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Emotional and Cognitive Engagement in Higher Education Classrooms

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A dissertation submitted to the faculty of
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Doctor of Philosophy

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ABSTRACT

Emotional and Cognitive Engagement in Higher Education Classrooms

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This is a multi-article format dissertation that explores emotional and cognitive engagement in higher education classrooms. Student engagement in higher education classrooms has been associated with desired outcomes such as academic achievement, retention, and graduation. Student engagement is a multi-faceted concept, consisting of behavioral, emotional, and cognitive components. A deeper understanding of how these components interact would allow instructors and course designers to facilitate more engaging learning experiences for students. The first article is an extended literature review that investigates the extant empirical research on the relationship between emotional and cognitive engagement, and between emotional engagement and academic outcomes in post-secondary classrooms. I find that this topic has been scantily researched in the past 16 years and conclude that the relationship between emotional and cognitive engagement is cyclical, rather than linear, and is influenced by student control appraisals, value appraisals, achievement goals, and the classroom environment. The second article investigates the longitudinal relationship between emotional and cognitive engagement in university blended learning courses across 2 institutions, with 68 students. Using intensive longitudinal data collection and structural equation modeling, I find that course design and student perception variables have a greater influence on engagement than individual student characteristics and that student multitasking has a strong negative influence on engagement. Students' perceptions of the importance of the activity has a strong positive influence on both cognitive and emotional engagement. An important outcome of engagement is the students' perceptions that they were learning and improving. While emotional and cognitive engagement are highly correlated, the results do not indicate that emotional engagement leads to higher levels of cognitive engagement.

Keywords: learner engagement, emotional experience, higher education, blended learning, structural equation models, student experience

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I am grateful for the mentoring, support, and learning opportunities provided by the entire BYU Instructional Psychology and Technology faculty in general, and my five committee members in particular. They are great examples of Inspiring Learning, the type of education for which the entire campus strives. In addition to supportive, competent, inspiring faculty, this project has also received tremendous support from my fellow students on our blended engagement research team. Lisa Halverson, Curtis Henrie and Bob Bodily have all made significant contributions to this work. They were a joy to work with.

Finally, I am completing this degree because of the encouragement, support and confidence of my family—my dear husband Todd, our four children and their families, and my loving parents. Their faith in me often exceeded my own. Cards were sent, meals were prepared, chocolate was purchased, and encouraging phone calls were made. One of the benefits of being a middle-aged student is the large, loving support system that comes from years of family building.

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DESCRIPTION OF RESEARCH AGENDA AND STRUCTURE OF THE DISSERTATION

Student engagement has been linked to important outcomes such as grades, persistence, college completion, and mental health (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008; Robinson & Hullinger, 2008; Svanum & Bigatti, 2009). Importantly, it is presumed to be malleable through interventions and changing contexts (Fredricks, Blumenfeld, & Paris, 2004; Kahu, 2013; Skinner & Pitzer, 2012). This makes the understanding of engagement within specific contexts an important endeavor with possibilities for designing interventions and modifications that could improve educational outcomes. Boekaerts (2016) went as far as to say, "comprehension of the motivational, emotional and cognitive aspects of student engagement and disengagement is undeniably one of the most crucial goals of educational psychology" because of its "far-reaching practical implications" (p. 76).

As implied by Boekarts, engagement is a multi-faceted concept and includes distinct emotional and cognitive aspects (Appleton, Christenson, Furlong, 2008; Fredricks, Blumenfeld, & Paris, 2004). In this dissertation I will explore the interaction between emotional and cognitive engagement in higher education classrooms. Many of the prominent researchers in the student engagement field focus their work on K-12 classrooms. Preventing high school student drop-out and promoting high school completion are common goals for engagement researchers (Reschly & Christenson, 2012). However, engagement research in higher education is also needed because while participation in higher education is increasing around the world, completion rates are not increasing at the same pace (Marginson, 2016; Shapiro et al., 2017). Classroom level engagement is seen by many as a potential solution, as it is associated with increased retention and graduation (Kuh et al., 2008; Svanum & Bigatti, 2009). But how applicable to higher education are the findings about student engagement produced through research in K-12 classrooms? The purpose of this dissertation was to investigate the relationship between emotional and cognitive engagement for adult learners. I accomplished this by reviewing the subset of the engagement literature that specifically focuses on emotional and cognitive engagement in higher education classrooms and by contributing original research on engagement and cognitive engagement in a growing type of higher education course—blended courses.

Article 1: Literature Review

The impetus for this literature review was the finding by members of our research team that emotional engagement is more often explored in K-12 settings than in higher education settings (Henrie, Halverson, & Graham, 2015). They responded, "We found it interesting that emotional engagement is considered important at the K-12 level but loses stature to researchers as students mature" (p. 44). Emotional engagement is thought to proceed and provide the emotional energy for cognitive engagement (Skinner & Pitzer, 2012). The purpose of this review was to discover whether this is true for adult learners. It is possible that adult learners bring additional cognitive, emotional and self-regulatory resources to their learning experiences that diminish the need for emotional engagement.

In pursuit of this goal, I identified and synthesized the extant research on the relationship between emotional and cognitive engagement, and between emotional engagement and academic outcomes in higher education classrooms. I identified 30 articles that explored this relationship. These 30 articles represented research conducted in a wide variety of course subjects, in 10 different countries. I found that the relationship between emotional and cognitive engagement is not necessarily linear, but cyclical, with emotional engagement as likely to be an *outcome* of cognitive engagement as an antecedent. The majority of articles reported that for adult learners, positive emotional engagement is indeed important to both cognitive engagement and academic outcomes. However, the relationship is seldom simple or direct. Student appraisals of their control over their ability to learn the course material, their appraisals of the value or relevancy of the course material, their mastery or achievement goals, autonomy orientation and even their epistemic beliefs all interact with their emotional engagement to lead to cognitive engagement and/or academic outcomes. For example, Ruthig et al. (2008) found that for students with high control appraisals, experiencing emotional engagement led to higher academic outcomes, while students with low control appraisals did not experience the same benefits. I conclude that qualitative and longitudinal research (collecting data at multiple points across a single course) provides the most insightful results on this topic. The relationship between emotional and cognitive engagement is dynamic and the methods used to study it need to be able to capture this active relationship.

I worked on this paper independently, with regular review, guidance, and mentorship from Dr. Graham. The BYU Social Science librarian provided guidance through a long, complicated literature search. I plan on submitting this article for publication to *Education Research Review*. The article, as currently formatted meets their content and length requirements but will need to be re-formatted to meet their style guidelines. I believe this paper will make a unique contribution to the field of engagement research in higher education because it is the first paper to specifically focus on the relationship between emotional and cognitive engagement in higher education classrooms and how this relationship varies across time in university courses.

Article 2: Research on Emotional and Cognitive Engagement in Blended Courses

The second article in this dissertation, "Investigating Engagement in Blended Learning Settings using Experience Sampling and Structural Equation Modeling," explores student engagement in a specific type of higher education classroom—blended courses. This research was accomplished while I was a member of a research team led by Dr. Charles R. Graham.

Blended learning is the "thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (Garrison & Kanuka, 2004, p. 96). Improving student engagement has been an important goal in blended learning course design across the globe (Garrison & Kanuka, 2004; Graham & Robison, 2007; Spring, Graham, & Hadlock, 2015). However, despite the recent increase in the practice of blended learning in higher education and its accompanying research, very little empirical research has focused exclusively on student engagement in blended learning experiences (Halverson, Graham, Spring, Drysdale, & Henrie, 2014).

A significant challenge to studying engagement in blended courses, is finding a way to collect engagement data in both face-to-face and online settings. Our research team addressed this challenge through the use of experience sampling methods (ESM). Experience sampling is an intensive longitudinal data collection strategy that allowed us to capture the immediate experiences of student engagement throughout an entire blended course and to link those experiences to specific educational activities and contexts (Eccles & Wang, 2012; Lawson & Lawson, 2013; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003). Using experience sampling method protocols, we surveyed students twice a week in six courses throughout the semester. Collecting intensive longitudinal data enabled us to investigate blended learning experiences holistically over the entire semester.

Using the results of our repeated surveys our team modeled the two distinct latent variables of emotional engagement and cognitive engagement. I used these two latent variables in a structural equation model to explore how the interaction of student-centered variables and specific pedagogies affected both aspects of engagement. I also used cross-lagged modeling to explore the longitudinal relationship between emotional and cognitive engagement.

While student characteristics such as gender, self-efficacy, and prior achievement affect engagement, we found that many things within an instructor's influence have a larger impact on engagement. Students who could see the relevance of learning activities and connect them to prior learning were more engaged. In addition, the types of learning activities instructors selected had different impacts on engagement. Challenging, active activities led to higher cognitive engagement but lower emotional engagement. Passive activities like lectures or video viewing led to higher emotional engagement but lower cognitive engagement. In terms of blended learning course design, we found that the type of activity was more important to engagement than whether it was online or face-to-face.

Finally, in our cross-lagged model we did not find the hypothesized relationship between emotional and cognitive engagement. Over the course of the semester, higher levels of emotional engagement did not lead to higher levels of cognitive engagement. However, this might be due to our small sample size of only 67 students.

I worked on this project with a research team, led, supported, and inspired by Dr. Graham. I worked with Lisa Halverson to create the ESM instrument and with Curtis Henrie to collect the survey data throughout the semester. I cleaned and formatted the complex data set. Curtis Henrie and I modeled the latent variables of engagement and I took the lead on the structural equation modeling, under the direction of Dr. Larsen. I wrote the article and received feedback from both Dr. Graham and Dr. Larsen. This article was approved in my prospectus by my full committee and was published by *Internet and Higher Education* in September 2017.

Article 1

Emotional and Cognitive Engagement in Higher Education Classrooms:

A Review of Empirical Work

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Abstract

Student engagement is associated with desired student outcomes such as academic achievement, retention, and graduation. Engagement is a multi-faceted concept, consisting of emotional, cognitive and behavioral components. It has been proposed that emotional engagement proceeds and provides the energy for cognitive engagement. We review 30 empirical articles published between 2000 and 2016 that investigated the relationship between emotional and cognitive engagement in higher education classrooms. Using the control-value theory as a framework, we synthesize the results in terms of antecedents to emotional engagement, the relationship between emotional and cognitive engagement, and the academic outcomes of emotional engagement. We find the connection between emotional and cognitive engagement is cyclical, rather than liner. Additional variables that mediate this relationship include control appraisals, value appraisals, achievement goals, autonomy orientation, and classroom environment. Qualitative and longitudinal research are the methods best able to model and investigate the cyclical and nuanced relationship between emotional and cognitive engagement.

Introduction

Student engagement has been labeled the "holy grail" of education (Sinatra, Heddy, & Lombardi, 2015). Engagement has been linked to important outcomes such as grades, persistence, college completion, and mental health (Kuh et al., 2008; Robinson & Hullinger, 2008; Svanum & Bigatti, 2009). Importantly, it is presumed to be malleable through interventions and changing contexts (Fredricks, Blumenfeld, & Paris, 2004; Kahu, 2013; Skinner & Pitzer, 2012). This makes the understanding of engagement within specific contexts an important endeavor with possibilities for designing interventions and modifications that could improve educational outcomes. Boekaerts (2016) went as far as to say, "comprehension of the motivational, emotional and cognitive aspects of student engagement and disengagement is undeniably one of the most crucial goals of educational psychology" because of its "far-reaching practical implications" (p. 76).

In particular, a deeper understanding of engagement, specifically for adult students is increasingly important. Higher education completion has great benefits for both individuals and society including greater economic security and civic engagement (DeAngelo et al., 2011). Participation in higher education is increasing worldwide, especially in emerging countries (Marginson, 2016). Yet, in the U.S., successful completion of higher education programs is barely over 50% (Shapiro et. al 2017). Improving student engagement is seen as an important strategy for increasing student retention and graduation (Kuh et al., 2008). Classroom level student engagement is associated with increased higher education retention and graduation (Svanum & Bigatti, 2009). A deeper understanding of student engagement and academic outcomes, specifically for adult learners, would be an important contribution toward improving higher education success rates.

Student engagement has been conceptualized as consisting of three inter-related components: (a) emotional engagement, the positive emotional response students experience while learning; (b) cognitive engagement, the mental energy students apply to learning; and (c) behavioral engagement, the behaviors students perform in pursuit of learning (Appleton, Christenson, Furlong, 2008; Fredricks, Blumenfeld, & Paris, 2004). Those who adopt this multi-facet model of engagement assert that it is important to understand how these facets interact and whether these interaction patterns are constant throughout the lifespan. The focus of this literature review is the interaction between emotional and cognitive engagement. It has been proposed that emotional engagement precedes, positively influences, and even facilitates cognitive engagement (Fredricks, Blumenfeld, & Paris, 2004; Janosz, 2012; Pekrun & Linnenbrink-Garcia, 2012). However, the three previously cited articles, in which this connection was proposed, discussed engagement primarily in the K-12 setting. It is unclear if this positive relationship exists for adult learners in the same way it does for younger learners. It is possible that adult learners bring additional emotional, cognitive, and self-regulatory resources to their learning experiences that alter or diminish the influence of positive emotional engagement on cognitive engagement and academic achievement (Cooper & Corpus, 2009; Fredricks, Blumenfeld, & Paris, 2004; Mahatmya, Lohman, Matjasko, & Farb, 2012; McRae et al., 2012). In light of these uncertainties, the purpose of this article is to review extant empirical work to provide clarity on the relationship between positive emotional engagement and cognitive engagement and achievement in higher education classrooms and other adult learning contexts.

Locating This Paper in the Engagement Literature

The literature on student engagement is broad and often suffers from a lack of conceptual precision (Boekaerts, 2016; Christenson, Reschly, & Wylie, 2012; Fredricks, Blumenfeld, &

Paris, 2004; Fredricks & McColskey, 2012). To provide clarity as to where this research review fits in the body of engagement research and theory, we will clearly articulate the focus of this paper in terms of levels of engagement research, conceptual definitions of engagement and age of focus.

Levels of engagement research. Student engagement is studied at three distinct levels of analysis: (a) the institution, (b) the classroom, and (c) the learning activity (Janosz, 2012; Skinner & Pitzer, 2012). The level of analysis chosen has a direct impact on how engagement is defined and measured as well as the associated outcomes. Course-level engagement explores engagement within a specific course or classroom. Benefits of course-level engagement for students extend beyond the individual classroom experience. Engagement in a single course is associated with graduating from college, quicker time to graduation, and final college GPA (Svanum & Bigatti, 2009). Research on engagement at this level provides insight into the fluidity and contextual malleability of student engagement—in other words, the extent to which "engagement is a function of stable and enduring qualities or a function of contextual factors" (Fredricks, Blumenfeld, & Paris, 2004, p. 67). This level of analysis is most likely to provide insights into student engagement experiences that are most amenable to change and intervention by instructional designers and classroom teachers. As Skinner and Pitzer (2012) pointed out, "No matter how many extracurriculars students undertake or how attached they are to school, they will not learn or achieve unless they are constructively engaged with the academic work of the classroom" (p. 22).

Definitions of emotional and cognitive engagement. Within the student engagement framework, the definitions of emotional and cognitive engagement differ depending on the level of analysis (institution, classroom, learning activity). Definitions of cognitive and emotional engagement also overlap with concepts used in other fields of educational research. In this review, we isolate the definition of cognitive engagement as deep focus, learning strategies, and self-regulation, and the definition of emotional engagement as enjoyment and positive activating emotions.

Cognitive engagement*.* At the classroom level of analysis, the most common definitions of cognitive engagement include the effortful use of cognitive learning strategies and self-regulatory strategies (Green, 2015; Reeve, 2012). This definition points to an obvious overlap with research on learner self-regulation. As reviewed by Wolters and Taylor (2012), definitions of cognitive engagement frequently include student use of the exact same cognitive strategies that are used in the definitions of self-regulated learning. In fact, sometimes, rather than list the individual components of cognitive engagement, cognitive engagement is often defined simply as “students’ self-regulation or use of self-regulation strategies” (Wolters & Taylor, 2012, p. 641). Wolters and Taylor (2012) claimed, “One might easily argue that there is little practical difference between what researchers studying student engagement describe as high levels of cognitive engagement and what others identify as the cognitive aspects of self-regulated learning” (p. 641). In response, it seems appropriate in this review to include research that labels cognitive strategies and self-regulation as cognitive engagement, as well as those that label these same practices as student self-regulation.

Emotional engagement. Definitions of emotional engagement at the classroom level include enthusiasm, interest, enjoyment, satisfaction, hope, pride, and vitality (Pekrun & Linnenbrink-Garcia, 2012; Skinner, Furrer & Marchand, 2008; Skinner, Kinderman, Connel, & Welborn, 2009). While Fredricks, Blumenfeld, and Paris (2004) included both positive and negative affect in their definition of emotional engagement, Skinner, Furrer, and Marchand

(2008) limited their definition to "energized emotional states," including enthusiasm, interest, and enjoyment (p. 495). The concept of "energized emotional states" is also used in the field of academic emotions and there is considerable overlap between the fields of academic emotion and student engagement. The circumplex model of emotions, widely used in academic emotions literature, clearly demonstrates where this overlap occurs. According to the circumplex model of emotions, shown in Figure 1, emotions can be divided between positive and negative valence and between activating and deactivating energy emotions. Only positive, activating emotions, in the upper right quadrant, are considered equivalent to emotional engagement because it is the energy these emotions provide that fuel engagement (Pekrun & Linninbrink-Garcia, 2012).

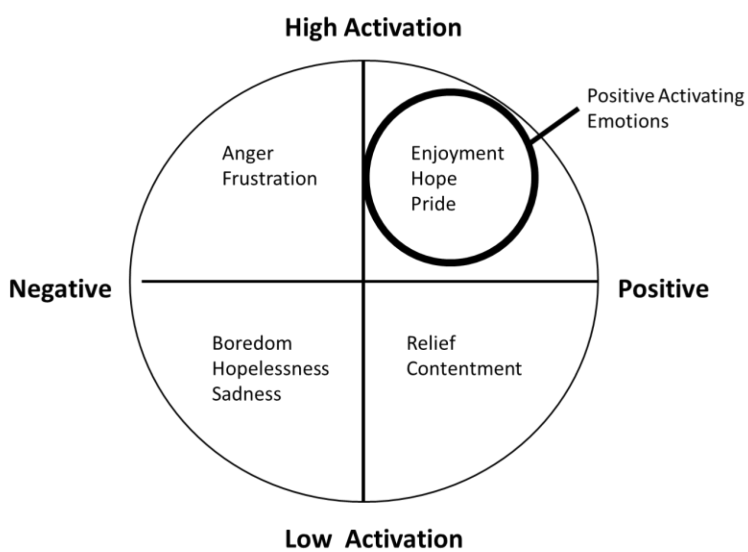

Figure 1. Academic emotions circumplex model, adapted from Pekrun & Linnenbrink-Garcia (2012).

Adult Learning Settings

A deep understanding of the relationship between emotional and cognitive engagement in higher education classrooms is important to the efforts to improve outcomes for adult students. However, Pekrun and Stephens (2010), in their review for the *Higher Education Handbook*, claimed that there was a dearth of research on academic emotions in adult settings in the previous decade and that research done on emotions and cognition in the K-12 setting was of limited value to adult settings. Similarly, cognitive psychologist Immordino-Yang (2011), reacting to research that has primarily been done in K-12 settings, called for more research and theory that attempts to "understand how best to characterize and capitalize on the emotional and social dimensions of learning in older students, including adults" (p. 102). This literature will address this research gap by consolidating and reviewing the research that has been done with emotional and cognitive engagement in adult classrooms.

Method

Article Selection

The purpose of our article selection strategy was to find all empirical research that investigated the relationship between positive emotional engagement and cognitive engagement, and between positive emotional engagement and academic outcomes in higher education and other adult learning settings. Research examining the relationship of emotional engagement and cognitive engagement has been described as fragmented (Boekaerts, 2016; Christenson, Reschly, & Wylie, 2012; Fredricks, Blumenfeld, & Paris, 2004; Fredricks & McColskey, 2012). To ensure confidence that all of the articles which present empirical work on the relationship between emotional engagement, including positive activating emotions, and cognitive engagement in adult learning settings were identified, we enacted a multi-pronged strategy. The components of this strategy included identifying search terms to use in academic databases, reviewing articles and chapters contained in special journal issues and handbooks, and searching citations associated with foundational articles on emotions and learning.

Search terms. We searched in EBSCO, PsychINFO and ERIC databases for articles using the terms *emotional engagement* and *cognitive engagement*, including variations of *emotional* and *cognitive*. In addition, we did separate searches using the terms *achievement emotions* and *academic emotions* (both terms are used in the field of academic emotions) combined with *self-regulation*. We only accepted peer-reviewed journal articles published between 2000 and 2016 in English with adult subjects. Between 245 and 749 articles were returned with each search, for a combined total of 1840 articles, though there were many duplicates.

Foundational articles and book chapters. We found some foundational articles and chapters that were especially effective in reviewing the current state of the topic. For example, Pekrun and Linnenbrink-Garcia (2012), which has been cited 189 times in 5 years (Google Scholar, 6/30/2017). In addition, Fredricks, Blumenfeld, and Paris (2004) wrote one of the original articles that discussed the distinction between emotional and cognitive engagement, an article that continues to be highly cited (4506 citations listed in Google Scholar on 6/30/2017). Finally, Pekrun, Goetz, Titz, and Perry (2002) reported on their quantitative and qualitative research on emotions in higher education classrooms. This text is foundational to the achievement emotions framework, especially for higher education (2038 citations in Google Scholar, 6/30/2017). We searched for articles that cited any of these three articles using the Scopus database and similar filters to the previous searches, which resulted in 1,238 articles. Again, there were many duplicates.

Inclusion criteria. We screened each set of articles individually to find the research articles that met the following criteria:

1. Empirical research in higher education contexts
2. Published 2000-2016

3. Investigated engagement at the classroom level and so the research needed to be clearly linked to a defined course. A major assumption of engagement research is that student engagement is malleable. This implies that it is not stable and unchanging across learning situations and school subjects (Boekaerts, 2016). There is a significant difference between enjoying learning, in general, and enjoying learning in a specific course. Furthermore, other qualities that interact with engagement, such as self-efficacy, are course or domain specific. Students can have high self-efficacy in general but low self-efficacy in a specific course such as math or physics.
4. Explicitly explored a relationship between emotional engagement, as defined by positive, activating emotions and cognitive engagement, including self-regulation, cognitive strategies or academic outcomes.

Search results. A total of 30 articles met each of the stated criteria. Though this seems like a small number of articles given the 16-year time span, this is in line with repeated declarations that this topic is under-researched. It is also evidence that the field of student engagement is broad and that this particular topic is not a dominant issue.

Limitations

The major limitation of this method and search is uncertainty that all relevant articles on this topic were identified. Though every attempt was made to find all the research that investigated emotional engagement and its relationship with cognitive engagement and/or academic outcomes, it is possible that not all articles were found. Researchers investigating this topic do not use a definitive set of search terms, so broad search terms were used. This led to searches in the academic databases that returned over a thousand citations, requiring reading through many abstracts. Human error and unclear abstracts could have led to dismissing relevant articles. As second limitation is that though peer review and robust discussions were conducted throughout this review, the article selection and coding were done by a single person. It is possible that a larger group of coders would have selected articles and synthesized them differently.

Findings

Overview

An overview of the 30 articles used in this analysis, in terms of publication date, geographical location of research, research methods, class subjects, number of citations, and general research orientation can be found in the Appendix. The 30 articles report on research conducted in the U.S. (21), Canada (4), Germany (3), and Austria, China, South Korea, New Zealand, Philippines, Saudi Arabia, Singapore, and an unspecified European country (1 each). Some articles included research conducted in more than one country. The majority of the articles reported using primarily quantitative analysis. Three articles reported qualitative research. While many authors called for more qualitative research to better understand students' experiences with emotions throughout a course and across different academic settings, few have undertaken the challenge.

The largest body of research was done in STEM courses (biology, chemistry, physics, computer science, math, and engineering). Increasing participation in STEM fields is a priority for many countries, and improving the emotional experience in STEM classes is viewed as an important part of making these fields more inviting for students and improving student achievement. Seven of the courses were either completely online or had a significant online or computer-based component. As instruction in higher education increasingly includes instructional designs outside of traditional settings, understanding students' emotional experiences as they learn in technology-mediated settings becomes a high priority.

This set of articles provides examples of research on this topic from a variety of theoretical perspectives. While each of the articles either measures emotional engagement or positive, activating emotions, only 9 of the 30 articles explicitly name and measure engagement. In terms of other theoretical perspectives, 10 articles explicitly use the achievement goal theory, 10 articles include a self-regulation framework, and 8 articles use the control-value theory of student emotions.

The final pertinent overview description of the articles that is the number of data collection points across each research design. In terms of research design, the number and spacing of data collection seems salient. Sansone and Thoman (2005) claimed that an important goal of research into student emotional experiences is understanding "the dynamic role that feelings and emotions have over time" (p. 507). In this group of research papers, 18 of the 30 articles collected data at more than one point in the semester, while 12 collected data only once.

Article Synthesis

The purpose of this article is to review the empirical findings about the relationship between emotional engagement and cognitive engagement in higher education and other adult learning courses. The reviewed articles represent many different orientations to this topic. Organizing a discussion that synthesizes the findings of such a heterogeneous group of articles required an organizing framework. The control-value theory of achievement emotions provided a useful organizing framework, not because it is the most prevalent theory used in these articles, but because nearly every article in this set contains parts of this framework, so the model was able to facilitate an organized discussion of disparate theories and findings.

The control-value theory, outlined in Figure 2, proposes that an individual's subjective appraisals (or beliefs) about their control over (ability to control the outcome) and the value of (how important it is to them) a learning experience are the most important antecedents to the emotions and emotional engagement students will experience in that learning context. High control and high value appraisals will lead to enjoyment because "enjoyment of learning presupposes that the student expects to be able to master the material, and is sufficiently interested in this material" (Pekrun et al., 2002, p. 165). These emotions, in turn, directly influence cognitive engagement and through cognitive engagement, indirectly influence academic outcomes (Pekrun, 2006; Pekrun, Elliot, & Maier, 2006). The elements of the theory as diagramed in Figure 2, including the number of articles that include this element, are the following:

1. Environmental influences such as the student characteristics, classroom environment, instructional design elements and previous educational experiences (A in Figure 2; 24 articles).
2. Control and value appraisals students make (conscious or unconscious) about their ability to control the outcome of an academic task (high or low) and the value they place on the experience (high or low) (B in Figure 2; 9 articles).
3. Achievement goals, which are the type of goal (performance or mastery) students set for their learning experiences (B1 in Figure 2; 10 articles).
4. Achievement emotions and emotional engagement. Everything to the left of this box are theorized as antecedents to the emotions students experience in relation to a learning experience. When these emotions are positive and activating, students are considered emotionally engaged (C in Figure 2; 30 articles).

5. Self-regulation and cognitive engagement. The quantity and quality of self-regulation and cognitive engagement is directly influenced by the emotions students experience. Negative emotions such as anxiety and boredom lead to less cognitive engagement. Positive, activating emotions (emotional engagement) lead to more and higher quality cognitive engagement (D in Figure 2; 18 articles).
6. Academic performance and grades are directly influenced by students' cognitive engagement and so indirectly influences by their emotional engagement (E in Figure 2; 20 articles).

Though this model is presented as a linear path from antecedents to emotional engagement to cognitive engagement to academic achievement, the assumption is that each element can be cyclical or recursive. For example, academic achievement in one setting becomes a precipitating element of the environment for a new learning situation. Similarly, positive emotions can lead to more positive control and value appraisals, leading to an upward spiral in emotional engagement (Kahu, 2015).

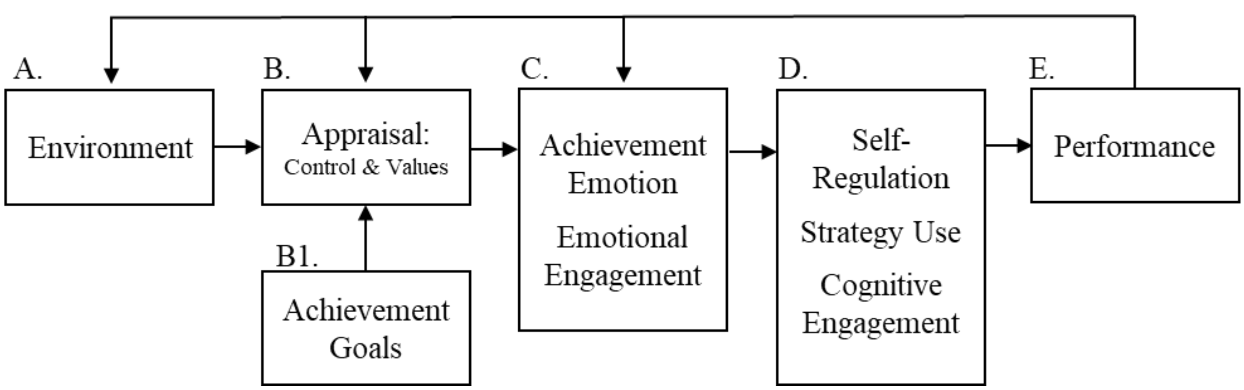

Figure 2. Control-value framework, adapted from Pekrun (2006).

While few of these articles investigate this full model, each article does investigate, at the very least, the relationship between emotional engagement and either cognitive engagement or academic achievement. Sometimes this is explicit, as when the relationship between achievement goals and positive emotions is being explored. Other times, we are locating their variables onto the model based on their assumptions and definitions. For example, when Sagayadevan and Jeyaraj (2012) explored the relationship between instructor–student interaction on achievement emotions, we coded the interaction variable as part of the learning environment. Though some of these decisions may seem arbitrary, unless these disparate conversations can be integrated, we can't consolidate results, build knowledge, or share insights in any meaningful way.

Qualitative Research

While there are only three qualitative research articles included in this review, we want to start with these because they provide the foundation for the empirical articles. These reports of qualitative research provide student voice to the quantitative research that makes up the majority of the research reported in the articles.

Pekrun et al. (2002) published summaries of a series of qualitative studies they conducted exploring the emotional experiences of university students. Their research designs included case studies, semi-structured interviews, and daily diary collections. They analyzed their qualitative data to "explore the occurrence and phenomenological structures of academic emotions" (p. 92). Prior to their research, anxiety had been essentially the only emotion studied in educational contexts. However, they reported that students experience enjoyment and other positive emotions in class and while studying just as frequently, if not more so, than they experience negative emotions. Pekrun et al. found that these positive emotions had cognitive consequences, including higher levels of interest, intrinsic motivation, meta-cognitive strategies, and flexible learning strategies. Furthermore, by analyzing diary accounts from 72 university students, they found these patterns of associations between positive emotions and enhanced learning occurred consistently across individuals with differing temperaments and ability levels. In contrast, the patterns associated with negative emotions in educational settings were not as consistent.

Building on Pekrun et al.'s (2002) research, Kahu, Stephens, Leach, and Zepke (2015) collected video diaries and interview data from mature (24 years and older) university students in a distance education program, contributing three important findings. First, they agreed with Pekrun et al. that enjoyment "arises from a combination of interest and a feeling of competence in the task" (p. 487). For example, they quoted a student: "I've been really excited about the soil paper and I'm like, 'Oh, oh, I can *do* stuff with this, and it fits my values . . . soil conservation, I could help farmers" (p. 487). Through their longitudinal data, they found that as a student's self-efficacy increased, the student's enjoyment of learning also increased. Second, they found that enjoyment positively influenced both behavior and cognitive engagement through increasing perseverance and cognitive ability. For example, a student might think, "I'm really, really, trying hard to do well because I am enjoying the paper and I'm enjoying the ideas" (p. 488). Third, they found evidence of a positive spiral, where enjoyment leads to academic success and satisfaction, which leads to greater enjoyment: "I am absolutely loving my study. School goes back tomorrow and I can't wait . . . I just love it . . . . The more I learn, the more I want to learn" (p. 488). The authors conclude their article by claiming the importance of positive emotional experiences for non-traditional students in higher education.

Liljedahl (2005) illustrated the cyclical nature of this positive relationship. He found that cognitive breakthroughs – aha experiences or moments of insight – also led to positive emotions as well as higher control and value appraisals. He invited over 100 students to write about an "aha" experience they experienced in a math class designed for math-resistant students. Such students tend to have beliefs that math is "difficult" and "useless" (p. 221). In Pekrun's model, these are low control and value appraisals. An "aha" experience is defined as a "moment of insight," or a "flash of understanding," when "everything seems to make sense" (p. 220). Though not explicitly using the control-value appraisal framework, he used students' accounts to describe a process of having an emotionally engaging experience which led to improved control and value appraisals in terms of math, which lead to increased perseverance and achievement. For example, "These [aha!] experiences inspire us and encourage us to keep going despite frustration and anxiety that often tends to overwhelm us in times of difficulty when attempting to solve a problem" (p. 231).

These student accounts from both the Kahu et al. (2015) and Liljedahl (2005) articles illustrate the insight that when students report that they enjoy an educational experience, this does not mean that they enjoy every minute of the process. It seems that a little bit of powerful enjoyment can compensate for other frustrating or less enjoyable experiences. This is important to keep in mind when interpreting quantitative research in which students report their enjoyment through questionnaires. Students are not necessarily indicating that they enjoy every minute of a course, but that there are enough enjoyable moments for them to evaluate their experience in a course as enjoyable. That this insight is only provided through qualitative research makes the paucity of qualitative research on the topic of positive emotional engagement regretful.

Antecedents to Emotional Engagement

Antecedents to engagement are particularly important because engagement is theorized as being malleable and open to intervention (Fredricks, Blumenfeld, & Paris, 2004; Skinner, Kindermann, & Furrer, 2009). Antecedents, events or conditions that influence student emotional engagement, are all possible points of intervention. In the control-value model there are three types of antecedents to positive emotions or emotional engagement: (a) environmental factors, including student characteristics and previous experiences, instructor characteristics, instructional design and classroom climate; (b) student control and value appraisals; and (c) student-selected achievement goals. Twenty-five of these 30 articles explored at least one of these three categories of antecedents in their analysis, and seven explored more than one antecedent. The following is a review of antecedents to emotional engagement or positive activating emotions for students in higher education classes.

Environment. Elements in the environment, including student and instructor characteristics were found to positively influence student emotional engagement. Understanding how the attributes and experiences students bring to a learning experience effect their emotional engagement is important. The student qualities researchers linked to emotional engagement in these articles include student autonomy orientation at the beginning of a course (Black & Deci, 2000; Lee, Sheldon, & Turban, 2003), student hopefulness at the beginning of a course (Daniels et al., 2009), student interest in the course topic along with their computer self-efficacy (Sun & Reuda, 2012), and student epistemic beliefs (Muis et al., 2015). All of these attributes were found to have statistically significant effects on students' emotional engagement and cognitive engagement. Using a simple regression model, Sun & Rueda (2012) investigated an online course and found that interest and self-regulation predicted both higher emotional engagement and cognitive engagement. That self-regulation predicted emotional engagement challenges the assertion of the control value model that self-regulation is an outcome of emotional engagement. Rather, it appears that these are related in a recursive relationship.

Two articles (Daniels et al., 2009; Lee et al., 2003) investigated a path to emotional and cognitive engagement through achievement goals (B1 in Figure 2). Using longitudinal data over the course of the semester and structural equation modeling, both found that qualities students brought into the classroom influenced the achievement goals they set and through these achievement goals, their levels of emotional and cognitive engagement. Daniels (2009) found that students with higher levels of hope in their class performance at the beginning of the course were more likely to set mastery and achievement-approach goals, which led to experiencing more emotional engagement and higher levels of academic achievement.

Lee et al. (2003) found that students with an autonomy orientation (intrinsically motivated) were more likely to select mastery goals and experience higher levels of cognitive engagement and enjoyment. On the other hand, students with a control orientation (extrinsically motivated) were likely to select either performance-approach or performance-avoid goals. Students who selected performance-approach goals were more likely to experience higher levels of cognitive engagement and through cognitive engagement, a significant indirect path to enjoyment. Once again, enjoyment was modeled as an outcome of cognitive engagement rather than an antecedent.

Extending the understanding of autonomy orientations and emotional engagement, Black and Deci (2000) found that students' autonomy orientations are malleable through course design. Investigating a chemistry course in which small student workshops were added to a traditionally large lecture course, Black and Deci (2000) measured the impact such workshops had on students' autonomy orientation, positive emotions, and achievement. By computing the differences between scores at the beginning and end of the semester, they measured how autonomy-supportive the individual workshop groups were. Consistent with Lee et al. (2003), students who entered the course with higher levels of autonomy experienced more positive emotions. However, while beginning levels of autonomy did not predict final performance, the amount of change students experienced from lower to higher levels of autonomy motivation did predict more positive emotions at the end of the course and higher final performance. This finding reinforces the theory that emotional engagement is malleable by course design. In this case, emotional engagement was increased by deliberately enhancing students' autonomy orientations throughout the course.

Muis et al. (2015) explored the relationship between epistemic beliefs and emotions and subsequent learning in three iterations of a research design in the U.S., Canada, and Germany that involved a unit in a class, rather than an entire course. Epistemic beliefs are beliefs about knowledge and knowing (e.g., how to evaluate the veracity of knowledge claims and determine what constitutes a knowledge claim). Epistemic beliefs are especially salient in fields such as climate change, where there are many conflicting knowledge claims. After students' epistemic beliefs were measured, students were given a deliberately unpleasant task of reading conflicting texts about climate change. Students who had an epistemic belief system that assumed that knowledge claims should be established following the rules of inquiry and using multiple sources rather than simply through personal experiences, experienced more enjoyment and curiosity during this unit on climate change. Further, experiencing enjoyment and curiosity in this context predicted higher levels of metacognitive self-regulation, critical thinking, elaboration, and rehearsal which led to higher achievement, even while controlling for previous knowledge. This finding is important because it demonstrates that students do not necessarily need courses to be fun to be enjoyable. With the right support, in this case epistemic beliefs, even challenging tasks can be experienced as enjoyable, even if the content or task is difficult at times.

In contrast to student attributes, instructors have a great deal of control over their classroom behavior and the design of their courses. Three studies explored instructor-related variables in terms of their impact on student emotional engagement. These variables included enthusiasm (Zhang, 2014), instructors' positive emotions (Zhang & Zhang, 2013), and instructor–student interaction (Sagayadevan & Jeyaraj, 2012).

Not surprisingly, instructor enthusiasm in a communications course, as rated by students, positively predicted emotional engagement cognitive engagement and mastery goals (Zhang 2014). However, emotional engagement in these contexts did not always lead to higher academic outcomes. Zhang and Zhang's (2013) research in U.S. and Chinese courses found that in U.S. classrooms, student emotional engagement partially mediated the relationship between instructors' positive emotions and students' cognitive engagement and critical thinking in U.S. classrooms and fully mediated this relationship in Chinese classrooms. Finally, Sagayadevan and Jeyaraj (2012) found that students who reported good instructor interaction (as measured by the Lecturer-student Interaction Questionnaire) experienced higher levels of emotional engagement, but students' emotional engagement was unrelated to their academic achievement.

The research reviewed in this section implies that initial student autonomy orientation and emotions have an effect on students' subsequent emotional and cognitive engagement during the rest of the semester and that there are instructor and course design attributes that can shape these experiences in positive ways. Teacher enthusiasm, supportive relationships, and autonomy support, can all help students experience more positive emotional engagement throughout a course.

Control and value appraisals. Control appraisals are students' beliefs about how much control they have over their desired academic outcome. Value appraisals are students' beliefs about how important, relevant or valuable the learning experience or academic outcome is to them personally. Control and value appraisals act as important antecedents to academic emotions experienced during the course, which then impact cognitive engagement and academic outcomes (Pekrun, 2006). Twelve articles in the reviewed set explicitly focused on measuring the relationship between control and value appraisals (element "B" in *Figure* 2) and emotional engagement or positive activating emotions. Pekrun, Goetz, Frenzel, Barchfeld, and Perry (2011) found that the positive activating emotions of enjoyment, hope, and pride all positively correlated with academic control, self-efficacy, and task-value appraisals. Further, they found that these positive activating emotions were positively correlated with intrinsic motivation and the cognitive engagement indicators of effort, elaboration of learning material, self-regulation of learning, and GPA. Shell and Husman (2008) explored a multi-dimensional conceptualization of control appraisals and their effects on student achievement goals, emotional experiences, and self-regulation. They conducted canonical correlation analysis and derived three canonical dimensions (similar to latent factors) for the interaction of control appraisals, self-regulation, and achievement goals. They found that, in every dimension, higher perceived control was always associated with more positive affect and mastery goal orientation.

Moving beyond correlational analysis to regression analysis, not all researchers investigating the relationship between student control and value appraisals and positive emotional engagement found clear results. Ruthig et al. (2008) found that, for students with high control appraisals, positive emotional engagement led to higher achievement. However, for students with appraisals of low control, their experiences of enjoyment did not have the same positive influence on their achievement. Artino, La Rochelle, and Durning (2010) found that students' high value appraisals at the beginning of a medical school course significantly and positively predicted enjoyment or emotional engagement, but there was not a significant link between control appraisals and enjoyment. They also found that enjoyment had a positive, significant relationship with medical board exams, but not with course grade.

Taasoobshirazi, Heddy, Bailey, and Farley (2016) investigated the relationships between control and value appraisals (measured as self-efficacy and relevance of learning physics) achievement goals (mastery and performance approach), positive activating emotions, and cognitive engagement, as well as how these factors influenced conceptual change in a college physics class. Their study included all of the elements of the control-value theory, but in a different order. Instead of positive control and value appraisals leading to emotional engagement, they modeled the reverse—emotional engagement, or enjoyment leading to more positive control and value appraisals. The results of their path analysis found that enjoyment was positively linked to students' control and value appraisals, deep cognitive engagement, course grade, and conceptual change. They concluded by stating that "In physics classrooms, we should be focusing on making physics more enjoyable" (p. 141).

Three of the articles investigating control and value appraisals on emotional engagement were published in a special 2012 edition of *Internet and Higher Education* that focused on emotions in online environments. Daniels and Stupnisky (2012), commenting on this special issue, reported that the control-value theory was the most tested framework of the articles included in the issue and that it appeared that the relationship between control and value appraisals and academic emotions applies to online learning environments in ways very similar to those used in traditional learning settings. Artino and Jones (2012) found that enjoyment was the greatest predictor of elaboration and the second largest predictor of metacognition, second to task value. Marchand and Gutierrez (2012) comparing an online and a traditional version of the same course found that high control and high value appraisals at the beginning of the course predicted hope, a positive activating emotion focused on future outcomes (enjoyment was not measured) in the middle of the course. Hope predicted meaningful use of learning strategies at the end of the course. The relationship between hope and learning strategy use was stronger for students in the traditional face-to-face version of the course than for students in the online version of the course. In contrast, the relationship between the utility value and hope was stronger for online students than for traditional students. While not traditionally associated with emotional engagement, Pekrun and Linnenbrink-Garcia (2012) categorize hope as a positive, activating emotion that fits in the model of emotional engagement. The different role of hope between an online and traditional class is an intriguing finding.

Noteborn et al. (2012) explored the pathway between task value, enjoyment, and final grade in a European graduate business course and reported that high student value appraisals predicted enjoyment, which, in turn, predicted a higher final course grade. They did not include control appraisals in their model. In contrast, You and Kang (2014) also investigated an online course and measured control appraisal but not value appraisal and found that enjoyment had a significant direct effect on self-regulated cognitive engagement, as well as a significant mediating effect of perceived academic control.

Since it has been reasonably established that student control and value appraisals have a significant impact on student emotional engagement and academic outcomes, it is important to know if these student appraisals can be influenced so that students perceive more control and more value or relevance in their courses. Two articles investigated interventions intended to change student control and value appraisals. Kim and Hodges (2012) introduced an emotion control treatment (a one-time video presentation) to help students with their control appraisals in an online remedial math course. Comparing the treatment group to the control group, they found that treatment students experienced more enjoyment in the course than the control group did, but that there was no difference in achievement outcomes between the two groups.

Heddy and Sinatra (2012) investigated a course that was designed to facilitate conceptual change and positive affect for students studying biological evolution. They compared students who participated in a course redesigned to focus on increasing the relevance of the course material to students' own lives (similar to a value appraisal) with a control group of students taking the same course content with the original course design. Students in the redesigned course experienced more enjoyment, controlling for their initial enjoyment and interest in the topic at the beginning of the course. They also demonstrated more conceptual change and competence regarding biological evolution. While a one-time, relatively shallow intervention, as presented in Kim and Hodges (2012), failed to lead to the desired academic outcomes, this study, reporting on a complete course redesign, supports the control value claim that increasing students' appraisals of the value of learning the course material will increase emotional engagement and academic outcomes.

Achievement goals. Achievement goals are defined as "competence-relevant aims that individuals strive for in achievement settings" (Pekrun, Elliot, & Maier, 2009, p. 115). Achievement goals are categorized as *mastery,* focused on the development of competence or mastery, or *performance*, focused on the appearance or performance of competence. Nine articles in this set investigated the role of achievement goals (B1 in *Figure* 2) as antecedents to emotional engagement.

In a series of studies, Pekrun, Elliot, and Maier (2006, 2009) investigated the relationship between achievement goals, emotions, and measured achievement in undergraduate psychology courses. Their 2006 article reports on two studies with similar methodology: one in Germany, and one in the United States. They used a trichotomous model of achievement goals (mastery, performance-approach, performance-avoidance). Their results showed that mastery goals were a positive predictor of emotional engagement, defined as enjoyment, hope, and pride, and that performance approach goals were a positive predictor of pride. They concluded that achievement goals are an important antecedent to academic emotions.

In their 2009 article, Pekrun, Elliot, and Muis reported on a U.S. study similar to their previous research, with the addition of two more data collection points: an exam grade and final grade were added to the model. Aligned with their previous research, mastery goals predicted enjoyment, hope, and pride; and performance approach goals predicted hope and pride. While performance approach goals positively predicted hope and pride, both of which were also positive predictors of performance, contrary to their hypothesis, neither mastery goals nor enjoyment were significantly predictive of performance.

Luftenegger et al. (2016) investigated the relationship among achievement goals, positive emotions, and achievement in a German psychology course. They used a more complex model of achievement goals, which included task-approach, task-avoidance, self-approach, self-avoidance, other-approach, and other-avoidance achievement goals. They found that all three approach goals were positively related to enjoyment. However, when controlling for achievement goals and their direct impact on achievement, enjoyment was not a significant predictor of exam performance.

Finally, Hazley et al. (2014) was the only article in the reviewed articles to look at how achievement goal orientations change throughout a semester in response to emotional experiences. Investigating students in a computer science course, they found that students generally begin the semester with positive approach goal orientations but then shift to negative goal orientations as the semester progresses. However, students who experienced more positive emotions were more likely to maintain their learning approach goals, while students who experienced fewer positive emotions were more likely to switch to a learning avoidance goal orientation. They also found a positive association between positive emotions and higher self-regulation and knowledge-building strategies (elements of cognitive engagement).

Each of these papers on control and value appraisals and achievement goals reveals that the relationship between appraisals, achievement goals, positive emotional engagement and academic outcomes is complex. While there was agreement that both mastery goals and performance approach goals and high control and value appraisals are consistently associated with positive emotional engagement, when appraisals and achievement goals are added to statistical modeling, the direct relationship between emotional engagement and academic outcomes is statistically less strong. Furthermore, though the control-value model proposes that appraisals and achievement goals are antecedents to emotional engagement, they are also likely to be outcomes of emotional engagement. Both qualitative research (as shown in Kahu, 2012) and longitudinal research (as shown in Hazley, 2014), where appraisals, achievement goals and emotional engagement are measured multiple times across a course, allow this cyclical relationship to be visible.

Outcomes of Emotional Engagement

A common assumption of student engagement theories is that positive emotional engagement is a desirable and valuable outcome linked to higher emotional well-being in students. This was especially true for authors investigating positive emotions in STEM courses. However, there is also usually an assumption that positive emotional engagement will also affect students' academic performance by influencing their motivation and effort, their use of learning strategies and self-regulation, and the availability of cognitive emotions needed for learning and performance. In this section we will review what these 30 articles reveal about the connection to cognitive engagement and self-regulation as well as to achievement, usually measured in terms of exam scores and/or final course grade.

Cognitive engagement and self-regulation. There are three remaining articles not yet discussed because they did not include any antecedents to emotional engagement in their research design. Two of these explicitly investigated the relationship between enjoyment and the use of self-regulation and learning strategies (D in *Figure* 2). Midway through a semester, Ben-Eliyahu and Linnenbrink-Garcia (2013) asked students to answer questions about their emotional, behavioral, and cognitive self-regulation in both their most enjoyable class and their least enjoyable class. They did not measure emotional engagement explicitly, but used "most enjoyable" and "least enjoyable" designations as proxies for high and low levels of emotional engagement. They assumed that students would report higher levels of self-regulation in their least enjoyed course. However, students reported higher levels of self-regulation in their favorite course. Achievement, as measured by final grade, was also higher in more enjoyable courses. They concluded with the hypothesis that enjoying a course gives students more energy with which to enact self-regulatory strategies, while less enjoyable courses deplete students of the requisite energy for active self-regulation.

Villavicencio and Bernardo (2012) measured emotions and self-regulation in a university math course. Comparing two regression models, they found that when enjoyment and self-regulation were both included in a model predicting students' final grade, enjoyment was a significant positive predictor, but self-regulation was not significant. When they added a term representing the interaction of self-regulation and enjoyment they found the interaction was statistically significant. The slopes revealed that students who experienced both high enjoyment and high self-regulation received higher final grades. However, students who experienced low enjoyment and high self-regulation received a lower grade than students with high enjoyment and low self-regulation. They interpreted their results as suggesting that the positive relationship between self-regulation and student learning may be contingent upon students' experiencing enjoyment in the learning process. These findings are similar to Ruthig et al.'s (2008) findings that positive emotions sometimes have significant interactive effects with other learning variables.

To summarize the findings of these articles on the impact of positive emotions on self-regulation and cognitive engagement, 18 of the 30 articles explored both positive emotional engagement and cognitive engagement or self-regulation. Four of these articles (Hazley et al., 2014; Pekrun et al., 2011; Shell & Husman, 2008; Zhang, 2014) had research designs that investigated both positive emotional engagement and cognitive engagement as parallel outcomes. In general, each of these articles reported that emotional engagement and cognitive engagement are influenced by the same factors. The remaining 14 articles investigated the interaction of these two variables. All three qualitative articles (Kahu, Stephens, Leach, & Zepke, 2015; Liljedahl, 2005; Pekrun et al., 2002) found a positive link between positive emotional experiences and an increase in self-regulated learning, though the link could not be tested in terms of statistical significance. Nine of the remaining quantitative articles reported either a direct or an indirect positive effect of positive emotional engagement on self-regulating strategies or cognitive engagement (Artino & Jones, 2012; Ben-Eliyahu & Linnenbrink-Garcia, 2015; Marchand & Gutierrez, 2012; Muis et al., 2015; Shell, Hazley, Soh, Ingraham, & Ramsay, 2013; Taasoobshirazi et al., 2016; Villavicenio & Bernardo, 2013; You & Kang, 2014; Zhang &

Zhang, 2013). Two articles (Lee, Sheldon, & Turban, 2003; Sun & Rueda, 2012) investigated the opposite relationship. Rather than assuming positive emotions predicted self-regulation, they successfully modeled that self-regulation and mental focus led to positive emotional engagement. Better longitudinal research, collecting measures of emotional and cognitive engagement over the course of a semester might reveal that the relationship between emotional and cognitive engagement is cyclical rather than simply linear.

Academic achievement. Student engagement is assumed to be an important catalyst of academic achievement. While most of the articles explored this relationship in the context of other, intermediary variables, Ismail (2015) only considered emotional engagement and achievement in his regression research. He conducted a regression predicting final course grade in an English language course in Saudi Arabia, using seven emotions as measured by the Academic Emotions Questionnaire (AEQ): (a) pride, (b) hope, (c) enjoyment, (d) anger, (e) anxiety, (f) shame, (g) hopelessness, and (h) boredom. Enjoyment and pride positively predicted achievement and shame had a negative relationship with achievement for students learning English at a Saudi university.

However, not all of the 16 articles that included a measure of final achievement reported unambiguous connections between enjoyment and student achievement. Three articles reported a positive correlation between enjoyment and achievement (Ben-Eliyahu & Linnenbrink-Garcia, 2015; Heddy & Sinatra, 2013; Pekrun et al., 2011). Three articles reported on regression studies that predicted a direct connection between enjoyment and achievement (Artino, La Rochelle, & Durning, 2010; Daniels et al., 2009; Noteborn et al., 2012). In contrast, Kim and Hodges (2012) did not find their hypothesized direct relationship between enjoyment and achievement. Pekrun, Elliot, and Maier (2009) reported mixed findings, with a positive effect of hope and pride on student achievement, but not enjoyment.

Three articles tested for both direct and indirect effects of enjoyment on achievement using structural equation modeling: (a) Shell et al. (2013), (b) Taasoobshirazi et al. (2016), and (c) Villavicencio and Bernardo (2013). Each of these articles reported both direct effects of enjoyment on achievement, as well as indirect effects of cognitive engagement and self-regulation. Tests of indirect effects alone were reported in four articles. While Hazley et al. (2014) and Luftenegger et al. (2016) reported positive of effects of enjoyment on achievement through approach goals, Sagayadevan and Jeyarej (2012) reported that they did not find a significant path from enjoyment to final grade, but they did find a significant indirect path to students' perceptions that they were learning something. Finally, the fourth article, Ruthig et al. (2008), reported an interesting interaction between enjoyment and control, reporting that enjoyment had an impact on achievement only for students with high control appraisals.

Discussion

This article reviewed the extant research on the relationship between positive emotional engagement, cognitive engagement, and academic achievement in higher education classrooms and other adult learning settings. This discussion will focus on what these articles contribute to our understanding of these relationships as well as how efficacious emotional engagement can be facilitated by instructors and instructional designers. In addition, gaps in the literature will be reviewed for those seeking to conduct future research on this topic.

The definition of emotional engagement we employed in this analysis was the experience of positive, activating emotions. Most often this was operationalized as enjoyment, though some researchers, primarily those using Pekrun, Goetz and Perry's (2005) Academic Emotions

Questionnaire (AEQ), also included classroom-focused hope and pride because these have been identified as positive, activating emotions. Though hope (measured by items such as "I am optimistic that I can keep up with the material" p. 9) and pride (measured by items such as "I take pride in being able to keep up with the material" p. 10) are rarely used in definitions of emotional engagement, in some studies of adult learners, hope and pride, proved to be more emotionally engaging and efficacious to academic outcomes than enjoyment. Those who study emotional engagement might want to consider adding these emotions to their conceptualization of emotional engagement when researching adult learners.

The student voices presented in the qualitative studies highlighted how experiencing enjoyment or emotional engagement in a course does not mean that every minute of the course is enjoyable. As is hypothesized, emotional engagement has a strong relationship with cognitive engagement or effortful learning. In qualitative research, students described feeling enjoyment as a by-product of perceiving the relevance of the subject matter and of experiencing success after deep cognitive engagement. The insights provided by the few qualitative articles on this topic demonstrate that more qualitative research on this topic may contribute to a deeper understanding of the dynamics of emotional engagement in adult classrooms.

Though the relationship between emotional engagement and cognitive engagement is often presented as linear, with emotional engagement preceding cognitive engagement, the narratives in the qualitative research, as well as a few quantitative studies, also presented emotional engagement as an *outcome* of cognitive engagement. An important take-away for instructors is that enjoyment is not equivalent to *easy* or *fun.* Encouraging students to engage in deep, effortful learning can lead to higher levels of emotional engagement. As evidence that the relationship between emotional and cognitive engagement is complex, Villavicencio and

Bernardo (2012) found that self-regulation, or deep cognitive engagement, had a significant impact on achievement only when students experienced enjoyment in the course.

Finally, though there is a strong connection between emotional engagement and cognitive engagement and academic outcomes, both types of engagement seem highly influenced by additional student-centered variables such as control appraisals, value appraisals and achievement goals. One of the important findings reported was Ruthig et al.'s (2008) finding that positive emotional engagement only led to higher academic outcomes for students with high control appraisals.

The decision to focus on classroom engagement was made so that the findings would be of use to teachers and instructional designers who work with adult learners. Kahu (2015) stated, "understanding the antecedents of emotions and the impact on student engagement enables improved course design and institutional support" (p. 494). Based on these articles, the most promising interventions that could enhance emotional and cognitive engagement include (a) developing student autonomy support, (b) helping students to enhance their control and value appraisals, and (c) helping students develop the epistemic beliefs that equip them to deal with conflicting information. Though encouraging mastery goals or performance approach achievement goals was explored, the connection between achievement goals and academic outcomes was not always consistent or strong. Similarly, strengthening instructor–student relationships and displaying instructor enthusiasm did not have as strong an impact on achievement as the student-centered variables of control and value appraisals. Only three articles explored the impact of deliberate interventions intended to improve control appraisals, value appraisals, and autonomy support. Clearly more research is needed to explore just how to design instruction to make positive emotional engagement more likely for adult learners.

In particular, more longitudinal and qualitative research are needed. As demonstrated by Hazley et al. (2014), the interaction between emotional and cognitive engagement is a process that takes place over the course of a semester. In addition, students don't make single control and value appraisals and they do not only set achievement goals at the beginning of the course. These seem to change in response to engagement experiences, and so emotional engagement requires longitudinal research to adequately model the process.

While several articles presented sophisticated models that included hypothesized causal relationships, in this group of research articles, these causal relationships often contradicted each other. For example, cognitive engagement was modeled both as an antecedent to emotional engagement as well as an outcome of emotional engagement. This could indicate that these relationships are recursive rather than causal. This is good news for instructors it means there are multiple opportunities for interventions, rather than just at the beginning of a course. It also means that instructors should pay attention to individual student control and value appraisals, their enjoyment and their willingness to engage in deep cognitive engagement throughout the course.

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APPENDIX: List of Articles Reviewed

Authors	Pub. Year	Research Location	Course Subject	Data Collection Instruments Used	Data Collec-tions	Citations[1]
Artino & Jones	2012	U.S.	Physiology	AEQ; MLSQ	1	70
Artino, La Rochelle & Durning	2010	U.S.	Medical Reasoning	Custom control/value scales, AEQ	3	121
Ben-Eliyahu & Linnenbrink-Garcia	2015	U.S.	various	Emotional regulation; behavioral regulation; cognitive regulation; self-regulated learning strategies	1	13
Black & Deci	2000	U.S.	Organic Chemistry	General Causality Orientations Scale (GCOS); Learning Self-Regulation Questionnaire (LSRQ); Interest/ Enjoyment (I/E); State-Trait Anxiety Inventory (STAI), Grade-Orientation (GO), GPA, Exam, Course Grade	2	1356
Daniels, Stupnisky, Stewart, Newall	2009	Canada	Psychology	AEQ; MLSQ	3	192
Hazley, Soh, Miller, Chiriacescu & Ingraham,	2014	U.S.	Computer science	PANAS; SPOCK	2	5
Heddy & Sinatra	2013	U.S.	Biology	Trans-formative experience survey evolutionary reasoning scale; evolution emotions survey	2	56
Ismail, N.	2015	Saudi Arabia	ESL	AEQ; final grades	1	4
Kahu, Stephens, Leach & Zepke	2015	New Zealand	general	Video diaries and interviews	16	21
Kim & Hodges	2012	U.S.	Math	AEQ-M; Course Interest Survey (CIS), exam	3	49
Lee, Sheldon & Turban	2003	U.S.	Management	Personality orientation; goal level; mental focus; grades; class enjoyment	5	268
Liljedahl	2005	Canada	Math	Student learning diary	1	73
Luftenegger, Klug, Harrer, Langear, Spiel, Schober	2016	Austria	Psychology	AEQ; AGQ	2	5

[1] as of 5/29/2017 on Google Scholar

Authors	Pub. Year	Research Location	Course Subject	Data Collection Instruments Used	Data Collec-tions	Citations[1]
Marchand & Gutierrez	2012	U.S.	research methods	AEQ; MLSQ; learning strategies; relevance	3	86
Muis, Pekrun, Sinatra, Azevedo, Trevors, Meier, Heddy	2015	Canada, U.S., Germany	Climate Science	Prior knowledge, epistemic beliefs, emotions, learning strategies	2	16
Noteborn; Carbonell; Dailey-Herber; Gijselaers	2012	Europe	Business	AEQ; MLSQ	2	36
Pekrun, Elliot, Maier	2006	U.S., Germany	Psychology	AGQ; AEQ	3	674
Pekrun, Elliot, Maier	2009	U.S.	Psychology	AGQ, AEQ	5	640
Pekrun, Goetz, Frenzel, Barchfeld, Perry	2011	Canada	Psychology	AEQ; MLSQ for learning strategies & control and value; perceived self-regulation of learning scale	1	540
Pekrun, Goetz, Titz, & Perry	2002	U.S., Canada, Germany	General	interviews, pre-AEQ	7	2038
Ruthig, Perry, Hladkyj, Hall, Pekrun & Chipperfield	2008	U.S.	Psychology	Academic control scale; AEQ; course grade, cumulative GPA, course retention	2	102
Sagayadevan & Jeyaraj	2012	Singapore	Psychology	LSI (lecturer-student interaction); CEQ (class related emotions, adapted from AEQ); POL (perceptions of learning)	1	22
Shell, Hazely, Soh, Ingraham & Ramsay	2013	U.S.	Computer Science	SPOCK; PANAS; self-developed goal orientation; perceived instrumentality; implicit intelligence beliefs; creative competency inventory; computational thinking	1	13
Shell & Husman	2008	U.S.	Psychology	PANAS, SPOCK	1	170
Sun & Rueda	2012	U.S.	Gerontology and Engineering	MLSQ; Situational Interest Scale, WUSE, Fredricks' engagement	1	137
Taasoobshiraz, Heddy, Bailey, & Farley	2016	U.S.	Physics	AGQ; AEQ; Approaches to Learning for Deep Cognitive, PMQ	1	0
Villavicencio & Bernardo	2013	Philippines	Math	AEQ-M; MLSQ, final grades	2	68

Authors	Pub. Year	Research Location	Course Subject	Data Collection Instruments Used	Data Collec-tions	Citations
You & Kang	2014	Korea	Introduction to Color	Perceived academic control; self-regulated learning; e-AES (adapted from AEQ)	1	28
Zhang	2014	U.S.	Communica-tions	Teacher enthusiasm scale, Fredricks' engagement; MLSQ goal orientation, and self-efficacy	1	12
Zhang & Zhang	2013	U.S., China	Various	PANAS, MLSQ, Fredricks' engagement	1	9

Article 2

Investigating Engagement in Blended Learning Settings Using Experience Sampling and Structural Equation Modeling

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Abstract

We investigate activity-level student engagement in blended learning classes at the university level. We used intensive longitudinal methodology to collect activity level engagement data throughout a semester for 68 students enrolled in 6 blended courses across 2 universities. We used structural equation modeling to gain a holistic understanding of learning environments, including the influence of personal characteristics, course design, and student perceptions of the learning experience on in-the-moment cognitive and emotional engagement. To investigate longitudinal relationships between emotional and cognitive engagement, we employed cross-lagged modeling techniques. Findings showed that course design and student perception variables have a greater influence on engagement than individual student characteristics and that student multitasking has a strong negative influence on engagement. Students' perceptions of the importance of the activity have a strong positive influence on both cognitive and emotional engagement. An important outcome of engagement is the students' perceptions that they were learning and improving.

Keywords: Emotional engagement, cognitive engagement, blended learning, structural equation modeling, intensive longitudinal methods, higher education

Introduction

Student engagement has been labeled the "holy grail of learning" (Sinatra, Heddy, & Lombardi, 2015, p. 1). At the higher education level it has been linked to important outcomes such as grades, persistence, and college completion (Kuh et al., 2008; Robinson & Hullinger, 2008). Student engagement is presumed to be malleable through direct interventions and changing contexts (Fredricks, Blumenfeld, & Paris, 2004; Lawson & Lawson, 2013; Skinner & Pitzer, 2012). This ability to directly influence student engagement makes the understanding of engagement within specific contexts important to improving learning experiences and outcomes.

One important specific context for studying learner engagement is in blended learning classrooms. Blended learning is the "thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (Garrison & Kanuka, 2004, p. 96). Improving student engagement has been an important goal in blended learning course design across the globe (Garrison & Kanuka, 2004; Graham & Robison, 2007, Spring & Graham, 2015). However, despite the recent increase in the practice of blended learning in higher education and its accompanying research, very little empirical research has focused exclusively on student engagement in blended learning experiences (Halverson, Graham, Spring, Drysdale, & Henrie, 2014).

Blended learning courses provide a distinctive context for studying learner engagement. Students need to navigate between different modes of instruction and increase their self-motivation to successfully engage in the online portions of the course (Meyer, 2014; Norberg, Dziuban, & Moskal, 2011). Most current measures of engagement are retrospective and employed at the course level. These types of measures do not have the potential to capture the ongoing complexity of blended courses, nor to provide clues about improving instruction in the moment. For researchers to fully understand students' engagement in blended learning, they need to collect student engagement data in both modalities. Intensive longitudinal methods can generate important insights about student engagement in blended learning by capturing the immediate experiences of student engagement throughout an entire blended course and linking those experiences to specific educational activities and contexts (Eccles & Wang, 2012; Lawson & Lawson, 2013; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003). Collecting intensive longitudinal data enabled us to investigate blended learning experiences holistically over the course of an entire semester.

Literature Review and Research Questions

Engagement

Three important issues are salient to an exploration of student engagement. First, engagement may be conceptualized as two or three distinct sub-constructs. Second, the interactive nature of engagement must be considered, with specific individual and contextual variables interacting to facilitate engagement. Third, engagement needs be conceptualized and studied at a consistent level.

Definition and conceptualization of engagement. Student engagement is associated with psychological investment and effort (Newmann, Wehlage, & Lamborn, 1992). Examples of definitions include "active, energetic, and approach-oriented involvement with academic tasks" (Pekrun & Linnenbrink-Garcia, 2012, p. 260) and "concentrated attentions, interest, and enjoyment" with instruction (Shernoff et al., 2003, p. 159). Both of these definitions include elements of emotion, cognition and behavior on the part of the student. Theoretic and empirical efforts to bring precision to the concept of engagement have led to a proposed multifaceted learner engagement model composed of two or three sub-constructs. Two common sub-constructs are *emotional engagement*, defined as students' affective reactions in the classroom, and *cognitive engagement*, specified as students' effort directed toward learning. Some researchers also include a sub-construct of *behavioral engagement*. (For a comprehensive review of the use of these sub-constructs see Fredericks, Blumenfeld, & Paris, 2004). However, the term *behavioral* is not used with consistency. Sometimes it refers to procedural behaviors such as attendance and homework. Other times it is defined as "effort, attention and persistence" (Skinner, Furrer, Marchand, & Kindermann, 2008, p. 766), which overlaps with common definitions of cognitive engagement. Sinatra, Heddy, and Lombardi (2015) emphasized that operationalizing these categories makes the boundaries between the sub-constructs less clear. In presenting this research we use the two-sub-construct model consisting of emotional and cognitive engagement, as our study concludes that their interaction, particularly at the activity level, which is the focus of this research, leads to the greatest learning gains. We define cognitive engagement as the mental energy students apply to learning, with emotional engagement as the positive emotional responses students have with learning. It has been proposed that emotional engagement proceeds or positively influences cognitive engagement (Fredricks, Blumenfeld & Paris, 2004). This relationship is still unclear. Over a decade after Fredricks et al.'s proposal, Janosz (2012) claimed we need to better understand to what extent emotional and cognitive engagement have separate and cumulative outcomes on student learning.

Engagement as a product of individual and contextual influences. The connection of engagement with positive outcomes warrants its investigation. Additionally important is that unlike academic success factors believed to be outside an educator's control, such as parental education and income levels, engagement is presumed to be malleable by direct intervention and by changes in context and environment (Fredricks et al., 2004; Lawson & Lawson, 2013; Skinner et al., 2009; Skinner & Pitzer, 2012). For example, Park, Holloway, Arendtsz, Bempechat, and Li (2012) found that student emotional engagement was influenced by the variables associated with *self-determination theory* (social relatedness, autonomy and competence). They concluded that “students’ emotional engagement is more accurately conceptualized and measured as a process that is sensitive to context rather than a global score” (p. 396).

Contextual variables that influence student engagement have been labeled as *engagement facilitators* (Skinner & Pitzer 2012) or *influences* (Shernoff 2010), which are of two types: (a) environmental and (b) perceptual. Environmental influences on student engagement include the particulars of the learning activity, such as the type of activity (Shernoff, 2013, 2010), class size (Gleason, 2012), and modality (face-to-face or online). Shernoff (2010) used the term *perceptual phenomena* to describe the different ways various classroom activities are experienced and internalized, including perceptions of autonomy, relatedness, challenge, and relevance.

It is thus assumed that engagement is an interaction of the individual qualities the learner brings to the learning situation and the contextual qualities facilitated by the course design elements created by the instructor or instructional designer, as illustrated by Figure 1. Inside the box representing engagement are those experiences that combine with the learner and instructor contributions to produce emotion and effort necessary for engagement. A more nuanced understanding of engagement can result if research techniques measure these “inside the box” factors as they occur, also controlling for the outside the box factors of learner characteristics and course design elements. This level of analysis requires a clear differentiation between those emotions and behaviors that *indicate* engagement and those that *facilitate* engagement (Ainley, 2012; Lawson & Lawson, 2013; Skinner et al., 2008; Skinner & Pitzer, 2012).

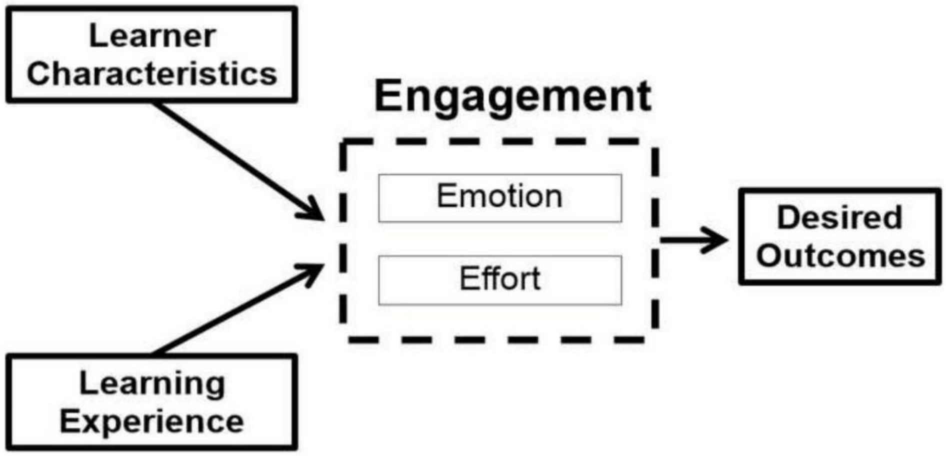

Figure 1. Model of learner engagement.

Levels of analysis in engagement research. Engagement has been conceptualized and studied at three distinct levels of analysis: (a) the institutional level, (b) the course level, and (c) the activity level. The level chosen directly impacts operationalization of engagement, measurement, relevant facilitators, and associated outcomes (Skinner & Pitzer, 2012).

Activity level ("in-the-moment") engagement has received less attention and research than institutional and course level engagement (Eccles & Wang, 2012; Sinatra et al., 2015). However, research at this level, especially over time, would help educators understand the extent to which "engagement is a function of stable and enduring qualities or a function of contextual factors" (Fredricks et al., 2004, p. 67). Several methodological challenges are associated with activity level engagement research. For example, how can engagement be measured "in-the-moment" without changing the moment? Which indicators of engagement are adequate at this level? Suggested methods for this level include observation, experience sampling, trace or log data, and biometrics (Eccles & Wang, 2012; Greene, 2015; Henrie, Halverson, & Graham, 2015;

Sinatra, Heddy, & Lombardi, 2015). A later section of this literature review further explores the use of experience sampling research in student engagement.

Engagement in Blended Learning

The definition of blended learning is fluid (Oliver & Trigwell, 2005). A foundational definition is the "thoughtful integration of classroom face-to-face learning experiences with online learning experiences" ((Garrison & Kanuka, 2004, p. 96). Other definitions focus on the percentage of time allocated for traditional face-to-face settings and online learning activities. Examples include 50% instruction online and 50% instruction face to face (Bernard et al., 2009) or somewhere between 30-79% online (Allen & Seaman, 2007). Graham (2013) reviewed the varied definitions of blended learning and concluded that the most common use of the term entails a combination of traditional face-to-face and online instruction. He further noted continued debates about how much online work is required for a course to be considered "blended learning" and whether the definition requires a reduction in seat time. Meanwhile, as the exact definition of the term remains contested, the use of blended learning pedagogy is increasing dramatically on higher education campuses across the globe (Bernard, Borokhovski, Schmid, Tamim, & Abrami, 2014; Lim & Wang, 2015; Norberg, Dziuban, & Moskal, 2011)

One reason for this increase in blended course design is the perception that blended learning has the potential to increase student engagement (Dringus & Seagull, 2013; Garrison & Kanuka, 2004; Graham & Robison, 2007). For example, blended learning designs tap into students' affinity and preference for technology (Dziuban, Moskal, Brophy-Ellison, & Shea, 2007), incorporate more active learning experiences than regular lecture-oriented classes (Dziuban, Moskal, Brophy-Ellison, Shea, 2007), and balance community building with efficiency (Garrison & Kanuka, 2004).

However, blended classes can also make engagement more difficult for students, as they must navigate between instructional modalities (Baneljee, 2011). The online portions of the course, in particular, can be challenging for students to engage, for instructors to gauge engagement, and for researchers to measure engagement. Dziuban et al. (2007) have suggested as examples of these challenges, the need for students to be more proactive and the isolation students may experience due to reduced classroom interaction with instructors and peers (see also Norberg et al., 2011). Meyers (2014) mentioned several personal characteristics that make engagement in online settings difficult, including low self-efficacy, low resilience, and low self-regulation, as well as preference for face-to-face learning settings. These additional student characteristics need to be included when investigating student engagement in blended learning. According to Sun and Rueda (2012), "There are unresolved issues related to students' engagement in the [online] learning process" (p. 191). Of course, in the face-to-face settings, engagement is also hard to identify (Dixson, 2010; Handelsman, Briggs, Sullivan, & Towler, 2005).

If we are to better understand engagement in blended learning, we need more research into how students navigate between the two modalities of blended learning along with how these two modalities interact to better support students and improve blended learning design (Bliuc, Goodyear, & Ellis, 2007; Means, Toyama, Murphy, & Baki, 2013). A clear methodology that provides commensurate data for investigating engagement across in-person and online learning experiences must be established. This type of research requires studying engagement at the activity level. Intensive longitudinal methods, which were designed for this type of person-centered context-specific research, have rich potential for providing a better understanding of engagement as students navigate different modalities throughout an entire blended learning course.

Intensive Longitudinal Methodology

Intensive longitudinal methods involve collecting multiple measurements of a phenomena from individuals, over time in order to model a change process (Bolger & Laurencesau 2013). Experience sampling methodology (ESM) is a form of intensive longitudinal methods in which the data are collected in the natural context of an individual's daily life. The data collected include information about what the subject is doing and feeling, along with as much contextual information as possible. These data enable an understanding of how certain psychological experiences change over time as well as the contextual factors that influence that change (Bolger & Laurenceau, 2013; Fleeson, 2007; Hektner, Schmidt, & Csikszentmihalyi, 2007). Two major advantages have been found for using longitudinal experience sampling for researching engagement. First, engagement data are tied to specific activities occurring in specific contexts, rather than to an abstract concept of engagement in general. Hektner et al. (2007) explained that "the researcher is able to link variations in attention, interest, or challenge to specific instructional practices or conditions" (p. 229). Second, student self-reports of engagement are likely to be more reliable because they are collected in the moment and not diminished by recall (Eccles & Wang, 2012; Park et al., 2012; Sinatra et al., 2015). A potential concern about intensive longitudinal methods may be reactivity. That is, participation in the process may affect or change the participant's experience. Certain situations have been shown to make reactivity more likely, such as participants trying to change a behavior, but overall, the novelty of repeatedly completing a short survey form typically dissipates after two or three days (Bogler, Davis, & Rafaeli, 2003; Conner, Barrett, Tugade, & Tennen, 2009). To minimize reactivity in our sample we did not interrupt their learning experience, sending them the survey after class, and we designed the instrument to be able to be completed in less than 3 minutes.

Previous educational applications of experience sampling method research have generated important understandings about student engagement (Conner & Mehl, 2012; Hektner, Schmidt, & Csikszentmihalyi, 2007). For example, Shernoff et al. (2003) found that high school student engagement was enhanced when the activity challenge and students' perceived skill levels were high and in balance, as well as when students had some control over the learning activity and found it relevant. Shernoff and Schmidt (2008) found that the link between engagement and achievement was weaker for Black students than for White students, and that engagement indicator of "being on task" was more strongly related to outcomes for Black students than for White students. Using ESM with high school students, Park (2012) found that student engagement varied by the contextual variables autonomy, social support, and relatedness. Peterson and Miller (2004) used an ESM model to investigate collaborative learning in a college education course, but only collected data twice during the semester. They found higher levels of engagement during collaborative learning activities than in large group instruction.

A challenge to using ESM specifically to study student engagement is deciding on the indicators to include in the survey instrument. Most existing engagement scales include items that do not apply to "in-the-moment" experience, but rather relate to the student's overall experience, for example, "Do you complete assigned homework for the course?" A large ESM engagement research project, The Sloan Study of Youth and Social Development (SSYSD), used a definition of engagement that did not include any sub-constructs. Instead, the Shernoff, Csikszentmihalyi, and Schmidt (2003, 2008) research team used a composite variable of interest, concentration, and enjoyment which they referred to as "engagement." Park et al.'s (2013) high school ESM study used the same three indicators—interest, concentration and enjoyment—to make a composite variable but labeled it “emotional engagement.” Fredricks et al. (2004) stated that ESM could gauge emotional engagement but said nothing about its application to cognitive or behavioral engagement. Sinatra et al. (2015) argued that ESM can be used to assess how students interact with others and with the particular learning environment to “produce a particular type, level, or form of engagement” without indicating the particular aspect of engagement they observed (p. 9). Recently Curtis et al. (under review) validated an engagement scale measuring both emotional and cognitive engagement at the activity level in a college setting. This scale is further described in the Method section of this paper.

Research Questions

The purpose of this research project was to expand our understanding of student engagement in blended learning by using intensive longitudinal, experience sampling methods to capture the day-by-day experiences of students as they navigate a semester-long blended learning course. These methods allow us to explore how much of student engagement is a stable characteristic of the student and how much engagement varies by course design elements that are controlled by an instructor. We are also interested in whether emotional engagement facilitates cognitive engagement as well as how the instructional mode (face-to-face versus online) of the learning activity influences engagement. These are particularly salient issues in a blended learning setting where some students may have a harder time sustaining engagement as they navigate back and forth between face-to-face and online learning activities. Furthermore, as institutions around the world are rapidly adopting blended learning models, this provides an opportunity to explore pedagogical approaches to blended learning that can transform learning for higher education students (Oakley, 2015; Zurita, Hasbun, Baloian, & Jerez, 2015).

We specifically investigated two research questions:

1. What impact do instructional design decisions, student characteristics, and student perceptions have on student emotional and cognitive engagement in blended learning classroom? What is the impact of the modality of the instruction (online or face-to-face) on these influences?
2. How are emotional and cognitive engagement related longitudinally throughout a semester blended learning class? Does higher emotional engagement at the beginning of the course proceed and lead to greater cognitive engagement later in the course?

Method

Context

Data were collected from students attending six different blended learning courses held at two medium-sized universities (approximately 30,000 and 25,000 students each) located in the western United States. One university has an approximate 51% acceptance rate while the second university has open enrollment and serves a more diverse student body. A multi-course, multi-institution design was constructed in order to overcome the idiosyncratic aspects of individual courses, to gain access to wide variety of students, and to improve generalizability to the study of student engagement in blended courses (Baneljee, 2011). Each of the blended learning courses in this study offered three hours of credit, met at least once every week during the 16-week semester and used online learning activities to reduce class time by at least one day a week. To increase the diversity of the student sample, five of the six courses were first or second year general education courses, designed for students with a variety of majors and goals. Two courses were first-year writing composition courses, three were second-year humanities courses, and one was an upper division nursing science course. Each instructor had received formal training in blended learning course design and had previously taught the course using a blended design. Class time in these courses was typically used for lecture, class discussion and small group work. Online work included watching videos, reading articles, taking tests and quizzes, and writing essays and critical responses. Five of the courses had between 14 and 25 students, while one course had 80 students. Teachers were recruited to participate in this research through email solicitation. We chose these courses because we believe they represent "typical" blended learning courses that are held on many campuses. The point of this study was not to test or evaluate any particular blended course design or intervention, but to glean understandings of student engagement in blended courses that could be globally applied.

Participants

Students in each class were recruited through a class visit by a member of the research team; they were offered gift cards as incentives for their participation. They were informed that their participation was voluntary and would not impact their grade in any way. Instructors were not informed as to which students were participating in the research. Students who agreed to participate signed a consent form and provided us with their contact information so that we could send survey links and reminders throughout the semester. IRB protocol was followed and approved at both universities. A total of 68 students chose to participate, one of whom did not complete the initial learner characteristics survey. Participation rates in the various classes ranged from 17% to 54%. Students reported being affiliated with 29 different majors, including "undecided." Demographic information for the participating students, including their previous experience with online and blended learning is provided in Table 1.

Table 1

Description of Participants

Characteristic	Number of students	Percentage of the sample
Year in school		
Freshman	11	16%
Sophomore	22	33%
Junior	12	18%
Senior	22	33%
First generation college student	14	21%
Age		
18-20 yrs.	13	19%
21-25 yrs.	47	70%
26-30 yrs.	3	4%
31-35 yrs.	0	0%
36+ yrs.	4	6%
Gender		
Female (n=29)	29	43%
Male (n=38)	38	57%
Previous online and blended experience		
Had taken a previous online course	36	55%
Had taken a previous blended course	18	27%

Data Collection

We created an event-contingent ESM design, a methodology that requires participants to complete a report every time a pre-defined event occurs (Bolger & Laurenceau, 2013). This design was a compromise from a pure ESM design because we wanted to collect data over the entire semester, and instructors did not want their class time to be repeatedly interrupted by our surveys. (In contrast, the Sloan Study of Youth and Social Development, a national high school student engagement ESM study, collected data through randomly timed surveys for seven days (Shernoff & Schmidt, 2008)). Instead, we designated two pre-defined data collection triggers for the blended learning classes: leaving a face-to-face class and completing an online activity. Starting the third week of the semester, each student was instructed to complete the ESM survey instrument twice a week: immediately (a) after a face-to-face class, and (b) after completing online course work. The surveys were administered online through Qualtrics. Most students took these surveys on their mobile devices. To remind students to complete them, text and email reminders with survey links were sent to students at the exact completion time of each face-to-face class and the day online assignments were due and the evening prior to the due date. While it would have been preferable to survey students while truly in-the-moment during their class or online time, most surveys were completed within an hour of attending class and on the day of completing online work and so we consider this data to accurately reflect their day-to-day engagement experiences. The 68 students completed 1400 surveys over the course of the semester. Compliance to the twice weekly protocol varied as described in the Missing Data section of this paper.

Longitudinal ESM Instrument

We modeled our ESM instrument after the ESM instrument used in the longitudinal Sloan Study of Youth and Social Development as presented in Hektner et al. (2007). Using this instrument as a template, we also used Skinner and Pitzer's (2012) model of items suggested as indicators and facilitators of engagement. The resulting 33-question instrument was designed to require less than three minutes to complete. Not every one of the 33 items were included in the analysis and modeling of the data for this study since some items were created to address separate research questions. A copy of the ESM instrument is provided in Appendix A.

Engagement Latent Factors

Using these repeated surveys to investigate student engagement with Structural Equation Modeling was a two-step process. First, latent factors to measure engagement were created and tested on additional data sets that were created with the same instrument but with different courses. Second, facilitator variables were added to the model to explore relationships. In a previous analysis Henrie et al. (under review), established a two-factor model of this engagement survey instrument which maintained good model fit across data sets. The first factor was labeled *cognitive engagement* because it demonstrated effort and cognitive energy. The three items that made up this factor were "How well were you concentrating?" "Rate yourself passive to active." "Rate yourself focused to distracted." The second factor was labeled *emotional engagement* and the four items that made up this factor were "Did you enjoy this activity?" "Was this activity interesting?" "Did you wish you had been doing something else?" "Rate yourself excited to bored." Descriptive information for variables from our data set is shown in Table 2.

Table 2

Description of Engagement Variables

Factor	Indicator	Min/ Max	Mean	Standard Deviation	Skewness	Kurtosis
Emotional engagement	Enjoy (Did you enjoy this activity?)	1–5	3.062	1.13	−0.252	−0.698
	Interesting (Was this activity interesting?)	1–5	3.252	1.15	−0.384	−0.695
	Something else (Did you wish you had been doing something else?)	1–5	3.397	1.27	−0.271	−1.041
	Excited-bored (Excited to bored bipolar response)	1–7	3.958	1.40	0.243	−0.472
Cognitive engagement	Concentration (How well were you concentrating?)	1–5	3.395	1.13	−0.357	−0.689
	Passive-active (Passive to active bipolar response)	1–7	3.682	1.60	0.188	−0.875
	Focused-distracted (Focused to distracted (bipolar response)	1–7	3.207	1.69	0.645	−0.492

Facilitating Variables

We included variables from three categories of engagement facilitators: (a) student personal characteristics, (b) course design characteristics, and (c) in-the-moment interpersonal perceptions that vary with each instructional activity. Descriptive data for these variables are found in Table 3.

Table 3

Descriptive Information for Facilitating Variables

Level of Analysis	Variable	Min/Max	Mean	Standard Deviation	Skewness	Kurtosis
Individual Level	Gender	0=male; 1=female			−.304	−1.966
	Year in school	1/4	2.65	1.117	−.050	−1.395
	GPA	1/4	3.37	.976	−1.005	.557
	Interest factor Score	3.22/2.08	.074	1.371	−.409	−5.24
	Self-efficacy factor score	−2.03/.944	-.02	.756	−.759	.137
	Tech self-efficacy factor score	−2.017/.655	.040	.636	−1.190	1.197
	Preferred mode	0=online; 2=f 2 f	.655	.489	−.495	−1.809
	1st generation college	0=parent w/college 1=no parent college	.32	.471	.772	−1.448
Instructional Design	Mode	1=online; 2=f2f	1.49	.500	.046	−2.001
	Choice	1/5	3.29	1.068	−.464	−.401
	Peer interaction	0=no; 1=yes	.189	.392	1.586	.515
	Content interaction	0=no; 1=yes	.1705	.376	1.755	1.080
	Active learning	0=no; 1=yes	.249	.433	1.162	−.652
Student Perception	Lonely-sociable	1/7	4.15	1.262	.128	.234
	Challenge	1/5	2.23	1.090	.608	−.441
	Relate	1/5	3.67	1.076	−.649	−.140
	Important	1/5	2.87	1.212	.057	−.935
	Learning	1/5	3.29	1.068	−.464	−.401
	Total other (Multi-tasking)	0/12	1.66	1.385	2.583	9.606

Personal characteristics were gathered from an initial one-time survey given to all participating students during the second week of the semester. These variables represent the type of personal qualities that students bring to the instructional experiences that remain constant throughout the semester. Based on a review of previous engagement and blended learning research, we included five self-reported variables: (a) gender, (b) GPA (4-point scale), (c) year in school, (d) first-generation college status, and (e) preferred learning environment (online, face-to-face). In addition, three latent factors were created from this initial survey to measure (a) self-efficacy (4 items from the Motivated Strategies for Learning Questionnaire (MLSQ) (Pintrich, Smith, Garcia, & McKeachie, 1993)), (b) initial subject matter interest (3 items created for this survey), and (c) computer self-efficacy (3 items created for this survey). Computer self-efficacy has been theorized to impact students' ability to navigate online learning activities (Bates & Khasawneh, 2007). The items used to create these three factors as well as the factor loadings are included in Appendix B. The fit statistics for this model of latent learner qualities was RMSEA = 0.018, CFI = 0.959, TLI = 0.942, SRMR = 0.088.

Course design variables were created from the ESM survey. Rather than merely comparing online with face-to-face activities, in the traditional manner of blended learning research, we created five variables to represent the course design elements the instructor brings to the learning experience: (a) the mode of the activity (*face-to-face* or *online*), (b) the amount of choice students had in the activity, from 1 (*not at all*) to 5 (*very much*), and (c) the type of activity (as entered by the student), represented by a series of dummy variables that indicated lecture, peer interaction activities, content interaction activities, or active learning activities. The coding scheme for these variables can be found in Table 4. The most frequent learning activity was lecture, and the dummy scheme was created to compare the other activities to lectures. Therefore, in the study results for the variables *peer interaction, content interaction, and active learning* will all be comparing those activities to lectures. Instructor presence is also an important aspect of course design but was not independently measured in this study but we did control for class membership in the SEM model. Interestingly, two of the instructors each taught two of the exact same courses in this study and for both of sets of courses there were significant differences in the students' mean emotional and cognitive engagement scores for the students in each of their courses. This may indicate that individual instructor was not a distinguishing facilitator of engagement for this particular group of courses.

Table 4

Coding Scheme for Learning Activity Variables

Category	Indicators	Number of times
Lecture	Lecture	473
Peer interaction	Student presentations	43
	Class discussion	42
	Discussion board	118
	Small group work	36
	Create group project	19
	Total	258
Content Interaction	Video	159
	Reading textbook	29
	Reading articles	44
	Total	232
Active Learning	Quiz or test	154
	Studying for quiz or test	5
	Working on project alone	33
	Researching online	14
	Writing paper or response	133
	Total	339

The final group of facilitator variables is in-the-moment student perceptions and affective states. These intrapsychic and interpersonal variables measure how the student is experiencing the learning activity as it is taking place. Though these variables measure student perceptions, these perceptions are created in response to a certain context that includes the student, the instructor, the instructional experience designed by the instructor, and the other students (Shernoff, 2010). This category included five variables:

1. *Relate*. Can you relate it to what you already know? (5 point Likert-type scale)
2. *Importan*ce. Is the activity important to you? (5 point Likert-type scale)

3. *Learning.* Are you learning anything or getting better at something? (5 point Likert-type scale)
4. *Challenge*. How challenging is the activity? (5 point Likert-type scale)
5. *Loneliness-sociability.* How lonely or sociable was the activity for you? (bipolar 7 point scale: lonely=1 and sociable =7)

As they took the ESM survey, students were asked to check all of the other things they were doing as they participated in the learning activity, such as listening to music, eating, engaging in social media, texting, daydreaming, and watching media. We created the variable multitasking, which summed all of their additional activities into a single number.

SEM Assumptions

All variables used in this analysis were checked for the SEM assumptions of normal distribution, linear relationship, normality of residuals, and equality of variance through descriptive statistics, histograms, and plots of regression residuals. Independent observations were not assumed, since data were longitudinal and thus specified as complex and clustered according to ID number in the analysis. Since only six courses were involved, clustering at the class level was not optimal, and we could not achieve convergence when we modeled class membership as a random effect. Class membership was partially accounted for by including a series of dummy variables representing membership in individual classes in the Full Information Maximum Likelihood (FIML) auxiliary command in Mplus discussed in the next section.

Missing Data

We used data from two sources: (a) bi-weekly ESM surveys, and (b) an individual learner characteristics survey collected from participants one time at the beginning of the research project. One student did not complete the learner characteristic survey. The ESM surveys had missing data on two levels: (a) missing surveys and (b) missing data on the submitted surveys.

Missing ESM surveys. The research design specified that each student would complete two surveys per week over the 11½ weeks of the study: (a) one after each face-to-face class experience and (b) one after each online class experience. Therefore, a student with 100% participation would have completed 23 surveys. The actual response rates for students ranged from 4% (1 completed survey) to 152% (35 completed surveys). A perfect completion rate would have generated 1,587 surveys, and we collected 1400, amounting to a response rate of 88%, with 12% of the surveys missing.

Computing the amount of missing data, however, has been more complex. Sixteen students completed more than 23 surveys. Either they reported on more than one face-to-face class during a week (one of the classes met twice weekly) or on more than one online experience. Thus, both extra data and missing data had to be explained. Not wanting to eliminate any of the surveys, we ran a regression on the completion rate for each student, with all of the covariates in order to understand and explain both the missing and extra data. Gender, year in school, and class membership (dummy coded to test for each class individually) all had a statistically significant relationship to the individual response rate. Together these variables accounted for nearly half of the variance in missing data; therefore, assuming the data are missing at random in the presence of these variables seems appropriate. In order to best handle these missing data we used Full Information Maximum Likelihood (FIML) in Mplus, which handles MAR well (Little & Rubin, 2013), adding gender, year in school, and class membership (coded individually) in the auxiliary command.

Missing survey data. The individual surveys submitted also had data missing. For individual items, these ranged from .04% (mode) to .07% (bored to excited). We dummy-coded each variable for whether it was missing or not and ran regressions to explain the missing data. Only gender was significant, as males were more likely to have missing items. Gender was included in the FIML approach to missing data in Mplus.

For both missing surveys and missing data within surveys, regression analysis has shown the data to be missing at random (MAR), since the likelihood of students with missing surveys and questions with missing answers can be explained by other covariates in the data set. By including these covariates in the auxiliary command in Mplus, we significantly reduced the potential of bias on the estimates.

Structural Equation Modeling

The structural equation modeling of these data was accomplished in three steps. First, we established model fit for the two latent variables, cognitive and emotional engagement. Second, we added individual level variables and in-the-moment variables indicating course design and student perceptions of the experience to predict cognitive and emotional engagement. Third, we created cross-lagged models to explore the potential causal relationship between cognitive and emotional engagement over time.

The Measurement Model

Using the MLR estimator in Mplus (v.7.3) and TYPE IS COMPLEX (cluster is person I.D.), two latent variables, emotional engagement and cognitive engagement*,* were modeled as described in Table 2. The underlying components of the cognitive engagement latent factor measured active, focused, concentration. Since the "focused/distracted" variable was measured along a continuum of focused (low end) to distracted (high end), the lower value indicates more focus and less distraction, hence the negative loading. The underlying components of the emotional engagement factor measured enjoyment, positive energy, interest, and lack of boredom. The variable “something else” asked students to rate how much they would rather be doing something else besides the learning activity. A lower score indicates a lack of wanting to be doing something else, and so there is a negative loading on the emotional engagement factor. Similarly, since the “excited to bored” variable was measured along a continuum of exited (low end) to bored (high end), the lower value indicates more positive energy and less boredom, hence the negative loading.

The initial model did not display the expected fit statistics based on the Curtis et al. (under review) research, so we consulted the modification indices and adjusted the model to estimate the correlation of the residual variances for the Interesting and Enjoyment variables. The fit statistics for this adjusted model were RMSEA = 0.069, CFI = .960, TLI = .930, SRMR = .039, AIC = 28284.50, BIC = 28693.53, sample size adjusted BIC = 28445.88). Guidelines indicate that a RMSEA value between 0.05 and 0.08 indicates good fit (Browne & Cudeck, 1993), a CFI value above .90 indicates good fit (Wang & Wang, 2012), a TLI value above .90 indicates good fit (Wang & Wang, 2012), and a SRMR value of less than .08 indicates good fit (Hu & Bentler, 1999); thus we decided this model had good fit. In order to confirm that a model with two latent engagement factors (cognitive and emotional) was better than one factor, we also modeled a single engagement factor with the same variables. Fit indices for this single factor model using the previously stated fit guidelines were poor (RMSEA = .134, CFI = .837; TLI = .737; SRMR = .064). In addition, the single factor model had higher AIC, BIC and aBIC values. Factor loadings for the two-factor model, as well as the individual ICC values for each item (since this is a multilevel model) are shown in Table 5.

Table 5

Engagement CFA Loadings and Correlations

	Unstandardized loading	Standard error	Intra Class Correlation	Correlations
Cognitive engagement				With emotional engagement .693
Passive to active	1.00**	.00	.28	
Focused to distracted	−1.78**	.18	.25	
Concentration	1.18**	.12	.18	
Emotional engagement				
Enjoyment	1.00**	.00	.29	With interest .465
Something else	−1.09**	.06	.41	
Interesting	.94**	.03	.30	
Excited to bored	−1.17**	.10	.24	

Note. ** p<.001

The Structural Model

With a good measurement model of engagement established, the next step of analysis was to examine the predictors of cognitive engagement and emotional engagement. Of the three categories of predictor variables, learner characteristic variables were assumed to remain constant throughout the semester, and course design variables and perceptual variables were assumed to vary from time point to time point because they are experienced "in the moment." To determine the most appropriate statistical technique, we tested for random slopes across time for both cognitive and emotional engagement using a two-level model. Cognitive engagement had a small negative (−0.002) non-significant (p = 0.757) slope. Emotional engagement also had a small negative (−0.012) non-significant (p = 0.052) slope. In addition, we graphed and visually analyzed the slopes. We were able to assume no change in the final model because the effects were small. In addition, given the large number of items in relationship to our small sample size (68 students) we ran the model with a Bayesian estimator which better handles small sample sizes (Heck & Thomas, 2015; Muthen, 2010). We saw the same pattern of results and so are reporting on the MLR estimator because the results are more commonly understood. Based on these results we continued with the SEM, TYPE IS COMPLEX, model approach in Mplus. The full model provides insight into the impact of all the different types of variables on both emotional and cognitive engagement in the presence of each other. The full model is described in Figure 2; the results of the model are shown in Table 6. The fit statistics for this model were indicated moderate fit: RMSEA =.04; SRMR = .03; CFI = .92; TLI = .88. The R-Squared for emotional engagement was .84 and the R-Squared for cognitive engagement was .53.

SEM Results

The results indicated that emotional and cognitive engagement have been uniquely influenced by a combination of individual, course design, and perceptual variables. The value of this research is to show how each variable influences engagement, controlling for all of the other variables in the model. The results of the SEM are organized according to the three groups of predictor variables, starting with the variables of learner characteristics.

Learner characteristics variables. In the group of individual level variables, a student's self-efficacy had the greatest impact on cognitive engagement (β of 0.13, $p <.05$), and a student's initial subject interest, as measured during the first week of class, had the greatest impact on emotional engagement (β of 0.16, $p <001$). Neither variable had a significant influence on the other type of engagement. Gender had a significant negative influence (β 0.11, $p < .001$) on emotional engagement, with females being less engaged emotionally, but no significant impact on cognitive engagement. GPA had a significant negative influence ($\beta= -0.09$, $p < .05$) on cognitive engagement, as students with higher GPAs had lower cognitive engagement, but no significant impact on emotional engagement. Computer self-efficacy had a significant negative

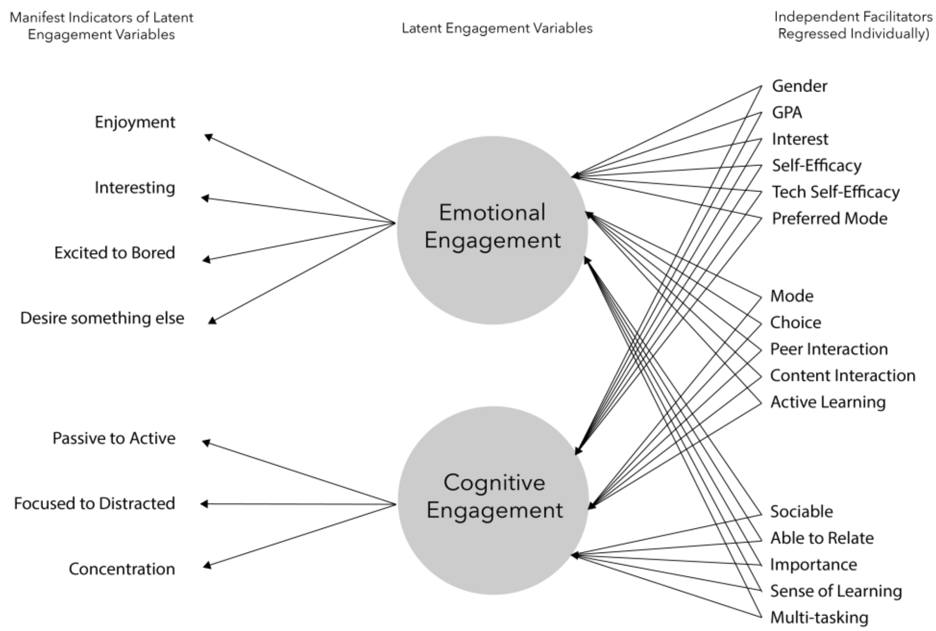

Figure 2. SEM model of emotional and cognitive engagement.

impact on emotional engagement (β = -0.11, $p < .001$) so that the higher a person's technical self-efficacy, the lower his or her emotional engagement. The rest of the variables—*year in school*, *preferred mode of instruction*, and *first-generation college status*—did not have a significant impact on cognitive or emotional engagement.

Course design variables. Among the instructional design variables, the mode of the activity (face to face or online) had a significant positive beta on cognitive engagement (β = 0.12, $p < .01$) which means online activities were more cognitively engaging than face-to-face interaction. This may be explained by most courses being designed to have quizzes and tests taken online rather than during face-to-face class time. Mode did not have a significant impact on emotional engagement. In contrast, choice (the degree to which students felt they had a choice affecting the activity) had a significant positive impact on emotional engagement

Table 6

Results of Full SEM Model, Facilitators Regressed on Cognitive and Emotional Engagement

	Cognitive			Emotional		
Variable	B	S. E. B	β (standardized)	B	S.E. B	β (standardized)
Individual level						
Gender	0.10	0.08	0.06	−0.21***	0.06	−0.11
Prior GPA	−0.06*	0.04	−0.09	0.01	0.03	0.01
Subject Interest	−0.03	0.03	−0.06	0.08***	0.03	0.16
Self -Efficacy	0.14*	0.07	0.13	−0.01	0.06	−0.01
IT self-efficacy	0.02	0.06	0.02	−0.16***	0.05	-0.11
Preferred mode (f2f = 1)	0.07	0.08	0.04	0.07	0.09	0.04
Class Design						
Mode (online or f2f)	0.19**	0.07	0.12	−0.06	0.05	−0.03
Choice in activity	0.01	0.02	0.01	0.10***	0.03	0.12
Peer interaction	0.19**	0.06	0.09	0.10	0.05	0.03
Content interaction	−0.05	0.08	−0.02	0.14*	0.07	0.05
Active learning	0.20**	0.08	0.10	−0.13*	0.06	−0.06
Perceptual						
Lonely-sociable	0.07**	0.03	0.11	0.13***	0.02	0.18
Challenge	0.07*	0.03	0.10	−0.13***	0.03	−0.15
Relate	0.12***	0.03	0.16	0.09**	0.03	0.01
Important	0.16***	0.04	0.23	0.28***	0.03	0.36
Learning	0.22***	0.04	0.29	0.36***	0.03	0.41
Multitasking	−0.15***	0.03	−0.25	−0.07***	0.02	−0.1

Note. N=1271. *p <. 05 **p < .01 ***p < .001.

(β=0.12, p < .001) but not on cognitive engagement. Peer interaction activities (as compared to lectures) had a significant, positive influence on cognitive engagement (β=0.09, p < .01) but not on emotional engagement. Compared to lectures, content interaction activities had a significant positive influence (β = 0.05, p < .05) on emotional engagement but not on cognitive engagement. In contrast, when comparing active learning activities with lectures, we found a significant positive influence on cognitive engagement (β = 0.10, p < .01) but a negative influence on emotional engagement (β = -0.06, p < .05).

Student perception variables. The next five variables measured students' in-the-moment perceptions of learning activities. These will be discussed in order of greatest to smallest effect size. Feeling like they were learning something or getting better at something had the greatest impact on both emotional engagement ($\beta = 0.41$, $p <.001$) and cognitive engagement ($\beta = 0.29$, $p <.001$) of any variable in the model. Perceiving the learning activity as important to them had the second greatest impact on emotional engagement ($\beta = .36$, $p< .001$) and the third highest impact on cognitive engagement ($\beta = 0.23$, $p < .001$). The more sociable students felt during an activity, the higher their emotional ($\beta = 0.18$, $p < .001$) and cognitive engagement ($\beta = 0.11$, $p < .01$). The final two variables in this category had interesting differences in their effects on emotional and cognitive engagement. Being able to relate the learning activity to something students already knew would positively impact both cognitive ($\beta = 0.16$, $p < .001$) and emotional engagement ($\beta = 0.01$, $p < .01$), but the size of the effect was much greater for cognitive engagement. The level of challenge the student perceived in the activity had a positive effect on cognitive engagement ($\beta = 0.10$, $p < .05$), but a larger negative effect on emotional engagement ($\beta = -0.15$, $p <.001$). A possible interpretation is that students do not always enjoy being challenged and cognitively engaged.

Finally, multitasking, the measure of how many other things students were doing during a learning activity, is not just a perceptual variable, but an indication of how the student is choosing to interact with the learning activity. While this variable had a negative effect on both cognitive ($\beta = -0.25$, $p < .001$) and emotional engagement ($\beta = -0.1$, $p <.001$), it had the second largest impact on cognitive engagement of any variable in the model.

This complete model explained quite a bit of the variance of emotional engagement ($R^2 = .817$) and a moderate amount of the variance of cognitive engagement ($R^2 = .527$).

Cross-Lagged Model

In addition to the regression analysis, we investigated the longitudinal interaction between emotional and cognitive engagement over the duration of a semester class. Specifically, we were interested in discovering whether high emotional engagement led to an increase in cognitive engagement later in the semester. In order to model an SEM cross-lagged model we computed each student's mean emotional and cognitive engagement for the first, second, and final third of the semester. Due to the small sample size of 66 individuals for this analysis, we used the Bayes estimator in Mplus to achieve convergence (Kenny, 1975; Kenny, 2005). The cross-lagged model, diagramed in Figure 3, computed the betas for the influence of emotional engagement at Time 1(A_1) on emotional engagement at Time 2 (A_2) and for emotional engagement at Time 2 (A_2) on engagement at Time 1 on cognitive engagement at Time 2 and for cognitive engagement at Time emotional engagement at Time 3 (A_3). The same pattern has been computed for cognitive 2 on cognitive engagement at Time 3. These self-influencing lag effects are indicated by the horizontal arrows; all are significant, as expected. Controlling for these, the model also

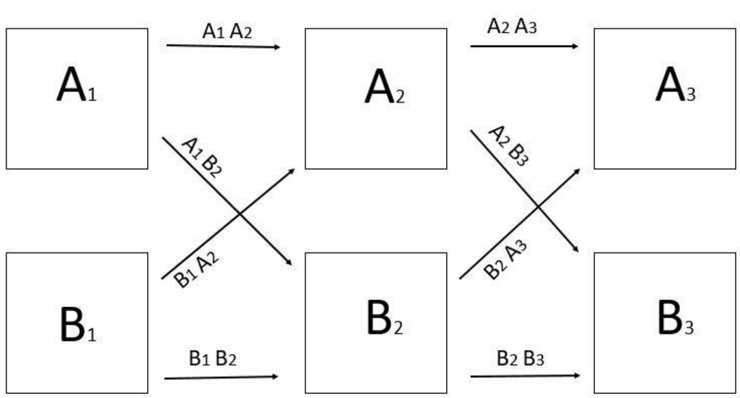

Figure 3. Cross lag model.

computed the betas for the influence of emotional engagement at Time 1 on cognitive engagement at Time 2 (A_1B_2) and for emotional engagement at Time 2 on cognitive engagement at Time 3, as well as the corresponding influences of cognitive engagement on emotional engagement. These betas are indicated with the cross-diagonal arrows. The results, as shown in Table 7, did not indicate any significant relationship between emotional and cognitive engagement between Time Points 1, 2, or 3. We ran both unconstrained (betas being free to differ between time points) and constrained (betas being constrained to be the same between time points). Though there was no difference in the pattern of results, we have reported the constrained betas because the constrained model had a lower BIC, indicating better model fit. The BIC for the constrained model was 453.013, and the BIC for the unconstrained model was 468.843.

We next explored the longitudinal relationship between emotional and cognitive engagement and the facilitators that had significant betas in the previous model. We chose to investigate learning (whether the student was learning anything or getting better at something), importance (whether the activity was important to the student), and multitasking since these had the largest betas in the SEM regression model. As with the previous model, we tested constrained and unconstrained iterations. The BIC was lower for the constrained models, indicating better model fit, and so those results are reported. The variables importance and multitasking did not show any significant relationship with emotional or cognitive engagement at Time Points 1, 2, or 3. Learning, however, showed a significant relationship that was the opposite of our hypothesis. Rather than facilitating cognitive and emotional engagement, learning appears to be a significant outcome of both cognitive and emotional engagement.

Cognitive and emotional engagement at Time Point 1 had a significant impact on “learning”—students’ perception that they were learning something or getting better at something at Time

Table 7

Results of Cross-Lagged Models

Cross lag Model	Time 1 to Time 2 unstandardized betas		Time 2 to Time 3 unstandardized betas	
Emotional & cognitive engagement	Emotional on emotional $(A_1 A_2)$	0.71*	Emotional on emotional $(A_2 A_3)$	0.71*
	Cognitive on cognitive $(B_1 B_2)$	0.66*	Cognitive on cognitive $(B_2 B_3)$	0.66*
	Emotional on cognitive $(A_1 B_2)$	0.06	Emotional *on* cognitive $(A_2 B_3)$	0.06
	Cognitive on emotional $(B_1 A_2)$	0.08	Cognitive *on* emotional $(B_2 A_3)$	0.08
Learning & emotional engagement	Learning on learning $(A_1 A_2)$	0.57*	Learning on learning $(A_2 A_3)$	0.57*
	Emotional on emotional $(B_1 B_2)$	0.76*	Emotional on emotional $(B_2 B_3)$	0.76*
	Learning on emotional $(A_1 B_2)$	0.05	Learning on emotional $(A_2 B_3)$	0.05
	Emotional on Learning $(B_1 A_2)$	0.19*	Emotional on learning$(B_2 A_3)$	0.19*
Learning & cognitive engagement	Learning on learning $(A_1 A_2)$	0.51*	Learning on learning $(A_2 A_3)$	0.51*
	Cognitive on cognitive $(B_1 B_2)$	0.68*	Cognitive on cognitive $(B_2 B_3)$	0.68*
	Learning on cognitive $(A_1 B_2)$	0.06	Learning on cognitive $(A_2 B_3)$	0.06
	Cognitive on learning $(B_1 A_2)$	0.26*	Cognitive on learning $(B_2 A_3)$	0.26*
Important & emotional engagement	Important on important $(A_1 A_2)$	0.85*	Important on important $(A_2 A_3)$	0.85*
	Emotional on emotional $(B_1 B_2)$	0.68*	Emotional on emotional $(B_2 B_3)$	0.68*
	Important on emotional $(A_1 B_2)$	0.15	Important on emotional $(A_2 B_3)$	0.15
	Emotional on important $(B_1 A_2)$	0.02	Emotional on important $(B_2 A_3)$	0.02
Important & cognitive engagement	Important on important $(A_1 A_2)$	0.79*	Important on important $(A_1 A_2)$	0.79*
	Cognitive on cognitive $(B_1 B_2)$	0.68*	Cognitive on cognitive $(B_1 B_2)$	0.68*
	Important on cognitive $(A_1 B_2)$	0.08	Important on cognitive $(A_1 B_2)$	0.08
	Cognitive on important $(B_1 A_2)$	0.10	Cognitive on important $(B_1 A_2)$	0.10
Multitasking & emotional engagement	Multitasking on multitasking $(A_1 A_2)$	0.68*	Multitasking on multitasking $(A_2 A_3)$	0.68*
	Emotional on emotional $(B_1 B_2)$	0.75*	Emotional on emotional $(B_2 B_3)$	0.75*
	Multitasking on emotional $(A_1 B_2)$	−0.04	Multitasking on emotional $(A_2 B_3)$	−0.04
	Emotional on multitasking $(B_1 A_2)$	0.034	Emotional on multitasking $(B_2 A_3)$	0.034
Multitasking & cognitive engagement	Multitasking on multitasking $(A_1 A_2)$	0.66*	Multitasking on multitasking $(A_1 A_2)$	0.66*
	Cognitive on cognitive $(B_1 B_2)$	0.79*	Cognitive on cognitive $(B_1 B_2)$	0.79*
	Multitasking on cognitive $(A_1 B_2)$	0.04	Multitasking on cognitive $(A_1 B_2)$	0.04
	Cognitive on multitasking $(B_1 A_2)$	−0.03	Cognitive on multitasking $(B_1 A_2)$	−0.03

Note. N=66. Model was constrained to identical betas between the two time periods. *= Significant Bayes p value

Point 2. Similarly, cognitive and emotional engagement at Time Point 2 also had a significant impact on students’ sense of learning at Time Point 3. These results are exploratory because our sample size was small (n=66) at this level of analysis. However, the results justify studying engagement longitudinally at the activity level to gain a more complete understanding of the distinction between facilitators and outcomes of engagement throughout a course.

Discussion

This study provided a valuable opportunity to gain a holistic understanding of student engagement in higher education blended learning classrooms. We will first discuss the implications of this research for student engagement generally and then engagement in blended learning classroom specifically.

Increasing student engagement is a primary objective for those who advocate for blended learning adoption in higher education settings in every region of the world. Student engagement is theorized to be multi-faceted, including a cognitive and an emotional component, and to be malleable by instructor intervention. Our analysis supports this multi-faceted view of engagement. While emotional and cognitive engagement were correlated and they both led to the outcome of students' perceptions of learning and getting better at something, they were each uniquely influenced by different aspects of individual student and classroom characteristics. Not surprisingly, a student's self-efficacy (measured in general terms at the beginning of class) was positively related to their cognitive engagement and a student's interest in the subject matter (as measured at the beginning of the class) was positively related to their emotional engagement. Though we did not intend to explore Pekrun's control-value theory of achievement emotions (Pekrun, 2006) with this research, these findings do somewhat confirm his hypothesis that students who have a positive sense that they can perform an academic task and perceive that the task has value or interest to them, will experience enjoyment (a key component of our emotional engagement factor) and will be willing to exert more cognitive effort toward the activity (a key component of our cognitive engagement factor). (For a discussion of the control-value theory of emotions in online settings see Daniels & Stupnisky, 2012). Further, we found that as students rated the specific learning activities as "important to them" and reported that they could relate the material to previous learning (measures of value), both their cognitive and emotional engagement increased, reinforcing the control-value theory's prediction of positive value and control appraisals leading to positive effects on cognitive and emotional engagement. It is important for instructors of students in higher education to clearly communicate the value of each learning experience in order to facilitate engagement, regardless of the modality in which the learning activity occurs.

A unique contribution of this research was exploring the impact that different learning activities had on engagement in higher education classrooms. Surprisingly, peer-interaction activities increased cognitive engagement, but not emotional engagement. However, students' ratings of feeling social (as opposed to lonely) at the time of the activity had a strong positive impact on both cognitive and emotional engagement. This indicates that feelings of sociality may operate independently of instructor directed peer-interaction. Lower levels of emotional engagement were associated with both active-learning activities and when students found the activities challenging. These findings support those that caution that emotional engagement, when it is defined by enjoyment and positive feelings, is not always possible during effortful learning experiences (Baker, D'mello, Rodrigo, Graesser, 2010). Instead, students will, and probably should, experience frustration and other negative emotions when working to gain knowledge and mastery. In fact, both active learning and challenging activities were associated with higher cognitive engagement, despite lower emotional engagement. These types of situations are why a nuanced view of engagement, one that includes both cognitive and emotional components is helpful to fully understanding student engagement.

In considering longitudinal effects of emotional and cognitive engagement, we did not find the hypothesized relationship that emotional engagement proceeds and facilitates cognitive engagement (Pekrun & Linnenbrink, 2012; Skinner & Pitzer, 2012). In this sample these two distinct types of engagement did not seem to influence each other over the course of the semester. This might indicate that young adult and adult learners are less reliant on their emotional experiences to facilitate their cognitive engagement. It might also be due to our small sample size relative to the complexity of the model. Due to the complexity of this model, a larger sample size is needed to support or contradict this finding. However, the longitudinal models did reveal that distinctions can be made between facilitators and outcomes of engagement. Specifically, student perceptions that they are learning something or improving in some way appear to be an outcome of engagement rather than a facilitator. This finding strengthens Shernoff's (2013) argument for many positive outcomes of engagement beyond grades. Future research with a larger data set will be able to further clarify and expand our understanding of the longitudinal nature of engagement over the course of a semester.

In terms of engagement in blended learning classes, our findings contribute to an understanding of how students navigate between the modalities of online and face-to-face learning activities and dispel a few concerns about the use of technology to replace seat-time. First, according to our findings, the location of the learning activity is less important to engagement than the actual pedagogical elements an instructor designs and the student perceptions of the learning experience. It is often assumed that the face-to-face component of blended learning classes contributes to meeting the emotional and social needs of students (Velasquez, Graham, & Osgothorpe, 2013) However, we found that the face-to-face setting of these classes was related to an increase in cognitive engagement and had no significant impact on emotional engagement, when controlling for the instructional activity. In addition to whatever social and emotional support in-person interactions provide, these in-person interactions appear to be important to students' cognitive engagement as well.

Blended and online learning course design is associated with flexibility and more opportunities for student choice in learning activities (Gu, 2015; Horn & Staker, 2014; Reeve & Tseng, 2011). We found that having choice in a learning activity was associated with higher levels of emotional engagement. Designing learning activities that provide student autonomy and choice and allow them to pursue personal interests is one of those factors within the instructors control that contribute to higher levels of emotional engagement for higher education students.

Other factors that have been mentioned as possible impediments to student engagement in blended courses were not found to be significant in our analysis. Lower scores of technology-related self-efficacy did not have a negative impact on student engagement. In fact, students with higher levels of technology self-efficacy had lower levels of emotional engagement. This might be due to the fact that none of the courses in our study were technology-related subjects. In addition, a student's first-generation status, their previous experience with online or blended courses, and their preference for face-to-face or online learning were all not found to have an impact on their engagement and so were dropped from an already complex model. The only impediment we did find to engagement was the high amount of multi-tasking by students as they participated in on-line learning activities.

In conclusion, our research helps clarify aspects of student engagement in blended learning, higher education classes. The good news is that the pedagogical decisions an instructor makes appear to have a stronger impact on student engagement than the location of the learning activity or the individual characteristics of the learner. Learning activities that provide learner choices, develop sociality, are perceived as important to the student and are seen as relevant or related to existing student knowledge are all associated with higher levels of both cognitive and emotional engagement. Learning activities that are challenging and require active participation are related to higher levels of cognitive engagement, but might lead to a temporary decline in emotional engagement.

This research has solidified our belief that blended learning instruction has the potential to improve student engagement in higher education. The flexibility of instructional activities facilitates student choice, autonomy and value appraisals while providing regular interaction with peers and the instructor. Future research in this area should explore specific pedagogical techniques that can be implemented in both online and face-to-face settings that enhance students' perceptions of control, value, and interest and that decrease tendency of students to multi-task when interacting with technology.

Unfortunately, our small sample size did not allow us to definitively understand the relationship of emotional and cognitive engagement over time for young adult and adult learners. We recommend exploring a new research design that allows for both the longitudinal data collection along with a larger sample size in order to gain the statistical power to validate a complex model of change in latent variables over time.

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APPENDIX A: ESM Survey Instrument

[Date and time collected in survey software]
Are you reporting on a face-to-face or online learning activity?
Where are you?
What is the main learning activity you were doing (or just did in class)?
What else were you doing?
Did you enjoy what you were doing? (5-point scale: 1 = *not at all* to 5 = *very much*)
How well were you concentrating? (5-point scale: 1 = *not at all* to 5 = *very much*)
Did you feel good about yourself? (5-point scale: 1 = *not at all* to 5 = *very much*)
Were you learning anything or getting better at something? (5-point scale: 1 = *not at all* to 5 = *very much*)
Did you have some choice in picking this activity? (5-point scale: 1 = *not at all* to 5 = *very much*)

Did you experience frustration? (5-point scale: 1 = *not at all* to 5 = *very much*)
Did you set a goal for yourself prior to the class or activity? (5-point scale: 1 = *not at all* to 5 = *very much*)
Did you feel socially connected to anybody during this learning activity? (5-point scale: 1 = *not at all* to 5 = *very much*)

Your mood as you participated in the learning activity (all on 7-point bipolar scale):
Happy–sad
Passive–active
Worried–relaxed
Lonely–sociable
Excited–bored
Focused–distracted
Curious–apathetic
Who were you with? (Check all that apply.)
How you felt about the main activity:
How challenging was it? (1-5)
Was it important to you? (1-5)
How skilled are you at it? (1-5)
Did you wish you had been doing something else? (1-5)
Was this activity interesting? (1-5)
How important was it to your future goals? (1-5)
Were you able to relate it to what you already know? (1-5)

Actions since you last filled out the survey:
How hard have you worked to keep up with this class? (1-5)
How much time have you spent on this class?
Have you interacted (in person, email, phone or online) with the teacher? (y/n)
Have you interacted (in person, email, phone or online) with classmates? (y/n)

APPENDIX B: Learner Characteristics Latent Variable CFA Results

Variable	Unstandardized loading	S.E.
Self-efficacy		
I believe I will receive an excellent grade in this class.	1.00	0.00
I am confident I can understand the most complex material in this course.	1.10	0.15
I am confident I can do an excellent job on the assignments and tests in this course.	1.05	0.08
Considering the difficulty of this course, the teacher, and my skills, I think I can do well in this class.	0.91	0.07
Subject interest		
I like the subject matter of this course.	1.00	0.00
I am very interested in the content area of this course.	0.92	0.14
Understanding the subject matter of this course is very important to me.	0.519	0.13
Computer/tech self-efficacy		
I am capable of solving or getting help to solve my computer-related problems.	1.00	0.00
I am very comfortable doing class work that is online.	1.30	0.32
I am capable of using the internet to find information I need.	.59	0.23

Fit statistics: RMSEA = 0.018, CFI: 0.959, TLI: 0.942, SRMR: 0.088.

DISSERTATION CONCLUSION

The purpose of this dissertation was to investigate the relationship between emotional and cognitive engagement for adult learners. Emotional engagement is assumed to proceed and provide energy for cognitive engagement (Fredricks, Blumenfeld & Paris, 2004; Janosz, 2012; Pekrun & Linnenbrink-Garcia, 2012). However, research on student engagement spans the developmental levels from kindergarten through higher education and so it is important to understand the precursors and outcomes of engagement at each developmental level (Mahatmya, Lohman, Matjasko, & Farb, 2012). In the first article we reviewed the extant research on emotional and cognitive engagement done in higher education classes. The research we reviewed was conducted in 10 different countries, in a wide range of courses. The largest category of courses was STEM courses, indicating a desire to understand the emotional experience of students in courses often thought to be more cognitively challenging.

As we reviewed the literature, we found that a simple linear relationship between emotional engagement, cognitive engagement, and academic achievement is an inadequate model of student engagement. Instead, the research seems to suggest that the relationship between emotional and cognitive engagement is cyclical, with emotional engagement as likely to be an outcome of cognitive engagement as it is an antecedent. Furthermore, both emotional and cognitive engagement are strongly influenced by the course-specific appraisals students make about their ability to control their achievement within a course, the relevance or value of a course, and the type of achievement (mastery or performance) they desire. Again, these relationships turned out to be complex. For example, Pekrun, Elliot, and Maier (2006) hypothesized that students with high control appraisals would experience high enjoyment in a course and subsequently, high levels of cognitive engagement and achievement. However, Ruthig et al. (2008) found that students with high control appraisals experienced both high and low enjoyment, but that the high control was only positively linked to academic achievement for students who also experienced high enjoyment. Students who did not experience enjoyment did not experience the positive connection between feelings of control and academic achievement. Further adding to the complexity, the few longitudinal and qualitative articles reported that students do not make single appraisals at the start of a course. These appraisals are made throughout the course in response to context and on-going experiences of engagement.

In our second article we reported on our own original research on emotional and cognitive engagement in a particular type of higher education classroom. We longitudinally investigated engagement in courses that deliberately blend face-to-face instruction with online, or technology mediated, learning environments. Blended learning courses are a challenging course type in which to monitor student engagement because students are remote from the instructor and other students for a significant amount of the instruction time. To meet this challenge, we used experience sampling methods to capture engagement experiences throughout the entire semester, both after in-person instruction and online instruction. Using structural equation modeling we were able to confirm that emotional and cognitive engagement are two distinct but related ways of engaging in a course. We were able to explore the types of experiences and pedagogy that contributed to both types of engagement. Our results confirm that student control and value appraisals are very important to experiencing both types of engagement. In addition, by capturing student's activity level engagement experiences rather than their overall rating of the course experience, we were able to show that when learning activities are challenging and require active participation, emotional engagement declines while cognitive engagement increases. This adds complexity to our understanding of the relationship between these two types of engagement.

Using a cross lagged model, we explored the cyclical relationship between emotional and cognitive engagement over the course of the semester, but were not able to do so successfully. This might be due to our relatively small sample size. However, we were able to model a cycle of both emotional and cognitive engagement leading to increased student perceptions that they were learning and becoming more skilled with the course content.

This dissertation makes a contribution to understanding emotional and cognitive engagement in higher education classrooms. We found that emotional engagement, while important for adult learners, is not sufficient for a productive learning experience. We decided to focus on the course level of engagement, as opposed to the institutional level, because this is the level that provides instructional designers and instructors greater opportunities to have the most impact on student outcomes. Engagement is important because it is seen as malleable and open to intervention (Fredricks, Blumenfeld, & Paris, 2004; Kahu, 2013; Skinner & Pitzer, 2012). While our research provides some important direction, more research is needed to provide guidance to instructors as to how to more systematically facilitate emotional and cognitive engagement in higher education courses.

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