120.43 ($p <.001$)
Loss of Valued Alternatives	-0.48**	-0.46**	0.04	< 0.001	0.21	0.26	480	134.40 ($p < .001$)
Emotional Cost corr. with ED	-0.66**	-0.66**	0.04	< 0.001	0.40	0.46	480	354.30 ($p < .001$)
EDEC	-0.68**	-0.68**	0.03	< 0.001	0.42	0.48	480	392.44 ($p < .001$)

*$p < .05$, **$p < .01$. N = 486.
Note 1. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; EEIV = Composite of emotional engagement and intrinsic value; EDEC = Composite of emotional disaffection and emotional cost.
Note 2. Each construct was alternately tested while gender and ethnicity are consistently remained in the regression model. The "baseline model" refers to a model with only gender and ethnicity entered; the change in R^2 is after each variable is entered above that baseline model.

Hierarchical linear regressions. Tables 16-31 present the results from the hierarchical linear regressions. These analyses included all of the motivational beliefs except the four separate dimensions of cost; these were averaged together to form an overall cost variable due to multicollinearity concerns. I also controlled for gender and ethnicity and these variables only explained between 0 – 8% of the variance in the engagement dimensions. These hierarchical regressions allowed me to see which variables were significant while controlling for the effects of the other variables. Additionally, separate models were run for each engagement dimension where intrinsic value correlated with emotional engagement was included as an independent variable and EEIV was included as an independent variable due to multicollinearity concerns. Thus, two models were run for each engagement dimension. Further, because I used overall cost instead of the four facets of cost, I did not include emotional disaffection correlated with emotional cost or EDEC as independent variables because of the overlap of emotional cost among the constructs. Thus, EDEC and emotional disaffection (correlated with emotional cost) were only treated as outcome variables in these analyses.

When behavioral engagement was the dependent variable and (intrinsic value correlated with emotional engagement) was included in the model, the adjusted R^2 at Step 2 was 0.32, indicating that 32% of the variance in behavioral engagement was explained by gender and ethnicity and the motivation variables. Attainment value and intrinsic value were the only significant variables associated with behavioral engagement with all other variables controlled. The strongest relationship based on the standardized betas was with intrinsic value ($*\widehat{\beta} = 0.37, p < .001$). The same results held when EEIV was included in the model instead of intrinsic value and this model explained 34% of the variance in behavioral engagement. EEIV was the strongest relationship ($*\hat{\beta} = 0.45, p < .001$).

When cognitive engagement was the outcome variable and intrinsic value (correlated with emotional engagement) was included in the model, the adjusted R^2 for this model at step 2 was 0.35, indicating that 35% of the variance in cognitive engagement was explained by this set of demographic and motivation variables. Competence-related beliefs, attainment value and intrinsic value were significantly positively associated with cognitive engagement. The strongest relationship based on the standardized betas was with attainment value ($*\hat{\beta} = 0.35, p < .001$). The same results held when EEIV was included in the model instead of intrinsic value and this model explained 35% of the variance in cognitive engagement. Attainment value was again the strongest relationship ($*\hat{\beta} = 0.35, p < .001$).

When emotional engagement (correlated with intrinsic value) was the outcome variable, neither intrinsic value nor EEIV were included as independent variables. The adjusted R^2 for this model at step 2 was 0.57, indicating that 57% of the variance in emotional engagement was explained by this set of demographic and motivation variables. Students' competence-related beliefs, utility value and utility for future were significantly positively associated and overall cost was significantly negatively associated with emotional engagement. The strongest relationship was with overall cost ($*\hat{\beta} = -0.36, p < .001$). For EEIV, the same results were found and 58% of the variance in EEIV were explained by these demographic and motivation variables. Overall cost was again the strongest relationship ($*\hat{\beta} = -0.34, p < .001$).

When social engagement was the outcome variable and intrinsic value (correlating with emotional engagement) was included in the model, the adjusted R^2 for this model at step 2 was 0.07, indicating that only 7% of the variance in social engagement was explained by this set of demographic and motivation variables. Attainment value, utility for future, and intrinsic value were significantly positively associated with social engagement and attainment value was the strongest relationship ($*\hat{\beta} = 0.22, p < .001$). When EEIV was placed into the model instead of intrinsic value, the same amount of variance in social engagement was explained and attainment value, utility for future, and EEIV were the only significant associations and attainment value was the strongest relationship ($*\hat{\beta} = 0.22, p < .001$).

When agentic engagement was the outcome variable and intrinsic value (correlated with emotional engagement) was included in the model, the adjusted R^2 for this model at step 2 was 0.10, indicating that 10% of the variance in agentic engagement was explained by this set of demographic and motivation variables. The demographic variable Asian was significantly positively associated with agentic engagement ($*\hat{\beta} = 0.10, p = .032$) indicating that Asian students had higher reported perceived agentic engagement compared to their Caucasian peers. Intrinsic value and overall cost were also significantly positively associated with agentic engagement and intrinsic value was the strongest relationship ($*\hat{\beta} = 0.29, p < .001$). The results remained the same when EEIV was placed into the model instead of intrinsic value.

When behavioral disaffection was the outcome variable and with intrinsic value (correlated with emotional engagement) was included in the model, the adjusted R^2 for this model at step 2 was 0.21, indicating that 21% of the variance in behavioral disaffection was explained by this set of demographic and motivation variables. Competence-related beliefs was significantly positively associated with behavioral disaffection and attainment value and intrinsic value were significant negative associations. Intrinsic value was the strongest association ($*\hat{\beta} = -0.51, p < .001$). When EEIV was included in the model instead of intrinsic value, 24% of the variance in behavioral disaffection was explained by this set of demographic and motivation constructs. Competence-related beliefs remained a positive significant association and attainment value and EEIV were significant negative associations with EEIV being the strongest association ($*\hat{\beta} = -0.58, p < .001$).

When emotional disaffection (correlated with emotional cost) was the outcome variable and intrinsic value (correlated with emotional engagement) was included in the model, the adjusted R^2 for this model at step 2 was 0.71, indicating that 71% of the variance in emotional disaffection was explained by this set of demographic and motivation variables. The dichotomous Female and Multi-Racial variables were significant with all other variables controlled, such that females ($*\hat{\beta} = 0.08, p = .003$) had higher perceived emotional disaffection than male students and Multi-Racial students ($*\hat{\beta} = -0.06, p = .020$) had lower perceived emotional disaffection than their Caucasian peers. Students' competence-related beliefs and intrinsic value were significant negative associations of emotional disaffection and utility value and overall cost were significant positive associations. Intrinsic value was the strongest association ($*\hat{\beta} = -0.50, p < .001$). When EEIV is included in the model instead of intrinsic value the findings remain the same. These variables explain 73% of the variance in emotional disaffection and EEIV is the strongest relationship ($*\hat{\beta} = -0.55, p < .001$).

When EDEC was the outcome variable and intrinsic value (correlated with emotional engagement) was included in the model, the adjusted R^2 for this model at step 2 was 0.84, indicating that 84% of the variance in EDEC was explained by this set of demographic and motivation variables. Overall cost was also included in this model and the VIF value (1.83) did not indicate there was a serious multicollinearity issue. The dichotomous Multi-Racial variable was significant with all other variables controlled for ($*\hat{\beta} = -0.21, p = .044$), such that Multi-Racial students had lower perceived EDEC than their Caucasian peers. Competence-related beliefs and intrinsic value were significant negative associations. Attainment value, utility value, and overall cost were significant positive associations. Overall cost was the strongest relationship ($*\hat{\beta} = 0.67, p < .001$). Results did change slightly when EEIV was included in the model instead of intrinsic value, 85% of the variance in EDEC was explained by these variables and overall cost remained the strongest association ($*\hat{\beta} = 0.66, p < .001$).

Summary. Overall, when all variables were included in the model at once I could see which variables remained significant associations while controlling for the effects of the other variables. These findings only partially support hypotheses 2B and 2C. Students' competence-related beliefs did not emerge as the strongest association with behavioral and cognitive engagement and students' attainment value was not one of the strongest associations of emotional engagement. Additionally, the cost constructs were not the strongest associations of behavioral and emotional disaffection. Intrinsic value correlated with emotional engagement and EEIV were the strongest associations of behavioral engagement, agentic engagement, behavioral disaffection, and emotional disaffection. Attainment value was the strongest association of cognitive and social engagement. Cost was the strongest positive association of EDEC, and the strongest negative association of emotional engagement correlated with intrinsic value and EEIV, whereas utility value was the strongest positive association of emotional engagement correlated with intrinsic value and EEIV. I will also follow-up with the stepwise regressions to fully determine whether these hypotheses were supported.

Table 16

Hierarchical Regression Analysis of Behavioral Engagement with All Constructs Entered as Independent Variables in the Same Analysis

	B	$*\hat{\beta}$	SE	*p-value*	VIF	B	$*\hat{\beta}$	SE	*p-value*	VIF
Female	-0.06	-0.04	0.08	0.432	1.01	0.02	0.01	0.05	0.822	1.09
Black	0.05	0.02	0.14	0.744	1.07	-0.06	-0.02	0.08	0.578	1.09
Asian	0.08	0.04	0.10	0.409	1.09	-0.06	-0.03	0.06	0.437	1.11
Hispanic	-0.14	-0.03	0.19	0.457	1.04	-0.15	-0.04	0.11	0.339	1.06
Multi	-0.07	-0.01	0.24	0.763	1.02	0.00	0.00	0.14	0.982	1.03
Competence						-0.01	-0.01	0.03	0.805	1.70
Attainment						0.38**	0.37**	0.04	< 0.001	1.20
Utility Value						0.06	0.07	0.02	0.275	2.63
Utility for Future						-0.07	-0.07	0.04	0.246	2.23
Intrinsic Value corr. w EE						0.35**	0.38**	0.05	< 0.001	2.40
Overall Cost						0.04	0.04	0.05	0.382	1.83
ΔR^2				0.01					0.33	
Adjusted R^2				-0.01					0.32	
df				485					485	
F-ratio				0.45 ($p = .815$)					21.38 ($p < .001$)	

$*p < .05$, $**p < .01$. N = 462.

Note. B = unstandardized regression coefficients; $*\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. Intrinsic value is the EAP score with Intrinsic Value correlating with Emotional Engagement. Overall Cost was used due to multicollinearity. EEIV was not included in this model.

Table 17

Hierarchical Regression Analysis of Behavioral Engagement with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.06	-0.04	0.08	0.432	1.01	0.02	0.01	0.07	0.739	1.09
Black	0.05	0.02	0.14	0.744	1.07	-0.06	-0.02	0.11	0.609	1.09
Asian	0.08	0.04	0.10	0.409	1.09	-0.07	-0.04	0.08	0.351	1.11
Hispanic	-0.14	-0.03	0.19	0.457	1.04	-0.14	-0.04	0.15	0.352	1.06
Multi	-0.07	-0.01	0.24	0.763	1.02	-0.02	0.00	0.20	0.925	1.03
Competence						-0.02	-0.03	0.05	0.597	1.70
Attainment						0.38**	0.37**	0.04	< 0.001	1.20
Utility Value						0.05	0.05	0.06	0.379	2.61
Utility for Future						-0.07	-0.07	0.06	0.204	2.22
EEIV						0.41**	0.45**	0.05	< 0.001	2.42
Overall Cost						0.07	0.07	0.05	0.141	1.87
ΔR^2				0.01					0.35	
Adjusted R^2				-0.01					0.34	
df				485					485	
F-ratio				0.45 (p = .815)					23.53 (p < .001)	

*$p < .05$, **$p < .01$. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. EEIV is unidimensional factor of Emotional Engagement and Intrinsic Value. Overall Cost was used due to multicollinearity. Intrinsic value correlated with emotional engagement was not included in this model.

Table 18

Hierarchical Regression Analysis of Cognitive Engagement with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.03	-0.02	0.08	0.724	1.01	0.12	0.07	0.06	0.091	1.09
Black	0.07	0.03	0.14	0.582	1.07	-0.04	-0.01	0.11	0.754	1.09
Asian	0.00	0.00	0.10	0.974	1.09	-0.13	-0.06	0.08	0.098	1.11
Hispanic	-0.30	-0.07	0.18	0.111	1.04	-0.27	-0.07	0.15	0.074	1.06
Multi	-0.05	-0.01	0.24	0.851	1.02	0.08	0.02	0.20	0.678	1.03
Competence						0.18**	0.19**	0.05	< 0.001	1.70
Attainment						0.36**	0.35**	0.04	< 0.001	1.20
Utility Value						0.10	0.12	0.05	0.056	2.63
Utility for Future						-0.05	-0.05	0.05	0.386	2.23
Intrinsic Value corr. w EE						0.16**	0.17**	0.05	0.003	2.40
Overall Cost						-0.05	-0.06	0.05	0.259	1.83
ΔR^2				0.01					0.35	
Adjusted R^2				0.01					0.35	
df				485					485	
F-ratio				0.64 (p = .667)					23.58 (p < .001)	

*$p < .05$, **$p < .01$. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. Intrinsic value is the EAP score with Intrinsic Value correlating with Emotional Engagement. Overall Cost was used due to multicollinearity. EEIV was not included in this model.

Table 19

Hierarchical Regression Analysis of Cognitive Engagement with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.03	-0.02	0.08	0.724	1.01	0.12	0.07	0.07	0.080	1.09
Black	0.07	0.03	0.14	0.582	1.07	-0.03	-0.01	0.11	0.781	1.09
Asian	0.00	0.00	0.10	0.974	1.09	-0.14	-0.07	0.08	0.080	1.11
Hispanic	-0.30	-0.07	0.18	0.111	1.04	-0.27	-0.07	0.15	0.078	1.06
Multi	-0.05	-0.01	0.24	0.851	1.02	0.07	0.01	0.20	0.706	1.03
Competence						0.17**	0.18**	0.05	< 0.001	1.70
Attainment						0.36**	0.35**	0.04	< 0.001	1.20
Utility Value						0.10	0.10	0.05	0.082	2.61
Utility for Future						-0.05	-0.05	0.05	0.339	2.22
EEIV						0.20**	0.22**	0.05	< 0.001	2.42
Overall Cost						-0.03	-0.04	0.05	0.459	1.87
ΔR^2				0.01					0.35	
Adjusted R^2				0.00					0.35	
df				485					485	
F-ratio				0.64 ($p = .667$)					24.35 ($p < .001$)	

*$p < .05$, **$p < .01$. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. EEIV is the unidimensional factor of Emotional Engagement and Intrinsic Value. Overall Cost was used due to multicollinearity. Intrinsic value correlated with emotional engagement was not included in this model.

Table 20

Hierarchical Regression Analysis of Emotional Engagement correlating with Intrinsic Value with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.38**	-0.20**	0.07	< 0.001	1.01	-0.04	-0.02	0.06	0.517	1.09
Black	0.00	0.00	0.09	0.997	1.07	-0.09	-0.03	0.10	0.373	1.08
Asian	0.32**	0.14**	0.10	0.002	1.09	0.13	0.06	0.07	0.062	1.10
Hispanic	-0.23	-0.05	0.20	0.244	1.04	-0.15	-0.03	0.13	0.272	1.06
Multi	-0.13	-0.02	0.26	0.623	1.02	0.12	0.02	0.17	0.503	1.03
Competence						0.20**	0.20**	0.04	< 0.001	1.61
Attainment						0.02	0.02	0.04	0.552	1.20
Utility Value						0.30**	0.29**	0.04	< 0.001	2.38
Utility for Future						0.13**	0.12**	0.04	0.006	2.18
Overall Cost						-0.36**	-0.36**	0.04	< 0.001	1.59
ΔR^2				0.07					0.52	
Adjusted R^2				0.06					0.57	
df				485					485	
F-ratio				6.73 ($p < .001$)					65.87 ($p < .001$)	

*$p < .05$, **$p < .01$. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. Overall Cost was used due to multicollinearity. EEIV was not included in this model.

Table 21

Hierarchical Regression Analysis of Emotional Engagement and Intrinsic Value (EEIV) with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.37**	-0.19**	0.09	< 0.001	1.01	-0.03	-0.01	0.06	0.646	1.09
Black	0.00	0.00	0.15	1.00	1.07	-0.09	-0.03	0.10	0.334	1.08
Asian	0.31**	0.14**	0.10	0.002	1.09	0.12	0.05	0.07	0.085	1.10
Hispanic	-0.24	-0.06	0.20	0.225	1.07	-0.16	-0.04	0.13	0.224	1.06
Multi	-0.14	-0.03	0.26	0.583	1.01	0.10	0.02	0.17	0.576	1.03
Competence						0.20**	0.19**	0.04	< 0.001	1.61
Attainment						0.03	0.02	0.04	0.450	1.20
Utility Value						0.32**	0.31**	0.04	< 0.001	2.39
Utility for Future						0.15**	0.14**	0.04	0.002	2.18
Overall Cost						-0.35**	-0.34**	0.04	< 0.001	1.59
ΔR^2				0.06					0.53	
Adjusted R^2				0.05					0.58	
df				485					485	
F-ratio				6.40 ($p < .001$)					67.54 ($p < .001$)	

*$p < .05$, **$p < .01$. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. Overall Cost was used due to multicollinearity. Intrinsic value correlated with emotional engagement was not included in this model.

Table 22

Hierarchical Regression Analysis of Social Engagement with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\widehat{\beta}$	SE	*p-value*	VIF	B	*$\widehat{\beta}$	SE	*p-value*	VIF
Female	0.12	0.07	0.08	0.138	1.01	0.13	0.07	0.08	0.119	1.09
Black	-0.06	-0.02	0.14	0.640	1.07	-0.13	-0.04	0.13	0.332	1.09
Asian	0.04	0.02	0.10	0.665	1.09	-0.01	-0.01	0.10	0.915	1.11
Hispanic	0.18	0.04	0.19	0.341	1.04	0.16	0.04	0.18	0.374	1.06
Multi	0.42	0.08	0.25	0.091	1.02	0.44	0.08	0.24	0.064	1.03
Competence						-0.08	-0.09	0.05	0.138	1.70
Attainment						0.23**	0.22**	0.05	< 0.001	1.20
Utility Value						-0.12	-0.12	0.06	0.087	2.63
Utility for Future						0.14*	0.13*	0.06	0.041	2.23
Intrinsic Value corr. w EE						0.15**	0.16*	0.06	0.018	2.40
Overall Cost						0.02	0.02	0.06	0.750	1.83
ΔR^2				0.01					0.08	
Adjusted R^2				0.00					0.07	
df				485					485	
F-ratio				1.27 (p = .274)					4.46 (p < .001)	

*p < .05, **p < .01. N = 462.

Note. B = unstandardized regression coefficients; *$\widehat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. Intrinsic value is the EAP score with Intrinsic Value correlating with Emotional Engagement. Overall Cost was used due to multicollinearity. EEIV was not included in this model.

Table 23

Hierarchical Regression Analysis of Social Engagement with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.12	0.07	0.08	0.138	1.01	0.13	0.07	0.08	0.112	1.09
Black	-0.06	-0.02	0.14	0.640	1.07	-0.13	-0.04	0.13	0.334	1.09
Asian	0.04	0.02	0.10	0.665	1.09	-0.01	-0.01	0.10	0.898	1.11
Hispanic	0.18	0.04	0.19	0.341	1.04	0.16	0.04	0.18	0.377	1.06
Multi	0.42	0.08	0.25	0.091	1.02	0.44	0.08	0.24	0.066	1.03
Competence						-0.08	-0.09	0.05	0.134	1.70
Attainment						0.23**	0.22**	0.05	< 0.001	1.20
Utility Value						-0.12	-0.12	0.06	0.090	2.61
Utility for Future						0.14*	0.14*	0.06	0.039	2.22
EEIV						0.15*	0.16*	0.06	0.017	2.42
Overall Cost						0.02	0.02	0.06	0.698	1.86
ΔR^2				0.01					0.08	
Adjusted R^2				0.00					0.07	
df				485					485	
F-ratio				1.27 (p = .274)					4.47 (p < .001)	

*p < .05, **p < .01. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. EEIV is the unidimensional factor of Emotional Engagement and Intrinsic Value. Overall Cost was used due to multicollinearity. Intrinsic value correlated with emotional engagement was not included in this model.

Table 24

Hierarchical Regression Analysis of Agentic Engagement with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.05	-0.03	0.08	0.513	1.01	0.03	0.02	0.08	0.715	1.09
Black	-0.06	-0.02	0.14	0.691	1.07	-0.05	-0.02	0.13	0.714	1.09
Asian	0.28**	0.13**	0.10	0.005	1.09	0.20*	0.10*	0.10	0.032	1.11
Hispanic	-0.05	-0.01	0.19	0.808	1.04	0.06	0.01	0.18	0.763	1.06
Multi	0.15	0.03	0.25	0.554	1.02	0.14	0.03	0.24	0.558	1.03
Competence						0.06	0.06	0.05	0.285	1.70
Attainment						-0.09	-0.09	0.05	0.068	1.20
Utility Value						0.06	0.06	0.06	0.368	2.63
Utility for Future						0.09	0.09	0.06	0.179	2.23
Intrinsic Value corr. w EE						0.27**	0.29**	0.06	< 0.001	2.40
Overall Cost						0.19**	0.20**	0.06	0.001	1.83
ΔR^2				0.02					0.10	
Adjusted R^2				0.01					0.10	
df				485					485	
F-ratio				1.97 (p = .082)					6.06 (p < .001)	

*$p < .05$, **$p < .01$. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. Intrinsic value is the EAP score with Intrinsic Value correlating with Emotional Engagement. Overall Cost was used due to multicollinearity. EEIV was not included in this model.

Table 25

Hierarchical Regression Analysis of Agentic Engagement with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.05	-0.03	0.08	0.513	1.01	0.03	0.02	0.08	0.675	1.09
Black	-0.06	-0.02	0.14	0.691	1.07	-0.05	-0.02	0.13	0.718	1.09
Asian	0.28**	0.13**	0.10	0.005	1.09	0.20*	0.10*	0.10	0.036	1.11
Hispanic	-0.05	-0.01	0.19	0.808	1.04	0.05	0.01	0.18	0.771	1.06
Multi	0.15	0.03	0.25	0.554	1.02	0.13	0.02	0.24	0.578	1.03
Competence						0.06	0.06	0.05	0.298	1.70
Attainment						-0.09	-0.09	0.05	0.065	1.20
Utility Value						0.07	0.07	0.06	0.343	2.61
Utility for Future						0.09	0.09	0.06	0.166	2.22
EEIV						0.27**	0.29**	0.06	< 0.001	2.42
Overall Cost						0.20**	0.21**	0.06	< 0.001	1.87
ΔR^2				0.02					0.10	
Adjusted R^2				0.01					0.10	
df				485					485	
F-ratio				1.97 (p = .082)					6.09 (p < .001)	

*p < .05, **p < .01. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. EEIV is the unidimensional factor of Emotional Engagement and Intrinsic Value. Overall Cost was used due to multicollinearity. Intrinsic value correlated with emotional engagement was not included in this model.

Table 26

Hierarchical Regression Analysis of Behavioral Disaffection with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\widehat{\beta}$	SE	*p-value*	VIF	B	*$\widehat{\beta}$	SE	*p-value*	VIF
Female	-0.02	-0.01	0.09	0.819	1.01	-0.10	-0.05	0.08	0.201	1.09
Black	0.04	0.01	0.14	0.799	1.07	0.09	0.03	0.13	0.501	1.09
Asian	-0.11	-0.05	0.10	0.263	1.09	0.02	0.01	0.09	0.791	1.11
Hispanic	-0.06	-0.01	0.20	0.759	1.04	-0.09	-0.02	0.18	0.593	1.06
Multi	-0.21	-0.04	0.26	0.409	1.02	-0.25	-0.04	0.23	0.279	1.03
Competence						0.13*	0.13*	0.05	0.016	1.70
Attainment						-0.18**	-0.17**	0.05	< 0.001	1.20
Utility Value						0.01	0.01	0.06	0.855	2.26
Utility for Future						0.01	0.01	0.06	0.896	2.23
Intrinsic Value corr. w EE						-0.50**	-0.51**	0.06	< 0.001	2.40
Overall Cost						-0.07	-0.07	0.05	0.209	1.83
ΔR^2				0.00					0.22	
Adjusted R^2				-0.01					0.21	
df				485					485	
F-ratio				0.43 (p = .831)					12.73 (p < .001)	

*p < .05, **p < .01. N = 462.

Note. B = unstandardized regression coefficients; *$\widehat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. Intrinsic value is the EAP score with Intrinsic Value correlating with Emotional Engagement. Overall Cost was used due to multicollinearity. EEIV engagement was not included in this model.

Table 27

Hierarchical Regression Analysis of Behavioral Disaffection with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.02	-0.01	0.09	0.819	1.01	-0.11	-0.06	0.08	0.154	1.09
Black	0.04	0.01	0.14	0.799	1.07	0.08	0.03	0.13	0.527	1.09
Asian	-0.11	-0.05	0.10	0.263	1.09	0.04	0.02	0.09	0.671	1.11
Hispanic	-0.06	-0.01	0.20	0.759	1.04	-0.10	-0.02	0.17	0.563	1.06
Multi	-0.21	-0.04	0.26	0.409	1.02	-0.23	-0.04	0.22	0.306	1.03
Competence						0.14**	0.14*	0.05	0.006	1.70
Attainment						-0.18**	-0.16**	0.05	< 0.001	1.20
Utility Value						0.03	0.03	0.06	0.697	2.61
Utility for Future						0.01	0.01	0.06	0.842	2.22
EEIV						-0.56**	-0.58**	0.06	< 0.001	2.42
Overall Cost						-0.10	-0.10	0.05	0.059	1.87
ΔR^2				0.00					0.25	
Adjusted R^2				-0.01					0.24	
df				485					485	
F-ratio				0.426 (p = .831)					14.958 (p < .001)	

*$p < .05$, **$p < .01$. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. EEIV is the unidimensional factor of Emotional Engagement and Intrinsic Value. Overall Cost was used due to multicollinearity. Intrinsic value correlated with emotional engagement was not included in this model.

Table 28

Hierarchical Regression Analysis of Emotional Disaffection correlated with Emotional Cost with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.49**	0.26**	0.08	0.000	1.01	0.14**	0.08**	0.05	0.003	1.09
Black	-0.03	-0.01	0.14	0.849	1.07	-0.05	-0.02	0.08	0.507	1.09
Asian	-0.22*	-0.10*	0.10	0.023	1.09	-0.03	-0.01	0.06	0.615	1.11
Hispanic	0.12	0.03	0.19	0.539	1.04	-0.11	-0.03	0.11	0.323	1.06
Multi	-0.08	-0.01	0.25	0.746	1.02	-0.33*	-0.06*	0.14	0.020	1.03
Competence						-0.19**	-0.20**	0.03	< 0.001	1.70
Attainment						0.03	0.02	0.03	0.374	1.20
Utility Value						0.10*	0.10*	0.04	0.015	2.26
Utility for Future						0.05	0.05	0.04	0.171	2.23
Intrinsic Value corr. w EE						-0.49**	-0.50**	0.04	< 0.001	2.40
Overall Cost						0.35**	0.35**	0.03	< 0.001	1.83
ΔR^2				0.08					0.63	
Adjusted R^2				0.07					0.71	
df				485					485	
F-ratio				8.42 ($p < .001$)					107.92 ($p < .001$)	

*$p < .05$, **$p < .01$. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. Intrinsic value is the EAP score with Intrinsic Value correlating with Emotional Engagement. Overall Cost was used due to multicollinearity. EEIV was not included in this model.

Table 29

Hierarchical Regression Analysis of Emotional Disaffection correlated with Emotional Cost with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.49**	0.26**	0.08	< 0.001	1.01	0.13**	0.07**	0.05	0.005	1.09
Black	-0.03	-0.01	0.14	0.849	1.07	-0.06	-0.02	0.08	0.458	1.09
Asian	-0.22*	-0.10*	0.10	0.023	1.09	-0.02	-0.01	0.05	0.750	1.11
Hispanic	0.12	0.03	0.19	0.539	1.04	-0.11	-0.03	0.10	0.299	1.06
Multi	-0.08	-0.01	0.25	0.746	1.02	-0.31*	-0.06*	0.14	0.023	1.03
Competence						-0.18**	-0.19**	0.03	< 0.001	1.70
Attainment						0.03	0.03	0.03	0.307	1.20
Utility Value						0.10**	0.10**	0.04	0.008	2.22
Utility for Future						0.05	0.05	0.04	0.153	2.61
EEIV						-0.53**	-0.55**	0.04	< 0.001	2.42
Overall Cost						0.32**	0.33**	0.03	< 0.001	1.87
ΔR^2				0.08					0.65	
Adjusted R^2				0.07					0.73	
df				485					485	
F-ratio				8.42 ($p < .001$)					117.75 ($p < .001$)	

*$p < .05$, **$p < .01$. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. EEIV is the unidimensional factor of Emotional Engagement and Intrinsic Value. Overall Cost was used due to multicollinearity. Intrinsic value correlated with emotional engagement was not included in this model.

Table 30

Hierarchical Regression Analysis of Emotional Disaffection and Emotional Cost (EDEC) with All Constructs Entered as Independent Variables in the Same Analysis

	B	*$\hat{\beta}$	SE	*p-value*	VIF	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.47**	0.24**	0.09	< 0.001	1.01	0.06	0.03	0.04	0.137	1.09
Black	0.03	0.01	0.14	0.847	1.07	0.00	0.00	0.06	0.977	1.09
Asian	-0.26*	-0.12*	0.10	0.011	1.09	-0.07	-0.03	0.04	0.090	1.11
Hispanic	0.15	0.04	0.20	0.432	1.04	-0.04	-0.01	0.08	0.649	1.06
Multi	0.12	0.02	0.26	0.648	1.02	-0.21*	-0.04*	0.11	0.044	1.03
Competence						-0.16**	-0.15**	0.02	< 0.001	1.70
Attainment						0.11**	0.10**	0.02	< 0.001	1.20
Utility Value						0.08**	0.08**	0.03	0.007	2.26
Utility for Future						0.01	0.01	0.03	0.819	2.23
Intrinsic Value corr. w EE						-0.26**	-0.26**	0.03	< 0.001	2.40
Overall Cost						0.68**	0.67**	0.03	< 0.001	1.83
ΔR^2				0.08					0.77	
Adjusted R^2				0.07					0.84	
df				485					485	
F-ratio				8.03 (p < .001)					394.04 (p < .001)	

*p < .05, **p < .01. N = 462.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. Intrinsic value is the EAP score with Intrinsic Value correlating with Emotional Engagement. Overall Cost was used due to multicollinearity. EEIV was not included in this model.

Table 31

Hierarchical Regression Analysis of Emotional Disaffection and Emotional Cost (EDEC) with All Constructs Entered as Independent Variables in the Same Analysis

	B	$*\hat{\beta}$	SE	*p-value*	VIF	B	$*\hat{\beta}$	SE	*p-value*	VIF
Female	0.47**	0.24**	0.09	< 0.001	1.01	0.05	0.03	0.04	0.169	1.09
Black	0.03	0.01	0.14	0.847	1.07	0.00	0.00	0.06	0.944	1.09
Asian	-0.26*	-0.12*	0.10	0.011	1.09	-0.07	-0.03	0.04	0.114	1.11
Hispanic	0.15	0.04	0.20	0.432	1.04	-0.04	-0.01	0.08	0.634	1.06
Multi	0.12	0.02	0.26	0.648	1.02	-0.21	-0.04	0.10	0.050	1.03
Competence						-0.15**	-0.15**	0.02	< 0.001	1.70
Attainment						0.11**	0.10**	0.02	< 0.001	1.20
Utility Value						0.09**	0.08**	0.03	0.005	2.61
Utility for Future						0.01	0.01	0.03	0.807	2.42
EEIV						-0.28**	-0.28**	0.03	< 0.001	2.41
Overall Cost						0.67**	0.66**	0.03	< 0.001	1.87
ΔR^2				0.08					0.77	
Adjusted R^2				0.07					0.85	
df				485					485	
F-ratio				8.03 ($p < .001$)					245.54 ($p < .001$)	

$*p < .05$, $**p < .01$. N = 462.

Note. B = unstandardized regression coefficients; $*\hat{\beta}$ = standardized regression coefficients; SE = standard error; VIF = Variance Inflation Factor; Multi = multi-racial. EEIV is the unidimensional factor of Emotional Engagement and Intrinsic Value. Overall Cost was used due to multicollinearity. Intrinsic value correlated with emotional engagement was not included in this model.

Stepwise regression results. Results from the stepwise regression are presented in Tables 32-48. As a reminder, I ran these analyses in addition to the hierarchical regression analyses because the stepwise approach handles possible multicollinearity issues better and uses an automated variable selection procedure for determining which variables have the strongest relationships. In these regressions intrinsic value (correlated with emotional engagement) and EEIV were not included in the same model due to empirical similarity, the same is true for emotional cost (correlated with emotional disaffection) and EDEC. Thus, each outcome variable had two separate stepwise regression models conducted, one model in which intrinsic value and emotional cost were included with the other demographic and motivation variables and one model where EEIV and EDEC were included with the other demographic and motivation variables.

When students' behavioral engagement was the outcome variable, the total R^2 with intrinsic value (correlated with emotional engagement) and emotional cost (correlated with emotional disaffection) included in the model was 0.34. Students' attainment value ($*\hat{\beta} = 0.34, p < .001$), intrinsic value ($*\hat{\beta} = 0.44,\ p < .001$), emotional cost ($*\hat{\beta} = 0.20, p = .002$), and outside effort cost ($*\hat{\beta} = -0.12, p < .025$) were the strongest relationships with behavioral engagement. The total R^2 was 0.37 when EEIV and EDEC were included in the model. EEIV ($*\hat{\beta} = 0.51, p < .001$), attainment value ($*\hat{\beta} = 0.33, p < .001$), EDEC ($*\hat{\beta} = 0.24, p < .001$), and outside effort cost ($*\hat{\beta} = -0.11, p = .033$) were the strongest relationships

When students' cognitive engagement was the outcome variable, the total R^2 with intrinsic value (correlated with emotional engagement) and emotional cost (correlated with emotional disaffection) included in the model was 0.35. Attainment value ($*\hat{\beta} = 0.37, p <$

$.001)$, intrinsic value ($*\hat{\beta} = 0.24, p < .001$), and competence-related beliefs ($*\hat{\beta} = 0.21, p < .001$) were the strongest relationships with cognitive engagement. The total R^2 was 0.36 when EEIV and EDEC were included in the model. Attainment value ($*\hat{\beta} = 0.36), p < .001$, EEIV ($*\hat{\beta} = 0.27, p < .001$), and competence-related beliefs ($*\hat{\beta} = 0.19, p < .001$) were the strongest relationships.

When I had students' emotional engagement (correlated with intrinsic value) as the outcome variable, I did not include intrinsic value (correlated with emotional engagement) or EEIV in either model. The total R^2 with emotional cost (correlated with emotional disaffection) included in the model was 0.65. Emotional cost ($*\hat{\beta} = -0.60, p < .001$), utility value ($*\hat{\beta} = 0.29$), $p < .001$, utility for future ($*\hat{\beta} = 0.10, p = .011$), attainment value ($*\hat{\beta} = 0.09, p = .006$), loss of valued alternatives ($*\hat{\beta} = 0.10, p = .015$), and competence ($*\hat{\beta} = 0.07, p = .050$) were the variables with the strongest relationship to emotional engagement. The total R^2 was 0.66 when EDEC was included in the model. EDEC ($*\hat{\beta} = -0.66, p < .001$), utility value ($*\hat{\beta} = 0.29$, $p < .001$), utility for future ($*\hat{\beta} = 0.11, p = .007$), attainment value ($*\hat{\beta} = 0.09, p = .003$), and loss of valued alternatives ($*\hat{\beta} = 0.11, p = .007$) were the strongest relationships.

When I had students combined emotional engagement and intrinsic value (EEIV) as the outcome variable, I did not include intrinsic value (correlated with emotional engagement) in either model. The total R^2 with emotional cost (correlated with emotional disaffection) included in the model was 0.64. Emotional cost ($*\hat{\beta} = -0.61, p < .001$), utility value ($*\hat{\beta} = 0.31, p < .001$), utility for future ($*\hat{\beta} = 0.12, p = .002$), attainment value ($*\hat{\beta} = 0.09, p = .002$), and loss of valued alternatives ($*\hat{\beta} = 0.10, p = .018$) were the variables with the strongest relationship to EEIV. The total R^2 was 0.66 when EDEC was included in the model. EDEC ($*\hat{\beta} = -0.63, p < .001$), utility value ($*\hat{\beta} = 0.30, p < .001$), utility for future ($*\hat{\beta} = 0.12, p = .002$), attainment value ($*\hat{\beta} = 0.09, p = .002$), and loss of valued alternatives ($*\hat{\beta} = 0.10, p = .014$) were the strongest relationships.

When students' social engagement was the outcome variable, the total R^2 with intrinsic value (correlated with emotional engagement) and emotional cost (correlated with emotional disaffection) included in the model was 0.09. Attainment value ($*\hat{\beta} = 0.29, p < .001$), intrinsic value ($*\hat{\beta} = 0.20$, $p = .002$), and emotional cost ($*\hat{\beta} = 0.13, = .025$) were the strongest relationships. The total R^2 was also only 0.09 when EEIV and EDEC were included in the model. Attainment value ($*\hat{\beta} = 0.19, p < .001$), EEIV ($*\hat{\beta} = 0.21, p = .001$), and EDEC ($*\hat{\beta} = 0.15, p = .021$) were the strongest relationships.

For students' agentic engagement, the total R^2 with intrinsic value (correlated with emotional engagement) and emotional cost (correlated with emotional disaffection) included in the model was 0.12. The dichotomous Asian demographic variable emerged as one of the significant associations ($*\hat{\beta} = 0.10, p = .029$), along with intrinsic value ($*\hat{\beta} = 0.29, p < .001$), loss of valued alternatives ($*\hat{\beta} = 0.18$, $p < .001$), and utility for future ($*\hat{\beta} = 0.11, p = .036$). The total R^2 was 0.12 when EEIV and EDEC were included in the model. The dichotomous Asian demographic variable ($*\hat{\beta} = 0.10, p = .032$), EEIV ($*\hat{\beta} = 0.29, p < .001$), loss of valued alternatives ($*\hat{\beta} = 0.19$, $p < .001$) and utility for future ($*\hat{\beta} = 0.11, p = .011$) were the strongest relationships.

When students' behavioral disaffection was the outcome variable, the total R^2 with intrinsic value (correlated with emotional engagement) and emotional cost (correlated with emotional disaffection) included in the model was 0.23. Students' Intrinsic value ($*\hat{\beta} = -0.47, p < .001$), attainment value ($*\hat{\beta} = -0.17, p < .001$), and competence-related beliefs $(^*\hat{\beta} = 0.15), p = .002)$ were the variables most strongly associated with behavioral disaffection. The total R^2 was 0.25 when EEIV and EDEC were included in the model. EEIV $(^*\hat{\beta} = -0.52, p < .001)$, attainment value $(^*\hat{\beta} = -0.16, p < .001)$, and competence-related beliefs $(^*\hat{\beta} = 0.18, p < .001)$ were the strongest relationships

When I had emotional disaffection (correlated with emotional cost) as the outcome I did not include emotional cost (correlated with emotional disaffection) or EDEC in either model. The total R^2 with intrinsic value (correlated with emotional engagement) included in the model was 0.70. The dichotomous Female $(^*\hat{\beta} = 0.07, p = .005)$ and Multi-Racial $(^*\hat{\beta} = -0.07, p = .004)$ demographic variables emerged along with intrinsic value $(^*\hat{\beta} = -0.51, p < .001)$, task effort cost $(^*\hat{\beta} = 0.32, p < .001)$, competence-related beliefs $(^*\hat{\beta} = -0.23, p < .001)$, and utility value $(^*\hat{\beta} = 0.16, p < .001)$ as the variables with the strongest relationship with emotional disaffection. The total R^2 was 0.72 when EEIV was included in the model. The dichotomous Female $(^*\hat{\beta} = 0.07, p = .006)$ and Multi-Racial $(^*\hat{\beta} = -0.07, p = .005)$ demographic variables emerged along with EEIV $(^*\hat{\beta} = -0.55, p < .001)$, task effort cost $(^*\hat{\beta} = 0.30, p < .001)$, competence-related beliefs $(^*\hat{\beta} = -0.22, p < .001)$, and utility value $(^*\hat{\beta} = 0.16, p < .001)$ as the strongest relationships.

When I had EDEC as the outcome variable I did not include emotional cost (correlated with emotional disaffection) in either model. The total R^2 with intrinsic value (correlated with emotional engagement) included in the model was 0.80. The dichotomous Asian $(^*\hat{\beta} = -0.05, p = .024)$ and Multi-Racial $(^*\hat{\beta} = -0.05, p = .012)$ demographic variables emerged along with task effort cost $(^*\hat{\beta} = 0.47, p < .001)$, intrinsic value $(^*\hat{\beta} = -0.30, p < .001)$, competence-related beliefs $(^*\hat{\beta} = -0.22, p < .001)$, attainment value

($*\hat{\beta} = 0.11, p < .001$), utility value ($*\hat{\beta} = 0.11, p < .001$) and loss of valued alternatives ($*\hat{\beta} = 0.13, p = .001$), as the strongest relationships with EDEC. It should be noted that the VIF value for task effort cost may indicate some multicollinearity (4.48). The total R^2 was 0.81 when EEIV was included in the model. The dichotomous Asian ($*\hat{\beta} = -0.05, p = .034$) and Multi-Racial ($*\hat{\beta} = -0.05,\ p = .015$) demographic variables emerged along with task effort cost ($*\hat{\beta} = 0.45, p < .001$), intrinsic value ($*\hat{\beta} = -0.33, p < .001$), competence-related beliefs ($*\hat{\beta} = -0.22, p < .001$), attainment value ($*\hat{\beta} = 0.11, p < .001$), utility value ($*\hat{\beta} = 0.11, p < .001$) and loss of valued alternatives ($*\hat{\beta} = 0.14, p < .001$), as the strongest relationships. Task effort cost again indicated a possible multicollinearity issue with a VIF of 4.52.

Summary. Overall, hypothesis 2b was partially supported. I hypothesized that students' competence-related beliefs would be most strongly associated with students' behavioral and cognitive engagement. However, competence-related beliefs did not emerge as significant in either the hierarchical or stepwise regression for behavioral engagement. In terms of students' cognitive engagement, competence-related beliefs did emerge as a significant association, but it was not the strongest relationship based on the standardized beta. Students' attainment value and intrinsic value (correlated with emotional engagement) were the strongest associations.

Hypothesis 2c was also partially supported. Students' attainment value, utility value, and utility for future life were more strongly associated with emotional engagement (correlated with intrinsic value) and EEIV than competence-related beliefs. However, emotional cost (correlated with emotional disaffection), EDEC, and loss of valued alternatives were also found to be significant in the stepwise regressions for emotional engagement and EEIV. Students' attainment value and intrinsic value, and EEIV were also more strongly associated with social engagement than competence-related beliefs. However, utility value and utility value for future life did not come out as significant associations in the stepwise regression for social engagement as predicted. In terms of students' agentic engagement, intrinsic value, EEIV, and utility for future were stronger associations than competence-related beliefs. However, attainment value and utility value did not emerge as significant associations in the stepwise regression as predicted for agentic engagement. Additionally, none of the cost constructs were significantly associated with students' behavioral disaffection. Task effort cost did emerge as one of the strongest associations of emotional disaffection (correlating with emotional cost) and loss of valued alternatives emerged alongside task effort cost as two of the strongest associations of EDEC. However, competence-related beliefs and value constructs also emerged in the stepwise regressions, which was not hypothesized.

Table 32

Stepwise Regression for Behavioral Engagement

	B	$*\hat{\beta}$	SE	*p-value*	VIF
Female	0.01	0.01	0.07	0.889	1.08
Black	-0.10	-0.03	0.11	0.392	1.10
Asian	-0.05	-0.02	0.08	0.549	1.11
Hispanic	-0.15	-0.04	0.15	0.341	1.05
Multi	0.04	0.01	0.20	0.848	1.03
Attainment	0.36**	0.34**	0.04	< 0.001	1.17
Intrinsic corr. w EE	0.40**	0.44**	0.05	< 0.001	1.97
Emotional Cost corr. w ED	0.19**	0.20**	0.06	0.002	3.01
Outside Effort Cost	-0.11*	-0.12*	0.05	0.025	2.10
R^2			0.34		
F-ratio (*p*-value)			27.46 ($p < .001$)		

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; $*\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Intrinsic corr. w EE = intrinsic value correlated with emotional engagement; Emotional Cost corr. ED = emotional cost correlated with emotional disaffection; EEIV and EDEC were not included in this model

Table 33

Stepwise Regression for Behavioral Engagement

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.01	0.01	0.07	0.779	1.08
Black	-0.09	-0.03	0.11	0.422	1.10
Asian	-0.06	-0.03	0.08	0.429	1.11
Hispanic	-0.14	-0.03	0.15	0.359	1.05
Multi	0.03	0.01	0.20	0.866	1.03
EEIV	0.46**	0.51**	0.05	< 0.001	2.17
Attainment	0.34**	0.33**	0.04	< 0.001	1.17
EDEC	0.22**	0.24**	0.06	< 0.001	3.14
Outside Effort Cost	-0.10*	-0.11*	0.05	0.033	2.01
R^2			0.37		
F-ratio (*p*-value)			30.43 (*p* < .001)		

**p* < .05, ***p* < .01. N = 486.

Note. B = unstandardized regression coefficients; *$\widehat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Intrinsic Value correlated with Emotional Engagement and Emotional Cost correlated with Emotional Disaffection were not included in this model

Table 34

Stepwise Regression for Cognitive Engagement

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.10	0.06	0.07	0.126	1.08
Black	-0.03	-0.01	0.11	0.819	1.08
Asian	-0.12	-0.06	0.08	0.121	1.11
Hispanic	-0.24	-0.06	0.15	0.110	1.05
Multi	0.07	0.01	0.20	0.713	1.03
Attainment	0.38**	0.37**	0.04	< 0.001	1.09
Intrinsic corr. w EE	0.22**	0.24**	0.04	< 0.001	1.52
Competence	0.20**	0.21*	0.04	< 0.001	1.45
R^2			0.35		
F-ratio (*p*-value)			31.66 ($p < .001$)		

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Intrinsic corr. w EE = intrinsic value correlated with emotional engagement; EEIV and EDEC were not included in this model

Table 35

Stepwise Regression for Cognitive Engagement

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.11	0.06	0.07	0.096	1.07
Black	-0.02	-0.01	0.11	0.830	1.08
Asian	-0.13	-0.07	0.08	0.094	1.11
Hispanic	-0.24	-0.06	0.15	0.107	1.05
Multi	0.07	0.01	0.20	0.727	1.03
Attainment	0.37**	0.36**	0.04	< 0.001	1.09
EEIV	0.24**	0.27**	0.04	< 0.001	1.54
Competence	0.18**	0.19**	0.04	< 0.001	1.47
R^2			0.36		
F-ratio (*p*-value)			32.99 (*p* < .001)		

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Intrinsic Value correlated with Emotional Engagement and Emotional Cost correlated with Emotional Disaffection were not included in this model

Table 36

Stepwise Regression for Emotional Engagement correlated with Intrinsic Value

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.00	0.00	0.06	0.971	1.10
Black	-0.06	-0.02	0.09	0.478	1.09
Asian	0.06	0.03	0.06	0.313	1.11
Hispanic	-0.15	-0.03	0.12	0.225	1.05
Multi	0.00	0.00	0.16	0.994	1.03
Emotional Cost corr. ED	-0.60**	-0.60**	0.05	< 0.001	3.43
Utility Value	0.30**	0.29**	0.04	< 0.001	2.37
Utility for Future	0.11*	0.10*	0.04	0.011	2.18
Attainment	0.10**	0.09**	0.04	0.006	1.26
LVA	0.11*	0.10*	0.04	0.015	2.40
Competence	0.08*	0.07*	0.04	0.050	1.85
R^2			0.65		
F-ratio (*p*-value)			78.89 ($p < .001$)		

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Emotional Cost corr. ED = emotional cost correlated with emotional disaffection; LVA = loss of valued alternatives; Intrinsic Value correlated with Emotional Engagement, EEIV and EDEC were not included in this model

Table 37

Stepwise Regression for Emotional Engagement correlated with Intrinsic Value

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.00	0.00	0.05	0.995	1.09
Black	-0.07	-0.02	0.09	0.446	1.09
Asian	0.06	0.03	0.06	0.309	1.11
Hispanic	-0.16	-0.04	0.12	0.172	1.05
Multi	-0.02	0.00	0.16	0.904	1.03
EDEC	-0.66**	-0.66**	0.04	< 0.001	2.43
Utility Value	0.29**	0.29**	0.04	< 0.001	2.37
Utility for Future	0.12**	0.11**	0.04	0.007	2.17
Attainment	0.10**	0.09**	0.03	0.003	1.23
LVA	0.11**	0.11**	0.04	0.007	2.24
R^2			0.66		
F-ratio (*p*-value)			93.02 (*p* < .001)		

**p* < .05, ***p* < .01. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; LVA = loss of valued alternatives; Intrinsic Value correlated with Emotional Engagement, EEIV, and Emotional Cost correlated with Emotional Disaffection were not included in this model

Table 38

Stepwise Regression for Emotional Engagement Combined with Intrinsic Value

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.00	0.00	0.06	0.994	1.09
Black	-0.08	-0.02	0.09	0.402	1.09
Asian	0.05	0.02	0.06	0.436	1.11
Hispanic	-0.19	-0.04	0.12	0.128	1.04
Multi	-0.03	-0.01	0.16	0.869	1.03
Emotional Cost corr. ED	-0.61**	-0.61**	0.04	< 0.001	2.59
Utility Value	0.32**	0.31**	0.04	< 0.001	2.37
Utility for Future	0.14**	0.12**	0.04	0.002	2.17
Attainment	0.12**	0.09**	0.04	0.002	1.24
LVA	0.11*	0.10*	0.04	0.018	2.38
R^2			0.64		
F-ratio (*p*-value)			85.54 (*p* < .001)		

**p* < .05, ***p* < .01. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Emotional Cost corr. ED = emotional cost correlated with emotional disaffection; LVA = loss of valued alternatives; Intrinsic Value correlated with Emotional Engagement and EDEC were not included in this model

Table 39

Stepwise Regression for Emotional Engagement Combined with Intrinsic Value

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.01	0.01	0.05	0.827	1.09
Black	-0.08	-0.02	0.09	0.394	1.09
Asian	0.06	0.03	0.06	0.373	1.11
Hispanic	-0.18	-0.04	0.12	0.138	1.05
Multi	-0.03	-0.01	0.16	0.840	1.03
EDEC	-0.63**	-0.63**	0.04	< 0.001	2.43
Utility Value	0.32**	0.30**	0.04	< 0.001	2.37
Utility for Future	0.13**	0.12**	0.04	0.002	2.17
Attainment	0.10**	0.09**	0.03	0.002	1.23
LVA	0.10*	0.10**	0.04	0.014	2.24
R^2			0.66		
F-ratio (*p*-value)			92.15 ($p < .001$)		

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; EDEC = unidimensional factor of emotional disaffection and emotional cost; LVA = loss of valued alternatives; Intrinsic Value correlated with Emotional Engagement and Emotional Cost correlated with Emotional Disaffection were not included in this model

Table 40

Stepwise Regression for Social Engagement

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.12	0.07	0.08	0.154	1.08
Black	-0.13	-0.04	0.13	0.350	1.08
Asian	0.00	0.00	0.10	1.00	1.11
Hispanic	0.17	0.04	0.18	0.365	1.04
Multi	0.45	0.08	0.24	0.060	1.02
Attainment	0.20**	0.29**	0.06	< 0.001	1.13
Intrinsic corr. EE	0.18**	0.20**	0.06	0.002	1.96
Emotional Cost corr. ED	0.13*	0.13*	0.06	0.025	1.87
R^2				0.09	
F-ratio (*p*-value)			5.82 ($p < .001$)		

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Intrinsic corr. w EE = intrinsic value correlated with emotional engagement; Emotional Cost corr. ED = emotional cost correlated with emotional disaffection; EEIV and EDEC were not included in this model

Table 41

Stepwise Regression for Social Engagement

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.12	0.07	0.08	0.147	1.08
Black	-0.12	-0.04	0.13	0.355	1.08
Asian	-0.01	0.00	0.10	0.960	1.11
Hispanic	0.16	0.04	0.18	0.367	1.04
Multi	0.45	0.08	0.24	0.060	1.02
Attainment	0.20**	0.19**	0.05	< 0.001	1.13
EEIV	0.19**	0.21**	0.06	0.001	2.16
EDEC	0.14*	0.15*	0.06	0.021	2.06
R^2			0.09		
F-ratio (*p*-value)			5.85 ($p < .001$)		

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; EEIV = combined emotional engagement and intrinsic value; EDEC = combined emotional disaffection and emotional cost; Intrinsic Value correlated with Emotional Engagement and Emotional Cost correlated with Emotional Disaffection were not included in this model

Table 41

Stepwise Regression for Agentic Engagement

	B	$*\widehat{\beta}$	SE	*p-value*	VIF
Female	0.03	0.02	0.08	0.733	1.05
Black	-0.05	-0.02	0.13	0.703	1.08
Asian	0.21*	0.10*	0.10	0.029	1.11
Hispanic	0.03	0.01	0.18	0.861	1.04
Multi	0.17	0.03	0.24	0.471	1.02
Intrinsic Value corr. EE	0.28**	0.29**	0.05	< 0.001	1.78
LVA	0.18**	0.18**	0.05	< 0.001	1.30
Utility for Future	0.11*	0.11**	0.05	0.036	1.44
R^2			0.12		
F-ratio (*p*-value)			8.24 (*p* < .001)		

**p* < .05, ***p* < .01. N = 486.

Note. B = unstandardized regression coefficients; $*\widehat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Intrinsic Value corr. EE = intrinsic value correlated with emotional engagement; LVA = loss of valued alternative; EEIV and EDEC were not included in this model

Table 42

Stepwise Regression for Agentic Engagement

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.03	0.02	0.08	0.683	1.06
Black	-0.05	-0.02	0.13	0.708	1.08
Asian	0.20*	0.10*	0.10	0.032	1.11
Hispanic	0.03	0.01	0.18	0.868	1.04
Multi	0.17	0.03	0.24	0.485	1.02
EEIV	0.28**	0.29**	0.05	< 0.001	1.77
LVA	0.18**	0.19**	0.05	< 0.001	1.32
Utility for Future	0.12*	0.11*	0.05	0.027	1.40
R^2				0.12	
F-ratio (*p*-value)				8.23 ($p < .001$)	

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; EEIV = combined emotional engagement and intrinsic value; LVA = loss of valued alternatives; Intrinsic Value correlated with Emotional Engagement and Emotional Cost correlated with Emotional Disaffection were not included in this model

Table 43

Stepwise Regression for Behavioral Disaffection

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.11	-0.06	0.08	0.153	1.07
Black	0.09	0.03	0.13	0.472	1.08
Asian	0.03	0.01	0.09	0.760	1.11
Hispanic	-0.08	-0.02	0.17	0.650	1.05
Multi	-0.26	-0.05	0.23	0.246	1.03
Intrinsic Value corr. EE	-0.46**	-0.47**	0.05	< 0.001	1.52
Attainment	-0.18**	-0.17**	0.05	< 0.001	1.09
Competence	0.15**	0.15**	0.05	0.002	1.45
R^2			0.23		
F-ratio (*p*-value)			17.35 ($p < .001$)		

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Inrinsic Value corr. EE = intrinsic value correlated with emotional engagement; EEIV and EDEC were not included in this model

Table 44

Stepwise Regression for Behavioral Disaffection

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	-0.13	-0.07	0.08	0.101	1.07
Black	0.09	0.03	0.13	0.479	1.08
Asian	0.04	0.02	0.09	0.632	1.11
Hispanic	-0.08	-0.02	0.17	0.652	1.05
Multi	-0.25	-0.05	0.22	0.254	1.03
EEIV	-0.50**	-0.52**	0.05	< 0.001	1.54
Attainment	-0.17**	-0.16**	0.05	< 0.001	1.09
Competence	0.18**	0.18**	0.05	< 0.001	1.47
R^2				0.25	
F-ratio (*p*-value)				20.05 ($p < .001$)	

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; EEIV = combined emotional engagement and intrinsic value; Intrinsic Value correlated with Emotional Engagement and Emotional Cost correlated with Emotional Disaffection were not included in this model

Table 45

Stepwise Regression for Emotional Disaffection correlated with Emotional Cost

	B	$*\hat{\beta}$	SE	*p-value*	VIF
Female	0.14**	0.07**	0.05	0.005	1.08
Black	-0.08	-0.03	0.08	0.337	1.08
Asian	-0.06	-0.03	0.06	0.333	1.11
Hispanic	-0.15	-0.04	0.11	0.167	1.05
Multi	-0.41**	-0.07**	0.14	0.004	1.04
Intrinsic Value corr. EE	-0.50**	-0.51**	0.04	< 0.001	2.32
Task Effort Cost	0.32**	0.32**	0.03	< 0.001	1.70
Competence	-0.23**	-0.23**	0.03	< 0.001	1.59
Utility Value	0.16**	0.16**	0.03	< 0.001	1.62
R^2			0.70		
F-ratio (*p*-value)			124.58 ($p < .001$)		

$*p < .05$, $**p < .01$. N = 486.

Note. B = unstandardized regression coefficients; $*\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Intrinsic Value corr. EE = intrinsic value correlated with emotional engagement; EEIV and EDEC were not included in this model

Table 46

Stepwise Regression for Emotional Disaffection correlated with Emotional Cost

	B	$*\hat{\beta}$	SE	*p-value*	VIF
Female	0.13**	0.07**	0.05	0.006	1.08
Black	-0.08	-0.03	0.08	0.312	1.08
Asian	-0.04	-0.02	0.06	0.446	1.11
Hispanic	-0.15	-0.04	0.11	0.158	1.05
Multi	-0.39**	-0.07**	0.14	0.005	1.04
EEIV	-0.53**	-0.55**	0.04	< 0.001	2.34
Task Effort Cost	0.29**	0.30**	0.03	< 0.001	1.73
Competence	-0.22**	-0.22**	0.03	< 0.001	1.60
Utility Value	0.16**	0.16**	0.03	< 0.001	1.58
R^2			0.72		
F-ratio (*p*-value)			136.26 ($p < .001$)		

$*p < .05$, $**p < .01$. N = 486.

Note. B = unstandardized regression coefficients; $*\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; EEIV = emotional engagement combined with intrinsic value; Intrinsic Value correlated with Emotional Engagement and EDEC were not included in this model

Table 47

Stepwise Regression for Emotional Disaffection Combined with Emotional Cost

	B	*$\hat{\beta}$	SE	*p-value*	VIF
Female	0.06	0.03	0.04	0.133	1.10
Black	-0.04	-0.01	0.07	0.548	1.10
Asian	-0.11*	-0.05*	0.05	0.024	1.12
Hispanic	-0.11	-0.03	0.09	0.230	1.06
Multi	-0.31*	-0.05*	0.12	0.012	1.06
Task Effort Cost	0.48**	0.47**	0.04	< 0.001	4.48
Competence	-0.23**	-0.22**	0.03	< 0.001	1.60
Intrinsic Value corr. EE	-0.30**	-0.30**	0.03	< 0.001	2.32
Attainment	0.12**	0.11**	0.03	< 0.001	1.21
Utility Value	0.12**	0.11**	0.03	< 0.001	1.79
LVA	0.14**	0.13**	0.04	0.001	3.64
R^2				0.80	
F-ratio (*p*-value)				174.01 ($p < .001$)	

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\hat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; Intrinsic Value corr. EE = intrinsic value correlated with emotional engagement; LVA = loss of valued alternatives; EEIV, EDEC and Emotional Cost correlated with Emotional Disaffection were not included in this model

Table 48

Stepwise Regression for Emotional Disaffection Combined with Emotional Cost

	B	*$\widehat{\beta}$	SE	*p-value*	VIF
Female	0.06	0.03	0.04	0.160	1.10
Black	-0.04	-0.01	0.07	0.534	1.10
Asian	-0.10*	-0.05*	0.05	0.034	1.12
Hispanic	-0.11	-0.03	0.09	0.226	1.06
Multi	-0.29*	-0.05*	0.12	0.015	1.06
Task Effort Cost	0.46**	0.45**	0.04	< 0.001	4.52
EEIV	-0.33**	-0.33**	0.03	< 0.001	2.34
Competence	-0.22**	-0.22**	0.03	< 0.001	1.60
Attainment	0.13**	0.11**	0.03	< 0.001	1.21
Utility Value	0.12**	0.11**	0.03	< 0.001	1.75
LVA	0.14**	0.14**	0.04	< 0.001	3.64
R^2			0.81		
F-ratio (*p*-value)			181.37 (*p* < .001)		

*$p < .05$, **$p < .01$. N = 486.

Note. B = unstandardized regression coefficients; *$\widehat{\beta}$ = standardized regression coefficients; SE = standard error; Multi = multi-racial; EEIV = emotional engagement combined with intrinsic value; LVA = loss of valued alternatives; Intrinsic Value correlated with Emotional Engagement and Emotional Cost correlated with Emotional Disaffection were not included in this model

Hypothesis 3

The third hypothesis stated that students' competence-related beliefs, perceived task values, and engagement related reciprocally. To test this hypothesis, I conducted cross-lagged panel analyses using structural equation modeling in M*plus* (Muthén & Muthén, 2012 – 2019). As mentioned previously, I first did the two kinds of measurement invariance tests, tests of differential item functioning (DIF) for the categorical variables using

FlexMIRT v.3.51 (Cai, 2012) software and tested for measurement invariance for continuous variables using Mplus. Items demonstrating DIF or which were not found to be invariant across time were appropriately freely estimated, rather than constrained to be equal. Items that did not have DIF and were invariant across time were constrained to be equal. I ran separate cross-lagged models (two variables at a time) for competence-related beliefs and each dimension of engagement, and each component of task values in relation to each dimension of engagement. I also ran these models using EDEC and EEIV; however, emotional disaffection correlated with emotional cost was not included in these analyses due to non-convergence, the same is true for emotional engagement correlated with intrinsic value. Thus, separate cross-lagged models were also run using emotional disaffection as its own factor, emotional cost as its own factor, emotional engagement as its own factor and intrinsic value as its own factor.

Differential item functioning across categorical variables. All of the measures with Likert scales of five or less categories exhibited differential item functioning (DIF), or lack of measurement invariance across the two time points. As a reminder, I conducted post hoc analyses in order to determine whether the DIF was specifically in the slope parameters or just in the thresholds. Thus, I will discuss DIF in terms of whether it was found to be significant in the slopes, in the thresholds, or both.

On the behavioral disaffection subscale, items four and five demonstrated DIF in the slopes and the thresholds. The larger slope values for time one on item four (a_{T1} = 4.91, SE= 0.13; a_{T2} = 3.36, SE = 0.35) and item five (a_{T1} = 4.86, SE= 0.63; a_{T2} = 3.21, SE = 0.31) indicates these two items are more discriminating at time one than time two, i.e., a one-unit increase in behavioral disaffection level is associated with a greater increase in the probability of a student endorsing a given response category during time one than in time two. For the emotional disaffection subscale, items two, three, and four demonstrated DIF. However, items two and three had DIF only in the thresholds, whereas item four had DIF in the slope and thresholds (see Table S3 in the supplemental materials).

The behavioral engagement subscale demonstrated DIF in every item except for item two. All items with DIF differed significantly in their slopes between time one and time two. Item five did not differ significantly in the thresholds (see Table S3). The cognitive engagement subscale demonstrated DIF on items three, five, six, seven, and eight. Items three (a_{T1} = 1.30, SE= 0.16; a_{T2} = 1.07, SE = 0.13), five (a_{T1} = 1.79, SE= 0.18; a_{T2} = 1.74, SE = 0.16), and eight (a_{T1} = 2.03, SE= 0.20; a_{T2} = 1.97, SE = 0.18) significantly differed in their slopes across time one and time two. For the social engagement subscale, only item three demonstrated DIF (a_{T1} = 2.26, SE= 0.21; a_{T2} = 2.00, SE = 0.18) and the slopes were significantly different.

For the unidimensional model of emotional engagement and intrinsic value (EEIV), items four, six, nine, and ten from the emotional engagement subscale and items one, three, and four from the intrinsic value subscale demonstrated DIF. All of these items, except for item four from the emotional engagement subscale, demonstrated significant DIF in the slopes (see Supplemental Table 3). When I examined emotional engagement on its own and not combined with intrinsic value, additional items demonstrated DIF. In this instance, every item except for item 10 demonstrated DIF. Items one, three, and seven did not demonstrate significant DIF in their slopes, only in their thresholds. Items two, four, five, six, eight, and nine had significant DIF in their slopes (see Supplemental Table 3). For the intrinsic value subscale, only items three and four demonstrated DIF, and only item three demonstrated significant DIF in the slopes (a_{T1} = 6.14, SE= 0.71; a_{T2} = 4.92, SE = 0.45). For the attainment value subscale from the Value Facets Questionnaire (Gaspard et al., 2015), all four items demonstrated DIF. However, item one did not have significant DIF in the slopes (see Supplemental Table 3). Thus, for items demonstrating significant DIF in the slopes, their slopes were not constrained to be equal across time one and time two and instead were freed during the cross-lagged models.

Measurement invariance across continuous variables. I used M*plus* v.8.4 (Muthén & Muthén, 2012-2019) in order to test for measurement invariance among the continuous variables (i.e., any item with a Likert scale greater than five options). The continuous variables included in these analyses were competence-related beliefs, loss of valued alternatives, task effort cost, outside effort cost, emotional cost, and agentic engagement. Utility value, utility value for future life, and the single attainment item from the Children's Ability Beliefs and Subjective Task Values Scale (Eccles & Wigfield, 1995) were not included because these subscales had two or less items and thus measurement invariance cannot be properly checked. Therefore, these items were constrained to be equal across both time point one and time point two.

I calculated whether configural invariance (factor loadings and intercepts freed across groups), weak factor invariance (factor loadings equal across groups) and strong factor invariance (loadings and intercepts equal across groups) was reasonable across the two time points (Meredith, 1993; Widaman & Reise, 1997). I also followed Chen (2012) and Cheung and Rensvold's (2005) recommendations regarding model fit: an increase in the model fit of the more restrictive model of around .01 for the CFI, around .015 for the

RMSEA, and an increase in the SRMR of around .030 indicates support for the more constrained model across the variables. I also followed Byrne (1989) and examined the individual fit indices. Competence-related beliefs, loss of valued alternatives, task effort cost, outside effort cost, and emotional cost all had CFIs at or above .95 for the more constrained model, suggesting a good fit (Schreiber, Stage, King, Nora, & Barlow, 2006). Agentic engagement had a CFI of .928 for the more constrained model, but the RMSEA (0.67) was within range of a good fitting model (Hooper, Coughlan, & Mullen, 2008) and was lower than the less constrained models. Thus, I determined that these measures were invariant across time and items from these scales were constrained to be equal across the two time points (see Supplemental Tables 5-9 for model fit information).

I now turn to the cross-lagged analyses. As a reminder, there were five weeks in between the end of time point one and the beginning of time point two. I discuss the synchronous correlations, the autoregressive correlations, and the cross-lagged correlations in each model. The cross-lagged correlations are the ones most relevant to Hypothesis 3, so I put them in **bold.**

Competence-related beliefs and dimensions of engagement. With regard to students' competence-related beliefs and dimensions of engagement, the cross-lagged analyses indicated several significant effects (see Figure 6). Competence-related beliefs and behavioral disaffection were significantly negatively correlated at time one (r = -.115, p = .017), but were not significantly correlated at time two (r = .086, p = .421). **Competence-related beliefs at time one significantly negatively predicted behavioral disaffection at time two (*$\boldsymbol{\widehat{\beta} = -.115, p = .017}$). However, behavioral disaffection at time one did not predict competence-related beliefs at time two (*$\boldsymbol{\widehat{\beta} = -.084, p =}$**

$\mathbf{.164}$**).** Competence-related beliefs at time one did significantly predict competence-related beliefs at time two (*$\hat{\beta} = .666,\ p < .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two (*$\hat{\beta} = .654,\ p < .001$).

Competence-related beliefs and behavioral engagement were significantly positively correlated at time one (*r* = .267, *p* = .017), but were not significantly correlated at time two (*r* = .179, *p* = .257). **Competence-related beliefs at time one did not predict behavioral engagement at time two (***$\hat{\boldsymbol{\beta}} =\mathbf{.079},\ \boldsymbol{p} = \mathbf{.149}$**). However, behavioral engagement at time one did predict competence-related beliefs at time two (***$\hat{\boldsymbol{\beta}} =\mathbf{.150}, \boldsymbol{p} = \mathbf{.044}$**).** Competence-related beliefs at time one did significantly predict competence-related beliefs at time two (*$\hat{\beta} = .625,\ p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two (*$\hat{\beta} = .783,\ p < .001$).

Competence-related beliefs and cognitive engagement were significantly positively correlated at time one (*r* = .406, $p < .001$) and significantly correlated at time two (*r* = .362, $p < .001$). **Competence-related beliefs at time one did not predict cognitive engagement at time two (***$\hat{\boldsymbol{\beta}} =\mathbf{.057},\ \boldsymbol{p} = \mathbf{.303}$**) and cognitive engagement at time one also did not predict competence-related beliefs at time two (***$\hat{\boldsymbol{\beta}} =\mathbf{.018},$ $\boldsymbol{p} = \mathbf{.787}$**).** Competence-related beliefs at time one did significantly predict competence-related beliefs at time two (*$\hat{\beta} = .672,\ p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two (*$\hat{\beta} = .650,\ p < .001$).

Competence-related beliefs and social engagement were not significantly correlated at time one (*r* = .010, *p* = .852) or at time two (*r* = .084, *p* = .520). **Competence-related beliefs at time one did not predict social engagement at time**

two ($*\hat{\boldsymbol{\beta}} = .071$, $\boldsymbol{p} = .101$) and social engagement at time one also did not predict competence-related beliefs at time two ($*\hat{\boldsymbol{\beta}} = .044$, $\boldsymbol{p} = .484$). Competence-related beliefs at time one did significantly predict competence-related beliefs at time two ($*\hat{\beta} = .679$, $p < .001$), and social engagement at time one did significantly predict social engagement at time two ($*\hat{\beta} = .677$, $p < .001$).

Competence-related beliefs and agentic engagement were significantly positively correlated at time one ($r = .146$, $p < .001$), but not significantly correlated at time two ($r = .095$, $p = .314$). **Competence-related beliefs at time one did significantly predict agentic engagement at time two ($*\hat{\boldsymbol{\beta}} = .086$, $\boldsymbol{p} = .034$), but agentic engagement at time one did not predict competence-related beliefs at time two ($*\hat{\boldsymbol{\beta}} = .097$, $\boldsymbol{p} = .072$).** Competence-related beliefs at time one did significantly predict competence-related beliefs at time two ($*\hat{\beta} = .662$, $p < .001$), and agentic engagement at time one did significantly predict agentic engagement at time two ($*\hat{\beta} = .541$, $p < .001$).

Competence-related beliefs and emotional engagement were significantly positively correlated at time one ($r = .581$, $p < .001$) and significantly correlated at time two ($r = .666$, $p < .001$). **Competence-related beliefs at time one did not significantly predict emotional engagement at time two ($*\hat{\boldsymbol{\beta}} = .076$, $\boldsymbol{p} = .158$) and emotional engagement at time one also did not predict competence-related beliefs at time two ($*\hat{\boldsymbol{\beta}} = -.046, \boldsymbol{p} = .531$).** Competence-related beliefs at time one did significantly predict competence-related beliefs at time two ($*\hat{\beta} = .706$, $p < .001$and emotional engagement at time one did significantly predict emotional engagement at time two ($*\hat{\beta} = .695$, $p < .001$

Competence-related beliefs and EEIV were significantly positively correlated at time one (r = .537, $p <$ .001) and significantly correlated at time two (r = .631, $p <$ .001)**. Competence-related beliefs at time one did not significantly predict EEIV at time two (*$\hat{\beta} = .013$, $p = .782$) and EEIV at time one also did not predict competence-related beliefs at time two (*$\hat{\beta} = -.032$, $p = .603$).** Competence-related beliefs at time one did significantly predict competence-related beliefs at time two (*$\hat{\beta} =$ .698, $p <$ .001), and EEIV at time one did significantly predict EEIV at time two (*$\hat{\beta} =$ .631, $p <$ .001).

Competence-related beliefs and emotional disaffection were significantly negatively correlated at time one (r = -.618, $p <$ .001) and significantly negatively correlated at time two (r = -.654, $p <$ .001). **Competence-related beliefs at time one did significantly negatively predict emotional disaffection at time two (*$\hat{\beta} = -.137, p = .008$). However, emotional disaffection at time one did not predict competence-related beliefs at time two (*$\hat{\beta} = .040$, $p = .669$).** Competence-related beliefs at time one did significantly predict competence-related beliefs at time two (*$\hat{\beta} =$ .702, $p <$ .001), and emotional disaffection at time one did significantly predict emotional disaffection at time two (*$\hat{\beta} =$ .535, $p <$ .001

Competence-related beliefs and EDEC were significantly negatively correlated at time one (r = -.641, $p <$ .001and significantly negatively correlated at time two (r = -.660, $p <$ .001). **Competence-related beliefs at time one did significantly negatively predict EDEC at time two (*$\hat{\beta} = -.113$, $p = .017$). However, EDEC at time one did not predict competence-related beliefs at time two (*$\hat{\beta} = .079$, $p = .229$).** Competence-related beliefs at time one did significantly predict competence-related beliefs at time two ($^*\hat{\beta} = .732,\ p < .001$), and EDEC at time one did significantly predict EDEC at time two ($^*\hat{\beta} = .473,\ p < .001$).

Summary. Overall, competence-related beliefs at time one significantly predicted agentic engagement, behavioral disaffection, emotional disaffection, and EDEC at time two. Only behavioral engagement at time one significantly predicted competence-related beliefs at time two. In sum, the cross-lagged models explained between 46% - 47% of the variance of students' reported competence-related beliefs at time two and 31% - 65% of the variance of students' reported engagement at time two.

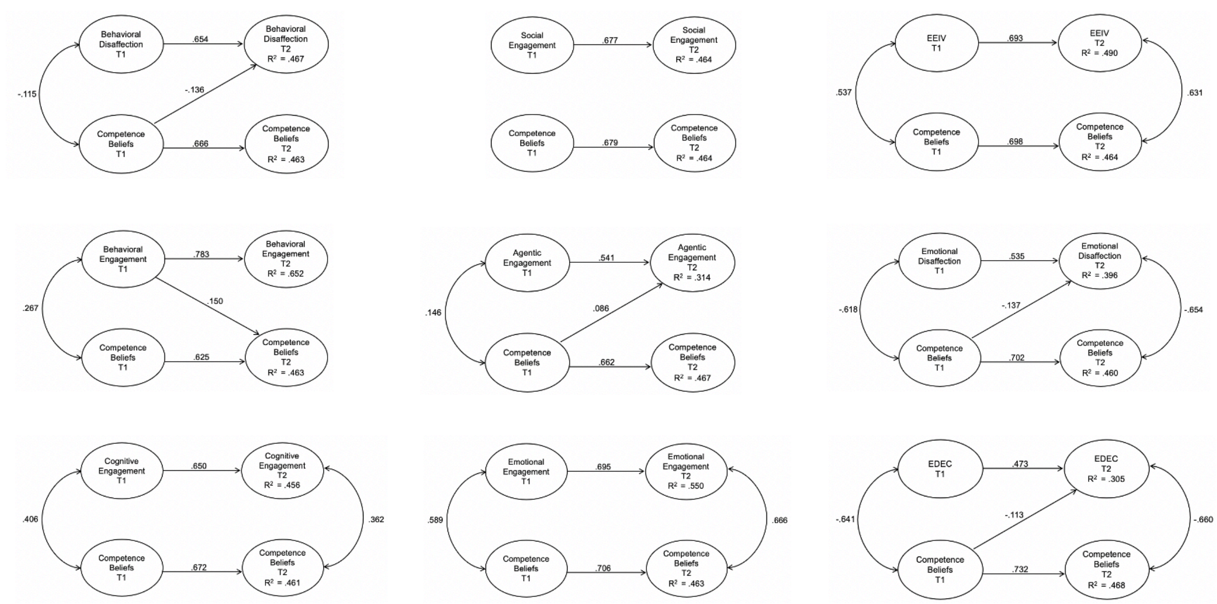


Figure 6. Cross-lagged structural equation models relating competence-related beliefs and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

Attainment value and dimensions of engagement. Figure 7 presents the cross-lagged results for attainment value and the engagement variables. Attainment value and behavioral disaffection were significantly negatively correlated at time one (r = -.318, p = .001) and significantly negatively correlated at time two (r = -.385, p = .001).

Attainment value at time one did significantly negatively predict behavioral disaffection at time two (*$\hat{\boldsymbol{\beta}} = -.201,\ p = .003$). However, behavioral disaffection at time one did not predict attainment value at time two (*$\hat{\boldsymbol{\beta}} = -.099,\ p = .053$). Attainment value at time one did significantly predict attainment value at time two (*$\hat{\beta} = .546,\ p < .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two (*$\hat{\beta} = .650,\ p < .001$).

Attainment value and behavioral engagement were significantly positively correlated at time one ($r = .597,\ p < .001$) and significantly correlated at time two ($r = .710,\ p < .001$). **Attainment value at time one did not predict behavioral engagement at time two (*$\hat{\boldsymbol{\beta}} = .070,\ p = .248$). However, behavioral engagement at time one did predict attainment value at time two (*$\hat{\boldsymbol{\beta}} = .173,\ p = .003$).** Attainment value at time one did significantly predict attainment value at time two (*$\hat{\beta} = .475,\ p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two (*$\hat{\beta} = .748,\ p < .001$).

Attainment value and cognitive engagement were significantly positively correlated at time one ($r = .561,\ p < .001$) and significantly correlated at time two ($r = .729,\ p < .001$). **Attainment value at time one did not predict cognitive engagement at time two (*$\hat{\boldsymbol{\beta}} = .082,\ p = .255$). However, cognitive engagement at time one also did significantly predict attainment value at time two (*$\hat{\boldsymbol{\beta}} = .122,\ p = .029$).** Attainment value at time one did significantly predict attainment value at time two (*$\hat{\beta} = .507,\ p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two (*$\hat{\beta} = .624,\ p < .001$).

Attainment value and social engagement were significantly correlated at time one (r = .268, $p <$ .001) and at time two (r = .475, $p <$ .001). **Attainment value at time one did not significantly predict social engagement at time two (*$\hat{\beta} = -.013$, $p = .801$) and social engagement at time one also did not significantly predict attainment value at time two (*$\hat{\beta} = .086$, $p = .104$).** Attainment value at time one did significantly predict attainment value at time two (*$\hat{\beta} = .555$, $p <$ .001), and social engagement at time one did significantly predict social engagement at time two (*$\hat{\beta} =$ .681, $p <$ .001).

Attainment value and agentic engagement were not significantly positively correlated at time one (r = .040, p = .474) or at time two (r = .144, p = .208). **Attainment value at time one did not significantly predict agentic engagement at time two (*$\hat{\beta} = -.042$, $p = .423$), nor was the reverse true, (*$\hat{\beta} = .002$, $p = .965$).** Attainment value at time one did significantly predict attainment value at time two (*$\hat{\beta} = .554$, $p <$ .001), and agentic engagement at time one did significantly predict agentic engagement at time two (*$\hat{\beta} = .556$, $p <$ .001).

Attainment value and emotional engagement were significantly positively correlated at time one (r = .242, $p <$ .001) and significantly correlated at time two (r = .532, $p <$ .001). **Attainment value at time one did not significantly predict emotional engagement at time two (*$\hat{\beta} = .026$, $p = .593$) and emotional engagement at time one also did not predict attainment value at time two (*$\hat{\beta} = .090$, $p = .065$).** Attainment value at time one did significantly predict attainment value at time two (*$\hat{\beta} = .547$, $p <$ .001), and emotional engagement at time one did significantly predict emotional engagement at time two (*$\hat{\beta} = .756$, $p <$ .001).

Attainment value and EEIV were significantly positively correlated at time one (*r* = .263, $p < .001$) and significantly correlated at time two (*r* = .748, $p < .001$). **Attainment value at time one significantly negatively predicted EEIV at time two (*$\hat{\beta} = -.116$, $p = .015$). EEIV at time one did not significantly predict attainment value at time two (*$\hat{\beta} = .067$, $p = .129$).** Attainment value at time one did significantly predict attainment value at time two (*$\hat{\beta} = .585$, $p < .001$), and EEIV at time one did significantly predict EEIV at time two (*$\hat{\beta} = .719$, $p < .001$).

Attainment value and emotional disaffection were significantly negatively correlated at time one (*r* = -.137, *p* = .004) and significantly negatively correlated at time two (*r* = -.298, *p* = .002). **Attainment value at time one did not significantly negatively predict emotional disaffection at time two (*$\hat{\beta} = .000$, $p = .996$). Emotional disaffection at time one also did not significantly predict attainment value at time two (*$\hat{\beta} = -.084$, $p = .135$).** Attainment value at time one did significantly predict attainment value at time two (*$\hat{\beta} = .545$, $p < .001$), and emotional disaffection at time one did significantly predict emotional disaffection at time two (*$\hat{\beta} = .727$, $p < .001$).

Attainment value and EDEC were not significantly correlated at time one (*r* = -.010, *p* = .859) or at time two (*r* = -.207, *p* = .083). **Attainment value at time one did not significantly predict EDEC at time two (*$\hat{\beta} = .008$, $p = .826$). EDEC at time one also did not predict attainment value at time two (*$\hat{\beta} = -.056$, $p = .273$).** Attainment value at time one did significantly predict attainment value at time two (*$\hat{\beta} = .546$, $p < .001$), and EDEC at time one did significantly predict EDEC at time two (*$\hat{\beta} = .546$, $p < .001$).

Summary. Overall, attainment value at time one significantly predicted behavioral disaffection and EEIV at time two and behavioral engagement at time one significantly predicted attainment value at time two. The cross-lagged models explained between 30% - 37% of the variance of students' reported attainment value at time two and 30% - 63% of the variance of students' reported engagement at time two. Thus, there was some support for reciprocal relationships among attainment value and the engagement dimensions.

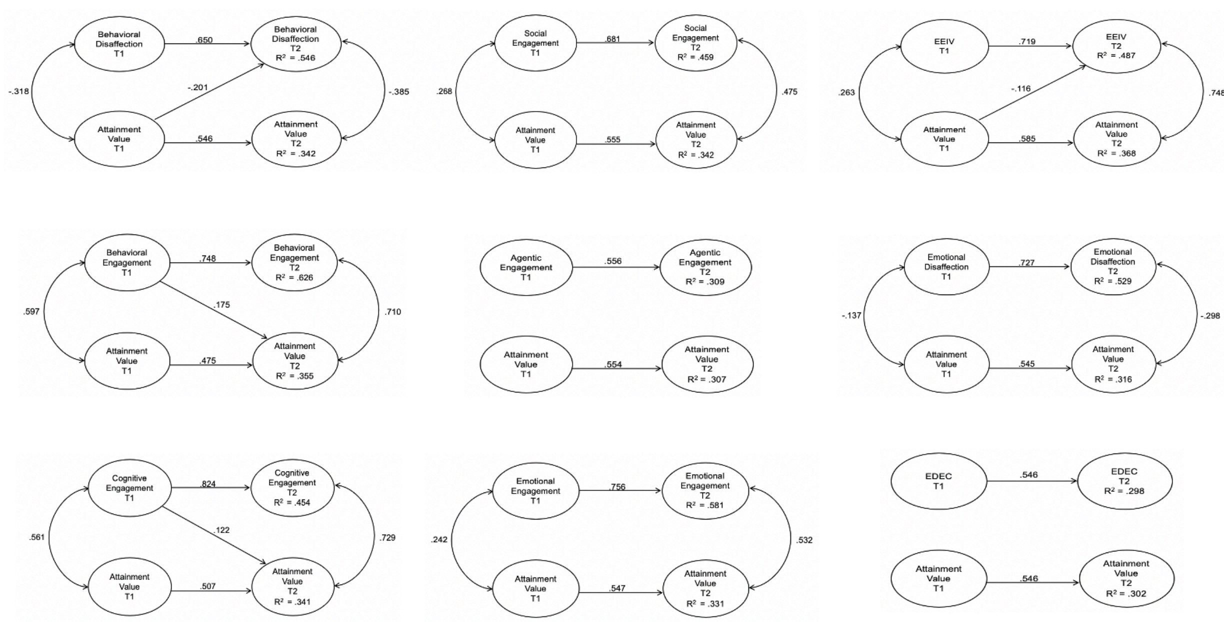


Figure 7. Cross-lagged structural equation models relating attainment value and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

Utility value and dimensions of engagement. With regard to students' utility value and dimensions of engagement, the cross-lagged analyses indicated several significant effects (see Figure 8). Utility value and behavioral disaffection were significantly negatively correlated at time one (r = -.246, p = .001), but were not correlated at time two (r = -.091, p = .206). **Utility value at time one did significantly**

negatively predict behavioral disaffection at time two (*$\hat{\boldsymbol{\beta}} = -.169$, $\boldsymbol{p} < .001$). Behavioral disaffection at time one also significantly negatively predict utility value at time two (*$\hat{\boldsymbol{\beta}} = -.161$, $\boldsymbol{p} = .022$). Utility value at time one did significantly predict utility value at time two (*$\hat{\beta} = .538$, $p < .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two (*$\hat{\beta} = .635$, $p < .001$).

Utility value and behavioral engagement were significantly positively correlated at time one (r = .367, $p < .001$), but were not correlated at time two (r = .157, p = .188**). Utility value at time one did significantly predict behavioral engagement at time two (*$\hat{\boldsymbol{\beta}} = .104$, $\boldsymbol{p} = .013$). However, behavioral engagement at time one did not predict utility value at time two (*$\hat{\boldsymbol{\beta}} = .130$, $\boldsymbol{p} = .147$).** Utility value at time one did significantly predict utility value at time two (*$\hat{\beta} = .565$, $p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two (*$\hat{\beta} = .773$, $p < .001$).

Utility value and cognitive engagement were significantly positively correlated at time one (r = .375, $p < .001$) and significantly correlated at time two (r = .242, p = .012**). Utility value at time one did significantly predict cognitive engagement at time two (*$\hat{\boldsymbol{\beta}} = .139$, $\boldsymbol{p} = .005$). However, cognitive engagement at time one did not significantly predict utility value at time two (*$\hat{\boldsymbol{\beta}} = -.041$, $\boldsymbol{p} = .647$).** Utility value at time one did significantly predict utility value at time two (*$\hat{\beta} = .653$, $p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two (*$\hat{\beta} = .613$, $p < .001$).

Utility value and social engagement were not correlated at time one (r = .011, p = .662) or at time two (r = .017, p = .666). **Utility value at time one did significantly predict social engagement at time two (*$\hat{\beta} = .071$, $p = .033$). Social engagement at time one did not significantly predict utility value at time two (*$\hat{\beta} = -.007$, $p = .864$).** Utility value at time one did significantly predict utility value at time two (*$\hat{\beta}$ = .063, $p =$ .037), and social engagement at time one did significantly predict social engagement at time two (*$\hat{\beta}$ = .678, $p <$ .001).

Utility value and agentic engagement were significantly positively correlated at time one (r = .225, $p <$ .001) and at time two (r = .319, $p <$ .001). **Utility value at time one did not significantly predict agentic engagement at time two (*$\hat{\beta} = -.024$, $p = .583$). Agentic engagement at time one also did not significantly predict utility value at time two (*$\hat{\beta} = .054$, $p = .275$).** Utility value at time one did significantly predict utility value at time two (*$\hat{\beta}$ = .593, $p <$ .001), and agentic engagement at time one did significantly predict agentic engagement at time two (*$\hat{\beta}$ = .561, $p <$ .001.

Utility value and emotional engagement were significantly positively correlated at time one (r = .510, $p <$ .001) and significantly correlated at time two (r = .374, $p <$ .001). **Utility value at time one did not significantly predict emotional engagement at time two (*$\hat{\beta} = .038$, $p = .410$). Emotional engagement at time one did significantly predict utility value at time two (*$\hat{\beta} = .185$, $p = .012$).** Utility value at time one did significantly predict utility value at time two (*$\hat{\beta}$ = .542, $p <$ .001), and emotional engagement at time one did significantly predict emotional engagement at time two (*$\hat{\beta}$ = .885, $p <$ .001

Utility value and EEIV were significantly positively correlated at time one (*r* = .567, $p <$ .001) and significantly correlated at time two (*r* = .477, $p <$ .001). **Utility value at time one did not predict EEIV at time two (*$\hat{\beta} = .070$, $p = .105$). EEIV at time one also did not significantly predict utility value at time two (*$\hat{\beta} = .098$, $p = .222$).** Utility value at time one did significantly predict utility value at time two (*$\hat{\beta}$ = .606, $p <$ .001), and EEIV at time one did significantly predict EEIV at time two (*$\hat{\beta}$ = .669, $p <$ .001).

Utility value and emotional disaffection were significantly negatively correlated at time one (*r* = -.337, $p <$ .001) and significantly negatively correlated at time two (*r* = -.231, *p* = .013). **Utility value at time one did not significantly predict emotional disaffection at time two (*$\hat{\beta} = .002$, $p = .966$). Emotional disaffection at time one also did not significantly predict utility value at time two (*$\hat{\beta} = -.121$, $p = .108$).** Utility value at time one did significantly predict utility value at time two (*$\hat{\beta}$ = .583, $p <$ .001), and emotional disaffection at time one did significantly predict emotional disaffection at time two (*$\hat{\beta}$ = .731, $p <$ .001.

Utility value and EDEC were significantly negatively correlated at time one (*r* = -.280, $p <$ .001), but not at time two (*r* = -.126, *p* = .111**). Utility value at time one did not significantly predict EDEC at time two (*$\hat{\beta} = -.034$, $p = .289$). EDEC at time one also did not predict utility value at time two (*$\hat{\beta} = -.034$, $p = .289$).** Utility value at time one did significantly predict utility value at time two (*$\hat{\beta}$ = .567, $p <$ .001), and EDEC at time one did significantly predict EDEC at time two (*$\hat{\beta}$ = .521, $p <$ .001).

Summary. Overall, utility value at time one significantly predicted behavioral disaffection, behavioral engagement, cognitive engagement, and social engagement at time two. Behavioral disaffection and emotional engagement at time one significantly predicted utility value at time two. In sum, the cross-lagged models explained between 0.4% - 44% of the variance of students' reported utility value at time two and 28% - 82% of the variance of students' reported engagement at time two.

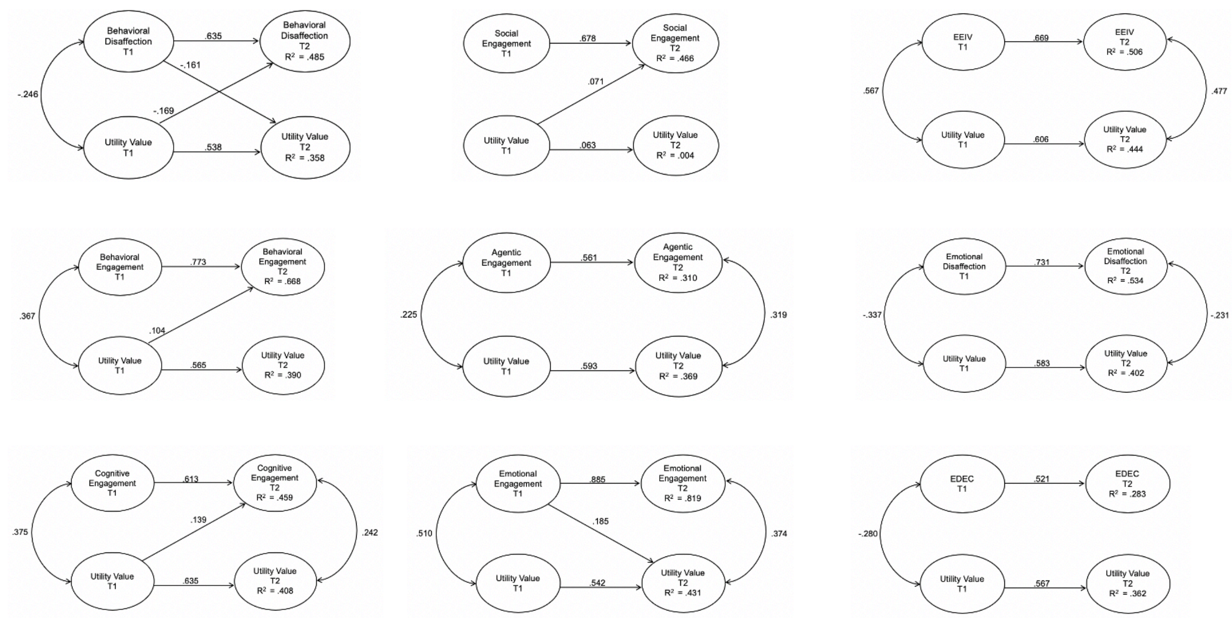


Figure 8. Cross-lagged structural equation models relating utility value and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

Utility value for future life and dimensions of engagement. Figure 9 presents the cross-lagged results for utility value for future life and the engagement variables. Utility value for future life and behavioral disaffection were significantly negatively correlated at time one (*r* = -.243, $p < .001$) and at time two (*r* = -.206, *p* = .019). **Utility value for future life at time one did not significantly predict behavioral disaffection at time two (*$\hat{\beta} = -.043,\ p = .431$). Behavioral disaffection at time one did**

significantly negatively predict utility value for future life at time two (*$\boldsymbol{\hat{\beta} = -.150}$, $\boldsymbol{p = .001}$). Utility value for future life at time one did significantly predict utility value for future life at time two (*$\hat{\beta} = .392$, $p < .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two (*$\hat{\beta} = .665$, $p < .001$).

Utility value for future life and behavioral engagement were significantly positively correlated at time one (r = .293, $p < .001$) and at time two (r = .287, p = .045). **Utility value for future life at time one did not significantly predict behavioral engagement at time two (*$\boldsymbol{\hat{\beta} = .075}$, $\boldsymbol{p = .125}$). However, behavioral engagement at time one did significantly predict utility value for future life at time two (*$\boldsymbol{\hat{\beta} = .157}$, $\boldsymbol{p = .002}$).** Utility value for future life at time one did significantly predict utility value for future life at time two (*$\hat{\beta} = .384$, $p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two (*$\hat{\beta} = .787$, $p < .001$).

Utility value for future life and cognitive engagement were significantly positively correlated at time one (r = .299, $p < .001$) and significantly correlated at time two (r = .352, $p < .001$). **Utility value for future life at time one did not significantly predict cognitive engagement at time two (*$\boldsymbol{\hat{\beta} = .086}$, $\boldsymbol{p = .147}$). However, cognitive engagement at time one did significantly predict utility value for future life at time two (*$\boldsymbol{\hat{\beta} = .086}$, $\boldsymbol{p = .043}$).** Utility value for future life at time one did significantly predict utility value at time two (*$\hat{\beta} = .412$, $p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two (*$\hat{\beta} = .646$, $p < .001$).

Utility value for future life and social engagement were significantly positively correlated at time one (r = .126, p = .009), but not at time two (r = .169, p = .124). **Utility value for future life at time one did significantly predict social engagement at time two (*$\hat{\beta} = .106$, $p = .023$). Social engagement at time one also significantly predicted utility value for future life at time two (*$\hat{\beta} = .102$, $p = .020$).** Utility value for future life at time one did significantly predict utility value for future life at time two (*$\hat{\beta} = .422$, $p < .001$), and social engagement at time one did significantly predict social engagement at time two (*$\hat{\beta} = .667$, $p < .001$).

Utility value for future life and agentic engagement were significantly positively correlated at time one (r = .245, $p < .001$) and at time two (r = .239, $p < .001$). **Utility value for future life at time one did not significantly predict agentic engagement at time two (*$\hat{\beta} = .011$, $p = .843$). Agentic engagement at time one also did not significantly predict utility value for future life at time two (*$\hat{\beta} = .065$, $p = .086$).** Utility value for future life at time one did significantly predict utility value for future life at time two (*$\hat{\beta} = .435$, $p < .001$), and agentic engagement at time one did significantly predict agentic engagement at time two (*$\hat{\beta} = .569$, $p < .001$).

Utility value for future life and emotional engagement were significantly positively correlated at time one (r = .476, $p < .001$) and significantly correlated at time two (r = .475, $p < .001$). **Utility value for future life at time one did not significantly predict emotional engagement at time two (*$\hat{\beta} = .007$, $p = .888$). Emotional engagement at time one did significantly predict utility value for future life at time two (*$\hat{\beta} = .746$, $p < .001$).** Utility value for future life at time one did significantly predict utility value for future life at time two (*$\hat{\beta} = .363$, $p < .001$), and emotional engagement at time one did significantly predict emotional engagement at time two ($*\hat{\beta} = .746,\ p < .001$).

Utility value for future life and EEIV were significantly positively correlated at time one (r = .547, $p < .001$) and significantly correlated at time two (r = .661, $p < .001$). **Utility value for future life at time one did not predict EEIV at time two ($*\hat{\beta} = -.050,\ p = .385$). EEIV at time one did significantly predict utility value for future life at time two ($*\hat{\beta} = .171,\ p < .001$).** Utility value for future life at time one did significantly predict utility value for future life at time two ($*\hat{\beta} = .334,\ p < .001$), and EEIV at time one did significantly predict EEIV at time two ($*\hat{\beta} = .713,\ p < .001$).

Utility value for future life and emotional disaffection were significantly negatively correlated at time one (r = -.320, $p < .001$) and significantly negatively correlated at time two (r = -.241, p = .003). **Utility value for future life at time one did significantly predict emotional disaffection at time two ($*\hat{\beta} = .118,\ p = .023$). Emotional disaffection at time one also significantly predicted utility value at time two ($*\hat{\beta} = -.187,\ p < .001$).** Utility value for future life at time one did significantly predict utility value for future life at time two ($*\hat{\beta} = .354,\ p < .001$), and emotional disaffection at time one did significantly predict emotional disaffection at time two ($*\hat{\beta} = .758,\ p < .001$).

Utility value for future life and EDEC were significantly negatively correlated at time one (r = -.301, $p < .001$) and at time two (r = -.209, p = .018). **Utility value for future life at time one did not significantly predict EDEC at time two ($*\hat{\beta} = .042$, $p = .281$). EDEC at time one did significantly predict utility value for future life at**

time two (*$\hat{\boldsymbol{\beta}} = -.155,\ \boldsymbol{p} = .001$). Utility value for future life at time one did significantly predict utility value for future life at time two (*$\hat{\beta} = .380,\ p < .001$), and EDEC at time one did significantly predict EDEC at time two (*$\hat{\beta} = .569,\ p < .001$).

Summary. Overall, students' utility for future at time at one significantly predicted emotional disaffection and social engagement at time two. However, behavioral disaffection, behavioral engagement, cognitive engagement, emotional disaffection, EDEC, emotional engagement, EEIV, and social engagement at time one were significant predictors of utility for future life at time two. Thus, it appears that engagement dimensions may need to be developed first in order for students to see the utility of their math or science class for their future. In sum, the cross-lagged models explained between 20% - 21% of the variance of students' reported utility value for future life at time two and 31% - 66% of the variance of students' reported engagement at time two.

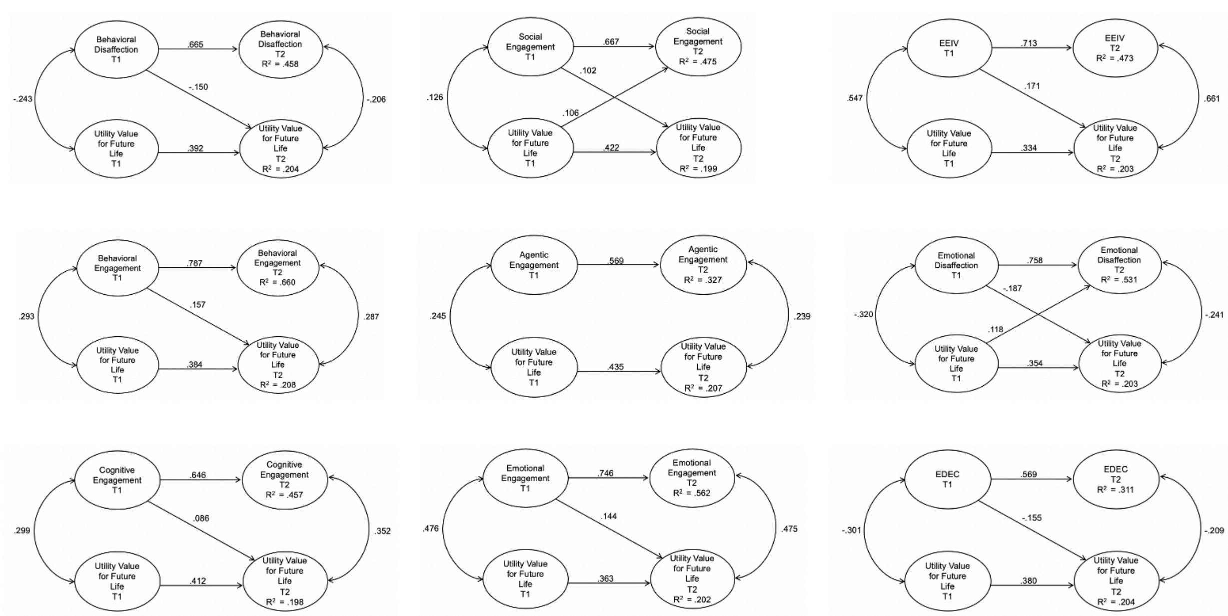


Figure 9. Cross-lagged structural equation models relating utility value for future life and engagement dimensions across Time 1 and Time 2. For clarity reasons only

statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

Intrinsic value and dimensions of engagement. With regard to students' intrinsic value and dimensions of engagement, the cross-lagged analyses indicated several significant effects (see Figure 10). Intrinsic value and behavioral disaffection were significantly negatively correlated at time one ($r = -.376$, $p < .001$), but were not significantly correlated at time two ($r = -.182$, $p = .158$). **Intrinsic value at time one did significantly negatively predict behavioral disaffection at time two (*$\hat{\beta} = -.194$, $p < .001$). Behavioral disaffection at time one also significantly negatively predict intrinsic value at time two (*$\hat{\beta} = -.134$, $p = .034$).** Intrinsic value at time one did significantly predict intrinsic value at time two (*$\hat{\beta} = .784$, $p < .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two (*$\hat{\beta} = .611$, $p < .001$).

Intrinsic value and behavioral engagement were significantly positively correlated at time one ($r = .457$, $p < .001$) and correlated at time two ($r = .423$, $p = .002$). **Intrinsic value at time one did not significantly predict behavioral engagement at time two (*$\hat{\beta} = .087$, $p = .140$). Behavioral engagement at time one also did not predict intrinsic value at time two (*$\hat{\beta} = .088$, $p = .192$).** Intrinsic value at time one did significantly predict intrinsic value at time two (*$\hat{\beta} = .791$, $p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two (*$\hat{\beta} = .780$, $p < .001$).

Intrinsic value and cognitive engagement were significantly positively correlated at time one ($r = .443$, $p < .001$) and significantly correlated at time two ($r = .547$, $p <$

.001). **Intrinsic value at time one did not significantly predict cognitive engagement at time two (*$\hat{\beta} = .113$, $p = .058$). Cognitive engagement at time one also did not significantly predict intrinsic value at time two (*$\hat{\beta} = -.048$, $p = .442$).** Intrinsic value at time one did significantly predict intrinsic value at time two (*$\hat{\beta} = .855$, $p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two (*$\hat{\beta} = .612$, $p < .001$).

Intrinsic value and social engagement were significantly positively correlated at time one ($r = .152$, $p = .004$) and at time two ($r = .413$, $p = .004$)**. Intrinsic value at time one did significantly predict social engagement at time two (*$\hat{\beta} = .119$, $p = .006$). Social engagement at time one did not significantly predict intrinsic value at time two (*$\hat{\beta} = .036$, $p = .570$).** Intrinsic value at time one did significantly predict intrinsic value at time two (*$\hat{\beta} = .819$, $p < .001$), and social engagement at time one did significantly predict social engagement at time two (*$\hat{\beta} = .663$, $p < .001$).

Intrinsic value and agentic engagement were significantly positively correlated at time one ($r = .284$, $p < .001$) and at time two ($r = .380$, $p < .001$). **Intrinsic value at time one did not significantly predict agentic engagement at time two (*$\hat{\beta} = .068$, $p = .125$). Agentic engagement at time one also did not significantly predict intrinsic value at time two (*$\hat{\beta} = .045$, $p = .347$).** Intrinsic value at time one did significantly predict intrinsic value at time two (*$\hat{\beta} = .791$, $p < .001$), and agentic engagement at time one did significantly predict agentic engagement at time two (*$\hat{\beta} = .541$, $p < .001$).

The model with intrinsic value and emotional engagement did not converge, likely due to the high degree of correlation between the two variables.

Intrinsic value and emotional disaffection were significantly negatively correlated at time one (r = -.777, $p < .001$) and significantly negatively correlated at time two (r = -.586, $p < .001$). **Intrinsic value at time one did not significantly predict emotional disaffection at time two ($*\hat{\beta} = -.029$, $p = .760$). Emotional disaffection at time one also did not significantly predict intrinsic value at time two ($*\hat{\beta} = .138$, $p = .308$).** Intrinsic value at time one did significantly predict intrinsic value at time two ($*\hat{\beta} = .947$, $p < .001$), and emotional disaffection at time one did significantly predict emotional disaffection at time two ($*\hat{\beta} = .674$, $p < .001$).

Intrinsic value and EDEC were significantly negatively correlated at time one (r = -.547, p < .001) and at time two (r = -.297, p < .001). **Intrinsic value at time one did not significantly predict EDEC at time two ($*\hat{\beta} = -.118$, $p = .242$). EDEC at time one also did not significantly predict intrinsic value at time two ($*\hat{\beta} = -.040$, $p = .544$).** Intrinsic value at time one did significantly predict intrinsic value at time two ($*\hat{\beta} = .802$, $p < .001$), and EDEC at time one did significantly predict EDEC at time two ($*\hat{\beta} = .560$, $p < .001$).

Summary. Overall, students' intrinsic value at time one significantly predicted behavioral disaffection and social engagement at time two and behavioral disaffection at time one also significantly predicted intrinsic value at time two. Thus, the relationship between behavioral disaffection and intrinsic value is reciprocal in that high intrinsic value at time one will predict lower behavioral disaffection at time two but high behavioral disaffection at time one will predict lower intrinsic value at time two. In sum, the cross-lagged models explained between 65% - 71% of the variance of students reported intrinsic value at time two and 32% - 68% of the variance of students' reported engagement at time two.

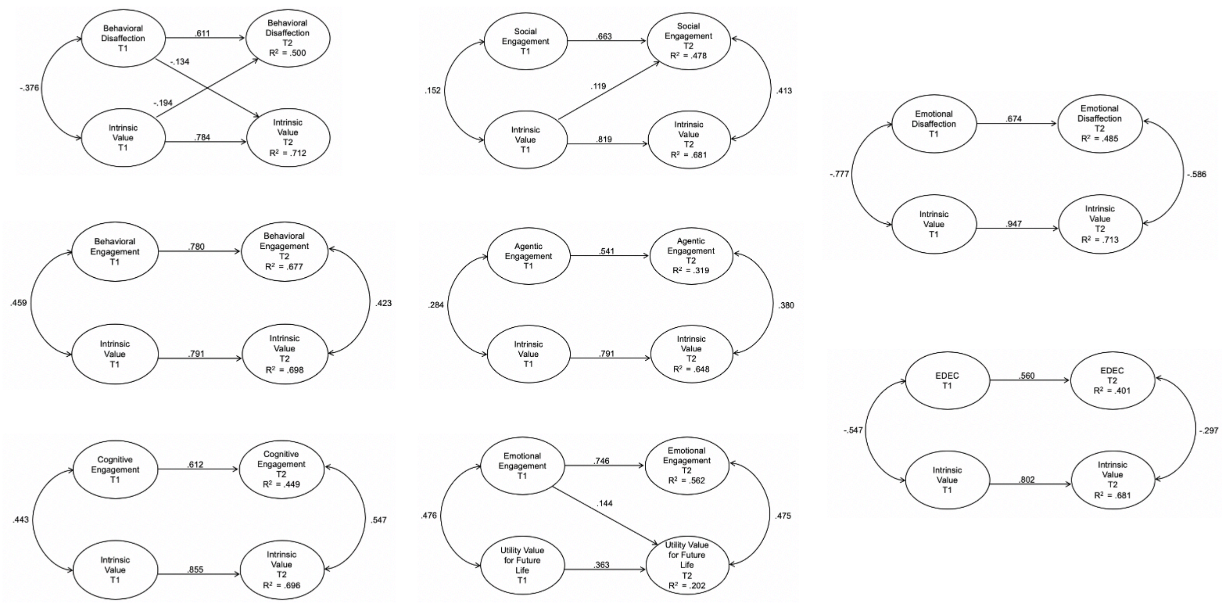


Figure 10. Cross-lagged structural equation models relating intrinsic value and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

EEIV and dimensions of engagement. Figure 11 presents the cross-lagged results for combination of emotional engagement and intrinsic value (EEIV) and dimensions of engagement. EEIV and behavioral disaffection were significantly negatively correlated at time one (r = -.410, p < .001) and at time two (r = -.380, p < .001). **EEIV at time one did significantly negatively predict behavioral disaffection at time two (*$\boldsymbol{\widehat{\beta} = -.170,\ p = .001}$). Behavioral disaffection at time one did not significantly negatively predict EEIV at time two (*$\boldsymbol{\widehat{\beta} = -.102, p\ = .063}$).** EEIV at time one did significantly predict EEIV at time two (*$\widehat{\beta} = .717,\ p <\ .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two (*$\widehat{\beta} = .555,\ p <\ .001$).

EEIV and behavioral engagement were significantly positively correlated at time one (r = .499, p < .001) and at time two (r = .787, p < .001). **EEIV at time one did not significantly predict behavioral engagement at time two (*$\hat{\boldsymbol{\beta}} = .005,\ \boldsymbol{p} = .938$). Behavioral engagement at time one also did not significantly predict EEIV at time two (*$\hat{\boldsymbol{\beta}} = .029,\ \boldsymbol{p} = .600$).** EEIV at time one did significantly predict EEIV at time two (*$\hat{\beta} = .740,\ p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two (*$\hat{\beta} = .822,\ p < .001$).

EEIV and cognitive engagement were significantly positively correlated at time one (r = .460, p < .001) and significantly correlated at time two (r = .787, p < .001**). EEIV at time one did significantly predict cognitive engagement at time two (*$\hat{\boldsymbol{\beta}} = .126,\ \boldsymbol{p} = .014$). Cognitive engagement at time one did not significantly predict EEIV at time two (*$\hat{\boldsymbol{\beta}} = -.143,\ \boldsymbol{p} = .080$).** EEIV at time one did significantly predict EEIV at time two (*$\hat{\beta} = .838,\ p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two (*$\hat{\beta} = .512,\ p < .001$).

EEIV and social engagement were not significantly correlated at time one (r = .095, p = .055), but were significantly positively correlated at time two (r = .638, p < .001). **EEIV at time one did significantly predict social engagement at time two (*$\hat{\boldsymbol{\beta}} = .093,\ \boldsymbol{p} = .015$). Social engagement at time one did not significantly predict EEIV at time two (*$\hat{\boldsymbol{\beta}} = -.035,\ \boldsymbol{p} = .588$).** EEIV at time one did significantly predict EEIV at time two (*$\hat{\beta} = .766,\ p < .001$), and social engagement at time one did significantly predict social engagement at time two (*$\hat{\beta} = .651,\ p < .001$).

EEIV and agentic engagement were significantly positively correlated at time one (r = .251, p < .001) and at time two (r = .479, p < .001). **EEIV at time one did not**

significantly predict agentic engagement at time two (*$\widehat{\boldsymbol{\beta}} = .009,\ \boldsymbol{p} = .851$). Agentic engagement at time one also did not significantly predict EEIV at time two (*$\widehat{\boldsymbol{\beta}} = .007,\ \boldsymbol{p} = .886$). EEIV at time one did significantly predict EEIV at time two (*$\widehat{\beta} = .705,\ p < .001$), and agentic engagement at time one did significantly predict agentic engagement at time two (*$\widehat{\beta} = .556,\ p < .001$).

EEIV and emotional disaffection were significantly negatively correlated at time one (r = -.854, p < .001) and significantly negatively correlated at time two (r = -.850, p < .001). **EEIV at time one did not significantly predict emotional disaffection at time two (*$\widehat{\boldsymbol{\beta}} = -.157,\ \boldsymbol{p} = .222$). Emotional disaffection at time one also did not significantly predict EEIV at time two (*$\widehat{\boldsymbol{\beta}} = .026,\ \boldsymbol{p} = .827$).** EEIV at time one did significantly predict EEIV at time two (*$\widehat{\beta} = .784,\ p < .001$), and emotional disaffection at time one did significantly predict emotional disaffection at time two (*$\widehat{\beta} = .612,\ p < .001$).

EEIV and EDEC were significantly negatively correlated at time one (r = -.587, p < .001) and at time two (r = -.473, p = .001). **EEIV at time one did significantly negatively predict EDEC at time two (*$\widehat{\boldsymbol{\beta}} = -.176,\ \boldsymbol{p} = .017$). EDEC at time one did not significantly predict EEIV at time two (*$\widehat{\boldsymbol{\beta}} = -.017,\ \boldsymbol{p} = .792$).** EEIV at time one did significantly predict EEIV at time two (*$\widehat{\beta} = .770,\ p < .001$), and EDEC at time one did significantly predict EDEC at time two (*$\widehat{\beta} = .513,\ p < .001$).

Summary. Overall, EEIV at time one significantly predicted behavioral disaffection, cognitive engagement, social engagement, and EDEC at time two. None of the engagement constructs at time one significantly predicted EEIV at time two, suggesting that EEIV must be developed first before engagement. In sum, the cross-lagged models explained between 48% - 61% of the variance of students reported combined emotional engagement and intrinsic value at time two and 31% - 68% of the variance of students' reported engagement at time two.

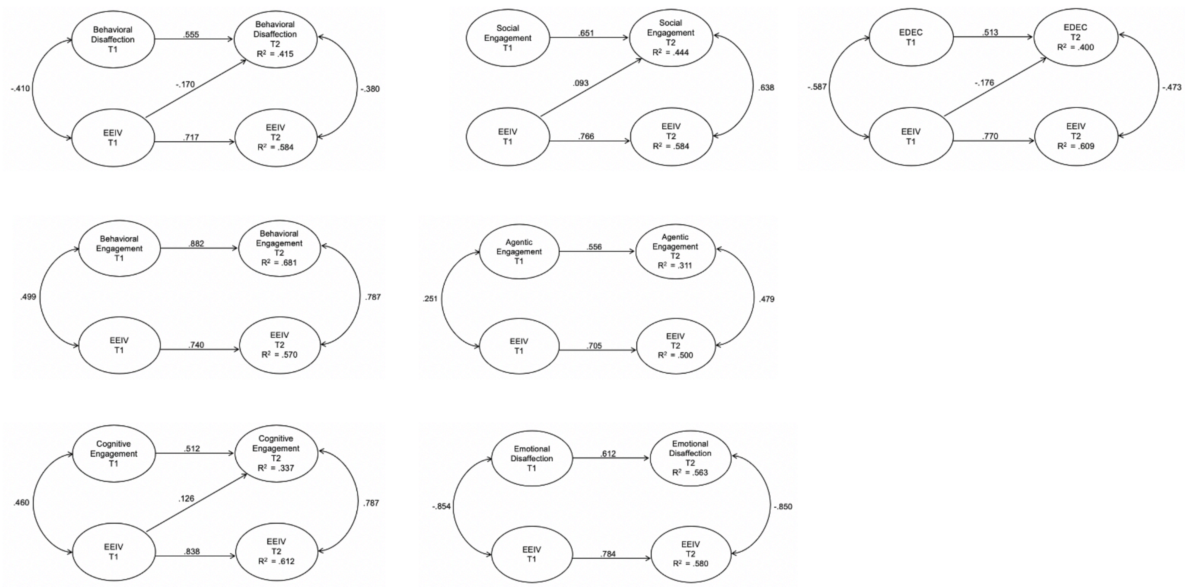


Figure 11. Cross-lagged structural equation models relating emotional engagement combined with intrinsic value and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

Task effort cost and dimensions of engagement. With regard to students' task effort cost and dimensions of engagement, the cross-lagged analyses indicated several significant effects (see Figure 12). Task effort cost and behavioral disaffection were significantly positively correlated at time one (r = .162, p < .001), but were not significantly correlated at time two (r = -.121, p = .202). **Task effort cost at time one did significantly positively predict behavioral disaffection at time two (*$\boldsymbol{\hat{\beta} = .116}$, $\boldsymbol{p = .015}$). Behavioral disaffection at time one did not significantly predict task effort cost at time two (*$\boldsymbol{\hat{\beta} = .093, p = .137}$).** Task effort cost at time one did significantly predict task effort cost at time two (*$\hat{\beta} = .592,\ p < .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two ($^*\hat{\beta} = .654,\ p < .001$).

Task effort cost and behavioral engagement were significantly negatively correlated at time one (r = -.221, p < .001), but were not significantly correlated at time two (r = .089, p = .538). **Task effort cost at time one did not significantly predict behavioral engagement at time two ($^*\hat{\boldsymbol{\beta}} = \mathbf{-.071},\ \boldsymbol{p} = \mathbf{.141}$). Behavioral engagement at time one did not predict task effort cost at time two ($^*\hat{\boldsymbol{\beta}} = \mathbf{-.061}$, $\boldsymbol{p} = \mathbf{.373}$).** Task effort cost at time one did significantly predict task effort cost at time two ($^*\hat{\beta} = .596,\ p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two ($^*\hat{\beta} = .797,\ p < .001$).

Task effort cost and cognitive engagement were significantly negatively correlated at time one (r = -.279, p < .001), but not significantly correlated at time two (r = -.104, p = .363). **Task effort cost at time one did not significantly predict cognitive engagement at time two ($^*\hat{\boldsymbol{\beta}} = \mathbf{-.092},\ \boldsymbol{p} = \mathbf{.074}$). Cognitive engagement at time one did not significantly predict task effort cost at time two ($^*\hat{\boldsymbol{\beta}} = \mathbf{-.033},\ \boldsymbol{p} = \mathbf{.647}$).** Task effort cost at time one did significantly predict task effort cost at time two ($^*\hat{\beta} = .603,\ p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two ($^*\hat{\beta} = .637,\ p < .001$).

Task effort cost and social engagement were not correlated at time one (r = -.012, p = .811) or at time two (r = -.185, p = .114). **Task effort cost at time one did significantly negatively predict social engagement at time two ($^*\hat{\boldsymbol{\beta}} = \mathbf{-.112},\ \boldsymbol{p} = \mathbf{.004}$). Social engagement at time one did not significantly predict task effort cost at time two ($^*\hat{\boldsymbol{\beta}} = \mathbf{.061},\ \boldsymbol{p} = \mathbf{.393}$).** Task effort cost at time one did significantly predict task effort cost at time two (*$\hat{\beta} = .612,\ p < .001$), and social engagement at time one did significantly predict social engagement at time two (*$\hat{\beta} = .677,\ p < .001$).

Task effort cost and agentic engagement were not significantly correlated at time one (r = -.073, p = .067) or at time two (r = -.002, p = .979)**. Task effort cost at time one did not significantly predict agentic engagement at time two (*$\hat{\boldsymbol{\beta}} = -.041,\ \boldsymbol{p} = .249$). Agentic engagement at time one also did not significantly predict task effort cost at time two (*$\hat{\boldsymbol{\beta}} = .043,\ \boldsymbol{p} = .574$).** Task effort cost at time one did significantly predict task effort cost at time two (*$\hat{\beta} = .615,\ p < .001$), and agentic engagement at time one did significantly predict agentic engagement at time two (*$\hat{\beta} = .553,\ p < .001$).

Task effort cost and emotional engagement were significantly negatively correlated at time one (r = -.606, p < .001) and significantly negatively correlated at time two (r = -.617, p < .001). **Task effort cost at time one did not significantly predict emotional engagement at time two (*$\hat{\boldsymbol{\beta}} = .014,\ \boldsymbol{p} = .813$). Emotional engagement at time one did not significantly predict task effort cost at time two (*$\hat{\boldsymbol{\beta}} = -.117,\ \boldsymbol{p} = .139$).** Task effort cost at time one did significantly predict task effort cost at time two (*$\hat{\beta} = .534,\ p < .001$), and emotional engagement at time one did significantly predict emotional engagement at time two (*$\hat{\beta} = .891,\ p < .001$).

Task effort cost and EEIV were significantly negatively correlated at time one (r = -.549, p < .001) and significantly negatively correlated at time two (r = -.427, p < .001)**. Task effort cost at time one did not predict EEIV at time two (*$\hat{\boldsymbol{\beta}} = -.031,\ \boldsymbol{p} = .531$). EEIV at time one also did not significantly predict task effort cost at time two (*$\hat{\boldsymbol{\beta}} = -.094,\ \boldsymbol{p} = .214$).** Task effort cost at time one did significantly predict task effort cost at time two ($^*\hat{\beta} = .554,\ p < .001$), and EEIV at time one did significantly predict EEIV at time two ($^*\hat{\beta} = .682,\ p < .001$).

Task effort cost and emotional disaffection were significantly positively correlated at time one (r = .555, p < .001) and significantly positively correlated at time two (r = .560, p < .001). **Task effort cost at time one did not significantly predict emotional disaffection at time two ($^*\hat{\boldsymbol{\beta}} = .048,\ \boldsymbol{p} = .427$). Emotional disaffection at time one did significantly predict task effort cost at time two ($^*\hat{\boldsymbol{\beta}} = .171,\ \boldsymbol{p} = .027$).** Task effort cost at time one did significantly predict task effort cost at time two ($^*\hat{\beta} = .504,\ p < .001$), and emotional disaffection at time one did significantly predict emotional disaffection at time two ($^*\hat{\beta} = .669,\ p < .001$).

Task effort cost and EDEC were significantly positively correlated at time one (r = .866, p < .001) and at time two (r = .950, p < .001). These high correlations suggest a multicollinearity issue and results should be interpreted with caution. **Task effort cost at time one did not significantly predict EDEC at time two ($^*\hat{\boldsymbol{\beta}} = -.029,\ \boldsymbol{p} = .788$). EDEC at time one also did not predict utility value at time two ($^*\hat{\boldsymbol{\beta}} = .067,\ \boldsymbol{p} = .598$).** Task effort cost at time one did significantly predict task effort cost at time two ($^*\hat{\beta} = .538,\ p < .001$), and EDEC at time one did significantly predict EDEC at time two ($^*\hat{\beta} = .604,\ p < .001$).

Summary. Overall, students' task effort cost at time one was a significant predictor of behavioral disaffection and social engagement at time two, and emotional disaffection at time one was a significant predictor of task effort cost at time two. Thus, if students enter the classroom feeling emotionally disengaged from the course, they are likely to experience increasing feelings of task effort cost across the semester. In sum, the cross-lagged models explained between 36% - 38% of the variance of students' reported task effort cost at time two and 31% - 61% of the variance of students' reported engagement at time two.

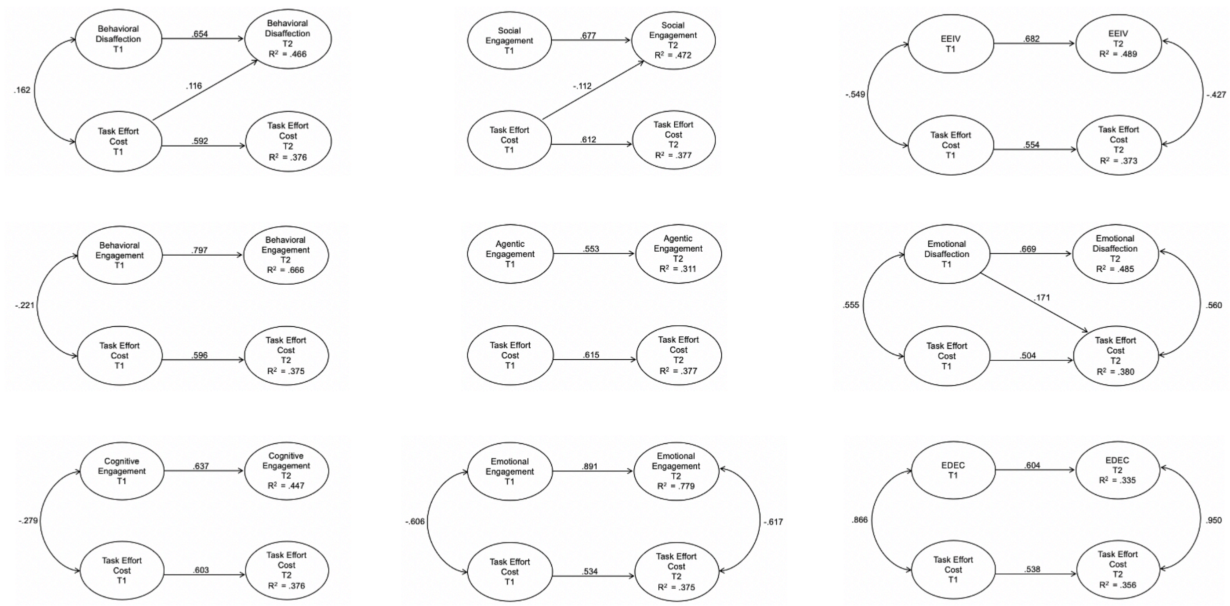


Figure 12. Cross-lagged structural equation models relating task effort cost and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

Outside effort cost and dimensions of engagement. Figure 13 presents the cross-lagged results for students perceived outside effort cost and dimensions of engagement. Outside effort cost and behavioral disaffection were significantly positively correlated at time one (r = .147, p < .001), but were not significantly correlated at time two (r = .006, p = .946). **Outside effort cost at time one did not significantly predict behavioral disaffection at time two (*$\boldsymbol{\hat{\beta} = .079}$, $\boldsymbol{p = .065}$). Behavioral disaffection at time one did not significantly predict outside effort cost at time two (*$\boldsymbol{\hat{\beta} = .097}$, $\boldsymbol{p = .264}$).** Outside effort cost at time one did significantly predict outside effort cost at time two (*$\hat{\beta} = .587,\ p < .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two (*$\hat{\beta} = .662,\ p < .001$).

Outside effort cost and behavioral engagement were significantly negatively correlated at time one (r = -.223, p < .001), but were not significantly correlated at time two (r = -.035, p = .787). **Outside effort cost at time one did not significantly predict behavioral engagement at time two (*$\boldsymbol{\hat{\beta} = -.050,\ p = .229}$). Behavioral engagement at time one did not significantly predict outside effort cost at time two (*$\boldsymbol{\hat{\beta} = -.145,\ p = .122}$).** Outside effort cost at time one did significantly predict outside effort cost at time two (*$\hat{\beta} = .565,\ p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two (*$\hat{\beta} = .802,\ p < .001$).

Outside effort cost and cognitive engagement were significantly negatively correlated at time one (r = -.238, p < .001) and significantly negatively correlated at time two (r = -.210, p = .039). **Outside effort cost at time one did not significantly predict cognitive engagement at time two (*$\boldsymbol{\hat{\beta} = -.047,\ p = .290}$). Cognitive engagement at time one did not significantly predict outside effort cost at time two (*$\boldsymbol{\hat{\beta} = -.110,\ p = .228}$).** Outside effort cost at time one did significantly predict outside effort cost at time two (*$\hat{\beta} = .576,\ p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two (*$\hat{\beta} = .656,\ p < .001$).

Outside effort cost and social engagement were not correlated at time one (r = -.027, p = .581) or at time two (r = -.072, p = .522). **Outside effort cost at time one did significantly negatively predict social engagement at time two (*$\boldsymbol{\hat{\beta} = -.110,\ p = .002}$). Social engagement at time one did not significantly predict outside effort**

cost at time two (*$\widehat{\boldsymbol{\beta}} = -.025$, $\boldsymbol{p} = .827$). Outside effort cost at time one did significantly predict outside effort cost at time two (*$\widehat{\beta} = .608$, $p < .001$), and social engagement at time one did significantly predict social engagement at time two (*$\widehat{\beta} = .672$, $p < .001$).

Outside effort cost and agentic engagement were not significantly correlated at time one (r = -.021, p = .603) or at time two (r = -.002, p = .976). **Outside effort cost at time one did not significantly predict agentic engagement at time two (*$\widehat{\boldsymbol{\beta}} = -.027$, $\boldsymbol{p} = .464$). Agentic engagement at time one also did not significantly predict outside effort cost at time two (*$\widehat{\boldsymbol{\beta}} = -.074$, $\boldsymbol{p} = .453$).** Outside effort cost at time one did significantly predict outside effort cost at time two (*$\widehat{\beta} = .606$, $p < .001$), and agentic engagement at time one did significantly predict agentic engagement at time two (*$\widehat{\beta} = .556$, $p < .001$).

Outside effort cost and emotional engagement were significantly negatively correlated at time one (r = -.449, p < .001) and significantly negatively correlated at time two (r = -.346, p = .001). **Outside effort cost at time one did not significantly predict emotional engagement at time two (*$\widehat{\boldsymbol{\beta}} = .029$, $\boldsymbol{p} = .502$). Emotional engagement at time one did significantly negatively predict outside effort cost at time two (*$\widehat{\boldsymbol{\beta}} = -.158$, $\boldsymbol{p} = .030$).** Outside effort cost at time one did significantly predict outside effort cost at time two (*$\widehat{\beta} = .524$, $p < .001$), and emotional engagement at time one did significantly predict emotional engagement at time two (*$\widehat{\beta} = .911$, $p < .001$).

Outside effort cost and EEIV were significantly negatively correlated at time one (r = -.410, p < .001) and significantly negatively correlated at time two (r = -.292, p < .001). **Outside effort cost at time one did not predict EEIV at time two (*$\widehat{\boldsymbol{\beta}} = .022$,**

$\boldsymbol{p = .584}$). **EEIV at time one also did not significantly predict outside effort cost at time two (*$\boldsymbol{\hat{\beta} = -.123,\ p = .068}$).** Outside effort cost at time one did significantly predict outside effort cost at time two (*$\hat{\beta} = .546,\ p < .001$), and EEIV at time one did significantly predict EEIV at time two (*$\hat{\beta} = .715,\ p < .001$).

Outside effort cost and emotional disaffection were significantly positively correlated at time one ($r = .436$, $p < .001$) and significantly positively correlated at time two ($r = .335$, $p < .001$). **Outside effort cost at time one did not significantly predict emotional disaffection at time two (*$\boldsymbol{\hat{\beta} = .017,\ p = .738}$). Emotional disaffection at time one did significantly predict outside effort cost at time two (*$\boldsymbol{\hat{\beta} = .215,\ p = .018}$).** Outside effort cost at time one did significantly predict outside effort cost at time two (*$\hat{\beta} = .497,\ p < .001$), and emotional disaffection at time one did significantly predict emotional disaffection at time two (*$\hat{\beta} = .691,\ p < .001$).

Outside effort cost and EDEC were significantly positively correlated at time one ($r = .658$, $p < .001$) and at time two ($r = .635$, $p < .001$). **Outside effort cost at time one did not significantly predict EDEC at time two (*$\boldsymbol{\hat{\beta} = .025,\ p = .648}$). EDEC at time one also did not predict utility value at time two (*$\boldsymbol{\hat{\beta} = .165,\ p = .149}$).** Outside effort cost at time one did significantly predict outside effort cost at time two (*$\hat{\beta} = .490,\ p < .001$), and EDEC at time one did significantly predict EDEC at time two (*$\hat{\beta} = .540,\ p < .001$).

Summary. Overall, outside effort cost at time one only significantly predicted social engagement at time two; however, emotional disaffection and emotional engagement at time one both significantly predicted outside effort cost at time two. In sum, the cross-lagged models explained between 37% - 39% of the variance of students reported outside effort cost at time two and 31% - 81% of the variance of students' reported engagement at time two.

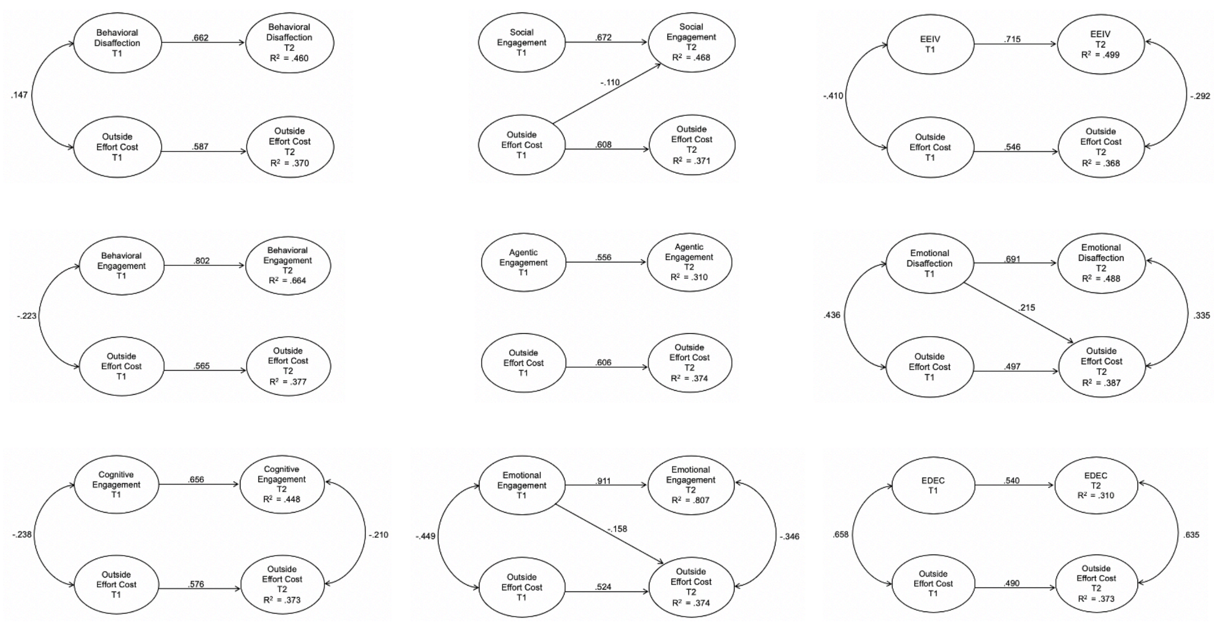


Figure 13. Cross-lagged structural equation models relating outside effort cost and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

Loss of valued alternatives and dimensions of engagement. With regard to students' loss of valued alternatives and dimensions of engagement, the cross-lagged analyses indicated several significant effects (see Figure 14). Loss of valued alternatives and behavioral disaffection were significantly positively correlated at time one (r = .117, p = .006), but were not significantly correlated at time two (r = -.035, p = .693). **Loss of valued alternatives at time one did not significantly predict behavioral disaffection at time two (*$\widehat{\beta} = .070,\ p = .148$). Behavioral disaffection at time one did not significantly predict loss of valued alternatives at time two (*$\widehat{\beta} = .113,\ p\ = .125$).** Loss of valued alternatives at time one did significantly predict loss of valued alternatives at time two ($*\hat{\beta} = .589,\ p < .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two ($*\hat{\beta} = .667,\ p < .001$).

Loss of valued alternatives and behavioral engagement were significantly negatively correlated at time one (r = -.222, p < .001), but were not significantly correlated at time two (r = -.050, p = .714). **Loss of valued alternatives at time one did not significantly predict behavioral engagement at time two ($*\hat{\boldsymbol{\beta}} = -.067,\ \boldsymbol{p} = .229$). Behavioral engagement at time one did not significantly predict loss of valued alternatives at time two ($*\hat{\boldsymbol{\beta}} = -.049,\ \boldsymbol{p} = .636$).** Loss of valued alternatives at time one did significantly predict loss of valued alternatives at time two ($*\hat{\beta} = .755,\ p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two ($*\hat{\beta} = .798,\ p < .001$).

Loss of valued alternatives and cognitive engagement were significantly negatively correlated at time one (r = -.246, p < .001) and significantly negatively correlated at time two (r = -.199, p = .046). **Loss of valued alternatives at time one did not significantly predict cognitive engagement at time two ($*\hat{\boldsymbol{\beta}} = -.072,\ \boldsymbol{p} = .160$). Cognitive engagement at time one did not significantly predict loss of valued alternatives at time two ($*\hat{\boldsymbol{\beta}} = -.023,\ \boldsymbol{p} = .781$).** Loss of valued alternatives at time one did significantly predict loss of valued alternatives at time two ($*\hat{\beta} = .610,\ p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two ($*\hat{\beta} = .643,\ p < .001$).

Loss of valued alternatives and social engagement were not correlated at time one (r = -.022, p = .671), but were significantly negatively correlated at time two (r = -.228, p = .034). **Loss of valued alternatives at time one did significantly negatively predict**

social engagement at time two (*$\hat{\boldsymbol{\beta}} = -.123$, $\boldsymbol{p} = .001$). Social engagement at time one did not significantly predict loss of valued alternatives at time two (*$\hat{\boldsymbol{\beta}} = .091$, $\boldsymbol{p} = .360$). Loss of valued alternatives at time one did significantly predict loss of valued alternatives at time two (*$\hat{\beta} = .615$, $p < .001$), and social engagement at time one did significantly predict social engagement at time two (*$\hat{\beta} = .673$, $p < .001$).

Loss of valued alternatives and agentic engagement were not significantly correlated at time one (r = -.005, p = .905) or at time two (r = .022, p = .793). **Loss of valued alternatives at time one did not significantly predict agentic engagement at time two (*$\hat{\boldsymbol{\beta}} = -.010$, $\boldsymbol{p} = .785$). Agentic engagement at time one also did not significantly predict loss of valued alternatives at time two (*$\hat{\boldsymbol{\beta}} = .010$, $\boldsymbol{p} = .916$).** Loss of valued alternatives at time one did significantly predict loss of valued alternatives at time two (*$\hat{\beta} = .616$, $p < .001$), and agentic engagement at time one did significantly predict agentic engagement at time two (*$\hat{\beta} = .556$, $p < .001$).

Loss of valued alternatives and emotional engagement were significantly negatively correlated at time one (r = -.448, p < .001) and significantly negatively correlated at time two (r = -.480, p = .001**). Loss of valued alternatives at time one did not significantly predict emotional engagement at time two (*$\hat{\boldsymbol{\beta}} = -.046$, $\boldsymbol{p} = .333$). Emotional engagement at time one did not significantly predict loss of valued alternatives at time two (*$\hat{\boldsymbol{\beta}} = -.049$, $\boldsymbol{p} = .585$).** Loss of valued alternatives at time one did significantly predict loss of valued alternatives at time two (*$\hat{\beta} = .587$, $p < .001$), and emotional engagement at time one did significantly predict emotional engagement at time two (*$\hat{\beta} = .726$, $p < .001$).

Loss of valued alternatives and EEIV were significantly negatively correlated at time one (r = -.449, p < .001) and significantly negatively correlated at time two (r = -.330, p < .001). **Loss of valued alternatives at time one did not predict EEIV at time two (*$\hat{\boldsymbol{\beta}} = -.025,\ \boldsymbol{p} = .566$). EEIV at time one also did not significantly predict loss of valued alternatives at time two (*$\hat{\boldsymbol{\beta}} = -.082,\ \boldsymbol{p} = .313$).** Loss of valued alternatives at time one did significantly predict loss of valued alternatives at time two (*$\hat{\beta} = .572,\ p < .001$), and EEIV at time one did significantly predict EEIV at time two (*$\hat{\beta} = .691,\ p < .001$).

Loss of valued alternatives and emotional disaffection were significantly positively correlated at time one (r = .471, p < .001) and significantly positively correlated at time two (r = .452, p < .001**). Loss of valued alternatives at time one did not significantly predict emotional disaffection at time two (*$\hat{\boldsymbol{\beta}} = .054,\ \boldsymbol{p} = .352$). Emotional disaffection at time one did not significantly predict loss of valued alternatives at time two (*$\hat{\boldsymbol{\beta}} = .162,\ \boldsymbol{p} = .082$).** Loss of valued alternatives at time one did significantly predict loss of valued alternatives at time two (*$\hat{\beta} = .524,\ p < .001$), and emotional disaffection at time one did significantly predict emotional disaffection at time two (*$\hat{\beta} = .678,\ p < .001$).

Loss of valued alternatives and EDEC were significantly positively correlated at time one (r = .761, p < .001) and at time two (r = .826, p < .001). **Loss of valued alternatives at time one did not significantly predict EDEC at time two (*$\hat{\boldsymbol{\beta}} = .054$, $\boldsymbol{p} = .473$). EDEC at time one also did not predict utility value at time two (*$\hat{\boldsymbol{\beta}} = -.050,\ \boldsymbol{p} = .721$).** Loss of valued alternatives at time one did significantly predict loss of valued alternatives at time two ($*\hat{\beta} = .651,\ p < .001$), and EDEC at time one did significantly predict EDEC at time two ($*\hat{\beta} = .520,\ p < .001$).

Summary. Overall, loss of valued alternatives at time one was only a significant predictor of social engagement at time two and none of the engagement dimensions at time one significantly predicted loss of valued alternatives at time two. In sum, the cross-lagged models explained between 38% - 59% of the variance of students' reported loss of valued alternatives at time two and 31% - 66% of the variance of students' reported engagement at time two.

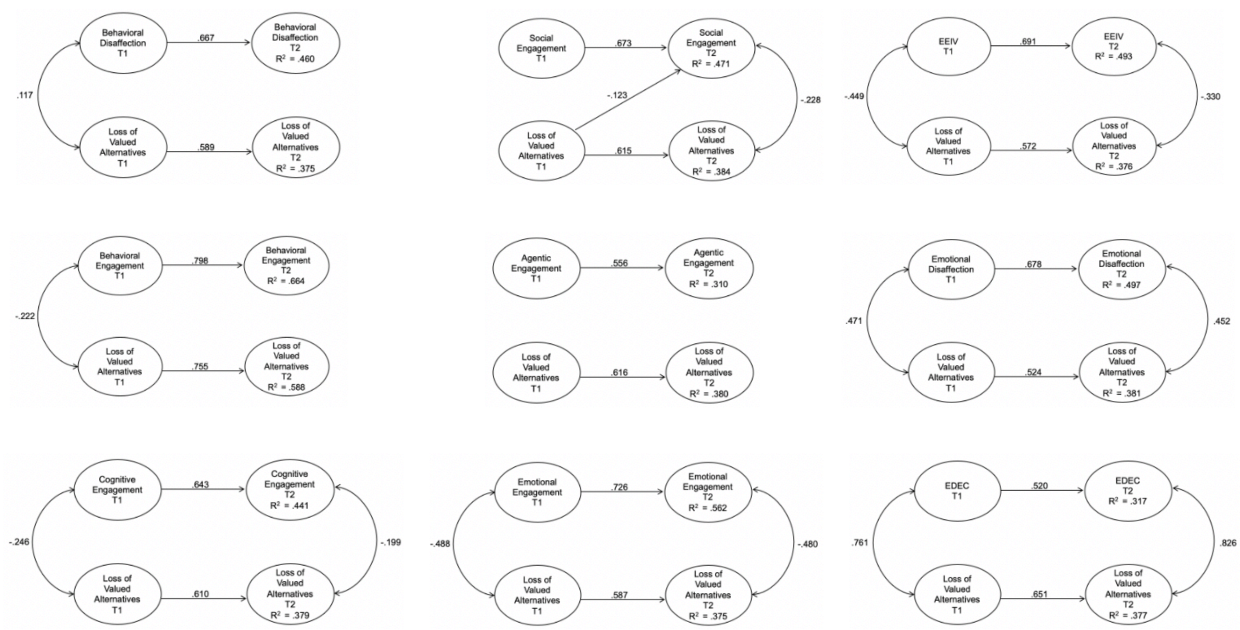


Figure 14. Cross-lagged structural equation models relating loss of valued alternatives and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

Emotional cost and dimensions of engagement. Figure 15 presents the cross-lagged results for students perceived emotional cost and dimensions of engagement. Emotional cost and behavioral disaffection were significantly positively correlated at time one (r = .131, p = .001), but were not significantly correlated at time two (r = .041, p = .641). **Emotional cost at time one did significantly positively predict behavioral disaffection at time two (*$\boldsymbol{\hat{\beta} = .091,\ p = .043}$). Behavioral disaffection at time one did not significantly predict emotional cost at time two (*$\boldsymbol{\hat{\beta} = .054,\ p = .386}$).** Emotional cost at time one did significantly predict emotional cost at time two (*$\hat{\beta}$ = .612, $p <$ .001), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two (*$\hat{\beta}$ = .656, $p <$ .001).

Emotional cost and behavioral engagement were significantly negatively correlated at time one (r = -.163, p = .001), but were not significantly correlated at time two (r = -.020, p = .889). **Emotional cost at time one did not significantly predict behavioral engagement at time two (*$\boldsymbol{\hat{\beta} = -.054,\ p = .255}$). Behavioral engagement at time one did not significantly predict emotional cost at time two (*$\boldsymbol{\hat{\beta} = -.072,\ p = .291}$).** Emotional cost at time one did significantly predict emotional cost at time two (*$\hat{\beta}$ = .605, $p <$ .001), and behavioral engagement at time one did significantly predict behavioral engagement at time two (*$\hat{\beta}$ = .802, $p <$ .001).

Emotional cost and cognitive engagement were significantly negatively correlated at time one (r = -.243, p < .001) and significantly negatively correlated at time two (r = -.281, p = .003). **Emotional cost at time one did not significantly predict cognitive engagement at time two (*$\boldsymbol{\hat{\beta} = -.056,\ p = .272}$). Cognitive engagement at time one did not significantly predict emotional cost at time two (*$\boldsymbol{\hat{\beta} = .004,\ p = .952}$).** Emotional cost at time one did significantly predict emotional cost at time two (*$\hat{\beta}$ = .624, $p <$ .001), and cognitive engagement at time one did significantly predict cognitive engagement at time two (*$\hat{\beta}$ = .645, $p <$ .001).

Emotional cost and social engagement were not correlated at time one (*r* = .044, *p* = .367) or at time two (*r* = -.109, *p* = .399). **Emotional cost at time one did significantly negatively predict social engagement at time two (*$\boldsymbol{\hat{\beta} = -.125,\ p = .002}$). Social engagement at time one did not significantly predict emotional cost at time two (*$\boldsymbol{\hat{\beta} = .017,\ p = .826}$).** Emotional cost at time one did significantly predict emotional cost at time two (*$\hat{\beta} = .623,\ p < .001$), and social engagement at time one did significantly predict social engagement at time two (*$\hat{\beta} = .680,\ p < .001$).

Emotional cost and agentic engagement were significantly negatively correlated at time one (*r* = -.079, *p* = .039), but not significantly correlated at time two (*r* = -.099, *p* = .237). **Emotional cost at time one did not significantly predict agentic engagement at time two (*$\boldsymbol{\hat{\beta} = -.021,\ p = .601}$). Agentic engagement at time one also did not significantly predict emotional cost at time two (*$\boldsymbol{\hat{\beta} = -.037,\ p = .605}$).** Emotional cost at time one did significantly predict emotional cost at time two (*$\hat{\beta} = .652,\ p < .001$), and agentic engagement at time one did significantly predict agentic engagement at time two (*$\hat{\beta} = .558,\ p < .001$).

Emotional cost and emotional engagement were significantly negatively correlated at time one (*r* = -.693, *p* < .001) and significantly negatively correlated at time two (*r* = -.780, *p* = .001). **Emotional cost at time one did not significantly predict emotional engagement at time two (*$\boldsymbol{\hat{\beta} = -.084,\ p = .178}$). Emotional engagement at time one did not significantly predict emotional cost at time two (*$\boldsymbol{\hat{\beta} = -.038,\ p = .667}$).** Emotional cost at time one did significantly predict emotional cost at time two (*$\hat{\beta} = .592,\ p < .001$), and emotional engagement at time one did significantly predict emotional engagement at time two (*$\hat{\beta} = .655,\ p < .001$).

Emotional cost and EEIV were significantly negatively correlated at time one (r = -.583, p < .001) and significantly negatively correlated at time two (r = -.534, p < .001**). Emotional cost at time one did not significantly predict EEIV at time two (*$\boldsymbol{\hat{\beta} = -.041,\ p = .411}$). EEIV at time one also did not significantly predict emotional cost at time two (*$\boldsymbol{\hat{\beta} = -.100,\ p = .203}$).** Emotional cost at time one did significantly predict emotional cost at time two (*$\hat{\beta} = .557,\ p < .001$), and EEIV at time one did significantly predict EEIV at time two (*$\hat{\beta} = .671,\ p < .001$).

Emotional cost and emotional disaffection were significantly positively correlated at time one (r = .700, p < .001) and significantly positively correlated at time two (r = .774, p < .001). **Emotional cost at time one did not significantly predict emotional disaffection at time two (*$\boldsymbol{\hat{\beta} = .012,\ p = .122}$). Emotional disaffection at time one did significantly predict emotional cost at time two (*$\boldsymbol{\hat{\beta} = .046,\ p = .639}$).** Emotional cost at time one did significantly predict emotional cost at time two (*$\hat{\beta} = .581,\ p < .001$), and emotional disaffection at time one did significantly predict emotional disaffection at time two (*$\hat{\beta} = .536,\ p < .001$).

Summary. Overall, emotional cost at time one was a significant predictor of behavioral disaffection and social engagement at time two. None of the engagement dimensions at time one significantly predicted emotional cost at time two. In sum, the cross-lagged models explained between 38% - 43% of the variance of students reported emotional cost at time two and 31% - 66% of the variance of students' reported engagement at time two.

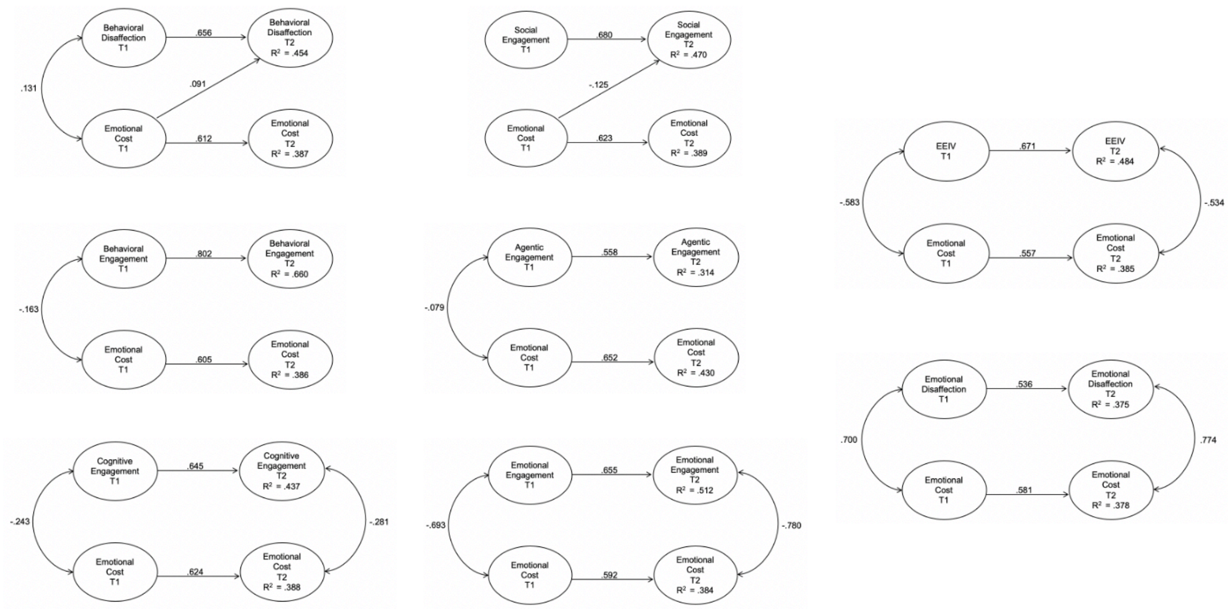


Figure 15. Cross-lagged structural equation models relating emotional cost and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

EDEC and dimensions of engagement. With regard to students combined emotional disaffection and emotional cost (EDEC) and dimensions of engagement, the cross-lagged analyses indicated several significant effects (see Figure 16). EDEC and behavioral disaffection were significantly positively correlated at time one (r = .151, p < .001), but were not significantly correlated at time two (r = .079, p = .352). **EDEC at time one did not significantly predict behavioral disaffection at time two (*$\boldsymbol{\hat{\beta} = .068}$, $\boldsymbol{p = .197}$). Behavioral disaffection at time one did not significantly predict EDEC at time two (*$\boldsymbol{\hat{\beta} = .064}$, $\boldsymbol{p = .321}$).** EDEC at time one did significantly predict EDEC at time two (*$\hat{\beta} = .615$, $p < .001$), and behavioral disaffection at time one did significantly predict behavioral disaffection at time two (*$\hat{\beta} = .696$, $p < .001$).

EDEC and behavioral engagement were significantly negatively correlated at time one (r = -.132, p = .008), but were not significantly correlated at time two (r = -.050, p =

.697). **EDEC at time one did not significantly predict behavioral engagement at time two (*$\boldsymbol{\hat{\beta} = -.097,\ p = .088}$). Behavioral engagement at time one did not significantly predict EDEC at time two (*$\boldsymbol{\hat{\beta} = -.102,\ p = .069}$).** EDEC at time one did significantly predict EDEC at time two (*$\hat{\beta} = .567,\ p < .001$), and behavioral engagement at time one did significantly predict behavioral engagement at time two (*$\hat{\beta} = .786,\ p < .001$).

EDEC and cognitive engagement were significantly negatively correlated at time one (*r* = -.222, *p* < .001), but were not significantly correlated at time two (*r* = -.112, *p* = .387). **EDEC at time one did not significantly predict cognitive engagement at time two (*$\boldsymbol{\hat{\beta} = -.113,\ p = .058}$). Cognitive engagement at time one did not significantly predict EDEC at time two (*$\boldsymbol{\hat{\beta} = -.055,\ p = .340}$).** EDEC at time one did significantly predict EDEC at time two (*$\hat{\beta} = .594,\ p < .001$), and cognitive engagement at time one did significantly predict cognitive engagement at time two (*$\hat{\beta} = .717,\ p < .001$).

EDEC and social engagement were not correlated at time one (*r* = .004, *p* = .933) or at time two (*r* = -.125, *p* = .275). **EDEC at time one did significantly negatively predict social engagement at time two (*$\boldsymbol{\hat{\beta} = -.121,\ p = .008}$). Social engagement at time one did not significantly predict EDEC at time two (*$\boldsymbol{\hat{\beta} = .016,\ p = .832}$).** EDEC at time one did significantly predict EDEC at time two (*$\hat{\beta} = .632,\ p < .001$), and social engagement at time one did significantly predict social engagement at time two (*$\hat{\beta} = .672,\ p < .001$).

EDEC and agentic engagement were significantly negatively correlated at time one (*r* = -.131, *p* = .007), but not significantly correlated at time two (*r* = -.216, *p* = .067).

EDEC at time one did not significantly predict agentic engagement at time two ($*\hat{\beta} = .018,\ p = .762$). Agentic engagement at time one also did not significantly predict EDEC at time two ($*\hat{\beta} = -.014,\ p = .757$). EDEC at time one did significantly predict EDEC at time two ($*\hat{\beta} = .524,\ p < .001$), and agentic engagement at time one did significantly predict agentic engagement at time two ($*\hat{\beta} = .559,\ p < .001$).

EDEC and emotional engagement were significantly negatively correlated at time one (*r* = -.708, *p* < .001) and significantly negatively correlated at time two (*r* = -.702, *p* < .001)**. EDEC at time one did not significantly predict emotional engagement at time two ($*\hat{\boldsymbol{\beta}} = -.\mathbf{028},\ \boldsymbol{p} = .\mathbf{705}$). Emotional engagement at time one did significantly negatively predict EDEC at time two ($*\hat{\boldsymbol{\beta}} = -.\mathbf{271},\ \boldsymbol{p} = .\mathbf{000}$).** EDEC at time one did significantly predict EDEC at time two ($*\hat{\beta} = .355,\ p < .001$), and emotional engagement at time one did significantly predict emotional engagement at time two ($*\hat{\beta} = .754,\ p < .001$).

EDEC and EEIV were significantly negatively correlated at time one (*r* = -.587, *p* < .001) and significantly negatively correlated at time two (*r* = -.473, *p* < .001). **EDEC at time one did not significantly predict EEIV at time two ($*\hat{\boldsymbol{\beta}} = -.\mathbf{017},\ \boldsymbol{p} = .\mathbf{792}$). EEIV at time one did significantly negatively predict EDEC at time two ($*\hat{\boldsymbol{\beta}} = -.\mathbf{176},\ \boldsymbol{p} = .\mathbf{017}$).** EDEC at time one did significantly predict EDEC at time two ($*\hat{\beta} = .513,\ p < .001$), and EEIV at time one did significantly predict EEIV at time two ($*\hat{\beta} = .770,\ p < .001$).

Summary. Overall, EDEC at time one was only a significant predictor of social engagement at time two and emotional engagement at time one was the only significant predictor of emotional cost at time two. In sum, the cross-lagged models explained between 28% - 40% of the variance of students reported EDEC at time two and 31% - 65% of the variance of students' reported engagement at time two.

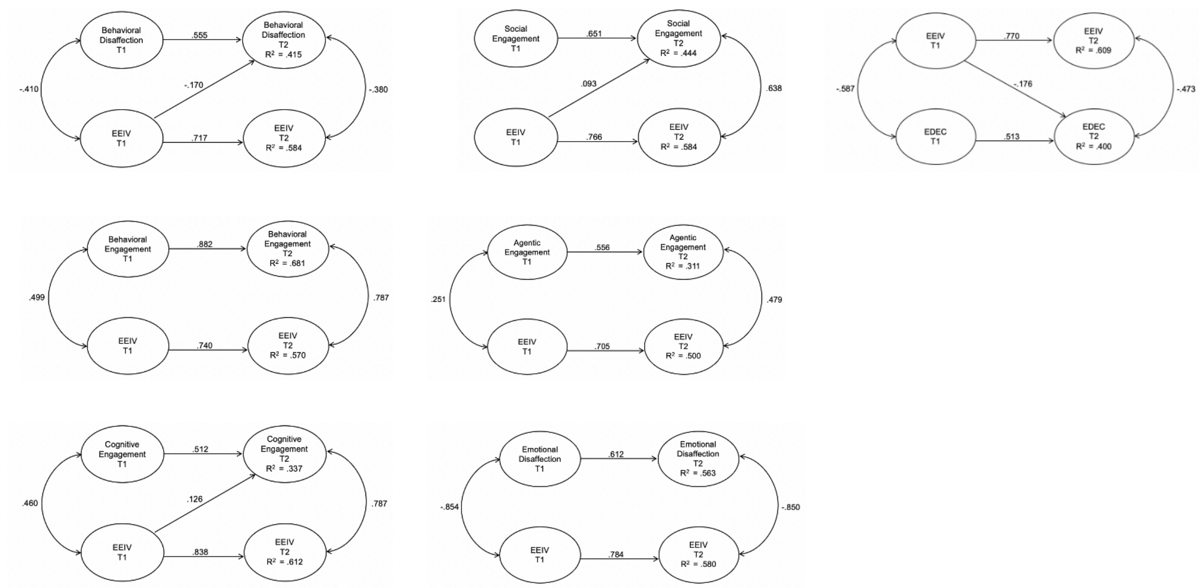


Figure 16. Cross-lagged structural equation models relating emotional disaffection combined with emotional and engagement dimensions across Time 1 and Time 2. For clarity reasons only statistically significant paths (one-tailed) are presented. Coefficients are standardized betas.

Overall Summary. In general, there was evidence for some reciprocal relationships among the EVT constructs and dimensions of engagement and disaffection. In general, students' competence-related beliefs and task values at time one were stronger predictors of the dimensions of engagement at time two. However, each of the engagement dimensions, except for agentic engagement, significantly predicted at least one EVT construct at time two. Thus, providing evidence that engagement is not always a consequence of motivation but can also cause motivation.

Research Question

To answer my single research question regarding whether dimensions of engagement mediate the relationship between competence-related beliefs, values, and domain-specific grades, I utilized the structural equation modeling approach to mediation (Little, Card, Bovaird, Preacher, & Crandall, 2007). Separate models were run for each mediator. Competence-related beliefs, one item from the attainment value subscale of Eccles and Wigfield's (1995) subjective task value scale, utility value, task effort cost, outside effort cost, loss of valued alternatives, emotional cost, and agentic engagement items were treated as continuous item responses because they had more than five categories. Four attainment value items from Gaspard et al., (2015) Value Facets Questionnaire, intrinsic values, utility for future life, behavioral and emotional disaffection, behavioral, cognitive, emotional, and social engagement items were treated as categorical item responses because they had five or fewer categories. Competence-related beliefs and values were treated as exogenous variables, the engagement dimensions were the endogenous variables, and domain-specific grades was the measured outcome. Full information maximum likelihood (FIML) estimation was used in order to handle missing data. To capture more accurately a mediation effect, data from time one was used for competence-related beliefs and values, and data from time two was used for the engagement dimensions.

As mentioned previously, the unidimensional model of emotional engagement and intrinsic value (EEIV) and the unidimensional model of emotional disaffection and emotional cost (EDEC) were treated as both exogenous and endogenous variables. This was done because it is unclear whether these variables should be treated as motivation constructs or engagement constructs. Further, when the two-factor correlated model of emotional engagement and intrinsic value was used as an exogenous variable, there was only a direct path to grades and the endogenous mediator from the intrinsic value factor (see Supplemental Figure 1). When this factor structure was used as an endogenous mediator, the path arrows only went from and came to emotional engagement and not to intrinsic value (see Supplemental Figure 2). The same pattern occurred for the two-factor correlated model of emotional disaffection and emotional cost: when this factor structure was used as the exogenous variable, there was only a direct path from emotional cost to grades and the endogenous mediator (see Supplemental Figure 3). When this factor structure was used as the endogenous mediator, the path arrows only went to and came from emotional disaffection, not emotional cost (see Supplemental Figure 4). Intrinsic value and emotional cost were treated as the exogenous factors because they are motivation constructs, whereas emotional engagement and emotional disaffection are engagement constructs and thus were treated as the endogenous mediators. This was done in order to answer my final research question regarding whether dimensions of engagement mediate the relationship between my motivation constructs and domain-specific grades.

Competence-related beliefs. The only significant mediator of the relationship between competence-related beliefs and domain-specific grades was emotional disaffection correlating with emotional cost ($*\hat{\beta} = .045,\ p =\ .002$). Competence-related beliefs had a significant direct effect for domain-specific grades regardless of which engagement dimension was entered into the model (see Table 49).

Attainment value. Behavioral engagement ($*\hat{\beta} = .138,\ p =\ .003$), cognitive engagement ($*\hat{\beta} = .154,\ p =\ .001$), EEIV ($*\hat{\beta} = .038, p =\ .016$), emotional engagement (correlated with intrinsic value) ($*\hat{\beta} = .017, p =\ .031$), and emotional disaffection (correlated with emotional cost) ($*\hat{\beta} = .038, p =\ .029$) significantly mediated the relationship of attainment value and domain-specific grades. Attainment value did not have a significant direct effect on domain-specific grades in any of the models (see Table 50).

Utility value. Behavioral engagement ($*\hat{\beta} = .106, p = .001$), cognitive engagement ($*\hat{\beta} = .142, p < .001$), EEIV ($*\hat{\beta} = .123, p = .001$), EDEC ($*\hat{\beta} = .098, p < .001$), and emotional disaffection correlated with emotional cost ($*\hat{\beta} = .038, p = .033$) significantly mediated the relationship of utility value and domain-specific grades (see Table 51). Utility value only had a significant direct effect on domain-specific grades ($*\hat{\beta} = -.127, p = .042$), when cognitive engagement was included as the mediator.

Utility value for future life. Behavioral engagement ($*\hat{\beta} = .090, p = .003$), cognitive engagement ($*\hat{\beta} = .118, p = .001$), EEIV ($*\hat{\beta} = .138, p < .001$), and EDEC ($*\hat{\beta} = .085, p = .001$) were significant mediators of the relationship between utility value for future life and domain-specific grades (see Table 52). Utility value had a significant direct effect on domain-specific grades when cognitive engagement ($*\hat{\beta} = -.141, p = .024$) was included as the mediator and when EEIV ($*\hat{\beta} = -.160, p = .021$) was included as the mediator in separate models.

Task effort cost. Students' behavioral engagement ($*\hat{\beta} = .064, p = .005$), cognitive engagement ($*\hat{\beta} = -.081, p = .002$), EEIV ($*\hat{\beta} = -.104, p = .008$), emotional engagement correlated with intrinsic value ($*\hat{\beta} = -.025, p = .008$), and EDEC ($*\hat{\beta} = -.291, p < .001$) were significant mediators of the relationship between task effort cost and domain-specific grades (see Table 53). Task effort cost had a significant direct effect on domain-specific grades when behavioral disaffection ($*\hat{\beta} =$

$-.107, p = .046$), social engagement ($*\hat{\beta} = -.106, p = .031$), agentic engagement ($*\hat{\beta} = -.107, p = .046$) and EDEC ($*\hat{\beta} = .179, p = .019$) were included as mediators in separate models.

Outside effort cost. Behavioral engagement ($*\hat{\beta} = -.053, p = .008$), cognitive engagement ($*\hat{\beta} = -.058, p = .005$), EEIV ($*\hat{\beta} = -.057, p = .013$), emotional engagement correlated with intrinsic value ($*\hat{\beta} = -.026, p = .005$), and EDEC ($*\hat{\beta} = -.161, p < .001$) were significant mediators of the relationship between outside effort cost and domain-specific grades (see Table 54). Task effort cost had a significant direct effect on domain-specific grades when behavioral disaffection ($*\hat{\beta} = -.136, p = .009$), social engagement ($*\hat{\beta} = -.132, p = .007$), agentic engagement ($*\hat{\beta} = -.138$, $p = .004$) and emotional engagement correlated with intrinsic value ($*\hat{\beta} = -.110, p = .027$) were included as mediators in separate models.

Loss of valued alternatives. Students' behavioral engagement ($*\hat{\beta} = -.059$, $p = .007$), cognitive engagement ($*\hat{\beta} = -.073, p = .003$), EEIV ($*\hat{\beta} = -.084, p = .007$), emotional engagement correlated with intrinsic value ($*\hat{\beta} = -.027, p = .005$), and EDEC ($*\hat{\beta} = -.232, p < .001$) were significant mediators of the relationship between loss of valued alternatives and domain-specific grades (see Table 55). Loss of valued alternatives had a significant direct effect on domain-specific grades when behavioral disaffection ($*\hat{\beta} = -.136, p = .009$), social engagement ($*\hat{\beta} = -.100, p = .046$) and agentic engagement ($*\hat{\beta} = -.110, p = .026$) were included as mediators in separate models.

EEIV. As mentioned previously, EEIV was also treated as an exogenous variable. Behavioral engagement ($*\hat{\beta} = .075, p = .032$), cognitive engagement ($*\hat{\beta} = .099$,

$p = .005$), EDEC (*$\hat{\beta} = .187, \rho < .001$), and emotional disaffection correlated with cost (*$\hat{\beta} = .109,\ p < .001$) were significant mediators of the relationship between EEIV and domain-specific grades (see Table 56). EEIV had a significant direct effect on domain-specific grades when behavioral disaffection (*$\hat{\beta} = .226,\ p < .001$), social engagement (*$\hat{\beta} = .187,\ p < .001$) and agentic engagement (*$\hat{\beta} = .185,\ p < .001$) were included as mediators in separate models.

Emotional engagement correlated with intrinsic value. For emotional engagement correlated with intrinsic value, the paths were from intrinsic value only. Students' behavioral engagement (*$\hat{\beta} = .07,\ p = .024$), cognitive engagement (*$\hat{\beta} = .102,\ p = .004$), EDEC (*$\hat{\beta} = .198, p < .001$), and emotional disaffection correlated with cost (*$\hat{\beta} = .107,\ p < .001$) were significant mediators for the relationship between intrinsic value and domain-specific grades (see Table 57). Intrinsic value had a significant direct effect on domain-specific grades when behavioral disaffection (*$\hat{\beta} = .213,\ p = .001$), social engagement (*$\hat{\beta} = .179,\ p < .001$) and agentic engagement (*$\hat{\beta} = .176,\ p < .001$) were included as mediators in separate models.

EDEC. As mentioned previously, EDEC was also treated as an exogenous variable. Students' behavioral engagement (*$\hat{\beta} = -.46,\ p = .017$) and cognitive engagement (*$\hat{\beta} = -.060,\ p = .005$)were significant mediators of the relationship between EDEC and domain-specific grades (see Table 58). EDEC had a significant direct effect on domain-specific grades regardless of which engagement variable was included in the model as the mediator.

Emotional disaffection correlated with emotional cost. For emotional disaffection correlated with emotional cost, the paths were from emotional cost only.

Behavioral engagement ($*\hat{\beta} = -.044,\ p = .016$), cognitive engagement ($*\hat{\beta} = -.058,$ $p = .005$, and emotional engagement correlated with intrinsic value ($*\hat{\beta} = -.022,\ p = .046$) were significant mediators of the relationship between emotional cost and domain-specific grades (see Table 59). Emotional cost had a significant direct effect on domain-specific grades regardless of which engagement variable was included in the model as the mediator.

Overall Summary. Overall, there was evidence that different engagement dimensions mediated the relationship between competence-related beliefs and domain-specific grades and task values and domain-specific grades. The only significant mediator of the relations between competence-related beliefs and grades was emotional disaffection correlated with emotional cost, and this was only a partial mediation. Emotional disaffection correlated with emotional cost was also a significant mediator for attainment value, utility value, EEIV, and intrinsic value correlated with emotional engagement and domain-specific grades. EDEC was a significant mediator of the relationship between all EVT constructs and domain-specific grades except for competence-related beliefs and attainment value. Behavioral and cognitive engagement were significant mediators of all the EVT constructs and domain-specific grades except for competence-related beliefs. Social and agentic engagement and behavioral disaffection were not significant mediators for any of the EVT constructs and domain-specific grades. EEIV was also a significant mediator of most EVT constructs and domain-specific grades; however, it was not a significant mediator of competence-related beliefs, emotional cost correlated with emotional disaffection, and EDEC and domain-specific grades. Finally, emotional engagement correlated with intrinsic value was also a significant mediator for many of the EVT constructs and domain-specific grades, including attainment value, task effort cost, outside effort cost, loss of valued alternatives, and emotional cost correlated with emotional disaffection.

Table 49

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Competence-Related Beliefs to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	.416***	(.04)	< .001	-.030	(.02)	.128	.446***	(.05)	< .001
Behavioral Engagement	.417***	(.04)	< .001	.020	(.02)	.315	.397***	(.05)	< .001
Cognitive Engagement	.416***	(.04)	< .001	.032	(.02)	.156	.384***	(.05)	< .001
Social Engagement	.419***	(.04)	< .001	.001	(.01)	.824	.418***	(.04)	< .001
Agentic Engagement	.418***	(.04)	< .001	-.002	(.01)	.853	.419***	(.04)	< .001
EEIV	.414***	(.04)	< .001	-.037	(.03)	.265	.451***	(.06)	< .001
EE with IV	.421***	(.04)	< .001	.010	(.01)	.327	.411***	(.05)	< .001
EDEC	.419***	(.04)	< .001	.046	(.03)	.177	.373***	(.06)	< .001
ED with EC	.368***	(.05)	< .001	.045**	(.01)	.002	.323***	(.05)	< .001

*** $p < .001$**$p < .01$, *$p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; EDEC = combined emotional disaffection and emotional cost; ED with EC = emotional disaffection with emotional cost; SE = standard error

Table 50

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Attainment Value to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	-.011	(.05)	.833	.005	(.03)	.857	.007	(.07)	.920
Behavioral Engagement	.011	(.05)	.834	.138**	(.05)	.003	-.127	(.08)	.100
Cognitive Engagement	.013	(.05)	.805	.154**	(.05)	.001	-.141	(.08)	.061
Social Engagement	.012	(.06)	.831	.007	(.01)	.859	.004	(.06)	.939
Agentic Engagement	.015	(.06)	.784	-.004	(.01)	.517	.019	(.06)	.734
EEIV	.016	(.05)	.772	.038*	(.02)	.016	-.022	(.06)	.693
EE with IV	.021	(.06)	.706	.017*	(.01)	.031	.003	(.06)	.949
EDEC	.014	(.06)	.801	.007	(.02)	.751	.007	(.05)	.896
ED with EC	.010	(.05)	.850	.038*	(.02)	.029	-.028	(.05)	.604

*** $p < .001$**$p < .01$, *$p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; EDEC = combined emotional disaffection and emotional cost; ED with EC = emotional disaffection with emotional cost; SE = standard error

Table 51

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Utility Value to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	.005	(.05)	.912	.014	(.03)	.577	-.009	(.06)	.881
Behavioral Engagement	.013	(.05)	.779	.106**	(.03)	.001	-.093	(.06)	.126
Cognitive Engagement	.014	(.05)	.762	.142***	(.04)	< .001	-.127*	(.06)	.042
Social Engagement	.017	(.05)	.721	.011	(.01)	.335	.007	(.05)	.894
Agentic Engagement	.022	(.03)	.523	.006	(.01)	.354	.015	(.03)	.651
EEIV	.012	(.05)	.800	.123**	(.04)	.001	-.111	(.07)	.085
EE with IV	-.019	(.05)	.722	.015	(.01)	.062	-.034	(.05)	.520
EDEC	.003	(.05)	.947	.098***	(.03)	< .001	-.095	(.05)	.064
ED with EC	-.024	(.05)	.656	.038*	(.02)	.033	-.062	(.06)	.267

*** $p < .001$**$p < .01$, *$p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; EDEC = combined emotional disaffection and emotional cost; ED with EC = emotional disaffection with emotional cost; SE = standard error

Table 52

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Utility for Future Life to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	-.021	(.05)	.678	.016	(.02)	.419	-.037	(.06)	.519
Behavioral Engagement	-.023	(.05)	.653	.090**	(.03)	.003	-.113	(.06)	.062
Cognitive Engagement	-.023	(.05)	.646	.118**	(.04)	.001	-.141**	(.06)	.024
Social Engagement	-.020	(.05)	.701	.018	(.02)	.248	-.038	(.06)	.503
Agentic Engagement	-.021	(.05)	.677	.013	(.01)	.240	-.034	(.05)	.516
EEIV	-.022	(.05)	.657	.138***	(.04)	< .001	-.160*	(.07)	.021
EE with IV	-.054	(.05)	.306	.006	(.01)	.427	-.061	(.05)	.245
EDEC	-.019	(.05)	.709	.085**	(.03)	.001	-.105	(.06)	.060
ED with EC	-.055	(.05)	.289	.015	(.02)	.422	-.070	(.05)	.192

*** $p < .001$**$p < .01$, *$p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; EDEC = combined emotional disaffection and emotional cost; ED with EC = emotional disaffection with emotional cost; SE = standard error

Table 53

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Task Effort Cost to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	-.108*	(.05)	.024	-.001	(.02)	.935	-.107*	(.05)	.046
Behavioral Engagement	-.109*	(.05)	.023	-.064**	(.02)	.005	-.045	(.06)	.419
Cognitive Engagement	-.108*	(.05)	.024	-.081**	(.03)	.002	-.028	(.06)	.621
Social Engagement	-.111*	(.05)	.022	-.005	(.01)	.425	-.106*	(.05)	.031
Agentic Engagement	-.111*	(.05)	.023	-.004	(.01)	.451	-.107*	(.05)	.028
EEIV	-.109*	(.05)	.019	-.104**	(.04)	.008	-.005	(.07)	.943
EE with IV	-.115*	(.05)	.021	-.025**	(.01)	.008	-.089	(.05)	.086
EDEC	-.112*	(.05)	.013	-.291***	(.05)	< .001	.179*	(.08)	.019
ED with EC	-.012	(.05)	.817	-.027	(.02)	.143	.015	(.05)	.773

*** $p < .001$**$p < .01$, *$p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; EDEC = combined emotional disaffection and emotional cost; ED with EC = emotional disaffection with emotional cost; SE = standard error

Table 54

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Outside Effort Cost to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	-.135**	(.05)	.005	.001	(.02)	.949	-.136**	(.05)	.009
Behavioral Engagement	-.135**	(.05)	.004	-.053**	(.02)	.008	-.083	(.05)	.117
Cognitive Engagement	-.135**	(.05)	.005	-.058**	(.02)	.005	-.077	(.05)	.140
Social Engagement	-.137**	(.05)	.004	-.005	(.01)	.473	-.132**	(.05)	.007
Agentic Engagement	-.138**	(.05)	.004	.000	(.00)	.907	-.138**	(.05)	.004
EEIV	-.135**	(.05)	.004	-.057*	(.02)	.013	-.078	(.06)	.158
EE with IV	-.136**	(.05)	.004	-.026**	(.01)	.005	-.110*	(.05)	.027
EDEC	-.137**	(.05)	.003	-.161***	(.03)	< .001	.024	(.06)	.691
ED with EC	-.063	(.05)	.202	-.010	(.02)	.521	-.053	(.05)	.295

*** $p < .001$** $p < .01$, * $p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; EDEC = combined emotional disaffection and emotional cost; ED with EC = emotional disaffection with emotional cost; SE = standard error

Table 55

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Loss of Valued Alternatives to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	-.135**	(.05)	.005	.001	(.02)	.949	-.136**	(.05)	.009
Behavioral Engagement	-.104*	(.05)	.033	-.059**	(.02)	.007	-.044	(.06)	.420
Cognitive Engagement	-.103*	(.05)	.034	-.073**	(.02)	.003	-.030	(.06)	.589
Social Engagement	-.106*	(.05)	.030	-.006	(.01)	.434	-.100*	(.05)	.046
Agentic Engagement	-.107*	(.05)	.029	.003	(.01)	.553	-.110*	(.05)	.026
EEIV	-.103*	(.05)	.030	-.084**	(.03)	.007	-.019	(.06)	.757
EE with IV	-.100*	(.05)	.046	-.027**	(.01)	.005	-.072	(.05)	.165
EDEC	-.105*	(.05)	.024	-.232***	(.05)	< .001	.127	(.07)	.070
ED with EC	-.019	(.05)	.710	-.030	(.02)	.102	.011	(.05)	.836

*** $p < .001$**$p < .01$, *$p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; EDEC = combined emotional disaffection and emotional cost; ED with EC = emotional disaffection with emotional cost; SE = standard error

Table 56

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Emotional Engagement Combined with Intrinsic Value to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	.185***	(.05)	< .001	-.041	(.04)	.264	.226***	(.06)	< .001
Behavioral Engagement	.188***	(.05)	< .001	.075*	(.04)	.032	.113	(.06)	.073
Cognitive Engagement	.187***	(.05)	< .001	.099**	(.04)	.005	.088	(.06)	.157
Social Engagement	.191***	(.05)	< .001	.004	(.01)	.694	.187***	(.05)	< .001
Agentic Engagement	.190***	(.05)	< .001	.005	(.01)	.567	.185***	(.05)	< .001
EDEC	.187***	(.04)	< .001	.182***	(.04)	< .001	.005	(.07)	.940
ED with EC	.112*	(.05)	.021	.109***	(.03)	< .001	.003	(.06)	.956

*** $p < .001$** $p < .01$, * $p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; EDEC = combined emotional disaffection and emotional cost; ED with EC = emotional disaffection with emotional cost; SE = standard error; EEIV and EE with IV were not included as mediators

Table 57

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from IV (correlated with Emotional Engagement) to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	.178***	(.05)	< .001	-.035	(.04)	.327	.213**	(.06)	.001
Behavioral Engagement	.180***	(.05)	< .001	.078*	(.04)	.024	.102	(.06)	.105
Cognitive Engagement	.179***	(.05)	< .001	.102**	(.04)	.004	.078	(.06)	.214
Social Engagement	.184***	(.05)	< .001	.005	(.01)	.677	.179***	(.05)	< .001
Agentic Engagement	.182***	(.05)	< .001	.005	(.01)	.575	.176***	(.05)	< .001
EDEC	.183***	(.05)	< .001	.198***	(.05)	< .001	-.015	(.07)	.833
ED with EC	.106*	(.05)	.031	.107***	(.03)	< .001	-.001	(.06)	.985

*** $p < .001$** $p < .01$, * $p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; EDEC = combined emotional disaffection and emotional cost; ED with EC = emotional disaffection with emotional cost; SE = standard error; EEIV and EE with IV were not included as mediators

Table 58

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Emotional Disaffection Combined with Emotional Cost to College Grades

	Total Effect			Indirect Effect			Direct Effect		
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	-.236***	(.05)	< .001	.011	(.02)	.529	-.247***	(.05)	< .001
Behavioral Engagement	-.237***	(.05)	< .001	-.046*	(.02)	.017	-.192***	(.05)	< .001
Cognitive Engagement	-.237***	(.05)	< .001	-.060**	(.02)	.005	-.177**	(.05)	.001
Social Engagement	-.240***	(.05)	< .001	-.004	(.01)	.546	-.236***	(.05)	< .001
Agentic Engagement	-.239***	(.05)	< .001	-.003	(.00)	.459	-.236***	(.05)	< .001
EEIV	-.233***	(.04)	< .001	-.042	(.05)	.365	-.191**	(.07)	.008
EE with IV	-.238***	(.05)	< .001	-.022	(.01)	.055	-.216***	(.05)	< .001

*** $p < .001$** $p < .01$, *$p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; SE = standard error; EDEC and ED with EC were not included as mediators

Table 59

Standardized Total, Indirect and Direct Effects for the Hypothesized Path Models from Emotional Cost (correlated with Emotional Disaffection) to College Grades

Direct Effect	Total Effect			Indirect Effect					
Mediator	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value	Est.	(SE)	*p*-value
Behavioral Disaffection	-.235***	(.05)	< .001	.009	(.02)	.578	-.245***	(.05)	< .001
Behavioral Engagement	-.237***	(.05)	< .001	-.044*	(.02)	.016	-.192***	(.05)	< .001
Cognitive Engagement	-.236***	(.05)	< .001	-.058**	(.02)	.005	-.179**	(.05)	.001
Social Engagement	-.239***	(.05)	< .001	-.004	(.01)	.537	-.235***	(.05)	< .001
Agentic Engagement	-.238***	(.05)	< .001	-.003	(.00)	.463	-.235***	(.05)	< .001
EEIV	-.232***	(.04)	< .001	-.045	(.04)	.312	-.187**	(.07)	.008
EE with IV	-.236***	(.05)	< .001	-.022*	(.01)	.046	-.214***	(.05)	< .001

*** $p < .001$** $p < .01$, * $p < .05$.

Note. EEIV = combined emotional engagement and intrinsic value; EE with IV = emotional engagement correlated with intrinsic value; SE = standard error; EDEC and ED with EC were not included as mediators

Chapter 5: Discussion

In this dissertation, I addressed several fundamental issues regarding the relations of the central motivation beliefs and values in EVT and engagement. First, is their potential overlap. This study is the first to explore whether there is empirical overlap among certain dimensions of engagement and the task value constructs in EVT and provides clear answers about these constructs' relative distinctiveness or overlap. Along with the "overlap issue" is the issue of which motivation constructs are associated with which dimensions of engagement. In the present literature, it is currently unclear which EVT constructs are associated with which dimensions of engagement. The present study provides information about these relations. Another issue that this study addresses is whether motivation always precedes engagement. Eccles (personal communication, September, 2018; Eccles & Wang, 2012) stated that these relationships likely become reciprocal over time, especially by college; however, until this dissertation study no one has explored how these constructs relate across time. Thus, findings from the cross-lagged analyses in this study provided new information regarding the relationship between motivation defined under EVT and the various dimensions of engagement across two time-points.

Finally, results of this study contribute to our understanding of how students' motivational beliefs, values and engagement predict students' domain-specific grades, as well as whether dimensions of engagement mediate the relationship between competence-related beliefs, task values, and domain-specific achievement. Understanding whether dimensions of engagement mediate the relationship between motivational beliefs and values and domain-specific achievement could have implications for the EVT model.

Eccles has stated that some dimensions of engagement (i.e., behavioral and cognitive) are considered outcomes of competence-related beliefs and subjective task values; however, the model has not been changed to accommodate this addition (Eccles, personal communication, November 1, 2017). Thus, if students' engagement mediates the relationship between motivational beliefs and values and achievement, then engagement should probably be placed in its own box appearing after expectations for success and task values but before achievement-related choices (see Figure 1). Further, this mediation analyses will allow for a better understanding of the processes by which motivational beliefs and values predict achievement outcomes. In some instances, engagement dimensions may be the action that helps drive the relationship between motivational beliefs, values and grades.

In this study I proposed the following research hypotheses:

1A. Emotional disaffection and emotional cost will overlap empirically.

1B. Emotional engagement and intrinsic value will overlap empirically.

2A. Students' competence-related beliefs, attainment value, intrinsic value, and utility value will be positively associated with their engagement and cost negatively associated with it. Students' competence-related beliefs, attainment value, intrinsic value, and utility value will be negatively associated with behavioral and emotional disaffection and cost will be positively associated with it.

2B. Students' competence-related beliefs will be more strongly associated with behavioral and cognitive engagement than any of the task value variables.

2C. Students' attainment value, intrinsic value, and utility value will be more strongly associated with emotional engagement, social engagement and agentic engagement than students' competence-related beliefs. Students' cost will be more strongly associated with behavioral and emotional disaffection than students' competence-related beliefs, attainment value, intrinsic value, and utility value.

3. Students' competence-related beliefs and values and engagement will have a reciprocal relationship.

I also examined one research question: Will dimensions of engagement mediate the relationship between competence-related beliefs, values, and domain-specific grades?

In this chapter, I discuss the results pertaining to each hypothesis, provide explanations for why the hypotheses were supported or not, and discuss the implications of my findings both for EVT and how we understand engagement. It is important to note that since there is not a theory of engagement, I will primarily discuss my findings in terms of EVT.

Hypothesis 1: Overlap Among EVT Constructs and Dimensions of Engagement

As discussed in previous chapters, there is disagreement among researchers about how empirically distinct motivation constructs are from dimensions of engagement (Fredricks et al., 2004; Martin, 2007, 2012); however little empirical work has been done to begin to address this issue. In this study I focused on the potential overlap of two aspects of subjective task value as defined in Eccles and colleagues' (Eccles, 2005; Eccles (Parsons) et al., 1983; Wigfield et al., 2016) EVT and one dimension of engagement defined by Wang and colleagues (2016) and one dimension of disaffection defined by Skinner and colleagues (2009): emotional cost and emotional disaffection, and intrinsic value and emotional engagement. I hypothesized that emotional disaffection and emotional cost would overlap empirically because both definitions emphasized students experiencing negative emotions such as stress and frustration. I further hypothesized that emotional engagement and intrinsic value would overlap empirically because they were both defined as including positive emotions such as valuing, showing interest, and enjoying a subject.

Results from my confirmatory factor analysis did not support hypotheses 1A and 1B. Model fit information indicated that the correlated two-factor models, which posits that the constructs are empirically distinct but related, fit the data best for both pairs of constructs. However, there are important caveats to these findings. First, these scales used different Likert ranges. Emotional disaffection was measured on a four-point Likert scale whereas emotional cost was measured on a nine-point Likert scale, and emotional engagement was measured on a five-point Likert scale and intrinsic value was measured on a four-point Likert scale. These differences in Likert scale ranges could have had an impact on the model fit, and thus future research should explore these empirical differences using similar Likert ranges. Further, although the correlated-two factor models showed the best fit among the constructs, the correlations were very high in the two models. The high degree of correlations indicate that these constructs are likely measuring the same thing. Additionally, in interpreting results from CFAs it is also important to examine the factor loadings and not just rely on the model fit criteria (Morell et al., under review). The factor loadings for the unidimensional models were also high indicating that the items could reasonably make up a single factor (see supplemental tables 1-2). Thus, although the correlated two-factor model fit best in both cases, the high correlations and strong factor loadings suggest that the unidimensional could also be appropriate. Indeed, even though in a strict sense results did not support my hypotheses, I conclude that the unidimensional model is the most appropriate one to use when predicting outcomes because the introduction of these pairs into the same model, without them being correlated-two factors, is likely to lead to multicollinearity issues

These findings also provide some support for Fredricks and colleagues' (2004) point that student engagement inherently includes some motivation constructs. However, one could also argue the reverse: that student motivation inherently includes some engagement constructs. Further, these results may suggest a jangle fallacy (e.g., Block, 1995; Whiteside & Lynham, 2001) may be operating with respect to the particular motivation and engagement constructs I examined with the Math and Science Engagement (Wang et al., 2016), Engagement versus Disaffection with Learning (Skinner et al., 2009), Value Facets Questionnaire (Gaspard et al., 2015), and Perceptions of Cost (Flake et al., 2015) scales. The wording of items on Skinner and colleagues' (2009) emotional disaffection and Flake and colleagues (2015) emotional cost scales and items on the emotional engagement (Wang et al., 2016) and intrinsic value (Gaspard et al., 2015) scales are so similar that it would be difficult to say which items actually belong to which scale. For example, one item on the emotional disaffection scale reads "When I'm in this class, I feel worried" and one item on the emotional cost scale reads "I worry too much about this class." One reason for this overlap in the measures could be because initially and for a long time researchers studying motivation and those studying engagement were publishing in different journals and oftentimes were not in contact with one another, which is a pervasive issue across many psychology disciplines (Wigfield &

Eccles, 2020). To illustrate this further, a more differentiated definition of engagement did not appear in the literature until Fredricks and colleagues' (2004) seminal review article on student engagement. However, as just noted they stated that engagement inherently includes some motivation constructs, but they did not differentiate these engagement dimensions from the already well-established EVT model (Eccles (Parsons) et al., 1983)

Additionally, researchers to date, to my knowledge, have simply not examined the potential overlap of particular motivational constructs and dimensions of engagement systematically. Researchers should pay particular attention to variables with very similar definitions or in how they are assessed to ensure that they are not inadvertently assessing the same thing, as appears to be the case with the particular task value and engagement variables I examined. The other motivation and engagement variables I studied did not have this problem. For example, items assessing competence-related beliefs focus on perceptions of how good one is at math or science whereas cognitive engagement focuses on skills and techniques one can do in order to become good in the class.

I should also note that the jangle fallacy is likely to not just be a problem with these two pairs of constructs, but also among other prominent motivation variables from different theoretical perspectives (e.g., general interest) and dimensions of engagement (see Bong & Skaalvik, 2003; Murphy & Alexander, 2000; Reschly & Christenson, 2012; for further discussion of this issue). My results bring into focus a larger issue that I have discussed throughout this Dissertation: that researchers often fail to define a given construct clearly and consistently. This lack of definitional clarity and consistency can lead to difficulties in comparing findings across studies and can lead to issues of scale development, where scales measuring different constructs are using very similar items. If motivation and engagement-based interventions are to be created, it will be especially important to focus on how these constructs are defined, operationalized, and measured.

Hypothesis 2: Students Competence Beliefs and Values and their Associations with Engagement

As mentioned above, many researchers have argued that motivation leads to subsequent engagement (Ainley, 2012; Appleton et al., 2006; Eccles & Wang, 2012; Russell et al., 2005; Wigfield & Guthrie, 2010). Eccles (personal communication, November 1, 2017; Eccles & Wang, 2012) proposed that student engagement is an outcome of competence-related beliefs and task values. Before examining this issue fully, however, research needs to establish how various motivational constructs relate to dimensions of engagement. More specifically, few researchers have examined how constructs in EVT are associated with behavioral, cognitive, and emotional engagement (Fredricks et al., 2018; Guo et al., 2016; Marchand & Guitierrez, 2016; Wang & Eccles, 2013) and little to no work that has examined how EVT constructs are associated with social and agentic engagement and behavioral and emotional disaffection.

I found that the individual regressions looking at the relations between these constructs demonstrated support for most of hypothesis 2A. Students' competence-related beliefs, attainment value, utility value, utility for future life, and intrinsic value were positively associated with, and cost constructs were negatively associated with behavioral, cognitive, and emotional engagement. Cost constructs were also positively associated with and competence-related beliefs, attainment value, utility value, utility for future and intrinsic value were negatively associated with behavioral and emotional disaffection. However, social engagement was not significantly associated with competence-related beliefs or any of the cost constructs and agentic engagement was not significantly associated with attainment value or any of the cost constructs. Competence-related beliefs may not have significantly been associated with social engagement because how much students perceive the class to be important and useful to them may make them particularly likely to socially engage in the course. For example, a student who views the class as being important to their identity and useful for their future goals may be more willing to work with another student who is struggling compared to a student who just believes they are competent in the course (Fredrick et al., 2018). Fredricks and colleagues (2018) also found that competence-related beliefs did not associate with social engagement in math and science.

Students' attainment value may not have significantly been associated with agentic engagement because perceiving a course as being important may not be enough to make students want to be active participants in the course. Students who are agentically engaged must be willing to speak and share opinions during class. Thus, this may be more tied to motivation constructs like intrinsic value because students who are intrinsically motivated are more likely to inherently like the course (Reeve, 2013). Another possibility that these associative relations did not emerge could be due in part to the relatively low levels of agentic engagement students reported. The average agentic engagement score ($M = 2.73$) is below the mid-point of the scale, suggesting students were in general not demonstrating proactive and constructive attempts to assert their agency and consequently influence the flow of instruction. This low average agentic score could be an artifact of the general structure of undergraduate math and science courses, which are typically instructor-led courses.

I expected that the cost dimensions would be negatively associated with social and agentic engagement because if students find the course to be costly, they may be less likely to enjoy it and as such be less likely to engage with their peers and be an active agent in their own learning during instruction (Rosenzweig et al., 2019). Results did not support my expectation. This study was the first to examine these relations and so, more research is needed to assess these relationships more fully, as well as help explain them more clearly.

I now discuss the findings from the hierarchical and stepwise regressions that pertain to hypotheses 2B and 2C, after first considering the strength of the relations across the different variables included in the analyses. In the hierarchical regressions the models explained 7% - 77% of the variance in the engagement dimensions. Students' competence beliefs and values explained the least amount of variance in social engagement (7%) and agentic engagement (10%). The stepwise regressions, which were conducted to control for effects of multicollinearity that may have impacted the hierarchical analyses, explained 9% - 81% of the variance in students' engagement; again it was social engagement (9%) and agentic engagement (12%) in which the motivation variables explained the least amount of variance. Thus, these motivational beliefs and values are relatively weakly associated with social and agentic engagement; more research is needed to explore what motivation, or other, variables do relate to them.

Why might the motivational beliefs and values have explained little variance in social engagement? In their EVT model, Eccles and colleagues (Eccles-Parsons et al., 1983; Eccles & Wigfield, 1995; Wigfield & Eccles, 2000) emphasized that certain social interactions impact the development of competence-related beliefs and values (see Figure 1). Therefore, the EVT constructs I examined perhaps do not explain much of the variability in social engagement because at least some kinds of social engagement precede motivational beliefs and values. However, it should be noted that the social interactions described within the EVT framework differ from social engagement in an important way—in EVT it is students' *perceptions of socializers* beliefs, expectations, and attitudes, whereas social engagement focuses more on the *quality* of social interactions and students' *perceptions of their own interactions.*

Turning to agentic engagement, Reeve (2013; Reeve & Tseng, 2011) stated that a key part of it is students' proactive attempts to influence instruction so it better supports their own motivation and learning by making instruction more interesting, valuable, and personable. In this instance, perhaps their competence-related beliefs and values did not associate with agentic engagement very strongly because agentic engagement needs to happen first (Patall et al., 2019).

Results of both the hierarchical and stepwise regressions provide only partial support for hypothesis 2B; students' competence related beliefs did not relate to behavioral and cognitive engagement more strongly than the task value variables. Interestingly, Wang and Eccles (2013) found that students' competence-related beliefs were a stronger predictor of behavioral and cognitive engagement than subjective task values. However, Wang and Eccles sampled seventh graders and their measures were not domain-specific and instead asked students questions at the school- and class-level. Thus, it is possible that the findings of my study and theirs were not similar because I used an older sample and my measures were domain-specific. Eccles and Wang (2012) argued that attainment value becomes more salient for engagement by older students, who have better-articulated identities. So, although competence-related beliefs were an important predictor of behavioral and cognitive engagement among adolescents, it may be less important for college students who have a better sense of their personal and social identities (Eccles & Wang). Further, Guo and colleagues (2016) found that attainment value plays an important role in promoting students' effort, which is a key component of both behavioral and cognitive engagement. Thus, students' attainment value may have been associated with behavioral and cognitive engagement because if students feel the task or course is important to them and their future goals, they may be more likely to engage in ways that support deeper learning and achievement (Guo et al., 2016; Voelkl, 2012).

My results also only provided partial support for Hypothesis 2C regarding the relative strength of students' task values compared to their competence beliefs in relation to emotional, social, and agentic engagement dimensions. In support of the hypothesis, students' attainment value, utility value, and utility for future were associated with emotional engagement, or EEIV most strongly. Interestingly, although I didn't predict this, students' emotional cost/EDEC and loss of valued alternatives also emerged as significant in the stepwise regressions for emotional engagement or EEIV. Thus, revealing they are also strongly associated with emotional engagement or EEIV. It is important to note that intrinsic value was not included in these analyses because of its strong overlap with emotional engagement. Although I did not predict that emotional cost and loss of valued alternatives would be strongly associated with emotional engagement, because emotional cost is so similar to emotional disaffection, it is very likely that emotional cost also would be associated negatively with emotional engagement. Further, if students feel like they have to give up things that they enjoy doing because of the course, they may begin to develop negative feelings towards the class, which would subsequently lead to lower emotional engagement in the course (Eccles (Parsons) et al., 1983; Perez, Cromley, & Cromley, 2014; Rosenzweig, Wigfield, & Hulleman, 2019). Future research should continue to explore how these variables predict and relate to emotional engagement in math and science as this is an understudied area of research.

Also supporting the hypothesis were the results showing that students' attainment value and intrinsic value/EEIV were the variables most strongly associated with social engagement. However, I also found that emotional cost/EDEC was also strongly associated with social engagement, which was not part of my hypothesis. Attainment value' s relations with social engagement may have been strong because if students view the course as being important to their sense of self, they may also be more likely to seek help from their peers and to understand other people's ideas in the class (Calabrese Barton et al., 2013; Cobb, Gresalfi, & Hodge, 2009; Eccles, 2009; Fredricks et al., 2018; Fredricks et al., 2016). The same may be true for students who are experiencing anxiety or frustration about their math or science course (Fredricks et al., 2018). Additionally, if students are interested in the course, they may be more willing to share ideas and talk with other students (Fredricks et al., 2018).

Students' intrinsic value/EEIV, loss of valued alternatives, and utility for future related most strongly to their agentic engagement. Thus, I only found partial support for my prediction of what would be most strongly associated with agentic engagement because I did not include loss of valued alternatives in the hypothesis. Students' sense of the loss of valued alternatives may have been significantly positively associated with their agentic engagement because if students perceive that they must give up a lot they may compensate for that by believing they have some agency over their learning in the course, particularly if they also feel the course is important for their future and they value it intrinsically (Johnson & Safavian, 2016; Rosenzweig, Jiang & Wigfield, 2017). Rosenzweig, and colleagues (2017) argued that when students perceive a task to be important, their perceptions of cost may increase because the stakes for failure are higher. Thus, students perceiving that they have to give up other things they enjoy due to the class doesn't necessarily mean they will be less engaged in the class. However, more research is needed before clear conclusions can be drawn regarding the relationships between the cost constructs and engagement.

Turning to the demographic control variables, interestingly, the dichotomous Asian demographic variable was significantly positively associated with agentic engagement in the stepwise regressions; the positive relations mean that the Asian students perceived themselves to be more agentic. Much of the work done on agentic engagement, including scale development and validity, has been conducted in Asian countries (Reeve, 2013; Reeve & Tseng, 2011; see Patall et al., 2019 for an exception). Thus, agentic engagement may be particularly relevant to students from Eastern cultures. More research should be conducted on agentic engagement in Western cultures to see how findings compare. However, this finding is surprising given the collectivist emphasis of Eastern cultures (Markus & Kitayama,1991). Because agentic engagement focuses on students making the instruction relevant for oneself, it would seem that agentic engagement should be more relevant for students from Western cultures where there is a focus on individualism.

I also found that some of the other demographic variables were significant in the stepwise regressions, including the dichotomous female and Multi-ethnic identities variables. For emotional disaffection, females reported significantly higher emotional disaffection compared to their male peers. This is not surprising given the pervasive stereotype that females are less good at math and science than males and as such may emotionally disengage from the course (Bian, Leslie, & Cimpian, 2017). Asian students and Multi-ethnic students reported lower perceptions of emotional disaffection/EDEC compared to their Caucasian peers. More research is needed to know why this may be the case.

My prediction in hypothesis 2C that the cost constructs would have the strongest associations with behavioral and emotional disaffection was not supported. Instead, intrinsic value/EEIV, attainment value and competence-related beliefs related more strongly with behavioral disaffection. Unexpectedly, competence-related beliefs emerged as being significantly *positively* associated with behavioral disaffection. Guo and colleagues (2016) found that attainment value was more associated with effort than was competence-related beliefs. If students hold the view that effort and ability are inversely related those who have strong beliefs about their ability in math and science may be less likely to put forth as much effort in the course because they feel like they do not need to (Dweck, 1999; Dweck & Leggett, 1998; Jagacinkski & Nicholls, 1984).

Turning to emotional disaffection, the only cost construct significantly associated with it in the stepwise regressions was task effort cost. Students who perceive the class as taking up too much of their time and energy may also be more likely to experience feelings of anxiety and worry in the class as a carry-over effect from how much effort they perceive they are exerting (Flake et al., 2015; Rosenzweig et al., 2019). Intrinsic value/EEIV and competence-related beliefs related negatively with emotional disaffection/EDEC; these relations were the strongest I observed for this variable. As mentioned previously, because intrinsic value overlaps with emotional engagement (the opposite of emotional disaffection), it is not surprising that it would also be strongly associated with emotional disaffection. Competence-related beliefs may also have been strongly negatively associated with emotional disaffection because students who perceive themselves as being good and successful in math or science may subsequently be less worried and discouraged while in class (Bandura, 1997; Meece et al., 1990; Muenks, Wigfield, & Eccles, 2018; Zeidner, 2007).

In summary, my results provide important support for some aspects of Hypothesis 2, but not others. Although researchers have examined relations among some EVT constructs and some dimensions of engagement, my study is the first to include all of the cost dimensions alongside competence-related beliefs and values as well as all five dimensions of engagement and two dimensions of disaffection. Therefore, more work is needed to understand and explain these relations fully.

Hypothesis 3: Reciprocal Relations of EVT Constructs and Dimensions of Engagement

As discussed earlier, motivation and engagement researchers have often debated about whether motivation precedes engagement (Eccles & Wang, 2012; Fredricks et al., 2004; Martin 2007; 2012; Reeve & Lee, 2014). Although in general I adopt the view that motivation precedes engagement, Eccles and colleagues (Eccles, personal communication; Eccles & Wang, 2012) provide another option that I addressed in this study: that students' competence-related beliefs, values, and engagement relate reciprocally. However, this reciprocal relationship is not currently depicted in the EVT model and researchers to my knowledge have not explored such relationships. Therefore, results from my cross-lagged analyses provides important new information regarding the reciprocal nature of competence-related beliefs, values, and engagement. As a reminder the cross-lagged relations that I am discussing here are relations between two different variables at the different time points (e.g., competence-related beliefs at time one to behavioral engagement at time two and vice versa). Additionally, the time between the two data collection time points was five weeks and the second data collection time point started after students finished their mid-terms. This time period was chosen because first and second year students may be more likely to make adjustments in their motivation and engagement after their first major exam in an introductory course (Misra & McKean, 2000).

Results showed that there indeed are reciprocal relationships among some of the motivational beliefs, values, and engagement variables, thus providing some support for my hypothesis. Reciprocal effects, in which both the EVT variable and engagement dimension at time one were significant predictors of the other at time two, were found for the following pairs of variables: Students' intrinsic value and behavioral disaffection, utility value and behavioral disaffection, utility for future life and emotional disaffection, and finally for utility for future life and social engagement. I will discuss the reciprocal relations first and then turn to discussion of the cross-lagged models showing more unidirectional relations between certain of the motivation and engagement variables, followed by a discussion of individual cross-lagged paths that were the strongest for the remaining motivational beliefs, values, and dimensions of engagement. I used the standardized betas to determine which of the relations were strongest (Raju, Fraliex, & Steinhaus, 1986; Rosenthal,1994).

Starting with the four pairs of variables showing reciprocal relations, the (negative) reciprocal relations of behavioral disaffection with intrinsic and utility value could be explained by the findings that students who withdraw in the course are likely to not have a high degree of task involvement and curiosity (Gottfried, Fleming, & Gottfried 2001; Skinner et al., 2009) which could also lead to lower perceptions of the utility of the course. Further, according to Skinner and colleagues (2009) motivational beliefs, such as task values, reciprocally relate to disaffection. Therefore, it is possible that by college, students who have lower intrinsic value and utility value for math and science are more prone to enter their math and science course disengaged. On the other hand, Fredricks and colleagues (2018) found that when students enjoyed the course and saw the relevance of the course for their future, they were more likely to be behaviorally engaged. Consequently, it would make sense then that if students start the semester with high perceptions of intrinsic and utility value, they may be less likely to behaviorally disengage from the course over the semester. Thus, it may be especially important to foster a sense of intrinsic value at the beginning of the semester to help prevent students from disengaging as the semester progresses.

Somewhat surprisingly, utility value for future and emotional disaffection related reciprocally. Although, students' utility for future life predicted emotional disaffection positively rather than in the expected negative direction. As noted earlier, Rosenzweig and colleagues' (2019) study of values and costs among college students may suggest this occurred because when the course or task is relevant to students' futures, the stakes for doing well increase. Subsequently, this added pressure can lead to an increase in feelings of worry and anxiety (Meece et al., 1990; Rosenzweig et al., 2019). Conversely, emotional disaffection at time one negatively predicted utility for future life at time two. Perhaps students who enter the course with feelings of worry and disinterest are less likely to care about how the course will be useful for them in the future. Thus, in this instance, if emotional disaffection develops first students' may be less likely to see the relevance of what they are learning for their future. This relationship illustrates an interesting possible feedback loop in which the direction of the effect is determined by whether disaffection or motivation develops first. This feedback loop is further supported by Eccles (personal communication, September, 2018) who stated that these motivational beliefs, values and engagement relationships are more likely to become reciprocal as students move through school.

Turing to the final reciprocal relationship, that between utility for future life and social engagement, the paths from time one to time two were positive for both constructs. Students who are socially engaged are sharing ideas, actively contributing to other's ideas, and working with other students. Thus, students who enter the course with a high degree of social interaction may subsequently come to see the relevance of the course for their future because of their interactions and discussions with others (Fredricks et al., 2016). Conversely, students who see the relevance for their math or science course for their future may be more likely to socially engage with their classmates because they want others to see the relevance as well. Another interesting aspect of these findings is that although the standardized betas for the two cross-lagged paths were very similar (.102 and .106), the amount of variability explained in these two variables was more than twice as much for social engagement compared to utility for future life. The cross-lagged model explained 47.5% of the variance in social engagement, and only 19.9% of the variance in utility for future life. Thus, it appears that utility for future life is more important for the development of social engagement than vice versa. In qualitative interviews, Fredricks and colleagues (2018) found that when students saw the utility of what they were learning they were more excited to engage socially, thus when the subject or task is personally relevant for one's future, they may be more willing to discuss it with peers.

I will now turn to a discussion of the cross-lagged correlations that showed significant unidirectional relations between one variable and the second but no evidence of reciprocal relations, I begin with competence-related beliefs. There were four instances in which students' competence-related beliefs predicted an engagement variable at time two: Students' competence beliefs positively predicted agentic engagement at time two and negatively predicted behavioral disaffection, emotional disaffection, and EDEC at time two. Competence-related beliefs may have significantly predicted agentic engagement because students' who are confident in their ability may not be afraid to ask questions or make suggestions (Reeve, 2013). Additionally, competence-related beliefs may have predicted lower behavioral and emotional disaffection across the semester because students who feel really confident in their ability may be more likely to put in effort in order to maintain the good grades that are tied to their ability beliefs (Wigfield &

Eccles, 2005). There were no other unidirectional effects from competence-related beliefs to engagement dimensions.

Students attainment value time one significantly negatively predicted behavioral disaffection at time 2. Previous research has found that students who find the course important to their sense of self may be more likely to be actively involved in the course (Skinner et al., 2009) and as such be less behaviorally disengaged. Attainment value at time one was also a significant negative predictor of emotional engagement combined with intrinsic value. As mentioned previously, work done by Rosenzweig and colleagues (2019) may suggest this occurs because when the course is important to one's sense of self it can heighten feelings of pressure to do well which can lead to less emotional engagement and intrinsic valuing.

Students' utility value at time one was a significant positive predictor of behavioral, cognitive, and social engagement. In their interview study, Fredricks and colleagues (2018) also found that students were more likely to be behaviorally, cognitively, and emotionally engaged when they saw the relevance in what they were learning. Thus, students' perceptions that a course has utility for them is an important construct for developing their subsequent engagement. In fact, many researchers have begun implementing utility value interventions as a way to increase positive academic outcomes (see Rosenzweig & Wigfield, 2016 for a review).

Students' intrinsic value at time one also predicted their social engagement at time two. As discussed previously, students who are interested in the course may be more willing to share ideas and talk with other students (Fredricks et al., 2018). The combined factor of emotional engagement and intrinsic value had significant unidirectional paths to behavioral disaffection, cognitive engagement, social engagement, and the combined emotional disaffection and emotional cost factor. Students who are highly interested in the course and like the course are likely to not be withdrawn in the class or not putting forth effort and are likely to engage in deeper strategies to help with their learning (Fredricks et al., 2018; Skinner et al., 2009). Thus, it makes sense that EEIV would negatively predict subsequent behavioral disaffection and positively predict cognitive engagement. Additionally, because being interested in and excited for a course is the opposite of being emotionally disengaged, it makes sense that it would negatively predict subsequent emotional disaffection (combined with emotional cost).

Several of the dimensions of cost predicted different aspects of engagement and disaffection. Students' task effort cost and emotional cost were significant positive predictors of behavioral disaffection and negative predictors of social engagement. If students enter the course with negative appraisals of the amount of effort they will need to exert and feelings of worry and anxiety they may subsequently withdraw from the course because they feel like they are not capable (Dweck, 1999; Muenks et al., 2018). Additionally, if students are already feeling like they have to give up too much to be in their math or science course, they may not feel inclined to put in the extra effort of socially engaging with their peers, which might include things like after-class homework groups. Outside effort cost, loss of valued alternatives and the combined emotional disaffection and emotional cost factor significantly negatively predicted social engagement at time two and this explanation just noted may also hold.

Students' perceptions of outside effort cost and loss of valued alternatives was a negative predictor of social engagement in the cross-lagged analyses. Interestingly, students' perception of the emotional cost of their STEM course positively related to social engagement in the regression analyses but negatively predicted it in the cross-lagged analyses. This may be a methodological issue that is being masked by the regressions and demonstrates another "danger" of making casual inferences about cross-sectional data. However, because there has only been limited work done on how the EVT constructs relate to social engagement, it will be important for future research to continue to explore how they relate over time and whether these constructs are even relevant to social engagement.

Finally, there were some significant unidirectional paths from the engagement dimensions to students' motivational beliefs and values. Students' reports that they were behaviorally engaged at time 1 predicted their competence beliefs at time 2. When students are behaviorally engaged, they are putting in effort, remaining focused, and completing assignments. Thus, it could be that because students are putting in the effort, they subsequently develop stronger beliefs about their ability and this effort leads to better grades. No other engagement dimensions were significant unidirectional predictors of competence-related beliefs, suggesting that engagement may not play as strong of a role in the development of competence-related beliefs.

Students' reports of their behavioral engagement also significantly positively predicted time two attainment value. As mentioned previously, when students are behaviorally engaged, they are putting in extra effort, and this extra effort may also lead students to place more emphasis on the importance of achievement because of how much effort they have put into the course (Dweck, 1999; Dweck & Leggett, 1998). Cognitive engagement was also a significant predictor of attainment value. Fredricks and colleagues also found that attainment value predicted cognitive engagement in math and science. When performing well on a task is important to one's self-schema, they may be more likely to implement deeper learning strategies to help ensure they perform well on the task.

Students' emotional engagement at time one was also a significant positive predictor of utility value at time two. Students' emotional engagement may be particularly likely to predict their utility value because as noted earlier according to Eccles, emotional engagement can be considered an antecedent of other types of engagement and can be part of the individual's affective reactions and memories box in the EV model (see Figure 1; Eccles & Wang, 2012). Students who enjoy the material and want to learn more in the class may be especially likely to develop ideas about the relevance of what they're doing in their math and/or science course because students who are emotionally engaged tend to also place a value in learning (Finn, 1989; Fredricks et al., 2018; Voelkl, 1997).

Interestingly, all of the engagement variables at time one (except agentic) and behavioral disaffection predicted students' utility value for future life at time two. This may have occurred because utility for future life as its name suggests emphasizes the future, which might mean it is a function of previous engagement. For example, if students are engaged in the class, they might be more likely to see the utility of the class for their life in the future because they have been actively participating in the class (Hulleman & Harackiewicz, 2009).

Students' reports of their emotional disaffection from their STEM course at time one significantly positively predicted their reports of outside effort cost and task effort cost at time two. Many of the students in this study were first- and second-year students and the courses in which they were enrolled during this study mostly were general required courses for all students. Previous work has shown that first and second year students experience anxiety and worry about managing their course load (Misra & McKean, 2000) and thus this anxiety may transform into feelings of frustration about having to put in additional effort into a required course that takes time away from a major-related course. Emotional engagement at time one was also a significant negative predictor of outside effort cost, which makes conceptual sense because emotional engagement can be considered the opposite of emotional disaffection.

None of the engagement dimensions were significant unidirectional predictors of emotional cost. However, students' reports of their emotional engagement significantly negatively predicted combined emotional disaffection and emotional cost. As mentioned previously, if students are emotionally engaged in the course at the beginning of the semester, this can help protect them from becoming emotionally withdrawn in the course.

In summary, there were only four reciprocal relations found among the EVT constructs and dimensions of engagement; all of the other relations were unidirectional. More specifically, an examination of figures 6 -16 showing the cross-lagged analyses indicates that there were 25 significant paths from motivational beliefs and values measured at time one to engagement dimensions at time two compared to 18 significant paths from engagement dimensions measured at time one to motivational beliefs or values measured at time two. In that sense students' motivational beliefs and values more often predicted their engagement than the reverse, supporting the views of theorists positing that motivation leads to engagement. However, because research examining these reciprocal and unidirectional effects within a cross-lagged modeling framework is so limited there is little other work to which my findings can be compared. Further, the findings that some engagement dimensions at time one are stronger predictors of EVT constructs at time two suggests that motivation cannot always be thought of to be the driving force of engagement but rather these constructs share a complex, yet interconnected relationship. Future research should continue to explore how reciprocal motivation and engagement really are. Doing so in different age groups would be especially useful.

Dimensions of Engagement as Mediators of the Relationship between EVT Constructs and Domain-Specific Grades

Researchers have treated engagement as both an outcome of motivation and as a predictor of academic achievement. Thus, how engaged students are in the task should predict their achievement, as long as students are also reporting that they are motivated to do the task. With respect to the current study, that means having positive competence beliefs for and valuing of the task. Therefore, it is possible that engagement mediates the relationship between motivational beliefs, task values, and grades; I explored this possibility in this study.

I found that students' behavioral and cognitive engagement indeed did mediate the relations of all the EVT constructs to domain-specific grades except for competence-related beliefs. Thus, behavioral and cognitive engagement are underlying mechanisms by which task values predict domain-specific grades. One explanation for why behavioral and cognitive engagement are more likely to mediate the relationship between task values and domain-specific grades could be because researchers have consistently found that competence-related beliefs directly predict students' achievement outcomes (such as test scores and GPA), whereas task values predict more strongly and directly students' course-taking choices and intentions (Durik, Vida, & Eccles, 2006; Guo et al., 2016; Eccles, 1987; Eccles-Parsons et al., 1983; Meece et al., 1990; Tonks et al., 2017; Wigfield et al., 2015). Therefore, students' task values may be particularly impactful on the subsequent development of their behavioral and cognitive engagement, and as such this behavioral and cognitive engagement leads to positive academic achievement.

The only significant partial mediator of the relations of students' competence-related beliefs to their grades was emotional disaffection (correlated with emotional cost). The direct path from competence-related beliefs to grades was much larger based on the standardized betas compared to the mediated path. As mentioned above, researchers have consistently found competence-related beliefs to be a strong predictor of academic achievement. These results suggest that emotional disaffection provides one partial mechanism for the relationship between competence-related beliefs and grades.

Students' emotional engagement and EEIV were also significant mediators of many of the relations of their task values to their domain-specific grades. Thus, developing positive emotional reactions to teachers, peers, and classroom activities can help facilitate the connection between perceptions that the class is important and help protect against the negative feelings associated with the cost constructs. However, because emotional engagement is an affective response which in Eccles et al.'s model is included in the "Individual's Affective Reactions and Memories" box, it should be considered more of a precursor and consequence of behavioral or cognitive engagement rather than as a consequence of motivational beliefs and values. (Eccles & Wang, 2012).

Researchers should continue to explore how emotional engagement relates to motivation, other engagement dimensions, and achievement outcomes.

Interestingly, students' social engagement, agentic engagement, and behavioral disaffection were not significant mediators of the relations between students' competence beliefs and values to their domain-specific grades. Social and agentic engagement are newly proposed dimensions of engagement and as such more research needs to be done in order to better understand how these dimensions relate to motivational beliefs, values and academic outcomes. Alternatively, perhaps these dimensions in general are not strong predictors of achievement. Wang and colleagues (2016) found that social engagement was a significant negative predictor of math and science achievement. The finding by Wang and colleagues and the finding in the present study suggests that social engagement is not a useful tool for increasing academic achievement in math and science. Reeve (2013) has found that agentic engagement is uniquely predictive of course achievement among students enrolled in an education course; however, the course was not a math or science course. Thus, perhaps agentic engagement has little relevance in the math or science domain. With respect to behavioral disaffection, it was surprising that it was not a significant mediator of any of the EVT constructs and domain-specific grades. Skinner and Pitzer (2012) stated that disaffection dimensions mediates the relationship between student motivation and student achievement. However, in this study, competence-related beliefs and values appeared to be strong predictors of domain-specific grades regardless of students' behavioral disaffection.

In conclusion, my results show that students' reports of their behavioral and cognitive engagement are the strongest mediators of some of the relationships between students' competence beliefs and values and domain-specific grades (particularly their task values). Students' competence beliefs themselves mostly directly predicted their grades. And several of the dimensions of engagement did not serve as mediator at all. Thus, this study provides some evidence that cognitive and behavioral engagement should be allocated their own box within the EV model, in between expectancies, values, and outcomes. Researchers should continue to explore which engagement dimensions mediate the relationship between students' motivational beliefs and values and their academic achievement in other domains and across various age groups.

Theoretical Implications

Results of this study have a number of important theoretical implications, both for the expectancy-value model and also the engagement construct. I've noted some of these in the discussions of the results for each hypothesis and the RQ; here I discuss some broader implications. Beginning with the EV model, there is some evidence that the four engagement dimensions I mentioned should be placed in different parts of the model (see Figure 17). Behavioral and cognitive engagement were found to be mediators of the relations between all the task value constructs and domain-specific grades. Therefore, I would place behavioral and cognitive engagement in their own box in between the "Subjective Task Values" box and "Achievement-Related Choices and Performance" box. Doing so would differ from Eccles,' view; she has stated that she has always considered engagement, particularly behavioral and cognitive engagement to be part of the outcomes box (e.g., see Eccles & Wang, 2013). Future longitudinal research could assess these competing views.

Another reason why behavioral and cognitive engagement should have their own box is that students' competence-related beliefs were not found to be very strongly associated with either their behavioral or cognitive engagement nor were competence-related beliefs found to be predictive of subsequent behavioral and cognitive engagement in the cross-lagged models. Thus, competence-related beliefs may be desired but are not a necessary component for students to be behaviorally and cognitively engaged. Therefore, a path from competence-related beliefs to behavioral and cognitive engagement may not be needed and is another reason why behavioral and cognitive engagement should be placed within the "Achievement-Related Choices and Performance" box.

In the cross-lagged models, emotional engagement was found to be more predictive of the EV constructs than vice versa. However, emotional engagement was also found to be a significant mediator of the relationship between many of the task value constructs and domain-specific grades. Therefore, I would place emotional engagement into the "Affective Reactions and Memories" box. I would also add a double-headed across time arrow from the "Subjective Task Value" box to the "Affective Reactions and Memories" box to take into account that emotional engagement can be a mediator of task values and achievement. Eccles and her colleagues also have stated that emotional engagement may be an antecedent of behavioral and cognitive engagement (e.g., Eccles & Wang, 2012). This can also be taken into account by placing emotional engagement into the "Affective Reactions and Memories" box. Future research could examine whether emotional engagement predicts behavioral and cognitive engagement.

In terms of social engagement, the cross-lagged models showed that each of the EV constructs predicted later social engagement; however, social engagement was not found to be a significant mediator of the relation between EV constructs and domain-specific grades. Thus, if social engagement were to be placed within the EV model, I would place it in its own box with arrows coming from "Expectation of Success" and "Subjective Task Value." Additionally, I would not place an arrow from social engagement to the "Achievement-Related Choices and Performance" box because it was not found to be a significant mediator of the EV constructs and domain-specific grades. More research is needed to understand better how social engagement may be related to achievement-related outcomes in the academic domain. It is also important to note that research done on social engagement in relation to math and science achievement has predominately been conducted among middle and high school students. Thus, more research is needed on social engagement among university students in order to better know whether this engagement dimension has important implications for achievement-related outcomes.

As discussed in Chapter Two, agentic engagement is a newly proposed dimension of engagement that is based in Self-Determination Theory (SDT; Reeve & Tseng, 2011). SDT theorists emphasize that autonomy and perceived control are crucial to motivation and being "agentic" captures that notion. One of the broader aims of this dissertation was to gain a better understanding of whether agentic engagement should be considered as another dimension of engagement. Further, I wanted to explore how agentic engagement relates to the motivational beliefs and values in EVT, in order to see if it could or should also be incorporated into Eccles and colleagues' (1983) EVT model. Additionally, there is limited evidence of how valid agentic engagement is in Western samples since the limited work done on agentic engagement has been conducted in Eastern cultures (Reeve, 2012; Reeve & Tseng, 2011). I did not find agentic engagement to be strongly associated with or predicted by the EV constructs and thus there is little evidence that agentic engagement should be incorporated into the EV model. Thus, as of now agentic engagement should be studied in terms of self-determination theory; however, more research is needed to better understand agentic engagement's potential unique contributions to student success.

Also as discussed in Chapter 2, behavioral and emotional disaffection are part of Skinner and colleagues (1993; 2008; 2009) self-system model of motivational development. However, I think they could also be incorporated into the EV model. In the cross-lagged models, behavioral disaffection was significantly predicted by most of the EV constructs; however, it was not a significant mediator of any of the relations between the EV constructs and domain-specific grades. Therefore, maybe behavioral disaffection is best placed within its own box with arrows leading to it from the "Expectation of Success" box and the "Subjective Task Value" box. Because of the strong relationship between emotional disaffection and emotional cost, I would incorporate emotional disaffection into the "Subjective Task Value" box.

Results from this study begin to provide evidence of how and whether engagement dimensions can be incorporated into the EV model. However, before the EV model can modified to include dimensions of engagement, additional research needs to be conducted in order to know whether these findings remain the same in different samples and domains.

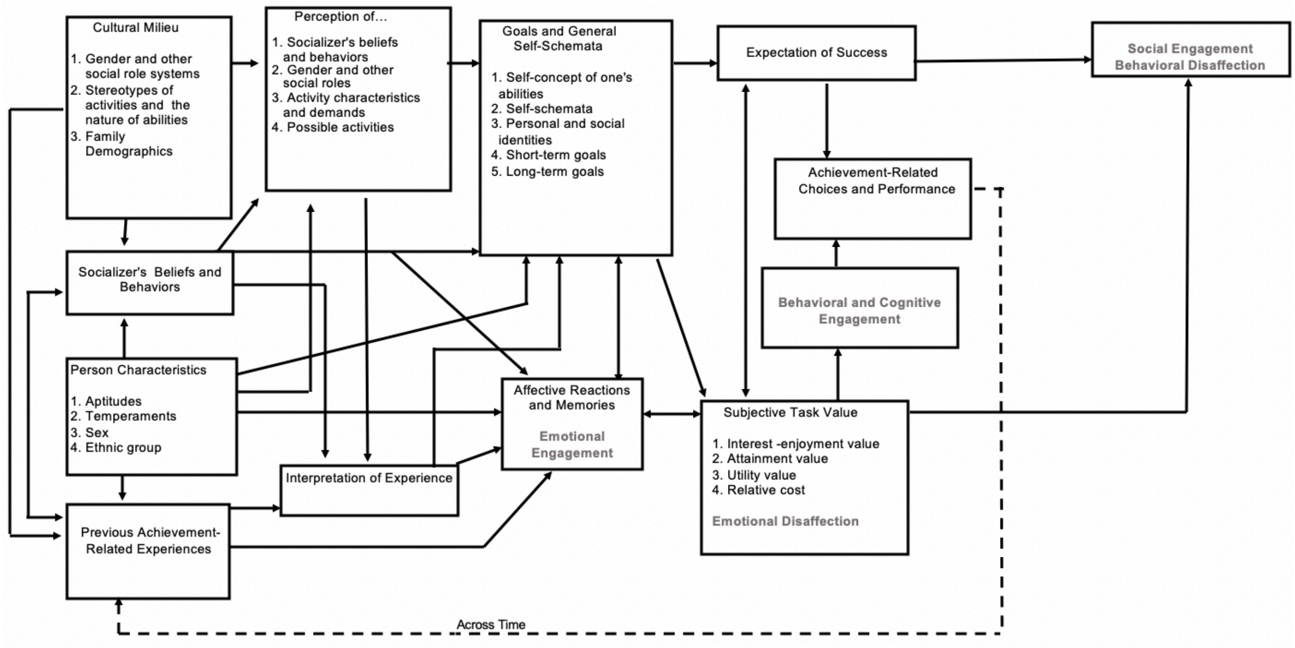


Figure 17. Expectancy-Value Theory with engagement dimensions incorporated into it.

Educational Implications

Educational policy makers are seeking to increase the number of STEM majors and understanding better student motivation and engagement in these subject areas will provide information relevant to this goal. The literature I reviewed in Chapter 2 made it clear that students' motivation and engagement in math and science relates to students' academic achievement, understanding, and long-term participation in STEM courses and careers. Essentially every career requires a basic understanding of math and science, and advanced careers in STEM fields are unattainable without a strong foundation of math and science. The findings of this study provide important information about the overlap of the motivation and engagement constructs, their relations both contiguously and over time, and their relations to students' performance. The findings also provide important information regarding how these constructs should and can be used in future interventions.

The finding that emotional cost and emotional disaffection and emotional engagement and intrinsic value are distinct but highly correlated has important implications for how these constructs, and others like them, are defined and measured. If we are to create motivation and engagement-based interventions, we need to pay particular attention to how we operationalize variables. In order to evaluate an intervention, you have to have good measures (see Rosenzweig & Wigfield, 2016 for discussion). Having clear operationalizations of variables will allow researchers to better modify characteristics of the intervention and be able to compare effects across studies.

The regression results suggest that attainment value and intrinsic value would be the two best EVT constructs to emphasize when implementing interventions targeted at increasing student engagement in math and science among college undergraduates because they were found to be strongly associated with most engagement dimensions. At the present time, there are not any attainment value interventions developed.

However, the results from the cross-lagged analyses showed that engagement dimensions (except for agentic engagement) can impact subsequent motivational beliefs and values. Thus, it is sometimes important to target engagement first in order to impact subsequent motivation. For example, getting students behaviorally engaged at the beginning of the semester could have long-term consequences for their competence-related beliefs and perceptions of how important the class is. Additionally, targeting decreasing emotional disaffection at the beginning of the semester could help protect the development of motivational beliefs and values throughout the semester.

The mediation findings also have implications for the creation of future STEM interventions. The mediation findings demonstrate that motivational beliefs, values, and behavioral and cognitive engagement in particular, should be targeted if the goal is to increase math and science achievement. Interventions aimed at increasing engagement and decreasing disengagement currently exist in the literature (see Christenson et al., 2012 for a review), but no intervention to my knowledge has focused on the explicit combination of motivation and engagement.

Limitations

Although this study provides important new insights into the complex relationships of EVT constructs and dimensions of engagement, there are several limitations that should be noted. The first limitation is the sample size. Although the sample size was appropriate for the analyses I conducted, a larger sample would have allowed for more complex structural equation models that could examine unique relations of motivational beliefs and values to engagement dimensions, rather than examining each relationship one at a time. Additionally, a larger sample could have allowed me to separate the data by math and science classrooms, rather than collapsing across the two domains. Gender and ethnicity differences were also not explored in-depth in this study. Gender differences in competence-related beliefs, task values and engagement are one explanation for why girls are less likely to pursue a STEM major or career (Fredricks et al., 2018). Thus, it will be important for future research to explore how these relations are similar or different among different demographic groups. Further examination of the associations between EVT constructs, engagement dimensions and achievement-related outcomes in other domains, across diverse national/international samples, would be useful for clarifying whether the current findings are replicable.

Another limitation of the present study is that students' motivational beliefs, values, and engagement were all self-report. Although self-report measures are the norm in the study of motivational beliefs, values, and engagement, including teacher report measures could add an additional layer to our understanding of the relations between these constructs. Additionally, these findings may look differently if examined in other domains. Some of the scales, such as the Math and Science Engagement Scale (Wang et al., 2016), were developed specifically for math and science classrooms and therefore these findings may not generalize to other domains. Finally, although this study has the strength of examining these relations over two time points, additional time points would have allowed me to make stronger conclusions about their reciprocal relations (Marsh et al., 2005). Future research should examine these relationships at multiple points to better explore their dynamic relations.

Conclusions

In conclusion, over the last thirty years researchers have discussed and studied the constructs of motivation and engagement; however, their relative distinctiveness and relations over time have not been examined closely. My dissertation study based in the Expectancy-Value Theory of motivation provides important new information about the overlap of two engagement dimensions and two task values and how EVT constructs are associated with the five proposed dimensions of engagement and two dimensions of disaffection. Further, the cross-lagged results provide some evidence that motivational beliefs and values are predictive of subsequent engagement. However, by college these relationships may become reversed, with behavioral, cognitive, emotional and social engagement preceding motivational beliefs and values. Finally, I found that two engagement dimensions, behavioral and cognitive engagement, mediate the relations of task values and domain-specific grades. These findings have implications for the potential integration of engagement dimensions into the EV model. Without a widely accepted theory of engagement, it becomes difficult to explain nuances in findings. Thus, beginning to discuss the integration of dimensions of engagement into well-developed theories of motivation could help excel the field forward and make comparisons and conclusions across studies easier.

Appendix A: Survey Measures

Instructions:
Welcome!

Before we begin, please enter your UID number:
Please enter your UID number again:

In this part of the survey you will be asked to report how much you agree or disagree with a number of statements about [**course name**]. It is very important that you think about [**course name**] when answering **all** of the following questions. We are simply interested in your opinions; there are no right or wrong answers. Please answer as accurately and honestly as you can.

Please note that the response scales may change slightly from one statement to the next.

Engagement vs. Disaffection with Learning Scale (Skinner et al., 2009): Items will be answered on a 4-point Likert scale ranging from "Not at all true" to "very true."

Behavioral Disaffection:
1. When I'm in class, I just act like I'm working.
2. I don't try very hard at school.
3. In class, I do just enough to get by.
4. When I'm in class, I think about other things.
5. When I'm in class, my mind wanders.

Emotional Disaffection:
1. When we work on something in class, I feel bored.
2. When I'm in class, I feel worried.
3. When we work on something in class, I feel discouraged.
4. When I'm in class, I feel bad.
5. Class is not all that fun for me.

Math and Science Engagement Scales (Wang et al., 2016): Items will be answered on a 5-point Likert scale ranging from "Not like me at all" to "Very much like me."

Behavioral Engagement:
1. I stay focused.
2. I put effort into learning science/math.
3. I keep trying even if something is hard.
4. I complete my homework on time.
5. I talk about science/math outside of class.
6. I don't participate in class.
7. I do other things when I am supposed to be paying attention.
8. If I don't understand, I give up right away.

Cognitive Engagement:
1. I go through the work for science/math class and make sure that it's right.
2. I think about different ways to solve a problem.
3. I try to connect what I am learning to things I have learned before.
4. I try to understand my mistakes when I get something wrong.
5. I would rather be told the answer than have to do the work.
6. I don't think that hard when I am doing work for class.
7. When work is hard I only study the easy parts.
8. I do just enough to get by.

Emotional Engagement:
1. I look forward to science/math class.
2. I enjoy learning new things about science/math.
3. I want to understand what is learned in science/math class.
4. I feel good when I am in science/math class.
5. I often feel frustrated in science/math class.
6. I think that science/math class is boring.
7. I don't want to be in science/math class.
8. I don't care about learning science/math.
9. I often feel down when I am in science/math class.
10. I get worried when I learn new things about science/math.

Social Engagement:
1. I build on others' ideas.
2. I try to understand other people's ideas in science/math class.
3. I try to work with others who can help me in science/math.
4. I try to help others who are struggling in science/math.
5. I don't care about other people's ideas.
6. When working with others, I don't share ideas.
7. I don't like working with classmates.

Agentic Engagement Scale (Reeve, 2013): Items will be answered on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree."

Agentic Engagement:
1. During class, I express my preferences and opinions.
2. During class, I ask questions.
3. I tell the teacher what I like and what I don't like.
4. I let my teacher know what I am interested in.
5. I offer suggestions about how to make the class better.

Children's Ability Beliefs and Subjective Task Values (Eccles & Wigfield, 1995): Items will be answered on a 7-point Likert scale with different anchors depending on the item.

Ability Beliefs
1. How good in science/math are you? (not at all good – very good)
2. If you were to list all the students in your class from the worst to the best in science/math, where would you put yourself (one of the worst – one of the best)
3. Some kids are better in one subject than in another. For example, you might be better in math than in reading. Compared to most of your other school subjects, how good are you in science/math? (a lot worse in science/math than in other subjects – a lot better in science/math than in other subjects)

Expectancy Beliefs
1. How well do you expect to do in science/math this year? (not at all well – very well).
2. How good would you be at learning something new in science/math? (not at all good – very good)

Attainment Value
1. Compared to most of your other activities, how important is it for you to be good at science/math? (not at all important – very important).

Utility Value
1. In general, how useful is what you learn in math? (not at all useful – very useful).
2. Compared to most of your other activities, how useful is what you learn in math? (not at all useful – very useful)

Value Facets Questionnaire (Gaspard et al., 2015): Items will be answered on a 4-point Likert scale ranging from "completely disagree" to "completely agree."

Importance of Achievement (Attainment Value)
1. It is important to me to be good at science/math.
2. Being good at science/math means a lot to me.
3. Performing well in science/math is important to me.
4. Good grades in science/math are very important to me.

Intrinsic Value
1. Science/math is fun to me.
2. I like doing science/math.
3. I simply like science/math.
4. I enjoy dealing with science/math topics.

Utility for Job
1. Good grades in science/math can be of great value to me later on.
2. Learning science/math is worthwhile, because it improves my job and career chances.

General Utility for Future Life

1. Science/math contents will help me in life.
2. I will often need science/math in my life.

Perceptions of Cost Scale (Flake et al., 2015): Items will be answered on a 9-point Likert scale ranging from "Completely disagree" to "Completely agree."

Task Effort Cost

1. This class demands too much of my time.
2. I have to put too much energy into this class.
3. This class takes up too much time.
4. This class is too much work.
5. This class requires too much effort.

Outside Effort Cost

1. I have so many other commitments that I can't put forth the effort needed for this class.
2. Because of all the other demands on my time, I don't have enough time for this class.
3. I have so many other responsibilities that I am unable to put in the effort that is necessary for this class.
4. Because of other things that I do, I don't have time to put into this class.

Loss of Valued Alternatives

1. I have to sacrifice too much to be in this class.
2. This class requires me to give up too many other activities I value.
3. Taking this class causes me to miss out on too many other things I care about.
4. I can't spend as much time doing the other things that I would like because I am taking this class.

Emotional Costs

1. I worry too much about this class.
2. This class is too exhausting.
3. This class is emotionally draining.
4. This class is too frustrating.
5. This class is too stressful.
6. This class makes me feel too anxious.

Demographics

1. What is your gender?
2. What is your ethnicity?
3. What is your age?
4. What year in school are you?
5. What is your major? If you have not declared a major, please indicate the field that you intend to major in if you know.
6. Is **[course name]** a required course for your major?
7. Are you the first in your family to attend a college or university?
8. How likely is it that you will take more math/science courses after this one during the rest of your time in college?
9. Are you required to take more math/science courses for your major?

Supplemental Materials

Table S1

Factor Loadings for Emotional Disaffection and Emotional Cost

Models	2 factors		Unidimensional
	Lambda 1 (SE)	Lambda 2 (SE)	Lambda 1 (SE)
ED_1	0.44 (.08)	----	0.30 (.09)
ED_2	0.79 (.05)	----	0.73 (.05)
ED_3	0.89 (.04)	----	0.74 (.06)
ED_4	0.91 (.03)	----	0.75 (.05)
ED_5	0.70 (.06)	----	0.59 (.07)
EC_1	----	0.87 (.03)	0.87 (.03)
EC_2	----	0.88 (.02)	0.88 (.02)
EC_3	----	0.92 (.02)	0.92 (.02)
EC_4	----	0.94 (.01)	0.94 (.01)
EC_5	----	0.97 (.01)	0.96 (.01)
EC_6	----	0.95 (.01)	0.95 (.01)

Note. ED = emotional disaffection; EC = Emotional Cost; SE = standard error

Table S2

Factor Loadings for Emotional Engagement and Intrinsic Value

Models	2 factors		Unidimensional
	Lambda 1 (SE)	Lambda 2 (SE)	Lambda 1 (SE)
EE_1	0.88 (.03)	----	0.87 (.03)
EE_2	0.77 (.04)	----	0.78 (.04)
EE_3	0.32 (.12)	----	0.31 (.12)
EE_4	0.87 (.03)	----	0.85 (.03)
EE_5	0.72 (.05)	----	0.70 (.06)
EE_6	0.80 (.04)	----	0.79 (.04)
EE_7	0.87 (.03)	----	0.85 (.03)
EE_8	0.44 (.09)	----	0.43 (.09)
EE_9	0.77 (.05)	----	0.74 (.05)
EE_10	0.68 (.06)	----	0.67 (.07)
IV_1	----	0.95 (.02)	0.93 (.02)
IV_2	----	0.88 (.03)	0.87 (.03)
IV_3	----	0.96 (.02)	0.94 (.02)
IV_4	----	0.89 (.03)	0.88 (.03)

Note. EE = emotional engagement; IV = intrinsic value; SE = standard error

Table S3

Item parameters and standard errors for items demonstrating DIF for Across the Two Time Points

Item	Time	*a*	c_1	c_2	c_3	c_4
BD-4*	T1	4.91 (.13)	5.93 (.77)	0.67 (.24)	-5.68 (.75)	----
	T2	3.36 (.35)	4.12 (.36)	0.64 (.17)	-4.61 (.41)	----
BD-5*	T1	4.86 (.63)	5.04 (.55)	0.68 (.16)	-5.18 (.59)	----
	T2	3.21 (.31)	4.05 (.32)	0.65 (.17)	-3.98 (.34)	----
ED-2	T1	2.91 (.23)	2.20 (.20)	-0.42 (.17)	-4.30 (.29)	----
	T2	3.32 (.25)	2.91 (.23)	-0.85 (.19)	-4.86 (.32)	----
ED-3	T1	3.97 (.39)	1.84 (.23)	-2.96 (.29)	-7.59 (.66)	----
	T2	3.53 (.31)	1.83 (.21)	-2.76 (.27)	-6.88 (.51)	----
ED-4*	T1	4.32 (.53)	0.61 (.20)	-3.95 (.45)	-8.29 (.91)	----
	T2	4.05 (.46)	0.29 (.19)	-4.03 (.43)	-7.81 (.76)	----
ED-5*	T1	2.71 (.23)	3.72 (.25)	-1.06 (.20)	-4.61 (.30)	----
	T2	2.45 (.19)	3.53 (.24)	-0.74 (.19)	-4.43 (.27)	----
BE-1*	T1	2.24 (.20)	5.65 (.40)	3.40 (.24)	0.44 (.15)	-3.75 (.27)
	T2	2.02 (.18)	3.25 (.20)	1.68 (.12)	0.15 (.15)	-1.34 (.12)
BE-3*	T1	2.17 (.21)	7.73 (.67)	6.23 (.45)	2.94 (.22)	-0.89 (.16)
	T2	2.25 (.23)	8.99 (.79)	6.11 (.41)	2.64 (.22)	-1.18 (.16)
BE-4*	T1	1.12 (.18)	7.46 (.52)	4.82 (.27)	2.69 (.19)	0.39 (.17)
	T2	1.13 (.17)	6.65 (.37)	4.76 (.25)	2.65 (.19)	0.25 (.17)
BE-5*	T1	0.89 (.14)	2.28 (.17)	0.33 (.14)	-1.60 (.15)	-3.51 (.21)
	T2	0.90 (.13)	3.01 (.19)	0.75 (.15)	-1.39 (.15)	-3.39 (.21)
BE-6*	T1	1.61 (.16)	3.90 (.24)	1.75 (.17)	-0.32 (.16)	-2.95 (.20)
	T2	1.55 (.16)	4.16 (.24)	2.09 (.18)	-0.14 (.16)	-2.63 (.19)
BE-7*	T1	2.25 (.20)	5.26 (.33)	2.93 (.22)	0.25 (.17)	-2.75 (.21)
	T2	1.98 (.17)	5.21 (.29)	2.96 (.21)	-0.15 (.17)	-2.77 (.21)
BE-8*	T1	1.40 (.16)	6.15 (.54)	4.70 (.32)	2.64 (.19)	0.04 (.13)
	T2	1.37 (.14)	6.37 (.50)	4.71 (.30)	2.81 (.19)	-0.27 (.13)
CE-3*	T1	1.30 (.16)	5.57 (.38)	3.43 (.22)	1.19 (.15)	-1.53 (.16)
	T2	1.07 (.13)	5.09 (.30)	3.36 (.20)	0.87 (.15)	-1.67 (.16)
CE-5*	T1	1.79 (.18)	5.27 (.34)	3.69 (.24)	1.56 (.17)	-1.62 (.17)
	T2	1.74 (.16)	5.65 (.34)	3.93 (.24)	1.76 (.18)	-1.87 (.17)
CE-6	T1	0.88 (.15)	4.85 (.29)	3.25 (.20)	1.18 (.15)	-1.90 (.16)
	T2	1.00 (.14)	6.24 (.41)	3.89 (.22)	1.46 (.16)	-1.68 (.16)
CE-7	T1	2.20 (.23)	7.02 (.59)	5.42 (.40)	3.01 (.24)	-0.22 (.15)
	T2	1.90 (.19)	7.33 (.57)	4.73 (.30)	2.49 (.21)	-0.31 (.15)
CE-8*	T1	2.03 (.20)	5.68 (.39)	3.20 (.22)	0.96 (.16)	-1.96 (.18)

	T2	1.97 (.18)	5.92 (.36)	3.37 (.23)	1.21 (.17)	-1.91 (.18)
SE-3	T1	2.26 (.21)	5.32 (.36)	2.70 (.21)	1.05 (.16)	-1.92 (.18)
	T2	2.00 (.18)	5.08 (.30)	3.30 (.22)	0.93 (.16)	-1.88 (.17)
EEIV-EE4	T1	3.18 (.21)	5.15 (.34)	1.11 (.17)	-2.61 (.20)	-5.82 (.36)
	T2	2.53 (.16)	4.68 (.27)	0.92 (.15)	-2.22 (.17)	-4.90 (.30)
EEIV-EE6*	T1	2.81 (.18)	4.97 (.30)	3.08 (.22)	0.29 (.16)	-3.10 (.21)
	T2	3.04 (.19)	5.61 (.31)	3.22 (.21)	0.28 (.16)	-3.48 (.23)
EEIV-EE9*	T1	2.18 (.16)	4.65 (.29)	2.89 (.20)	1.04 (.15)	-1.84 (.16)
	T2	1.77 (.13)	4.26 (.24)	2.63 (.17)	0.83 (.14)	-1.79 (.15)
EEIV-EE10*	T1	1.97 (.16)	4.82 (.29)	2.87 (.20)	0.39 (.15)	-1.86 (.17)
	T2	1.73 (.14)	4.24 (.24)	2.51 (.17)	0.48 (.14)	-2.01 (.16)
EEIV-IV1*	T1	4.34 (.34)	4.34 (.35)	-0.11 (.17)	-6.82 (.94)	----
	T2	3.92 (.28)	4.11 (.30)	0.10 (.16)	-4.98 (.36)	----
EEIV-IV3*	T1	5.72 (.44)	5.63 (.45)	-0.20 (.22)	-6.56 (.50)	----
	T2	5.91 (.45)	6.23 (.48)	0.50 (.22)	-6.93 (.54)	----
EEIV-IV4*	T1	3.43 (.24)	4.87 (.34)	0.91 (.17)	-3.71 (.26)	----
	T2	3.24 (.22)	4.75 (.31)	1.07 (.16)	-3.28 (.23)	----
EE-1	T1	3.49 (.24)	4.12 (.29)	0.45 (.17)	-3.05 (.23)	-6.22 (.40)
	T2	3.13 (.21)	3.70 (.24)	0.43 (.16)	-2.52 (.20)	-5.46 (.36)
EE-2*	T1	2.72 (.19)	7.00 (.46)	3.67 (.24)	0.64 (.17)	-2.64 (.20)
	T2	2.55 (.18)	6.79 (.39)	3.54 (.22)	0.39 (.16)	-2.83 (.20)
EE-3	T1	0.82 (.14)	6.83 (.63)	5.16 (.34)	3.43 (.21)	0.74 (.14)
	T2	1.15 (.14)	6.06 (.40)	4.72 (.26)	2.71 (.17)	-0.01 (.14)
EE-4*	T1	3.11 (.23)	4.85 (.35)	1.09 (.16)	-2.37 (.20)	-5.57 (.39)
	T2	2.40 (.17)	4.30 (.27)	0.93 (.14)	-1.90 (.16)	-4.43 (.30)
EE-5*	T1	2.59 (.18)	3.95 (.25)	2.08 (.18)	-0.18 (.16)	-3.43 (.23)
	T2	2.47 (.17)	3.97 (.23)	1.99 (.18)	-0.30 (.15)	-3.43 (.22)
EE-6*	T1	3.07 (.21)	5.36 (.33)	3.32 (.24)	0.32 (.17)	-3.37 (.23)
	T2	3.10 (.20)	5.94 (.32)	3.50 (.23)	0.43 (.17)	-3.52 (.24)
EE-7	T1	3.38 (.26)	5.74 (.40)	4.17 (.30)	1.48 (.18)	-1.79 (.18)
	T2	3.99 (.30)	6.57 (.45)	4.66 (.34)	1.96 (.21)	-1.48 (.19)
EE-8*	T1	1.20 (.14)	5.73 (.43)	4.34 (.27)	3.14 (.20)	0.32 (.13)
	T2	1.27 (.14)	5.57 (.36)	4.20 (.24)	2.39 (.17)	-0.21 (.13)
EE-9*	T1	2.57 (.19)	4.80 (.32)	2.98 (.22)	1.08 (.15)	-1.88 (.17)
	T2	2.18 (.16)	4.53 (.27)	2.85 (.19)	1.02 (.14)	-1.67 (.15)
IV-3*	T1	6.14 (.71)	5.90 (.66)	-0.11 (.24)	-7.02 (.77)	----
	T2	4.92 (.45)	5.10 (.45)	0.10 (.20)	-6.13 (.54)	----
IV-4	T1	3.54 (.29)	4.88 (.38)	1.00 (.18)	-3.78 (.30)	----
	T2	3.26 (.25)	4.79 (.34)	0.96 (.16)	-3.42 (.25)	----
AV-1	T1	3.17 (.37)	10.72 (1.31)	7.34 (.67)	1.98 (.26)	----

	T2	2.89 (.28)	8.66 (.66)	6.19 (.47)	1.61 (.23)	----
AV-2*	T1	2.77 (.29)	6.95 (.60)	4.23 (.36)	0.30 (.16)	----
	T2	2.51 (.23)	6.04 (.43)	4.12 (.33)	0.47 (.16)	----
AV-3*	T1	7.71 (2.66)	19.71 (6.33)	13.66 (4.34)	4.75 (1.63)	----
	T2	3.16 (.36)	9.02 (.87)	6.72 (.66)	2.12 (.30)	----
AV-4*	T1	2.98 (.40)	9.00 (1.07)	6.54 (.68)	2.74 (.34)	----
	T2	3.14 (.36)	10.83 (1.19)	7.56 (.72)	2.69 (.33)	----

Note. * indicates significantly different slopes between time one and time two Numbers in parentheses are standard errors.
a: item slope, c: item intercept, T1 = Time One; T2 = Time Two; BD = Behavioral Disaffection Scale; ED = Emotional Disaffection Scale; BE = Behavioral Engagement Scale; CE = Cognitive Engagement Scale; SE = Social Engagement Scale; EEIV= Emotional Engagement and Intrinsic Value as a single factor; EE = Emotional Engagement Scale; IV = Intrinsic Value Scale; AV = Attainment Value Scale

Table S4

Tests of Measurement Invariance of Agentic Engagement Across Time

Model	AIC	*BIC*	χ^2	DF	CFI	TLI	RMSEA	SRMR
M1: Configural invariance	15823.762	15988.314	139.992	29	.935	.899	.073	.056
M2: Weak measurement invariance	15822.795	15969.064	150.235	33	.931	.906	.071	.060
M3: Strong measurement invariance	15820.259	15943.673	160.968	38	.928	.914	.067	.063

Note. N = 714

Table S5

Tests of Measurement Invariance of Competence Beliefs Across Time

Model	AIC	*BIC*	χ^2	DF	CFI	TLI	RMSEA	SRMR
M1: Configural invariance	13714.511	13879.012	76.142	29	.981	.970	.048	.030
M2: Weak measurement invariance	13725.648	13871.872	92.545	33	.976	.967	.050	.055
M3: Strong measurement invariance	13783.957	13907.333	149.881	38	.954	.946	.064	.088

Note. N = 713

Table S6

Tests of Measurement Invariance of Task Effort Cost Across Time

Model	AIC	*BIC*	χ^2	DF	CFI	TLI	RMSEA	SRMR
M1: Configural invariance	16706.533	16870.984	93.845	29	.978	.966	.056	.023
M2: Weak measurement invariance	16706.103	16852.281	103.014	33	.976	.968	.055	.028
M3: Strong measurement invariance	16730.091	16853.429	134.082	38	.968	.962	.060	.045

Note. N = 712

Table S7

Tests of Measurement Invariance of Outside Effort Cost Across Time

Model	AIC	*BIC*	χ^2	DF	CFI	TLI	RMSEA	SRMR
M1: Configural invariance	13555.513	13687.987	29.444	15	.993	.987	.037	.018
M2: Weak measurement invariance	13550.556	13669.326	32.600	18	.993	.990	.034	.019
M3: Strong measurement invariance	13584.799	13685.297	68.738	22	.979	.973	.055	.066

Note. N = 712

Table S8

Tests of Measurement Invariance of Loss of Valued Alternatives Across Time

Model	AIC	*BIC*	χ^2	DF	CFI	TLI	RMSEA	SRMR
M1: Configural invariance	13721.889	13854.363	67.976	15	.973	.949	.070	.023
M2: Weak measurement invariance	13717.340	13838.110	70.667	18	.973	.958	.064	.025
M3: Strong measurement invariance	13737.964	13838.462	97.296	22	.961	.951	.069	.054

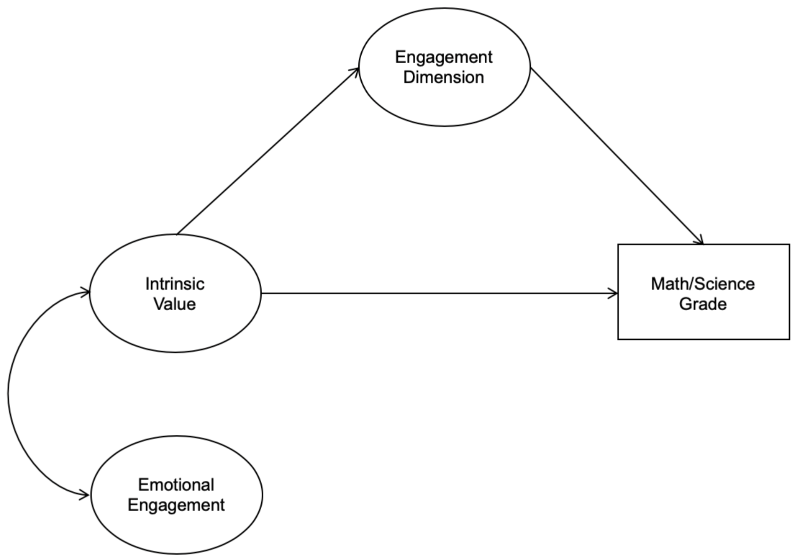
Note. N = 712

Table S9

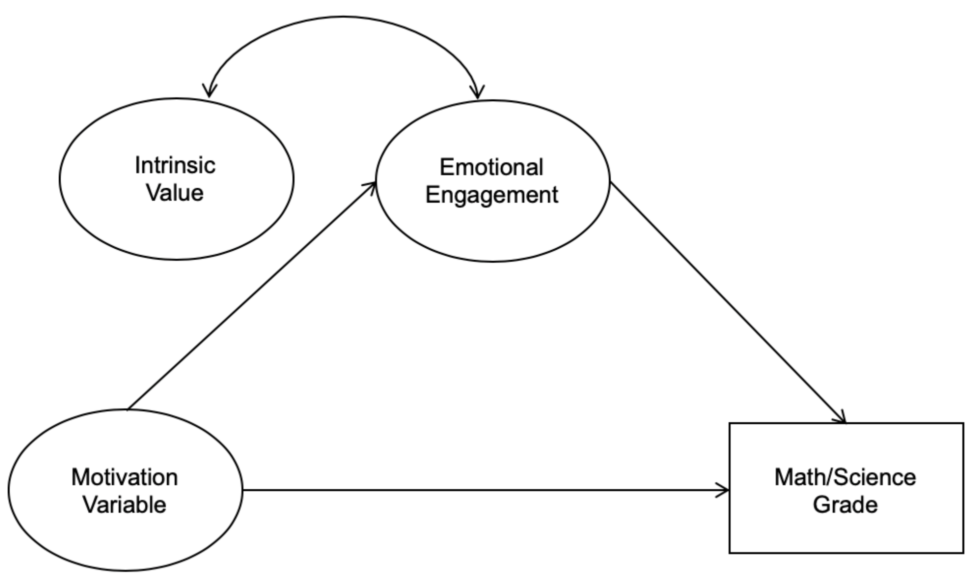
Tests of Measurement Invariance of Emotional Cost Across Time

Model	AIC	*BIC*	χ^2	DF	CFI	TLI	RMSEA	SRMR
M1: Configural invariance	20615.787	20812.215	126.750	47	.981	.973	.049	.023
M2: Weak measurement invariance	20610.240	20783.827	135.079	52	.980	.975	.047	.026
M3: Strong measurement invariance	20635.315	20781.493	168.440	58	.973	.970	.052	.043

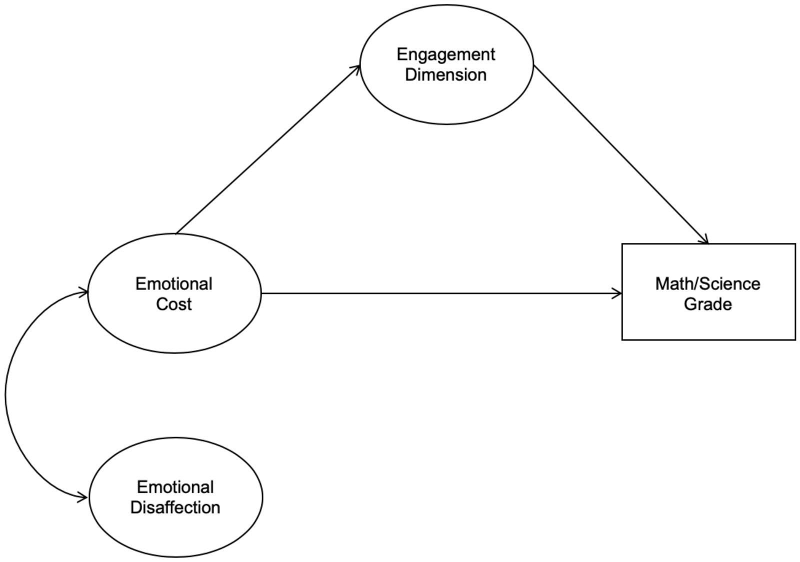
Note. N = 712



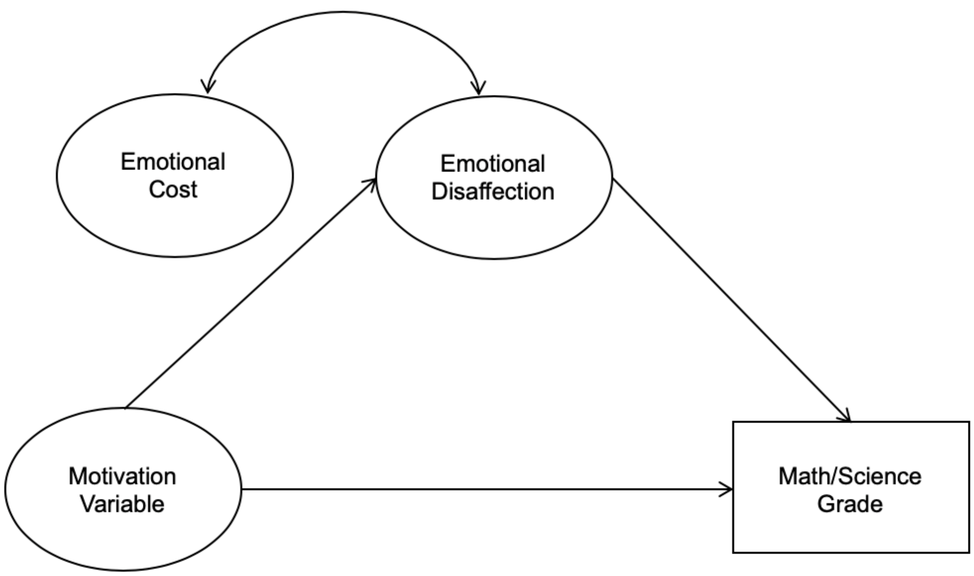
Supplemental Figure 1. The mediation model for intrinsic value correlated with emotional engagement.



Supplemental Figure 2. The mediation model for emotional engagement correlated with intrinsic value.



Supplemental Figure 3. The mediation model for emotional cost correlated with emotional disaffection.



Supplemental Figure 4. The mediation model for emotional disaffection correlated with emotional cost.

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