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Self-Determination Theory and Student Emotional Engagement in Higher Education

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A dissertation submitted to the faculty of
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Doctor of Philosophy

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ABSTRACT

Self-Determination Theory and Student Emotional Engagement
in Higher Education

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Studies have shown that increased student engagement is correlated with improved learning outcomes and overall positive results for students. While engagement can be viewed as a precursor to other outcomes, it should also be examined as an outcome itself. To increase student engagement and improve the learning experience for students, we must understand which factors can facilitate engagement and how educators can positively affect these factors. This research explored the influence of three proposed facilitators of engagement: autonomy, competence, and relatedness. Self-determination theory, a theory of motivation, posits that these are three innate psychological needs that must be fulfilled to experience the highest level of motivation, for which engagement has been used as a proxy.

In the format of a multiple-article dissertation, I present three articles. The first article reviewed the literature concerning self-determination theory and student engagement in both K-12 and higher education settings. It answered the following research question: *What has been found regarding the influence of autonomy, competence, and relatedness on student engagement?* The second article built upon findings from the first article and outlined the process to create and validate an instrument to measure autonomy, competence, relatedness with peers, relatedness with professors, and emotional engagement. Data were collected from university students through an online survey (n = 340). Confirmatory factor analysis results showed that survey items performed well and measured the intended constructs. Structural equation modeling was then used to identify the best fitting model for the data collected. Results showed that sense of competence had the largest predicted effect on emotional engagement. The third article employed the validated survey discussed in the second article. It was administered to students in an online higher education program (n = 3092). Confirmatory factor analysis and structural equation modeling were conducted on the sample. Students' sense of autonomy was found to have the greatest effect on emotional engagement.

Keywords: self-determination theory, student engagement, structural equation modeling, confirmatory factor analysis, higher education

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I am grateful to my parents and siblings for their encouragement throughout my graduate experience. Most importantly, I am indebted to my husband, Eugene, for the selfless love and support he has provided since day one of this journey. None of this would have been possible without him.

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DESCRIPTION OF RESEARCH AGENDA AND STRUCTURE OF DISSERTATION

This dissertation, *Self-Determination Theory and Student Emotional Engagement in Higher Education,* is written in a journal article format. The research is an exploration of self-determination theory and how its constructs—autonomy, competence, and relatedness—affect students' emotional engagement. Three journal articles follow in this dissertation: a literature review and two empirical studies.

The first article, a literature review, was to understand the current state of student engagement research and how self-determination theory (SDT) constructs have been applied in this area. Based on our findings, we identified the need to separate the influence of relatedness with peers and professors. We also identified the potential for an instrument that could be used to measure these constructs and emotional engagement. The second article chronicles the development and validation of the instrument. For the third article, we used the instrument with students in online courses to measure their sense of autonomy, competence, relatedness with peers, relatedness with instructors, and emotional engagement. A brief summary of each article is provided below.

Article 1: A Review of Self-Determination Theory Constructs and Their Influence on Student Engagement. The first article is a literature review of SDT and student engagement. In this review, we examine the literature surrounding student engagement that includes at least one of three proposed facilitators of engagement: autonomy, competence, and relatedness. We discuss the influence of each SDT construct on students. In our review we found that most of the literature in this area focuses on autonomy while relatedness is considered the least important of the SDT constructs. The review includes literature from K-12 and higher education settings. This

manuscript will be submitted to appropriate outlets, such as *Educational Research Review* and *Educational Psychology Review*, that publish literature reviews.

Article 2: Validating a Self-Determination Theory and Emotional Engagement Instrument. The second article outlines the process to create and validate an instrument to measure student sense of autonomy, competence, relatedness with peers, relatedness with professors, and emotional engagement in higher education. Survey items were adapted from the Intrinsic Motivation Inventory and other studies on emotional engagement. We collected data from students in higher education (n = 340) through a survey administered online. Survey responses were used to perform confirmatory factor analysis (CFA) and structural equation modeling (SEM). We found that survey items performed well and measured the intended constructs. SEM was used to confirm the best model to show the relation between the SDT constructs and emotional engagement. This article will be submitted for publication to journals such as *Journal of Educational Psychology* and *British Journal of Educational Psychology.*

Article 3: Examining the Influence of Self-Determination Theory Constructs in Online Higher Education. The last article builds upon the previous study, using the measurement instrument validated in Article 2 for data collection. This study sought to understand the influence of autonomy, competence, relatedness with peers, relatedness with instructors, and emotional engagement in an online higher education. The survey was administered to students in 23 courses in an online higher education program (n = 3092). To account for clustering in the data, we calculated the design effect and then performed CFA and SEM with this sample. Results from these analyses showed that autonomy had the largest effect on emotional engagement. Both relatedness with peers and relatedness with instructors were found to have the smallest effect. Findings from this study will be submitted for publication to

educational technology journals, such as *The Turkish Journal of Educational Technology* and *Australasian Journal of Educational Technology.*

ARTICLE 1

A Review of Self-Determination Theory Constructs and Their Influence on Student Engagement

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Abstract

In this article we review the literature surrounding self-determination theory and student engagement in K-12 and higher education contexts. Our search criteria included the terms *self-determination theory, learner engagement, autonomy, competence,* and *relatedness,* and our final sample of literature included 28 articles. Given the ever-increasing importance of engagement in education, we sought to understand how self-determination theory constructs can be used as facilitators of student engagement. In our analysis, we discuss the ways varying authors define engagement, the differences in K-12 and higher education settings for measuring autonomy, competence, and relatedness, and directions for future studies. We propose that future self-determination theory research devote more attention to identifying and understanding the influence of relatedness on engagement, through direct and indirect effects. We also propose the creation of a measurement instrument that can be used across contexts to measure autonomy, competence, relatedness, and engagement.

Keywords: self-determination theory, student engagement, autonomy, competence, relatedness

Introduction

Researchers in recent years have emphasized student engagement as an important aspect of the learning experience for students in both K-12 classrooms and higher education. This increased focus is propelled by findings that link engagement to improved persistence (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008), higher achievement (Anderson, Christenson, Sinclair, & Lehr, 2004; Connell & Wellborn, 1991), and overall performance (Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003). Engagement has been referred to as the "holy grail of education" (Sinatra, Heddy, & Lombardi, 2015, p. 1), yet there is no singular definition of student engagement that is widely accepted or studied. Many researchers agree that engagement is a multifaceted concept. One of the most highly cited and accepted articles on the topic mentions three components of engagement: behavioral, emotional, and cognitive (Fredricks, Blumenfeld, & Paris, 2004). Other authors propose two-component models of engagement comprised of emotional and cognitive aspects (Halverson & Graham, in press) or cognitive and behavioral factors (Skinner, Kindermann, & Furrer, 2009). Reeve and Tseng (2011) added the fourth aspect of agentic engagement to the foundational three of behavioral, emotional, and cognitive.

Though the definitions of engagement vary, most literature on the topic asserts that engagement is an important and malleable piece of the educational experience (Appleton, Christenson, & Furlong, 2008; Fredricks et al., 2004; Manwaring, Larsen, Graham, Henrie, & Halverson, 2017; Skinner et al., 2009). By identifying facilitators of engagement, researchers and practitioners can create interventions, such as changes to course structure and instructional strategies, to influence and improve the learning experience. Self-determination theory (SDT) is one framework that has been applied to engagement research. SDT is a theory of motivation that

suggests student autonomy, competence, and relatedness are three psychological needs that must be fulfilled in order for learners to experience higher levels of motivation and performance (Deci & Ryan, 2000; Deci, Vallerand, Pelletier, & Ryan, 1991). In an academic context, student engagement is commonly used as a proxy for the idea of motivation and performance (e.g., Reeve & Tseng, 2011; Skinner et al., 2009).

Some researchers have chosen to use SDT as a framework to understand how to "support the student motivation and engagement that is already there...in a way that allows for high- (rather than low-) quality motivation and engagement" (Reeve, 2012, p. 152). This is one way to counteract what Guay, Ratelle, and Chanal (2008) see as educational practitioners' emphasis on "control, rewards, and competition, which hamper self-motivation" (p. 233). According to SDT, motivation and engagement can be fostered through fulfilling students' need for autonomy, competence, and relatedness.

Although all three constructs are included in SDT as innate needs, our initial introduction to the literature in this area revealed that, to date, research involving student engagement and SDT has focused mainly on the effects of autonomy-supportive environments. Less attention seemed to be directed towards the psychological needs of relatedness and competence. This apparent lack of well-rounded literature regarding these two needs encouraged us to take on a thorough literature review. This review will examine the existing literature about SDT and student engagement in academic contexts, both at the K-12 level and in higher education. The purpose of this review is to better understand the role and influence of each SDT construct—autonomy, competence, and relatedness—on student engagement. By understanding how each construct affects student engagement, instructors will be better able to focus their limited time

and attention on those instructional strategies and course designs that will have the greatest impact on students. This review will seek to answer the following questions:

1. What research has been conducted about student engagement using self-determination theory constructs?
2. What has been found regarding the influence of autonomy, competence, and relatedness on student engagement?

Methods

The purpose of this literature review was to understand how each of the constructs cited in SDT influences student engagement in academic contexts at both the K-12 and higher education levels. Our research focused on identifying the influence of autonomy, competence, and relatedness on student engagement. We limited our search results to articles from peer-reviewed publications that were originally published in English.

Search Terms

We used the Education Resources Information Center (ERIC) database offered through EBSCOhost to search for articles on our topic. We selected ERIC due to its wide coverage of educational research and access to resources. To take advantage of the indexing in ERIC, we first accessed the thesaurus for the term *student engagement* to find the best descriptor for inclusion in subsequent searches. An ERIC descriptor is a word or phrase used to describe a main idea that may exist under multiple names. *Student engagement*, for example, is indexed in ERIC under the descriptor *learner engagement*. We completed our initial search in ERIC using both the descriptors *learner engagement* and *self-determination theory* to find articles on student engagement that used SDT as a framework for the study. This search yielded a total of 75 articles.

We then conducted another search using the descriptor *learner engagement* with the terms *autonomy, competence,* and *relatedness,* the three psychological needs included in SDT. We chose to add this search, recognizing that some studies may not explicitly cite SDT by name even though they focus on the same constructs. This could occur because an article was not indexed with the relevant descriptor or it could be indexed under one of the mini-theories that has emerged from SDT (e.g., cognitive evaluation theory). These mini-theories use the same constructs as SDT to answer or explain more specific facets of motivation (Ryan & Deci, 2002). Our attempt to account for these possibilities proved useful. For example, an article by Skinner, Furrer, Marchand, and Kindermann (2008) that was not a result in our initial search appeared in this second search. Our second effort resulted in an additional 20 articles; nine of these 20 articles were unique and did not overlap with results from our initial search. In total we found 84 articles that were possibly relevant and proceeded to apply our inclusion criteria to this body of literature.

Inclusion Criteria

Although there was a wide selection of valuable literature on student engagement, we were interested in a more focused sample. Our search criteria were the initial filter through which we sought relevant literature. We then screened each of the resulting articles to find those that met the following criteria:

1. Focused on SDT constructs as facilitators of engagement. Some of the articles that were returned by our search included components of SDT and a measure of engagement, however, they did not specifically examine the relationship between SDT and engagement.

2. Included the term *engagement*, or a variation of it, in the abstract. We wanted to ensure engagement was a central theme in the articles we reviewed.
3. Took place in an academic context, either K-12 or higher education, and focused on a subject matter other than physical education. Many of our search results included physical education-focused articles. We felt this context offered opportunities for student autonomy, competence, and relatedness in ways that could not be replicated in a traditional classroom setting.
4. Focused on engagement as opposed to disengagement. While we believe valuable information can be gleaned from examining learner disengagement, we chose to narrow our search to those studies that included some measure of engagement and how it can be influenced through SDT constructs.

Final Sample

The final sample included 24 articles that met our inclusion criteria. In addition to the results from the ERIC database, we included foundational articles and book chapters on the subject. This added an additional four articles to our review.

Results

In this section, we review our findings from the literature. We first present how researchers defined student engagement. We then discuss how SDT constructs were measured in K-12 and higher education contexts, including similarities and differences between the two. Finally, we present our analysis of the individual influences of autonomy, competence, and relatedness on engagement as revealed through our review.

Definitions of Engagement

As previously mentioned, within the student engagement domain there is no consensus on a single definition of engagement. In our review of the literature we found various ways authors chose to conceptualize engagement. Some definitions included the commonly mentioned aspects of behavioral, cognitive, and emotional engagement, while others' conceptualizations were without any mention of those components. Articles in our sample included measurements of engagement that ranged from one to six facets. Park, Holloway, Arendtsz, Bempechat, and Li (2012) were the only researchers who focused solely on emotional engagement, which they defined as the "students' affective response (e.g., happiness, anxiety, interest)" (p. 390) and sought to measure emotional engagement as interest, concentration, and enjoyment. Adapting the work of Skinner et al., (2009), researchers Raufelder, Regner, Drury, and Eid (2016) included behavioral and emotional engagement measures in their study with seventh- and eighth-grade students in Germany.

In her study with community college students, Schuetz (2008) defined engagement as a "state of interest, mindfulness, cognitive effort, and deep processing of new information" (p. 312). Although not included in her definition, Schuetz also discussed engagement as a state that includes a "lack of anxiety or anger" (p. 312). It was uncommon to see student engagement framed in terms of lacking such negative emotions; however, in their four-dimension classroom engagement, Jang, Kim, and Reeve (2012) included an aspect that considered "the presence of task-involving emotions such as interest and the absence of task-withdrawing emotions such as distress" (p. 1177). Most definitions highlighted actions or indicators of engagement, such as participation or effort.

Some studies introduced unique ways of segmenting engagement, such as Scogin and Stuessy, whose 2015 scientist-mentor study included eight inquiry stages as checkpoints of engagement. Leach (2016) used a six-perspective model of engagement, consisting of the following: motivation and agency, student/teacher interaction, student interaction, institutional support, active citizenship, and non-institutional support. In an earlier study, Zepke, Leach, and Butler (2010) used only the motivation and agency perspective for their higher education study.

There did not appear to be any relation between the number of engagement aspects measured and the educational context of either K-12 or higher education. These examples are not comprehensive of the sample but are meant to show the variability in the ways that engagement is ideated and measured. This affects the generalizability of findings to the larger field of engagement. It is important to interpret results in any study within the constraints imposed by authors' definitions. This principle should also be applied to interpretations of findings with autonomy, competence, and relatedness.

Measures of SDT Constructs in K-12 and Higher Education

Although all studies used SDT as a guiding framework, each employed a different way to collect data and measure the SDT constructs. Many researchers pulled sections from pre-existing measurement instruments and revised items or combined multiple instruments for the purposes of their own studies. The majority of articles outlined data collection procedures that measured student engagement, autonomy, competence, and relatedness through self-report surveys administered to students (e.g., Nie & Lau, 2009; Shih, 2015; Skinner et al., 2008). Self-report methods can have disadvantages, but in these studies it seemed to be the most appropriate method. Raufelder et al. (2016) and others (Jang et al., 2012; Koch, Dirsch-Weigand, Awolin, Pinkelman, & Hampe, 2017; Park et al., 2012; Skinner et al., 2008) specified in their article that

they were trying to measure students' *perceived* fulfillment of those needs. For such cases, self-report is a good way to capture how the student felt. Although literature describing both K-12 and higher education contexts employed surveys to collect data, only studies that took place in an elementary or secondary setting used observational data in conjunction with self-report surveys (Haakma, Janssen, & Minnaert, 2017; Kosko, 2015). One aspect of the research that seemed relatively consistent across both contexts was collecting cross-sectional data. Few researchers in K-12 or higher education collected data at multiple points. Whether cross-sectional or longitudinal data were collected, quantitative methods, such as SEM (Schuetz, 2008) and HLM (Kosko & Wilkins, 2015; Park et al., 2012), were used in the majority of the articles.

Skinner et al. (2008) were some of the few researchers who included a longitudinal design in their data collection (others include Haakma et al., 2017; Jang et al., 2012; Kosko, 2015; Liu & Breit, 2013; Park et al., 2012). In their study, Skinner and her colleagues administered self-report questionnaires to 805 students (a mixture of fourth-, fifth-, sixth-, and seventh-graders) in the fall and spring of an academic year. This questionnaire was meant to measure students' perceived levels of competence, autonomy, relatedness, teacher support, emotional engagement, and behavioral engagement. SPSS was used to analyze the data and identify any cross-year patterns for autonomy, competence, and relatedness. This longitudinal design examined the effect that these factors had from fall to spring terms. For example, children who reported a higher level of relatedness with the teacher at the first time point went on to exhibit increased effort and enjoyment throughout the academic year. Those who reported lower levels showed a higher likelihood to experience a decrease in their effort and higher levels of boredom. This article also illustrated an important distinction between K-12 and higher education studies: the role of the teacher.

For students in elementary and secondary education, teachers play a much larger role in the educational experience than for university students. Nie and Lau (2009) even went so far as to conceptualize autonomy and relatedness as *teacher control* and *teacher care*, respectively. Despite the fact that these studies are looking at the *students'* needs, the definition revolves around the teacher. This was not mirrored in the literature from university settings. Autonomy in higher education was focused more on student opportunities to exercise choice.

The way that relatedness is conceptualized is another noticeable difference between studies conducted in K-12 and higher education settings. Studies that focused on K-12 students tended to look at relatedness with peers, parents, and teachers (Deci et al., 1991; Furrer & Skinner, 2003; Liu & Breit, 2013; Park et al., 2012). Higher education, however, focused mostly on peers and professors (Koch et al., 2017; Leach, 2016; Schuetz, 2008; Zepke et al., 2010). There was no mention of parents or others outside of the educational realm as a source of relatedness that affected student academic engagement with university-level students.

Competence, which was normally equated with self-efficacy, was the only SDT construct that seemed to be defined rather consistently in K-12 and higher education studies. Despite the differences of definitions and measurements for SDT constructs among younger and older students, the findings about the influence of each need on student engagement were supported across the K-12 and university settings.

The number of items used to measure autonomy, competence, and relatedness was also not dependent upon the K-12 or higher education setting. Studies in elementary and secondary school settings ranged anywhere from just one item per SDT construct (Park et al., 2012) to six items (Kosko & Wilkins, 2015). Higher education settings also had a wide range from three items (Schuetz, 2008) to 10 items (Zepke et al., 2010).

Influence on Student Engagement

The purpose of this review is to examine what has been found about the fulfillment of each SDT construct and its individual influence on student engagement. We discuss findings in the literature regarding each SDT construct below.

Autonomy. Given that self-determination theory derives its name from the idea of students having the ability to act based on their own interests, it comes as no surprise that autonomy has been given the most attention in the literature. Scogin and Stuessy (2015) supported this stance that "SDT research claims that autonomy support is the most important factor in self-determined motivation" (p. 342). In their study, they used SDT as a guide in computer-mediated collaborative learning environments, purposed to support national science standards. Ten student teams of seventh-graders were formed to be subjects in case studies. A mixed methods approach was used to investigate correlations between scientist-mentor motivational support in an online discussion board and student inquiry engagement from team members. Correlational analysis showed no significance between autonomy support and student engagement. Scogin and Stuessy called this finding "unexpected" (p. 342), given the importance of autonomy in SDT. The authors suggested this could be due to the inherent autonomous nature of online learners or the fact that the online mentor did not make demands of the students or have influence over grades like a teacher normally would.

Other studies that took place within a more traditional teacher-student dynamic, reported that autonomy-supportive environments, which helped satisfy students' need for autonomy, did show correlation with engagement. Park et al. (2012) found that aggregated competence and relatedness measures from their sample of ninth-grade students (n = 94) had no association with emotional engagement. The aggregated autonomy score, however, was significantly associated

with engagement. Skinner et al. (2008) claimed that fulfillment of autonomy was "the clearest contributor to engagement" (p. 777), even though self-report questionnaires showed higher student averages in perceived competence and relatedness than on perceived autonomy. Koch et al. (2017) reported similar findings from their study with students in higher education who participated in a program designed to incorporate interdisciplinary study projects. Program participants were given a Likert-scale questionnaire to measure their level of relatedness, autonomy, competence, and academic engagement. Student answers showed that, on average, their need for relatedness was most fulfilled through the program, followed by autonomy, and then finally competence. Despite students' perception indicating relatedness as the need most fulfilled, statistical analysis showed their perceived autonomy was the highest predictor of engagement.

Supporting this finding, Zepke et al. (2010) "found a significant gap between perception and action" (p. 15). In their study, Zepke and his co-authors sought to obtain feedback from both teacher and first-time enrolled students at eight participating institutions in New Zealand (n = 1246). These settings represented differing types of educational institutions. A survey was sent out to university students with 24 questions, equally divided between all three SDT constructs, to measure how important students felt autonomy, competence, and relatedness were to their motivation. A second survey was given with 10 items that established how much time students spent on autonomy-, competence-, and relatedness-connected activities. Even though students' responses indicated that they considered competence the most important factor influencing their motivation, they engaged with autonomy-connected actions most frequently.

Competence. Competence is generally considered the second-most influential need in SDT (Deci & Ryan, 2000). In almost all of the articles that measured competence, it was found

to have a positive correlation with engagement (e.g., Guvenc, 2015; Kim, Ryu, Katuk, Wang, & Choi, 2014; Koch et al., 2017; Kosko, 2015) but did not surpass the correlation between autonomy and engagement. One study, however, found competence to be the most important need, even surpassing the influence of autonomy or engagement (Zepke et al., 2010). Despite the large differences among the characteristics of each institution included in the study, it was clear that fulfillment of the need for competence for this sample was more motivating than fulfillment of relatedness or agency. Students' belief in their competence was a motivating factor for them to stay engaged and continue to actively learn, even after facing short-term failure (Zepke et al., 2010).

On the opposite end of the spectrum, Eseryel, Law, Ifenthaler, Ge, and Miller (2014) found in their study about engagement and problem-solving in game-based learning that competence negatively impacted engagement. Participants were ninth-grade students (n = 88) from a rural high school in the Midwest who were required to play an online game at least twice a week. Student engagement was assessed by time spent playing the game and number of tasks completed. Autonomy, competence, relatedness, interest, and self-efficacy were measured using a motivation inventory. Interest and competence were found to be negatively correlated with engagement while autonomy and relatedness were not statistically significant. It would have been helpful to know how the authors measured competence and self-efficacy, considering these terms are normally used rather interchangeably.

Relatedness. In the academic context, we conceptualized relatedness as teacher-student or student-student relationships. Some researchers have found that positive academic relationships with teachers and peers help students become more engaged learners (Furrer & Skinner, 2003; Klem & Connell, 2004; Pianta, Hamre, & Allen, 2012). Scogin and Stuessy

(2015) found a high association between relatedness and engagement in their online, mentor-based study.

In their widely cited 2003 study, Furrer and Skinner focused on the student's sense of relatedness and its role as a motivational resource in children's academic engagement and performance. The authors collected data from students in the third through sixth grades (n = 641). Survey items measured the students' emotional engagement, behavioral engagement, sense of perceived control, and relatedness to their teachers, peers, and parents. Results show that teacher-student relatedness had the strongest impact on behavioral and emotional engagement over perceived control or the two other types of relatedness.

Raufelder et al. (2016) in their study with seventh- and eighth-grade students found that a student's level of self-determination is "bolstered by interpersonal relationships (particularly with peers)" (p.1256). This implies that social interaction and an increased sense of belonging can increase a student's level of self-determination, which the authors found to be positively correlated with engagement. Kosko (2015) in his examination of geometry students' participation in mathematical discussion also found that students were able to "pool the psychological resources of their groups" (p.14) to meaningfully participate in their classroom discussion. This means that their relatedness with their peers effectively impacted their other needs and increased their engagement.

In their three-year longitudinal study with ninth-graders (n = 94), Park et al. (2012) used experience sampling method to understand the effect of autonomy, competence, and relatedness on emotional engagement. They included gender, race/ethnicity, and GPA in their model in addition to the latent SDT variables. Of the many findings to come from their analysis, their data showed that "perceived opportunity for relatedness was more strongly associated with

engagement for higher achieving students than for their lower achieving counterparts" (p. 398). Park et al. (2012) suggested that this could be because lower achieving students are too overwhelmed by other challenges to take advantage of teachers' efforts to connect with them.

Schuetz (2008) proposed that a sense of belonging, the term she used to describe relatedness, "helps foster and maintain the long term engagement necessary to develop competence and autonomy" (p. 311). Even with findings that support the importance of relatedness, some authors will continue to assert that it is "less central than the other two needs" (Ryan & Deci, 2002, p. 22).

Discussion and Limitations

Even though all three constructs cited in SDT are posited as basic needs, we found that they are not given equal weight or consideration in the literature. In every article of the sample, the three SDT constructs were at least indicated. After the initial mention, however, relatedness was the most likely to be left out or unaccounted for (e.g., Kim et al., 2014; Kosko & Wilkins, 2015). Kim et al. (2014) even went so far as to say "SDT posits that an individual's active learning is mediated by their satisfaction of competence and autonomy" (p. 7) with no mention of relatedness. Skinner et al. (2008) made a point to mention that "relatedness tends to be overlooked as a self-perception in the academic domain" (p. 768). This could be because even in early literature on SDT, relatedness seems to be considered a "distal" need (Ryan & Deci, 2000, p. 71). It is reasonable that scholars building upon SDT followed this example set by Ryan and Deci. All of the articles in our review measured some form of autonomy in their studies and many measured competence.

We propose, however, that relatedness has a larger influence than currently accounted for in the literature. In Kosko and Wilkins' 2015 article, mathematical autonomy had a large

influence on students' perceived engagement. This sense of mathematical autonomy was fostered by interactions with the teacher over the course of the semester. In their study, teachers had the role of providing scaffolding throughout the students' development of mathematical autonomy, thereby influencing the students' competence as well. This suggests that teachers, and the relationship developed through the scaffolding they provided, affected their students' engagement through autonomy and competence as mediating variables. Raufelder et al. (2016) also highlighted that "special attention" (p. 1243) should be given to the social component of education. They suggested that teachers can satisfy the need for competence through feedback to students and scaffolding. Teachers can also use student-centered teaching practices to foster autonomy. Kim et al. (2014) suggested that "feelings of competence and autonomy can possibly exist in relation to an 'other' such as other colleagues or lecturers" (p. 25).

Some researchers acknowledged this fact and yet did not expand upon or research the effects. For example, Jang et al. (2012) stated that "a number of teacher characteristics contribute constructively to students' classroom motivation and functioning," including "relationship qualities such as caring" (p. 1175). Yet in their study they measured only perceived autonomy-support indicators of teachers' actions. The ways in which teachers and other adults, such as the mentors in Scogin and Stuessy's (2015) study, can influence student motivation should be more deeply studied. Leach (2016) stated that the "relationship between teacher and students is crucial" (p. 25) and that interactions with peers can predict engagement and outcomes. Despite this recognition, it appears there is a persistent idea conveyed in the literature that relatedness is the least influential SDT need on engagement.

One limitation of this literature review is that we did not distinguish between the types of engagement measured in the articles in our discussion. As mentioned earlier, there is currently no

singular definition of student engagement, so how it is conceptualized and measured varies among researchers as shown through the examples provided in this article. Our analysis, however, focused on engagement as a whole. Therefore, the way we discuss the influence of each SDT construct on learner engagement is referring to the aggregate and not to any specific sub-construct.

Another limitation is the multiple ways in which autonomy, competence, and relatedness are conceptualized. This is a potential limitation because it would affect the level of comparability between article findings. One set of researchers may define and measure *autonomy* slightly differently than another group of researchers. For example, some authors define autonomy as perceived choice (Raufelder et al., 2016), others consider the volition aspect of autonomy (Kosko & Wilkins, 2015), and still others include both pieces (Nie & Lau, 2009). Results from each of these studies should be viewed using the definition of *autonomy* in that context. We also saw the term *agency* used to describe the concept of autonomy (Zepke et al., 2010) but defined in the same way as was perceived choice by Raufelder et al. (2016). Although the definitions were the same in these cases, the terms used for the SDT construct varied.

Most researchers use the term *self-efficacy* to define competence; however, one study considered them as separate constructs and found that each had the opposite effect on engagement (Eseryel et al., 2014). Skinner and Pitzer (2012) defined competence as *perceived choice*, which most other authors used to define the construct of autonomy. Scogin and Stuessy (2015) equated *competence* with *technical skills.* In yet another example, Liu and Breit (2013) discuss the term *relatedness* in a way that more closely aligns with the idea of utility value or relevance. In their article, relatedness was a description of how well the subject area or activity related to the students' interests and values. As previously mentioned, some authors defined

relatedness in the same way yet used varied terms, like *belonging.* This confusion and contradiction among the definition of SDT constructs can be problematic. For the purposes of this literature review, we attempted to clarify the distinction between constructs in our discussion of the findings.

Conclusion

Self-determination theory considers autonomy, competence, and relatedness to be innate psychological needs. Kosko (2015) elaborated that although these needs may be "naturally occurring" (p. 19) they are also malleable by context and can shape student motivation. This means that educators can affect the fulfillment of their students' needs, which in turns influences the level of engagement experienced by those students. Knowing this can impact the learning experience teachers create for their students.

Our review of the literature supports the idea that autonomy, competence, and relatedness are three needs that can individually and collectively influence a student's level of engagement in contexts ranging from K-12 to higher education. Although we discussed each aspect of SDT separately, it is worth noting that some authors have suggested that all three needs are interdependent (Deci et al., 1991; Katz & Assor, 2007; Kosko, 2015). So while research, and our literature review, have focused on the separation between these needs, future research should establish the level of interdependence and any influence the fulfillment of one need exerts on the others. This could impact educators in subject areas that may be less well-suited for high levels of autonomy-supportive activities or contexts where competence tends to be lower for students.

Another potential for future research could be the development of an instrument that can be adapted across contexts to measure the SDT needs and components of engagement. While this review did not focus specifically on the types of instruments used to measure autonomy,

competence, relatedness, and engagement, we did note the various surveys cited by authors (e.g., AUSSE survey, Basic Psychological Needs Survey, Learning Experience Questionnaire, Student Transition Questionnaire). Many studies included items from different surveys for each facet to be measured. For example, items to measure autonomy were pulled from one questionnaire, items for competence from another, items for relatedness from yet another, and so forth. We propose a review of literature with the purpose of identifying which instruments researchers utilized, the frequency of particular combinations of measurement instruments, subsequent results, and the possible creation of a new measurement instrument flexible enough to meet varying needs.

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ARTICLE 2

Validating a Self-Determination Theory and Emotional Engagement Instrument

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Abstract

This study seeks to create and validate an instrument to measure university students' *sense of autonomy*, *competence*, *relatedness with peers*, *relatedness with professors*, and *emotional engagement*. We first review the literature and existing instruments to measure the aforementioned factors. We then detail the process used to create our own survey. Many of the survey items were adapted from the Intrinsic Motivation Inventory and other items were created, grounded in theory and the authors' conceptualization of the corresponding constructs. The survey was administered at an institution of higher education and survey responses (n = 340) were used to perform confirmatory factor analysis and structural equation modeling. Overall, we found that the survey items performed well and measured the intended constructs. Our analysis showed that *autonomy*, *competence*, and *relatedness with peers* all had a statistically significant positive influence on *emotional engagement. Relatedness with professors* was not found to have a statistically significant influence.

Keywords*:* self-determination theory, student engagement, structural equation modeling, confirmatory factor analysis, higher education

Introduction

In recent years, student engagement has been a highly researched area in education. This could be due to the link found between student engagement and improved learning outcomes for students in K-12 and higher education settings (Anderson, Christenson, Sinclair, & Lehr, 2004; Reeve, 2012; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003). Sinatra, Heddy, and Lombardi (2015) referred to engagement as the "holy grail of education" (p. 1) because of the impact it can have on student learning. Identifying facilitators of engagement makes it possible for researchers and practitioners to improve this influential aspect of students' academic experience. Previous studies have been conducted to identify such factors that can improve student engagement (e.g., Caraway, Tucker, Reinke, & Hall, 2003; Klem & Connell, 2004; Kosko, 2015).

Some researchers have used self-determination theory (SDT) as a theoretical lens to study increases in student engagement and motivation (Furrer & Skinner, 2003; Guay, Ratelle, & Chanal, 2008; Martin & Dowson, 2009). SDT is a theory of motivation that suggests autonomy, competence, and relatedness are three psychological needs that must be fulfilled for learners to experience higher levels of motivation and performance (Deci & Ryan, 2000; Deci, Vallerand, Pelletier, & Ryan, 1991). In an academic context, learner engagement can be used as a proxy for motivation and performance given that engagement is associated with positive learning outcomes (e.g., Reeve & Tseng, 2011; Skinner, Kindermann, & Furrer, 2009). According to SDT, motivation and engagement can be fostered through fulfilling students' need for autonomy, competence, and relatedness.

While the most widely accepted definition of engagement includes three components—behavioral, cognitive, and affective—there is no single definition of engagement (Fredricks,

Blumenfeld, & Paris, 2004). Some authors discuss engagement as having only two factors (e.g., Raufelder, Regner, Drury, & Eid, 2016; Spring, Graham, & Ikahihifo, 2017) and others define it with four aspects (e.g., Appleton, Christenson, & Furlong, 2008; Reeve & Tseng, 2011). For the purposes of this study, we have chosen to focus only on emotional engagement. Park, Holloway, Arendtz, Bempechat, and Li (2012) found in their review of the engagement literature that students who are not emotionally engaged tend to disengage behaviorally and cognitively. This means emotional engagement can be a precursor to the other types of engagement commonly cited. This project sought to create an instrument to measure students' sense of autonomy, competence, and relatedness to understand the influence these factors have on student emotional engagement.

Review of the Literature

Although our focus is on SDT constructs in higher education, we reviewed literature from both K-12 and higher education contexts due to the dearth of literature on this topic in the higher education domain. We sought to understand how researchers have defined each of the SDT constructs and the instruments they used to measure the needs and corresponding engagement. Our analysis only included articles that had SDT needs as facilitators of engagement and measured engagement as an outcome.

For the purposes of our research, we will first define autonomy, competence, and relatedness. We included the terms *sense of* before each of the SDT constructs because we employed self-report measures in this study. We defined *sense of autonomy* as student perception of how well the course structure allows for choices to make the experience more personally meaningful. Many definitions of autonomy include ideas of locus of causality (Niemiec & Ryan, 2009), volition (Stefanou, Perencevich, DiCintio, & Turner, 2004), and other similar ideas, but

we have related it more with perceived choice and the ability to tailor aspects of the course in a meaningful way. *Sense of competence* describes the students' belief in their ability to achieve the learning outcomes of a given course and is closely related to self-efficacy, as found in other literature (e.g., Park et al., 2012). The last SDT need, *sense of relatedness*, is defined as student perception of the connection with others in the course relating to their personal and academic well-being.

While reviewing the literature on SDT and engagement, we took note of the various methods employed to measure these areas. Many authors were vague in reporting their measurement methods or excluded them altogether. A small number of studies used observational techniques (Haakma, Janssen, & Minnaert, 2017; Kosko, 2015), but these were at the K-12 level. Many researchers whose work we reviewed used self-report instruments, such as the Learning Climate Questionnaire (Jang, Kim, & Reeve, 2012), Australasian Survey of Student Engagement (Zepke, Leach, & Butler, 2010), and Learning Experience Questionnaire (Kim, Ryu, Katuk, Wang, & Choi, 2014). None of these surveys, however, measured SDT needs in the capacity we conceptualized.

To examine the effects of SDT need fulfilment on student emotional engagement in higher education we address the following research questions:

1. To what extent does a student's *sense of autonomy* increase their perceived level of *emotional engagement* in the course?
2. To what extent does a student's *sense of competence* increase their perceived level of *emotional engagement* in the course?
3. To what extent does a student's *sense of relatedness* increase their perceived level of *emotional engagement* in the course?

4. Does the influence on emotional engagement differ between their *sense of relatedness with peers* and their *sense of relatedness with professors*?

Our review of the literature identified many possible ways to measure SDT needs and student engagement; however, we did not find any of them to be sufficiently relevant to our research questions. To remedy this disconnect, we began our research by creating a survey grounded in the literature and informed by measurement instruments used in the literature we reviewed.

Survey Creation

Our survey sought to measure students' *sense of autonomy, competence, relatedness with peers, relatedness with professors,* and *emotional engagement.* We created the survey by adapting items from other surveys, when possible, and creating our own items when there were no previously encountered items that encompassed what we aimed to measure. All items on the survey were on a scale from 1 (*not at all true*) to 7 (*very true*).

The items for autonomy and competence were adapted from the Intrinsic Motivation Inventory (IMI). The IMI consists of seven subscales, each with corresponding items. As stated in the IMI, researchers have generally "chosen the subscales that are relevant to the issues they are exploring" ("Intrinsic motivation inventory," n.d., para. 2). For the purposes of this research, we used the *perceived choice* and *competence* subscales. We consider the *perceived choice* items as relating to autonomy because they align with our definition of autonomy. We revised these items to refer to feelings of autonomy and competence at the course level instead of activity level. For example, the original IMI item "I am satisfied with my performance at this task" was changed to "I am satisfied with my performance in the course thus far." This better aligned with our research interests of perceived course-level emotional engagement.

Although the IMI includes a subscale and items pertaining to *relatedness*, we did not feel these items embodied how we conceptualized and defined relatedness. Many of the items on the IMI did not measure the sense of relatedness in terms of the class setting and academic support these relationships can provide. For example, one of the IMI items was "I'd like a chance to interact with this person more often." This could be generic to any setting or context. We created items intended to measure a sense of relatedness with peers and professors based on our definition of relatedness and the academic aspect we believe it should encompass in an educational setting. This included statements such as "I feel like my peers care about my success in this course" and "I feel comfortable approaching my professor for help with coursework." One item intended to measure sense of relatedness with peers was adapted from a survey question used by Rabe-Hemp, Woollen, and Humiston (2009). The item was originally worded as a question, however, for consistency, we revised it as a statement that could be answered on our scale (see Q14 in Table 1).

The last construct in our survey was emotional engagement. Our review of the literature found other authors who used questionnaires to survey students about their level of engagement (Reeve & Tseng, 2011; Skinner, Furrer, Marchand, & Kindermann, 2008; Skinner et al., 2009). We used the same items to measure emotional engagement that they employed in their studies. We made minor adjustments, such as updating the language to say *course* instead of *class*.

To ensure that the items were easily understood, we completed preliminary testing with the survey to solicit feedback from students in a higher education setting. We gave students a hard copy of the proposed survey and instructed them to think of any course they were currently taking, respond to the items, and make any notations on items they found confusing or poorly worded. Based on the feedback we received, we excluded some items and revised others. Once

we finalized the survey items, we created the survey in Qualtrics in a randomized order because the IMI suggested that items for factors be randomly ordered ("Intrinsic motivation inventory," n.d., para. 4). The randomization occurred only once, and all students received the same survey. The IMI has been previously validated, but we sought to validate our version of the survey with new items using confirmatory factor analysis. The results will be discussed in later sections.

Methods

After finalizing the survey items and receiving approval from the Institutional Review Board, we began soliciting participation. Given that our research interest focused on students in higher education, our data collection took place on the campus of a private institution of higher education located in the western United States. In order to sample across subject areas and contexts, we used the university registration system to select large-enrollment classes in traditional face-to-face and online settings. We reached out to the instructors via email, provided information about the study, and invited them to share the survey with their students. We contacted a total of 30 instructors, 15 of whom were willing to participate. These instructors taught courses across disciplines including psychology, history, writing, education, chemistry, biology, and statistics.

Data Collection

To collect data from their courses, professors were sent personalized survey links created in Qualtrics. We personalized surveys so that we could update the instructions to reflect the instructor's name. For example, the instructions followed the generic form of "Think of the course you are currently taking from [insert professor's name]. For each of the following statements, please indicate how true it is for you." One professor requested that we update the instructions to use past tense as the last day of class instruction had concluded and the students

were focused on finals. We received responses from 12 different courses. Our final sample contained 340 responses, eight of which had missing data on one to two items.

Data Analysis

Once data were collected from each course, we exported the survey responses from Qualtrics to Excel. First, we checked that all assumptions were met, including normality, linearity, and multicollinearity. We then imported the corresponding file to Mplus version 7.4 to complete the confirmatory factor analysis (CFA) for each latent construct. CFA is used to test if the theoretically defined factorial structure in the instrument is valid (Wang & Wang, 2012). Through CFA we were able to confirm that the survey items were measuring the intended latent construct. For example, CFA was used to verify that the five survey items intended to measure *sense of competence* worked well together and measured the same construct. We did not conduct an exploratory factor analysis prior to the CFA because given the previous validation of the IMI, we had a theoretical reason to believe the indicators would load onto the corresponding latent factor. This procedure aligned with Worthington and Whittaker's (2006) recommendation for scale development research. When running our CFAs, we used the MLR estimator to account for any missing data. Using this robust estimator allowed for non-normality in the data while still having unbiased parameter estimates and standard errors.

We used the following latent constructs in our analysis: *sense of autonomy*, *sense of competence*, *sense of relatedness with peers*, *sense of relatedness with professors*, and *emotional engagement*. Each latent variable had five corresponding survey items.

Results

In total, we conducted five CFAs and tested two models using structural equation modeling (SEM). The results of each CFA and SEM will be discussed below after reporting the

descriptive statistics of survey items. To avoid redundancy, as we discuss each of the latent variables, we will refer to them by the construct they were intended to measure without *sense of* at the beginning.

Survey Items

Descriptive statistics for the 25 survey items used in our analysis can be found Table 1. Items are organized by the latent variable they were intended to measure and numbered according to the order in which they appeared in the survey. Means for *competence*, *relatedness with peers*, *relatedness with professors*, and *emotional engagement* items were centered around 5; *autonomy* was the only construct whose items had a mean less than 4. The minimum and maximum values indicate full coverage because all items were on a scale from 1 to 7.

Confirmatory Factor Analysis

We ran individual CFAs to test how indicators loaded onto the latent construct. We used four fit statistics when assessing model fit: comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). A summary of the fit statistics for each construct can be found in Table 2.

According to Wang and Wang (2012) good model fit is shown by values greater than 0.90 for CFI and TLI and less than 0.08 for RMSEA and SRMR. In our initial analysis for *relatedness with professors* and *emotional engagement*, two of the four model fit indices fell outside of the recommended cut-off points for each model. Given those values, we reviewed the modification index (MI) for both models. The MI was used to identify corresponding fixed parameters that could be freed up to improve model fit. Wang and Wang (2012) recommend allowing parameters to be freely estimated one at a time, beginning with the largest MI first.

Table 1

Descriptive Statistics for Survey Items

Item	Mean	SD	Min	Max
Autonomy				
Q2. I believe I have some choice about how to do assignments in this course.	3.971	1.744	1.000	7.000
Q5. I feel like I have options for the activities I focus on in this course.	3.663	1.713	1.000	7.000
Q10. I believe I share in the decision-making process regarding course assignments.	3.086	1.810	1.000	7.000
Q24. I do the assignments in this course because I want to.	3.796	1.759	1.000	7.000
Q25. I feel like I can tailor aspects of the course to align with my interests.	3.716	1.832	1.000	7.000
Competence				
Q3. I believe if I put in effort, I can understand the course material well.	5.779	1.433	1.000	7.000
Q15. I am satisfied with my performance in the course thus far.	4.776	1.639	1.000	7.000
Q20. I am pretty skilled in this course.	4.472	1.660	1.000	7.000
Q22. I think I will do well in this course.	4.985	1.592	1.000	7.000
Q23. After studying this material for a while, I feel pretty competent.	5.065	1.610	1.000	7.000
Relatedness with Peers				
Q6. I feel comfortable approaching my peers for help with class work.	5.032	1.629	1.000	7.000
Q8. I find my academic relationship with my peers in this course to be satisfying.	4.962	1.557	1.000	7.000

Item	Mean	SD	Min	Max
Q11. I feel like my peers care about my success in this course.	3.938	1.736	1.000	7.000
Q14. I often talk to other students to prepare for class, discuss topics, or to socialize.	4.182	1.931	1.000	7.000
Q17. I feel like I can trust my peers in this course.	5.009	1.476	1.000	7.000
Relatedness with Professors				
Q1. I feel like I can trust my professor.	5.688	1.365	1.000	7.000
Q7. I feel like my professor is available to help me when I need it.	5.021	1.633	1.000	7.000
Q9. I feel comfortable approaching my professor for help with class work.	4.723	1.745	1.000	7.000
Q16. I find my academic relationship with my professor to be satisfying.	4.425	1.675	1.000	7.000
Q21. I feel like my professor cares about my success in this class.	5.027	1.759	1.000	7.000
Emotional Engagement				
Q4. This course is fun.	4.617	1.569	1.000	7.000
Q12. When we work on something in class, I feel interested.	4.732	1.480	1.000	7.000
Q13. When I am in class, I feel curious about what we are learning.	4.876	1.458	1.000	7.000
Q18. I enjoy learning new things in this course.	5.348	1.383	1.000	7.000
Q19. When I'm in class, I feel good.	4.808	1.552	1.000	7.000

Note. SD = standard deviation.

Using this approach, we freely estimated one parameter in the *relatedness with professors* model (item 9 with item 7) and two parameters in the *emotional engagement* model (item 13 with item 12 and item 18 with item 12). After allowing the residuals to covary, all five CFAs met at least three of the four cut-off points for the included fit statistics. Only *autonomy* and *competence* had RMSEA values greater than 0.90.

Table 2

Confirmatory Factor Analysis Fit Statistics for Latent Constructs

	Fit Statistics			
Latent Construct	CFI	TLI	RMSEA	SRMR
Autonomy	0.954	0.909	0.112	0.039
Competence	0.958	0.915	0.135	0.029
Relatedness with Peers	1.000	1.003	0.000	0.010
Relatedness with Professors	0.991	0.977	0.066	0.016
Emotional Engagement	0.998	0.992	0.044	0.010

Note. Fit statistics reported after allowing residuals to covary for *relatedness with professors* and *emotional engagement.*

Tables 3–7 report the results from individual CFAs conducted for *autonomy*, *competence*, *relatedness with peers*, *relatedness with professors*, and *emotional engagement*. All values included for *relatedness with professors* and *emotional engagement* are reported after correlating the aforementioned error terms. Each table includes the factor loadings, both standardized and unstandardized, standard error for the unstandardized factor loading, level of significance, and communalities. The first factor loading in each CFA is fixed to 1 for model identification

purposes. The value for the subsequent items indicates their strength relative to the first item. This means a value greater than 1 in a given table is indicative that the item has a stronger influence than the first item. All standardized factor loadings across CFAs and constructs were well above the suggested cut-off value of 0.40 (Wang & Wang, 2012; Worthington & Whittaker, 2006). Standardized factor loadings can range in value from 0 to 1 with a value closer to 1 indicating a stronger influence. *Autonomy* had the lowest values with a range between 0.57 to 0.84, and *emotional engagement* had the highest values on average ranging from 0.81 to 0.90. The three other constructs had ranges of 0.67 to 0.91 (*competence*), 0.67 to 0.87 (*relatedness with peers*), and 0.73 to 0.85 (*relatedness with professors*).

The last item we report in the tables, communalities, shows the amount of variance of each indicator accounted for by the factor in the model and can have a value between 0 and 1. Our results for the communalities showed values ranging from 0.32 to 0.82 with an average across constructs of 0.63. Worthington and Whittaker (2006) classify any communalities less than 0.40 as low but also acknowledged that none of the studies they reviewed for their article used item communalities as criteria for item deletion.

The results from the CFAs show that a unidimensional construct for each set of items models this data well. The high MI values for *relatedness with professors* and *emotional engagement* also suggest that some items used to measure those latent constructs may also measure something else in common. With the CFAs completed, statistically significant p-values, and good fit statistics, we proceeded to test our structural model.

Table 3

Confirmatory Factor Analysis Results for Autonomy

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
Q2. I believe I have some choice about how to do assignments in this course.	1.000[a]	NA	0.754	0.568
Q5. I feel like I have options for the activities I focus on in this course.	1.092**	0.061	0.838	0.703
Q10. I believe I share in the decision-making process regarding course assignments.	0.947**	0.070	0.688	0.473
Q24. I do the assignments in this course because I want to.	0.760**	0.076	0.568	0.323
Q25. I feel like I can tailor aspects of this course to align with my interests.	0.962**	0.089	0.691	0.478

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Table 4

Confirmatory Factor Analysis Results for Competence

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
Q3. I believe if I put in effort, I can understand the course material well.	1.000[a]	NA	0.665	0.442
Q15. I am satisfied with my performance in the course thus far.	1.528**	0.125	0.888	0.789
Q20. I am pretty skilled in this course.	1.479**	0.133	0.849	0.720
Q22. I think I will do well in this course.	1.514**	0.138	0.907	0.822
Q25. After studying this material for a while, I feel pretty competent.	1.422**	0.117	0.842	0.709

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Table 5

Confirmatory Factor Analysis Results for Relatedness with Peers

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
Q6. I feel comfortable approaching my peers for help with class work.	1.000[a]	NA	0.778	0.606
Q8. I find my academic relationship with my peers in this course to be satisfying.	1.063**	0.062	0.865	0.749
Q11. I feel like my peers care about my success in this course.	1.070**	0.065	0.781	0.610
Q14. I often talk to other students to prepare for class, discuss topics, or to socialize.	1.015**	0.072	0.667	0.444
Q17. I feel like I can trust my peers in this course.	0.967**	0.056	0.831	0.690

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Table 6

Confirmatory Factor Analysis Results for Relatedness with Professors

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
Q1. I feel like I can trust my professor.	1.000[a]	NA	0.759	0.576
Q7. I feel like my professor is available to help me when I need it.	1.150**	0.062	0.729	0.532
Q9. I feel comfortable approaching my professor for help with class work.	1.270**	0.065	0.753	0.568
Q16. I find my academic relationship with my professor to be satisfying.	1.350**	0.072	0.836	0.698
Q21. I feel like my professor cares about my success in this class.	1.441**	0.056	0.849	0.721

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Table 7

Confirmatory Factor Analysis Results for Emotional Engagement

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
Q4. This course is fun.	1.000[a]	NA	0.815	0.664
Q12. When we work on something in class, I feel interested.	0.984**	0.059	0.850	0.722
Q13. When I am in class, I feel curious about what we are learning.	0.967**	0.057	0.849	0.721
Q18. I enjoy learning new things in this course.	0.971**	0.051	0.899	0.807
Q19. When I'm in class, I feel good.	0.976**	0.049	0.805	0.648

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Structural Equation Model

To answer our research questions, our analysis went beyond conducting confirmatory factor analysis. Once we confirmed the measurement model through the CFA, we were able to examine the influence of each latent factor on emotional engagement through structural equation modeling. We tested two models: the hypothesized model and a revised model based on results from the first SEM. In both models, we continued to correlate the error terms for *relatedness with professors* and *emotional engagement.*

In the following sections we report fit statistics for both models and four values for each latent construct in the models: unstandardized beta (B), standard error (SE), standardized beta (β), and the associated *p*-value. The unstandardized beta indicates the relationship between the independent variable and outcome variable. This means for every one unit increase in the

independent variable, such as *autonomy*, we would expect the predicted value of *emotional engagement* to change by the value of the unstandardized beta, holding all else constant. The standardized beta shows a similar relationship between the standard deviations of the independent and dependent variables. For every one standard deviation increase in the independent variable, we would expect the predicted value of *emotional engagement* to change by the number of standard deviations indicated by the standardized beta.

Model 1. Our initial model shows the relationship we hypothesized, grounded in SDT, between *autonomy*, *competence*, *relatedness*, and *emotional engagement* (Figure 1). The *relatedness* construct was comprised of both *sense of relatedness with peers* and *sense of relatedness with professors*. We organized our model in this way to look at the influence of SDT needs—autonomy, competence, and relatedness—on emotional engagement.

The fit statistics indicated good fit (CFI=0.923, TLI=0.912, RMSEA=0.065, SRMR=0.063, χ^2=645.051, *df*=264, $p < 0.001$). The correlation matrix showed moderate correlation between the latent variables with only one $r > 0.800$ (see Table 8). The strongest correlation was between *relatedness* and *relatedness with professors* which will be discussed later.

Model results showed that with our dataset, *competence* (B=0.447, SE=0.111, β=0.337, $p < 0.001$) had the strongest influence on *emotional engagement* followed by *autonomy* (B=0.314, SE=0.133, β=0.310, $p < 0.05$). Of the three SDT needs regressed on emotional engagement, *relatedness* was the only one not found to be statistically significant (B=0.483, SE=0.319, β=0.250, $p > 0.05$). Both of the factor loadings onto *relatedness*, however, were statistically significant with *relatedness with professors* showing a slightly stronger loading (1.410) compared to *relatedness with peers* (fixed to 1.000).

Table 8

Correlation Matrix for Latent Variables in Model 1

	1.	2.	3.	4.	5.	6.
1. *Autonomy*	1.000					
2. *Competence*	0.581**	1.000				
3. *Relatedness with Peers*	0.425**	0.375**	1.000			
4. *Relatedness with Professors*	0.734**	0.648**	0.497**	1.000		
5. *Relatedness*	0.792**	0.699**	0.536**	0.927**	1.000	
6. *Emotional Engagement*	0.703**	0.691**	0.391**	0.677**	0.730**	1.000

**$p < 0.001$.

This finding motivated us to tease out the potential difference of *relatedness with peers* and *relatedness on professors* on *emotional engagement* without loading onto a higher order factor. Therefore, we tested the following post-hoc model, Model 2. We revised our model by removing the *relatedness* latent construct so *relatedness with peers* and *relatedness with professors* could be regressed on *emotional engagement*.

Model 2. Our revised model, which regressed *autonomy*, *competence*, *relatedness with peers*, and *relatedness with professors* onto *emotional engagement*, also showed good fit (CFI=0.924, TLI=0.913, RMSEA=0.065, SRMR=0.061, χ^2=638.929, *df*=262, $p < 0.001$). Once again, the correlation matrix for the latent variables showed low to moderate correlation between the constructs (see Table 9). This indicates that the latent constructs are distinct enough to be measured separately.

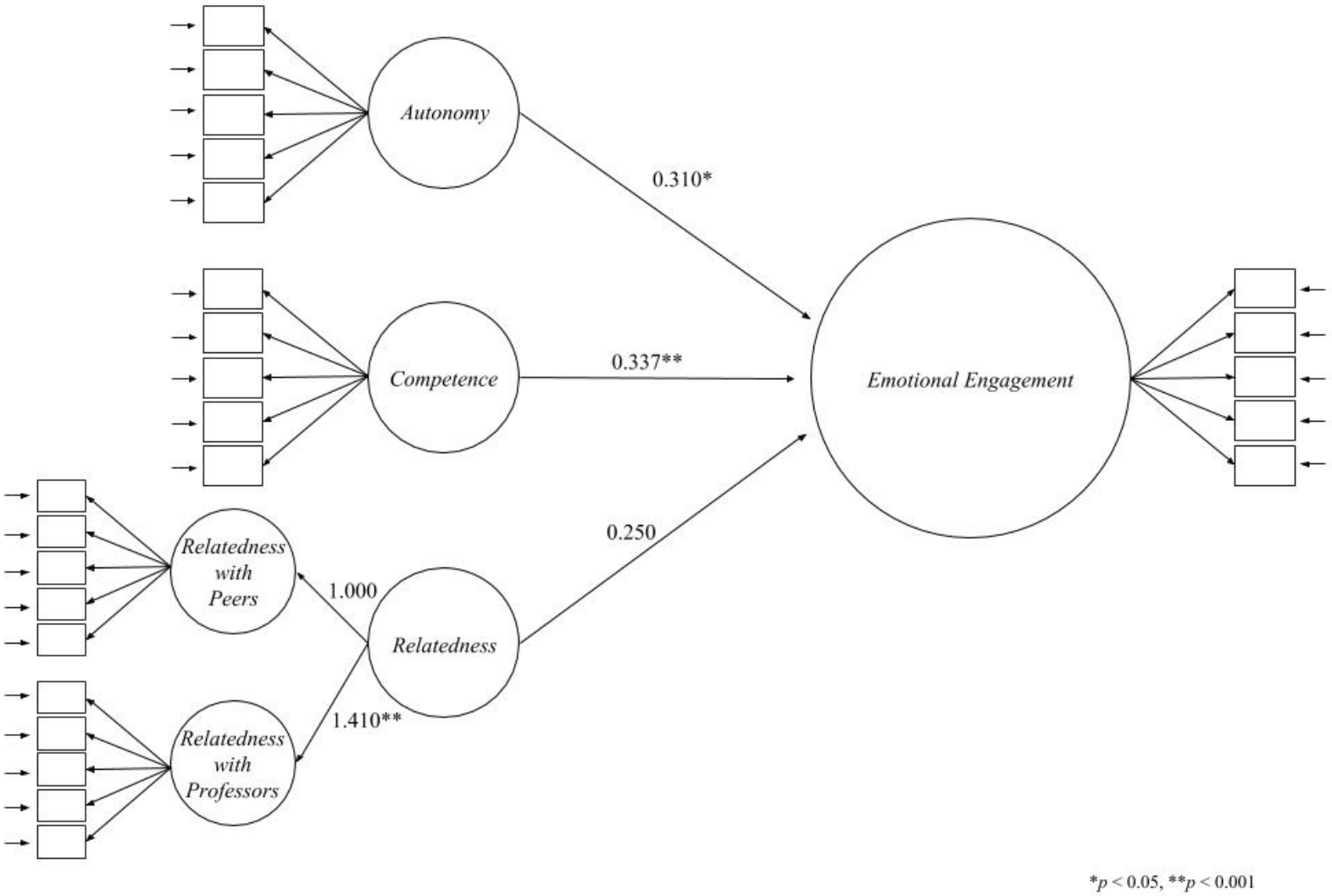

Figure 1. Model with self-determination theory constructs regressed on *emotional engagement*. Standardized betas reported. *Emotional engagement* $R^2 = 0.632$.

Model 2 supports the same findings from Model 1, specifically that in the presence of other variables, *competence* (B=0.484, SE=0.092, β=0.365, $p < 0.001$) had a stronger influence on *emotional engagement* than any of the other variables (see Figure 2). *Autonomy* (B=0.388, SE=0.097, β=0.384, $p < 0.001$) had the next largest effect on *emotional engagement*. When we separated *relatedness with peers* and *relatedness with professors*, we were able to see the individual effects on *emotional engagement*. This model showed that *relatedness with peers* (B=0.133, SE=0.057, β=0.128, $p > 0.05$) does have a positive, albeit small, influence on *emotional engagement*. In the presence of *autonomy*, *competence*, and *relatedness with peers*, the latent construct *relatedness with professors* (B=0.101, SE=0.120, β=0.080, $p > 0.05$) was not statistically significant in predicting *emotional engagement*.

We also tested the difference between the betas from *relatedness with peers* and *relatedness with professors* to *emotional engagement*. Although it would appear that *relatedness with peers* exhibits a larger influence on *emotional engagement* than *relatedness with professors*, the results showed that the two betas are not statistically different from each other ($p > 0.05$).

Table 9

Correlation Matrix for Latent Variables in Model 2

	1.	2.	3.	4.	5.
1. Autonomy	1.000				
2. Competence	0.581**	1.000			
3. Relatedness with Peers	0.368**	0.398**	1.000		
4. Relatedness with Professors	0.745**	0.643**	0.497**	1.000	
6. Emotional Engagement	0.703**	0.691**	0.454**	0.665**	1.000

**$p < 0.001$.

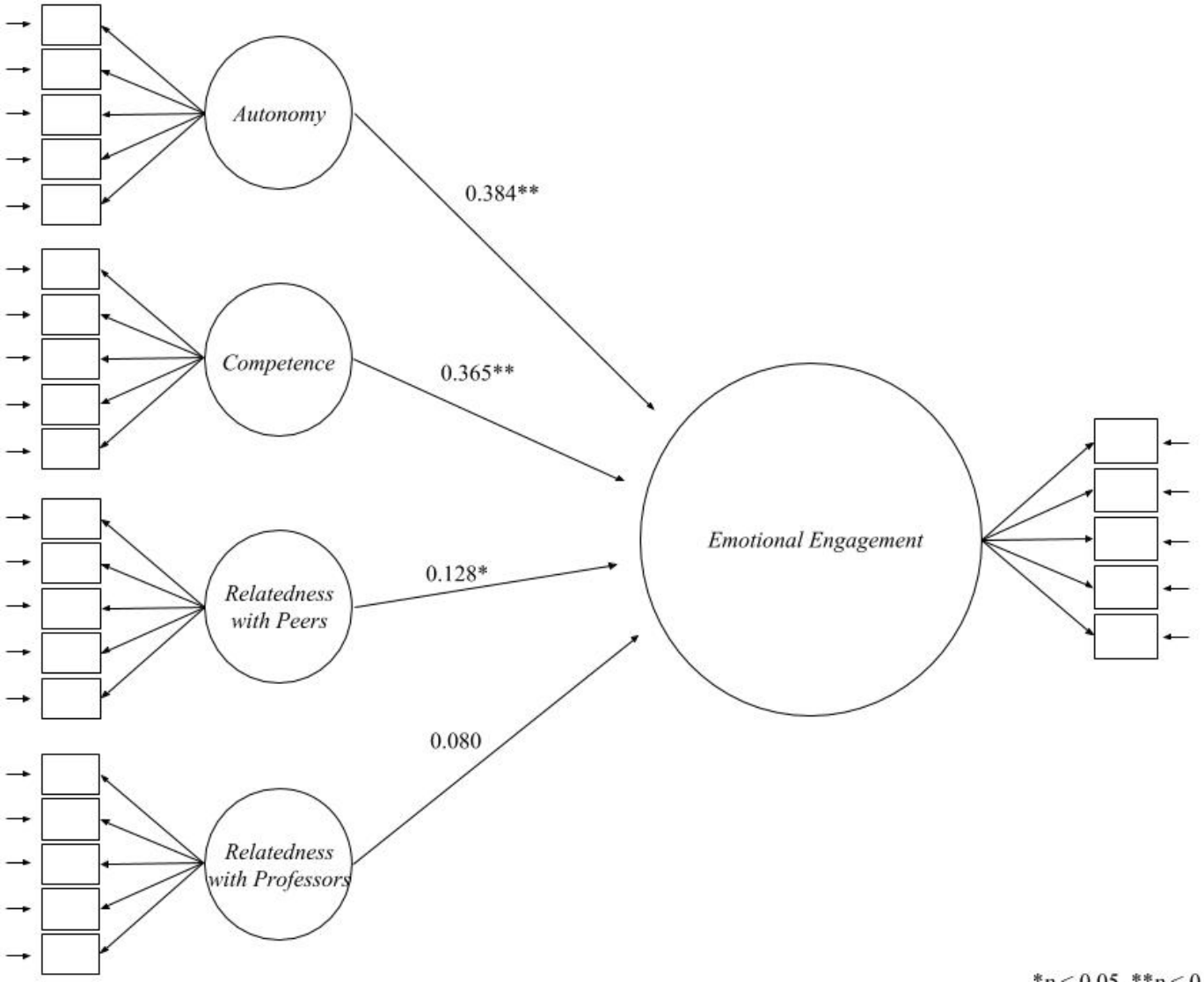

Figure 2. Model separating relatedness with peers and relatedness with professors to regress on emotional engagement. Standardized betas reported. *Emotional engagement* $R^2 = 0.634$.

Discussion and Limitations

Overall, our statistical analysis shows that the survey performed well. The indicators for each latent factor appear to measure the intended construct. We initially hypothesized that *relatedness* would have a larger impact than accounted for in the current literature and be comparable to the influence of *autonomy* and *competence*. Our analysis proved contrary to our hypothesis. In both models, *autonomy* and *competence* were found to have a larger impact on *emotional engagemen*t than either *relatedness with peers* or *relatedness with professors*. In response to our research questions, this analysis showed that sense of autonomy, competence, and relatedness with peers have a positive, yet relatively small, effect on student emotional engagement. *Sense of relatedness with professors* did not have a statistically significant effect on *emotional engagement* as we measured it.

Future research could examine interactions between each of the latent constructs and possible indirect effects on engagement due to these interactions. For example, Kosko and Wilkins (2015) acknowledged that teachers in their study had the role of providing scaffolding, which influenced students' competence, as students worked to develop mathematical autonomy. This suggests the relatedness students experienced with teachers affected student engagement through autonomy and competence. It is possible that in our sample *relatedness with professors* did not have a statistically significant effect on *emotional engagement* but may have indirect influence unaccounted for in the model. A model that includes interactions between the latent constructs and uses a longitudinal approach using this instrument could yield more in-depth knowledge in this area.

Through our analysis we also tested two structural models. Model 2 fit the data best and answered our research questions in a meaningful way. Model 1 did not clearly show the

individual effects of *relatedness with peers* and *relatedness with professors* on *emotional engagement*. Creating the composite factor, *relatedness*, made it appear as though *sense of relatedness* had no influence on engagement, but the revised model tells a different story. One reason *relatedness* might have not been statistically significant in the hypothesized model could be due to the high level of correlation (r = 0.927) between *relatedness* and *relatedness with professors*, which was not statistically significant in Model 2. While this strong correlation makes sense because *relatedness* is a composite of *relatedness with professors* and *relatedness with peers*, the correlation between *relatedness* and *relatedness with peers* was moderate (r = 0.536).

Findings from this study can be used to inform course design and instructional strategies employed by professors. In both models we were surprised to see that *sense of competence* had a stronger effect on *emotional engagement* than *autonomy*. This finding is contrary to the general consensus that "SDT research claims that autonomy support is the most important factor in self-determined motivation" (Scogin & Stuessy, 2015, p. 342). While most literature encourages professors to increase autonomy-supportive behavior, our finding can be used to show the importance of also providing meaningful feedback and scaffolding for students, which supports their sense of competence.

One limitation with this study could be the sample we collected. Although we looked to collect data from a large sample over many contexts and courses, participants ultimately self-selected. Professors made students aware of the opportunity to participate through an email or learning management system announcement. There is the possibility that those who filled out the survey were students who tend to be more engaged in their education and willing to dedicate an extra 10-15 minutes of their time for educational purposes. This could skew the results of self-

report measures to be higher than would be expected. We also did not test for differences across the face-to-face and online contexts because our sample size from online classes was too small to conduct meaningful analysis. Future research could compare results from face-to-face and online settings to see if any of the results change, specifically those pertaining to sense of relatedness with both peers and professors. Future research could also explore if students' sense of competence exhibits a stronger influence on emotional engagement than autonomy when the survey is administered to a different population.

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ARTICLE 3

Examining the Influence of Self-Determination Theory Constructs in Online Higher Education

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Abstract

This study employed a previously validated survey to measure student *sense of autonomy, competence, relatedness with peers,* and *relatedness with instructors* to understand how these variables influence student *emotional engagement*. Self-determination theory was used as a theoretical framework; however, we expanded the concept of relatedness to include peers and instructors separately. We administered this survey to students (n = 3092) in 23 online higher education courses. Design effects were calculated and then used to control for clustering at the course-level. Confirmatory factor analysis and structural equation modeling were then used to test our hypothesized model and identify relationships between the latent constructs. Results from our sample showed that all four variables had a positive, statistically significant influence on *emotional engagement*. Student *sense of autonomy* had the largest predicted effect on engagement, which supports the current literature surrounding self-determination theory and the touted importance of autonomy. *Relatedness with instructors* showed the smallest influence, with a value less than one-third that of *autonomy.*

Keywords: self-determination theory; student engagement; structural equation modeling; confirmatory factor analysis; online learning

Introduction

Studies have shown that increased student engagement is correlated with improved learning outcomes and positive student academic experience (Beachboard, Beachboard, Li, & Adkison, 2011; Filak & Sheldon, 2008; Kuh, Kinzie, Buckley, Bridges, & Hayek, 2007; Reeve, 2012). Leach (2016) proposed that "engagement is understood to be positively related to academic outcomes such as retention, progression and completion" (p. 23). Although many researchers suggest that engagement is an important aspect of the learning experience, there is no single definition of engagement. The most widely accepted explanation of engagement includes three components: behavioral, cognitive, and emotional (Fredricks, Blumenfeld, & Paris, 2004); however, researchers vary on which aspects to include in their conceptualizations of engagement. Raufelder, Regner, Drury, and Eid (2016) used a two-component model comprised of emotional and behavioral factors, while others focused on the emotional and cognitive factors of engagement (Halverson & Graham, in press; Spring, Graham, & Ikahihifo, 2017). Others have espoused four-component models that include the foundational three aspects and add on psychological or agentic components (e.g., Appleton, Christenson, & Furlong, 2008; Reeve & Tseng, 2011). As is evident based on the disagreement over definitions, student engagement is not a fixed aspect of the learning experience but is rather something that can be shaped by specific contexts and learning environments (Fredricks et al., 2004; Manwaring, Larsen, Graham, Henrie, & Halverson, 2017; Skinner, Kindermann, & Furrer, 2009).

Self-determination theory (SDT) is one framework that has been used to identify some characteristics that facilitate and influence engagement (Furrer & Skinner, 2003; Martin & Dowson, 2009). Autonomy, competence, and relatedness are cited in SDT as innate psychological needs (Deci, Vallerand, Pelletier, & Ryan, 1991). When these needs are fulfilled,

learners are able to experience higher levels of motivation. Although SDT is a theory of motivation, Gedera, Williams, and Wright (2015) propose that motivation is a prerequisite of student engagement and that the two are closely related. According to SDT, motivation can be increased through meeting students' need for autonomy, competence, and relatedness, which can then affect student engagement.

As the emphasis on student engagement has increased, the efforts to "identify the ways in which educational settings can be constructed that best meet students' learning needs" (Park, Holloway, Arendtz, Bempechat, & Li, 2012, p. 391) have also intensified. Identifying factors that influence student engagement makes it possible for researchers and practitioners to create interventions, such as changes in instructional strategies and course design, that positively impact this malleable aspect of the student experience. Reeve and Jang (2006) found that autonomy-supportive behaviors, such as allowing choice and providing feedback, increased students' perceived autonomy and competence, which in turn influenced student engagement and performance.

The SDT framework makes it possible for researchers to examine the influence of instructor behavior, social interactions with peers, and course structure on students' motivation and performance (Chen & Jang, 2010). With this knowledge, those responsible for course design can better understand which types of activities and course elements should be included and the role they may play in increasing student engagement. Instructors can also use this knowledge to emphasize specific instructional strategies. For example, if we find that a student's sense of autonomy has the largest effect on performance and engagement, courses can be designed in a way that allows for more student choice and instructors can adopt more autonomy-supportive practices in their teaching.

Literature Review

In our review of the literature regarding autonomy, competence, and relatedness, we found that across both K-12 and higher education contexts, autonomy appeared to consistently have the largest effect on engagement. Scogin and Stuessy (2015) recognized that "SDT research claims that autonomy support is the most important factor in self-determined motivation" (p. 342). Skinner, Furrer, Marchand, and Kindermann (2008) in their study with elementary school students found that fulfillment of the students' sense of autonomy was the "clearest contributor to engagement" (p.777), even though self-report questionnaires showed students had higher averages on their perceived competence and relatedness than on perceived autonomy. Statistical analysis in a similar study with university students showed that students' perceived autonomy was the highest predictor of engagement (Koch, Dirsch-Weigand, Awolin, Pinkelman, & Hampe, 2017). Most studies took place in a traditional face-to-face classroom setting. However, one study that was conducted in an online learning environment showed no significance between autonomy and student engagement (Scogin & Stuessy, 2015). The authors hypothesized this could be due to the fact that online learning already requires higher levels of autonomy. As Moore (2007) suggested, more autonomous students may be comfortable in courses that have less dialogue and deliver more information through structured course materials, such as many online classes are compared to face-to-face courses. This research could highlight an important difference between face-to-face and online contexts that may not currently be accounted for in the literature.

Researchers have found that students perceive face-to-face and online learning environments differently, which can affect students' motivation, learning, and satisfaction (Mullen & Tallent-Runnels, 2006). Chen and Jang (2010) proposed that the constructs included

in SDT correspond well to features of online learning, an area in engagement research that may be underrepresented. Redmond, Abawi, Brown, Henderson, and Heffernan (2018) noted that relatively little attention has been devoted to studying engagement in online learning. One study sought to compare the ability of students to learn autonomously, interact with their peers, and feel engaged in their learning in lecture halls versus online courses (Rabe-Hemp, Wollen, & Humiston, 2009). Their findings support the idea that online students may be encouraged to take on more autonomous learning practices. Shifting our focus to this area of research can provide valuable information that can be used to inform course design and instructional strategies specific to online settings in the future.

This study sought to understand the influence of autonomy, competence, and relatedness on the student learning experience in an online higher education setting as assessed by student engagement. For the purposes of our research, we will first define autonomy, competence, and relatedness. Because we employed a self-report survey in this research, we define each of the constructs with the terms *sense of* beforehand to reflect that these measures are based on student perceptions. *Sense of autonomy* describes student perception of how well the course allows students to make choices and align course material with their personal interests. We have chosen to focus more on the perceived choice aspect of autonomy instead of ideas such as locus of causality (Niemiec & Ryan, 2009) or volition (Stefanou, Perencevich, DiCintio, & Turner, 2004). We defined *sense of competence* as the students' belief in their ability to achieve the learning outcomes of a given course. This idea is closely related to self-efficacy. *Sense of relatedness* describes student perception of their connection with others in the course relating to their personal and academic well-being.

In this study, we focused only on the emotional aspect of engagement. Like Lam, Wong, Yang, and Liu (2012), we feel that the emotional, or affective, aspect of engagement "may be the engine that drives the other dimensions of student engagement" (p. 415). In their review of the literature, Park et al. (2012) found that students who are not emotionally engaged tend to disengage behaviorally and cognitively, two other aspects of engagement commonly cited. For this study, we also measured the influence of peer relatedness and instructor relatedness separately to identify if there were any differences between the role these relationships play. Our study addressed the following research question: What effects do the latent constructs of SDT (sense of autonomy, competence, relatedness with peers, and relatedness with instructors) have on perceived emotional engagement in an online setting?

Methods

To answer our research question within our intended context, we collected data from students enrolled in online higher education courses through a large, private university in the northwestern United States, which we will refer to as the University. After receiving approval from the Institutional Review Board, we began data collection.

Research Context

Participants for this research were sampled from a private institution that enrolls a wide range of students worldwide through its online university courses and through a separate, low-cost education initiative that seeks to help at-risk students start or return to college. The program provides affordable education to underserved populations. Many who enroll are non-traditional students who are balancing professional and family responsibilities. This initiative is a one-year, online program after which students can matriculate into the University at the same low cost. References to *University students* or *students* throughout this article will include students in both

the university courses and courses offered through the low-cost initiative, unless otherwise specified.

In order to serve the large number of students while providing a uniform experience, the University hires remote adjunct instructors who teach courses developed by full-time University faculty and curriculum developers. The resulting course is referred to as a "master" course. In this master course model, the same course content and assessments are used by all instructors who teach sections of that course (Piña & Bohn, 2014). Using the master course model is intended to provide a "standardized and familiar feel for students" (Borgemenke, Holt, & Fish, 2013, p. 20). Instructors are given very little autonomy and flexibility to reorganize or change course structure. The University courses we sampled from are semester-long, instructor-led courses that require weekly asynchronous, and sometimes synchronous, interactions between students, their peers, and the instructor. These interactions occur mainly through the learning management system (LMS).

Data Collection

Our study employed a previously validated survey created to measure student sen*se of autonomy, competence, relatedness with peers, relatedness with instructors,* and *emotional engagement* (see Article 2). This survey was created in Qualtrics and administered during a two-week period leading up to the end of Spring semester for the University students. The survey consisted of 25 items which students answered on a scale from 1 (not at all true) to 7 (very true). We solicited responses from 6,418 students enrolled in 23 different courses. The number of sections of each course varied, with some courses having fewer than 10 sections and others with more than 100. We randomly selected 10 students from each section of every course, when section numbers allowed. For sections with fewer than 10 students, all of those students gained

access to the survey. Once these students were selected, they were able to access the survey through their LMS. As part of the course experience, students were already assigned to complete weekly surveys accessed through the LMS. Our research survey replaced one of these weekly surveys; completion of our survey was voluntary for students and did not influence their course grade.

Our final sample included 3,092 responses from a total of 638 sections across 23 courses. This gave us an average response rate of 48% across all courses. Although we were unable to collect demographic information about the students who completed our survey, the typical student at the University is a Caucasian female from the United States between the ages of 18 to 24 years old. Students enrolled in courses through the low-cost education initiative tend to be a more diverse population comprised of non-traditional students. There is currently no published data on the typical student in this program.

Data Analysis

After the data were collected, we began our quantitative analysis using SPSS version 25 and Mplus version 8.1. Here we outline our analytical strategy; results will be discussed in the subsequent section. We started the analysis by checking that all statistical assumptions were met, including linearity, normality, equality of variance, and multicollinearity. Due to the clustered nature of our data, we then calculated the design effect for the section- and course-levels. After checking the statistical assumptions and calculating the design effect, we proceeded with confirmatory factor analysis (CFA).

Though we previously validated the factorial structure of the survey used to collect data, we conducted a CFA on the newly gathered data (see Article 2). CFA is used to test if the theoretically defined factorial structure in the instrument is valid (Wang & Wang, 2012). We ran

each construct individually and with the data as continuous and categorical. If our CFA resulted in good model fit, we then planned to use structural equation modeling (SEM) to test our hypothesized model.

The SEM would be conducted using the maximum likelihood estimator, and missing data would be handled using full information maximum likelihood. Our model and analysis were comprised of the latent variables *sense of autonomy*, *sense of competence*, *sense of relatedness with peers*, *sense of relatedness with professors*, and *emotional engagement*. Five survey items were used to measure each of these latent variables. See Table 1 for a complete list of survey items.

Results

To verify that our data met all statistical assumptions, we examined histograms and scatterplots in SPSS. We calculated the design effect to account for the violation of the independence assumption. Once we confirmed that the assumptions were met, we reviewed descriptive statistics for each survey item. These statistics can be found in Table 1 and are organized according to the latent variable they measure. The numbering found in the table next to each item reflects the order in which it appeared in the survey.

Table 1

Descriptive Statistics for Survey Items

Item	Mean	SD	Min	Max
Autonomy				
2. I believe I have some choice about how to do assignments in this course.	5.307	1.609	1.000	7.000
5. I feel like I have options for the activities I focus on in this course.	4.994	1.726	1.000	7.000
10. I believe I share in the decision-making process regarding course assignments.	4.615	1.997	1.000	7.000
24. I do the assignments in this course because I want to.	5.616	1.612	1.000	7.000
25. I feel like I can tailor aspects of the course to align with my interests.	5.272	1.731	1.000	7.000
Competence				
3. I believe if I put in effort, I can understand the course material well.	6.461	0.899	1.000	7.000
15. I am satisfied with my performance in the course thus far.	5.909	1.261	1.000	7.000
20. I am pretty skilled in this course.	5.474	1.372	1.000	7.000
22. I think I will do well in this course.	6.071	1.178	1.000	7.000
23. After studying this material for a while, I feel pretty competent.	5.968	1.163	1.000	7.000
Relatedness with Peers				
6. I feel comfortable approaching my peers for help with class work.	5.506	1.623	1.000	7.000
8. I find my academic relationship with my peers in this course to be satisfying.	5.456	1.584	1.000	7.000

Item	Mean	SD	Min	Max
11. I feel like my peers care about my success in this course.	5.218	1.763	1.000	7.000
14. I often talk to other students to prepare for class, discuss topics, or to socialize.	4.440	2.086	1.000	7.000
17. I feel like I can trust my peers in this course.	5.700	1.447	1.000	7.000
Relatedness with Instructors				
1. I feel like I can trust my instructor.	6.357	1.064	1.000	7.000
7. I feel like my instructor is available to help me when I need it.	6.209	1.221	1.000	7.000
9. I feel comfortable approaching my instructor for help with class work.	6.111	1.306	1.000	7.000
16. I find my academic relationship with my instructor to be satisfying.	5.849	1.439	1.000	7.000
21. I feel like my instructor cares about my success in this class.	6.245	1.219	1.000	7.000
Emotional Engagement				
4. This course is fun.	5.286	1.569	1.000	7.000
12. When we work on something in class, I feel interested.	5.656	1.411	1.000	7.000
13. When I am in class, I feel curious about what we are learning.	5.711	1.402	1.000	7.000
18. I enjoy learning new things in this course.	6.136	1.233	1.000	7.000
19. When I'm in class, I feel good.	5.891	1.394	1.000	7.000

Note. SD = standard deviation.

Items for *relatedness with instructors* had the highest means, averaging a score of 6.15. *Competence* had the next highest average with an average across items of 5.98. These two latent variables were followed, in order, by *emotional engagement* averaging 5.74 across all items, *relatedness with peers* averaging 5.26, and *autonomy* with an average of 5.16. All items were rated on a scale from 1 to 7; the minimum and maximum values in the table indicate full coverage.

Design Effect

As outlined in our data analysis section, we began by calculating the design effect. The design effect is an adjustment used to determine the effect of the clustering on the parameter estimates. It is calculated using the intraclass correlation of the given statistic and the average size of the cluster. We used a cut-off value of 2, as suggested by Muthén and Satorra (1995). If the design effect value was less than 2, we did not control for clustering at that level. All five constructs—s*ense of autonomy, competence, relatedness with peers, relatedness with instructors,* and *emotional engagement*—had design effects less than 2 at the section-level and much greater than 2, ranging from six to 19, at the course-level. Based on these results, we controlled for clustering at the course-level in our confirmatory factor analysis.

Confirmatory Factor Analysis

We initially ran two CFAs for each individual construct to see if classifying the data as continuous or categorical would yield differing results. Although Likert scale data with at least five points can be treated as continuous, we sought to conduct our analysis in the most appropriate way. Fit statistics for all five constructs resulted in the same outcome when ran as categorical or continuous, so we only report the results from the continuous data.

The fit statistics we considered when assessing model fit were comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). According to Wang and Wang (2012) good model fit is shown by values greater than 0.90 for CFI and TLI and less than 0.08 for RMSEA and SRMR. Three of the five latent constructs were within the cut-off values for all four fit indices examined. *Competence* met three of the four cut-off values, which we decided was acceptable to leave as is. *Autonomy*, however, had two fit indices outside the recommended cut-off points.

We examined the modification index (MI) for the five *autonomy* items on the survey to identify fixed parameters that could be freely estimated to improve model fit. Wang and Wang (2012) recommend beginning with the largest MI first. Based on the MI, we allowed the residuals of items 24 and 25 to covary, which allowed one parameter to be freely estimated. After making this adjustment, all four fit indices for *autonomy* met the recommended cut-off values. Table 2 shows the fit statistics from the CFAs.

Table 2

Confirmatory Factor Analysis Fit Statistics

	Fit Statistics			
Latent Construct	CFI	TLI	RMSEA	SRMR
Autonomy	0.992	0.979	0.072	0.013
Competence	0.969	0.937	0.085	0.033
Relatedness with Peers	0.998	0.996	0.034	0.010
Relatedness with Instructors	0.989	0.978	0.051	0.012
Emotional Engagement	0.993	0.987	0.076	0.019

Note. Fit statistics reported after allowing residuals for items 24 and 25 to covary for *Autonomy*.

Individual factor loadings for the items pertaining to each latent construct are shown in tables 3–7. We report on the item as listed in the survey, unstandardized factor loading, standard error, standardized factor loading, and communalities. The first factor loading is fixed to 1 for identification purposes. Values for the other items in the table indicate their strength relative to the first item. For example, a value greater than 1 shows the item had a stronger influence than the first item on the latent construct. Standardized factor loadings across the constructs ranged from 0.54 to 0.91, with a value closer to 1 indicating a stronger influence. *Emotional engagement* had the highest standardized factor loadings which ranged from 0.81 to 0.91 while *competence* had the lowest value and a range from 0.54 to 0.88. *Relatedness with instructors* and *relatedness with peers* had the next highest ranges from 0.83 to 0.89 and 0.69 to 0.88, respectively. *Autonomy* was only very similar to *competence* with a range from 0.56 to 0.87. Although there was a wide range of values, all standardized factor loadings were greater than the suggested cut-off value of 0.40 (Wang & Wang, 2012; Worthington & Whittaker, 2006).

The communalities value shows the amount of variance of a factor accounted for by each indicator in the model. Values can range between 0 and 1 with Worthington and Whittaker (2006) suggesting that anything less than 0.40 is low. Two communalities fell below this cut-off point: item 3 pertaining to *competence* (0.29) and item 24 for *autonomy* (0.32). This does not affect the overall fit or validity of the constructs, yet it is worth noting.

CFA results indicated a unidimensional construct for each set of items models this data well. Given these results, we proceeded to test our structural model.

Table 3

Confirmatory Factor Analysis Results for Autonomy

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
2. I believe I have some choice about how to do assignments in this course.	1.000[a]	NA	0.786	0.617
5. I feel like I have options for the activities I focus on in this course.	1.189**	0.026	0.870	0.757
10. I believe I share in the decision-making process regarding course assignments.	1.196**	0.044	0.757	0.574
24. I do the assignments in this course because I want to.	0.717**	0.035	0.563	0.317
25. I feel like I can tailor aspects of this course to align with my interests.	1.018**	0.028	0.742	0.550

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Table 4

Confirmatory Factor Analysis Results for Competence

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
3. I believe if I put in effort, I can understand the course material well.	1.000[a]	NA	0.541	0.293
15. I am satisfied with my performance in the course thus far.	2.023**	0.116	0.780	0.609
20. I am pretty skilled in this course.	2.109**	0.132	0.747	0.558
22. I think I will do well in this course.	2.105**	0.119	0.877	0.769
25. After studying this material for a while, I feel pretty competent.	1.979**	0.111	0.828	0.685

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Table 5

Confirmatory Factor Analysis Results for Relatedness with Peers

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
6. I feel comfortable approaching my peers for help with class work.	1.000[a]	NA	0.795	0.632
8. I find my academic relationship with my peers in this course to be satisfying.	1.063**	0.027	0.866	0.749
11. I feel like my peers care about my success in this course.	1.196**	0.028	0.876	0.767
14. I often talk to other students to prepare for class, discuss topics, or to socialize.	1.120**	0.026	0.693	0.480
17. I feel like I can trust my peers in this course.	0.952**	0.015	0.848	0.720

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Table 6

Confirmatory Factor Analysis Results for Relatedness with Instructors

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
1. I feel like I can trust my instructor.	1.000[a]	NA	0.832	0.692
7. I feel like my instructor is available to help me when I need it.	1.211**	0.026	0.878	0.772
9. I feel comfortable approaching my instructor for help with class work.	1.305**	0.025	0.885	0.783
16. I find my academic relationship with my instructor to be satisfying.	1.425**	0.031	0.877	0.770
21. I feel like my instructor cares about my success in this class.	1.198**	0.037	0.871	0.759

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Table 7

Confirmatory Factor Analysis Results for Emotional Engagement

Item	Factor Loading	SE	Standardized Factor Loading	Communalities
4. This course is fun.	1.000[a]	NA	0.802	0.644
12. When we work on something in class, I feel interested.	1.018 **	0.016	0.908	0.824
13. When I am in class, I feel curious about what we are learning.	0.997**	0.027	0.896	0.802
18. I enjoy learning new things in this course.	0.838**	0.022	0.856	0.733
19. When I'm in class, I feel good.	0.961**	0.021	0.868	0.753

Note. SE = standard error.
**$p < 0.001$.
[a]Factor loading fixed to 1.

Structural Equation Modeling

After conducting the CFA, we moved tested the hypothesized structure using SEM. SEM results identify the effect of each latent factor on *emotional engagement* in the presence of all other latent factors included. We looked at the correlation between the five latent variables to ensure that the items were distinct enough to be measured as separate variables. The correlation values, shown in Table 8, indicate that the variables are moderately related in hypothesized ways but still have discriminant validity; all correlations are less than 0.85, which can be considered moderate.

Once we confirmed all factors should be included as separate constructs, we tested the hypothesized model shown in Figure 1. We used the *type is complex* option, which controls for the clustering of the course-level, and fit statistics indicated good model fit (CFI=0.932,

TLI=0.922, RMSEA=0.062, SRMR=0.061, χ^2=3385.610, *df*=264, $p < 0.001$). The results from this model, which regressed *autonomy*, *competence*, *relatedness with peers*, and *relatedness with professors* onto *emotional engagement*, were used to answer our research question.

Table 8

Correlation Matrix for Latent Variables

Variable	1	2	3	4	5
1. Autonomy	1.000				
2. Competence	0.602**	1.000			
3. Relatedness with Peers	0.665**	0.489**	1.000		
4. Relatedness with Instructors	0.618**	0.631**	0.528**	1.000	
5. Emotional Engagement	0.785**	0.669**	0.663**	0.649**	1.000

**$p < 0.001$.

Effects on Emotional Engagement

To understand the effects of each latent construct on *emotional engagement,* we looked at the Mplus output of our SEM. In this section we report four values of the effect of each latent construct on *emotional engagement*: unstandardized beta (B), standard error (SE), standardized beta (β), and the associated *p*-value. The unstandardized beta indicates the relation between the independent variable and outcome variable. This means for every one unit increase in the independent variable, such as *autonomy*, we would expect the predicted value of *emotional engagement* to change by the value of the unstandardized beta, holding all else constant. The standardized beta shows a similar relation between the standard deviations of the independent and dependent variables. For every one standard deviation increase in the independent variable, we would expect the predicted value of *emotional engagement* to change by the number of standard deviations indicated by the standardized beta.

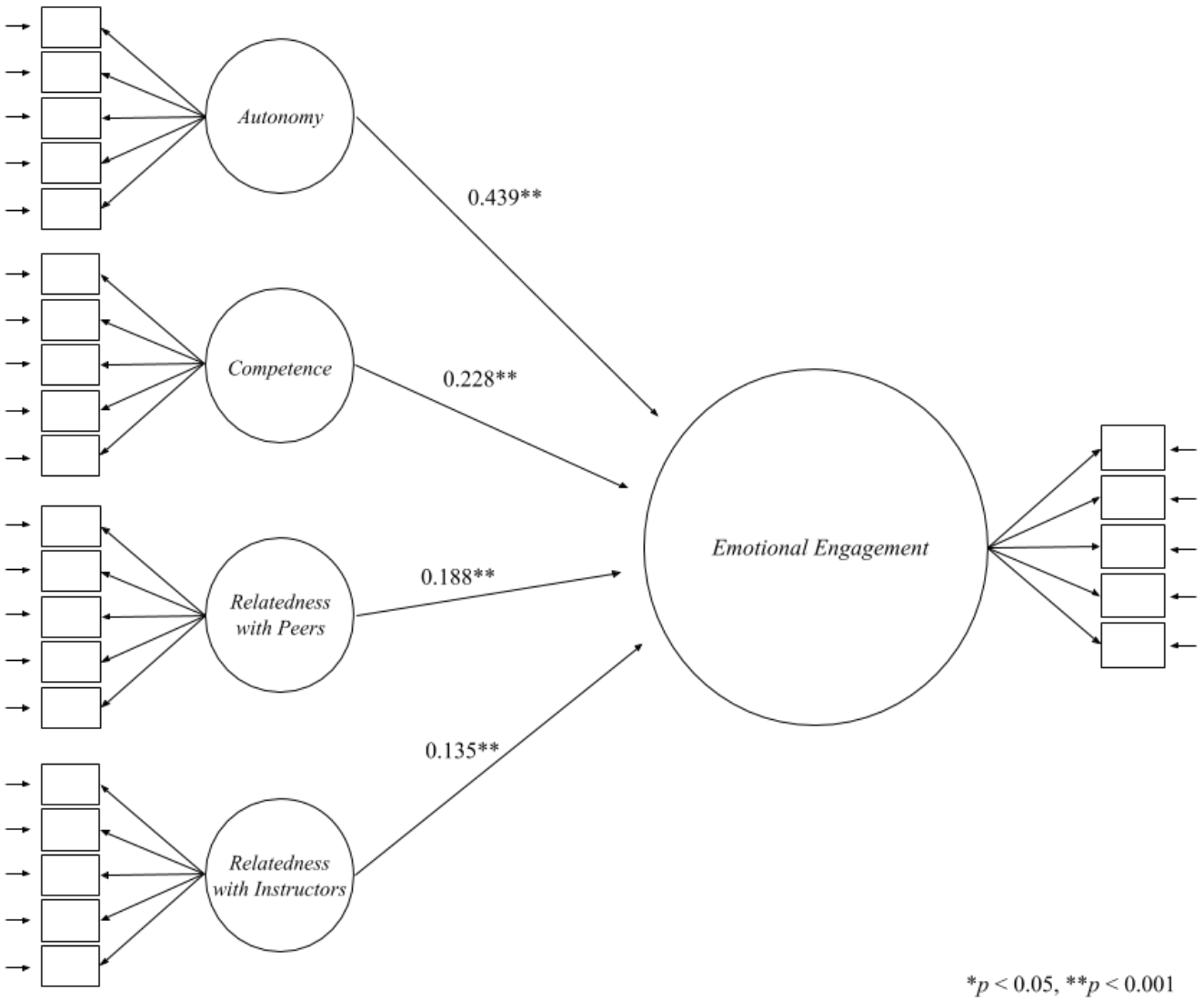

Figure 1. Hypothesized and tested structural model of self-determination theory constructs and engagement (n = 3092). Standardized betas reported. *Emotional engagement* R^2 = 0.709.

Given our dataset and analysis, all constructs—*autonomy, competence, relatedness with peers,* and *relatedness with instructors*—showed a statistically significant positive influence on *emotional engagement* in the presence of one another. *Autonomy* (B=0.459, SE=0.064, β=0.439, $p < 0.001$) exhibited the largest effect on *emotional engagement* while *competence* (B=0.554, SE=0.053, β=0.228, $p < 0.001$) was the next highest. Both relatedness measures showed less than half the influence of *autonomy* on *emotional engagement. Relatedness with peers* (B=0.187, SE=0.020, β=0.188, $p < 0.001$) showed a slightly larger effect than *relatedness with instructors* (B=0.196, SE=0.063, β=0.135, $p < 0.01$).

Discussion

Although we focused only on the emotional component of engagement, our findings support the prevalent idea in SDT literature that autonomy is the most influential factor in contributing to student engagement (Koch et al., 2017; Skinner et al., 2008). In our sample, the effect of *autonomy* was almost double that of the next most influential latent variable. The findings mirror those of Skinner et al. (2008). Despite having the lowest average on self-report survey items for each of the latent variables, *autonomy* was the "clearest contributor to engagement" (p. 777). The way we defined autonomy, and worded survey items according to our definition, suggests that students' perceived ability to align course activities with their personal interests has the greatest impact on their level of emotional engagement relative to *competence* or *relatedness* with peers or the instructor.

We acknowledge that students have personal preferences, which may make certain individuals more likely to benefit from increased autonomy in a course, while other students may feel greater engagement through their connections with peers and instructors. Every student brings their own past experiences and preferences into each course; Spring et al. (2017) in their

two-component engagement model referred to these as *learner characteristics.* As shown in Figure 2, these characteristics influence student engagement. They are, however, outside the control of instructors and designers. For this reason, we encourage practitioners to seek and make improvements where they can affect student engagement, namely through the course design and facilitation.

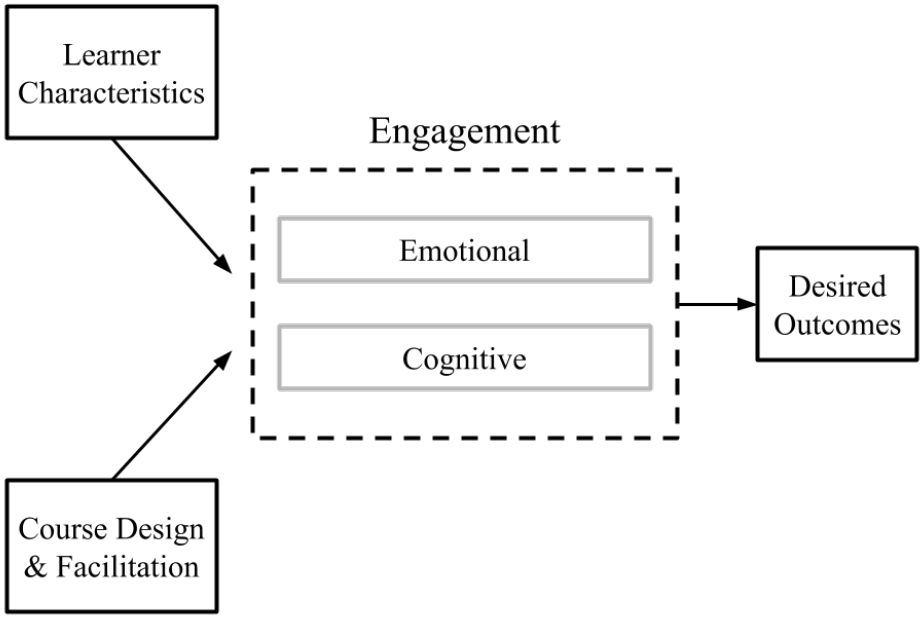

Figure 2. Model of learner engagement. Adapted from Spring, Graham, and Ikahihifo (2017).

In our sample, autonomy was by far the largest factor for increasing student interest, curiosity, and enjoyment in the course. With this knowledge, instructors and course designers can include autonomy-supportive activities to positively impact the student experience and increase emotional engagement. For practitioners, this highlights the importance of course design that allows flexibility for students to personalize their assignments in a way that incorporates their interests. Although not every course or topic lends itself to such flexibility, course designers can be mindful to include opportunities for such choice when possible. This is especially

important in master course models where instructors have little influence on course design and are perhaps unfamiliar with instructional strategies to promote student autonomy.

Instructors in such courses can contribute to their students' emotional engagement by emphasizing these autonomy-supportive assignments and encouraging students' perceived *sense of competence*, which was found to be the second-most influential factor in our sample. According to our review of the literature surrounding SDT and engagement this is a common finding (Guvenc, 2015; Koch et al., 2017; Kosko, 2015). Niemiec and Ryan (2009) argued that "students who feel competent, but not autonomous, will not maintain intrinsic motivation for learning" (p. 135). This emphasizes the idea that autonomy is the key for self-determined motivation. Even though autonomy may be considered the primary contributing factor to emotional engagement, practitioners should still seek to encourage students' perceived competence. This can be done by instructors in an online environment through providing meaningful feedback (Kosko & Wilkins, 2015), scaffolding (Ryan & Deci, 2000), and highlighting the relevance of course material. Guvenc (2015) also proposed that students' competence is connected with the structure implemented by the teacher. These suggestions encompass the course design and facilitation as shown in Figure 2.

While our results are in-line with many other studies that have researched SDT and engagement, we were surprised that relatedness measures did not have a larger influence, given that we were focusing solely on the emotional component of engagement. Based on their research, Lam et al. (2012) stated that "students' enthusiasm, interest, happiness, and comfort in school, then, seem to be shaped by their sense of relatedness to others" (p. 406). This aligns closely with how we defined and measured *emotional engagement*. As previously mentioned, in

our dataset *relatedness with peers* and *instructors* had the smallest predicted effect on *emotional engagement.*

This lack of greater influence from relatedness could be due in part to the way we defined each construct and created corresponding survey items. Our measure of *emotional engagement*, adapted from other authors (Reeve & Tseng, 2011; Skinner et al., 2008), measured student curiosity, interest, and enjoyment, and our relatedness items sought to understand students' level of trust, comfort, and perceived peer and instructor academic support. The wording of relatedness items also may not carry over seamlessly to an online context. Preliminary research using these items was done in a face-to-face context, so phrases such as *approaching* or *talk to* may not have the same meaning when students interact with their peers from a distance.

Aside from potential item revisions, it could also be that relatedness does not have as prominent a role in online courses for increasing emotional engagement. Perhaps students in online courses, especially those in the courses we sampled, are less interested in connecting with their peers and instructors. In her 2016 study with university students, Leach found that "some students do not value social and academic interactions with other students" which "may be influenced by the number of mature distance students who fit study into busy lives" (p. 39). This relates back to the *learner characteristics* that students bring with them into a course.

Limitations and Future Research

One limitation of this study is that we were unable to collect demographic information about survey participants. The university through which the study was conducted has students from over 126 countries and ages that range from teenagers to adults in their 60s and beyond. However, we cannot know what types of students (e.g., year in school, age) completed our

survey. If we assume the survey participants were like the average student as described in the data collection section, the generalizability of our findings is severely limited.

Another factor that limits generalizability is the population from which we gathered our sample. Nine of the 23 courses were part of the low-cost initiative, which serves more non-traditional students than a typical university. More than a quarter of our sample also came from students enrolled in religious education classes. Due to the religious nature of the courses, these classes and student responses may not be representative of the average university experience. Future research could be conducted in more general classes to assess if this model yields similar results in that setting.

For this study, we collected and analyzed cross-sectional data, which represents only one point in time of students' perception of these constructs and engagement. Park et al. (2012) found in their three-year longitudinal study that emotional engagement was more accurately measured as a process instead of a single point. Engagement can be sensitive to context and fluctuates over the course of a student's experience in a class. Future research could employ a longitudinal design to capture the product of such fluctuations on engagement. Another limitation of cross-sectional data is that it does not show long-term effects of measured factors. Perhaps the influence of relatedness with peers and instructors grows over time in a way unaccounted for in a short-term study such as ours. Relatedness has been found to be a "pervasive and powerful force" in students' persistence when completing a university degree (Pascarella & Terenzini, 2005).

Using contexts such as master course models, future research could use this structure to isolate the effects of relatedness. With varying instructors teaching a course that has consistent design, assignments, and general instructions across sections, differences in relatedness for

sections could be easier to identify. If such a study properly controlled for possible confounding variables, we could review instructor facilitation and its relation to changes in students' relatedness and engagement. This could be expanded to a longitudinal study that examines these effects across instructors over time. As instructors adapt or revise their instructional strategies, changes in student relatedness and engagement could be tracked throughout the time period to evaluate the effectiveness of such strategies.

We recommend that any future iteration of this survey and corresponding model be validated with the dataset collected. It may also be beneficial to revise items 3, 24, and 25 given the low communalities of the first two mentioned and the high correlation between the latter two. Considering the literature surrounding student engagement and its potential to positively affect learning outcomes, this model could also be used as a foundation for future studies to build upon. Additional outcomes, such as student performance, satisfaction, or retention, could be included with engagement serving as a mediating variable. Researchers could measure additional dimensions of engagement, such as behavioral and cognitive aspects, in conjunction with emotional engagement. Such studies would contribute to the literature on self-determination theory and student engagement.

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DISSERTATION CONCLUSION

This research explored the influence of autonomy, competence, and relatedness with peers and instructors on student engagement in higher education. Self-determination theory (SDT) was used as a guiding framework and the motivation for focusing on the influence of autonomy, competence, and relatedness. In the first article, I reviewed research that examined the effect of at least one of the three SDT constructs on student engagement. Much of the research in this area proposed that autonomy is the most important predictor of student engagement. Of all three constructs, autonomy was the only one to be included as a factor in all the studies from our search. Relatedness, although considered one of the three innate needs in SDT, was given much less attention. It seemed as though researchers considered this construct outranked by autonomy and competence.

Additionally, I found that many researchers combined items from various surveys to measure autonomy, competence, relatedness, and engagement that were consistent with how they conceptualized each construct. Although student engagement is a highly researched area, it is not defined nor researched in a consistent way across contexts. For this reason, I sought to create an instrument that would (1) measure autonomy, competence, and relatedness consistent with the most common definitions for each and (2) focus on one, clearly defined aspect of student engagement. We made the decision to separate relatedness into relatedness with peers and relatedness with instructors because we realize that higher education has unique opportunities for each. For example, large-enrollment courses limit the ability for instructors to develop close relationships with each of the students. In such cases relatedness with peers may prove important for student emotional engagement.

The second article presented in this dissertation outlines the process used for selecting, adapting, and creating survey items and validating the instrument to measure autonomy, competence, relatedness with peers, relatedness with instructors, and emotional engagement. The main finding from this study was that survey items performed well and measured the intended constructs. For the third article, we administered the survey to higher education students enrolled in online courses that follow a master-course model. This presented a unique opportunity as students across sections have the same course structure but encounter varying instructional strategies employed by the instructors. We believed this design could potentially tease out more of the influence from course facilitation and relatedness with instructors. In our sample we found that autonomy had the largest effect on emotional engagement, followed by competence, relatedness with peers, and finally relatedness with instructors.

While these studies did not find anything contrary to what is proposed in most literature on SDT and engagement, namely that autonomy has the largest influence, I believe this means there are still opportunities for more research to be conducted. Perhaps a longitudinal design using this instrument could better assess the influence of relatedness on students' engagement. Such a study could follow students after they have graduated from higher education and have had time to reflect on their academic experience. This could be used in conjunction with a qualitative approach to pinpoint what students found meaningful in their interactions with peers and instructors and any long-term effects they believe stemmed from these relationships.