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Predicting academic major satisfaction using environmental factors and self-determination theory

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Predicting academic major satisfaction using environmental factors and self-determination theory

by

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The student author and the program study committee are solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

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ABSTRACT

Environmental factors (faculty integration and student integration) and self-determination theory factors (perceived autonomy, perceived competence, and perceived relatedness) were used to predict academic major satisfaction. It was hypothesized that environmental factors and self-determination factors would directly predict major satisfaction. In line with this, it was predicted that a path model which included environmental factors would prove to be a better fit than a model that did not. It was also predicted that environmental factors would directly predict self-determination factors, and that self-determination factors would mediate the relation between environmental factors and major satisfaction. Path analysis was used to test the hypotheses. In a sample of 332 college students, it was found that environmental factors did not directly predict major satisfaction, and a path model which included environmental factors was not a better fit. Environmental factors did indirectly predict major satisfaction, with self-determination factors as a mediator. Self-determination factors were directly predicted by environmental factors, and did directly predict major satisfaction. Implications, limitations, and future directions are discussed.

Keywords: academic major satisfaction, perceived autonomy, perceived competence, perceived relatedness, perceived autonomy, faculty integration, student integration

CHAPTER 1. INTRODUCTION

The Importance of Academic Major Satisfaction in a Counseling Context

When doing career counseling with college students, counselors have two options for the focus of the counseling. Career counselors can focus on finding a job the student will be satisfied with and a major that will allow the client to eventually do that job. Or they can focus on what major a student will be satisfied with and explore which jobs a student might get after graduating with that major. Neither of these approaches is perfect. A focus only on academic major satisfaction might lead a student to choose a major that leads to limited career options or career options that are not attractive to the student. In contrast, focusing only on potential satisfaction of a future job (as opposed to potential satisfaction with a current major) means student and counselor will have to focus more on hypotheticals, instead of being able to focus on the present. This approach could be problematic if it leads a student to think about what she *might* be interested in, rather than what she is interested in now. Focusing on future job satisfaction might also mean that a student ends up in a major she doesn't enjoy—a concern that should not be ignored, since most students will be in their major for at least four significant years of their life. Since academic major satisfaction has been linked to life satisfaction among college students, we know that ignoring major satisfaction will lead to less-than-optimal outcomes in career counseling (Sovet, Park, & Jung, 2014).

Major satisfaction is associated with both positive current outcomes and positive future outcomes for students. Students are less likely to drop out of school when they are satisfied with their majors (Nauta, 2007) and are more likely to have a higher GPA (Leach & Patall, 2013; McIlveen, Beccaria, & Burton, 2013; Nauta, 2007). Choosing a major students will be satisfied with may be easier for them than choosing a job they will be satisfied with, since major is more

temporally relevant. Together, these advantages suggest that major satisfaction is a relevant and important topic for career counseling.

It is important, then, to understand what predicts academic major satisfaction so that career counselors might best help students find majors that will fit for them. Almost all of the research around academic major satisfaction has focused on how individual differences contribute to students' major satisfaction. The most studied topic in this area is interest (Allen, 1996; Nadziger, Holland, & Gottfredson, 1975; Logue, Lounsbury, Gupta, & Leong, 2007; Tranberg, Slane, & Ekeberg, 1993). Intrinsic motivation for a subject (Deemer, 2015), personality (Logue et al., 2007), and patterns of thinking, such as counterfactual thinking (Dahling & Thompson, 2012; Leach & Patall, 2013), also have been linked to major satisfaction.

This research helps us understand what we should know about students who have come in for career counseling, in order to be able to direct them toward a major they will be satisfied with. What it does not tell us is what environmental characteristics are predictive of major satisfaction.

Academic Major Satisfaction and Self-Determination Theory

One promising model for understanding how environmental factors support major satisfaction is self-determination theory (SDT), a theory of motivation (Deci & Ryan, 1980, 1991; Baumeister, 1994). An important subset of SDT is basic psychological needs theory, which suggests that intrinsic motivation (motivation to act for the sake of the action itself, instead of an external reward) can lead to well-being in many domains. The theory also suggests that in order to be intrinsically motivated, we must perceive three needs as being met: volitional autonomy, competence, and relatedness. For these three needs to be met, factors in the

environment must support them. If these environmental supports are absent, students' needs are thwarted, and they are less happy and less effective.

The research connecting SDT and major satisfaction is limited, and the connections between the two are indirect. Jadidian & Duffy (2012) examined the relations between academic major satisfaction and work volition (which is conceptually related to perceived volitional autonomy, defined as the feeling that one is able to make one's own decisions despite barriers), and found that work volition positively predicted academic major satisfaction. Other researchers have explored the relations between academic major satisfaction and academic self-efficacy (which is conceptually related to perceived competence, defined as a student's feeling that he or she can be successful at academic tasks), and found that academic self-efficacy positively predicted academic major satisfaction (Larson, Toulouse, Ngumba, Fitzpatrick, & Heppner, 1994). The evidence that factors conceptually similar to perceived volitional autonomy and competence have been predictive of major satisfaction suggests that perceived volitional autonomy and perceived competence should be predictive of major satisfaction.

In another study, college students' experiences of volitional autonomy, competence, and relatedness in the classroom predicted student ratings of teachers and courses. Specifically, higher perceived volitional autonomy and competence predicted higher ratings of courses, and higher perceived volitional autonomy, competence, and relatedness predicted higher teacher ratings (Filak & Sheldon, 2003). This suggests that environmental support for needs is predictive of course and teacher satisfaction, and since classes are related to major satisfaction, it seems likely that perceived volitional autonomy, perceived competence, and perceived relatedness will also be predictive of major satisfaction. Additionally, researchers found that students in natural sciences courses reported lower perceived volitional autonomy and perceived relatedness than

those in social science or humanities classes (Filak & Sheldon, 2003). This suggests that there may be a difference in the way psychological needs are supported across academic subjects, and possibly across majors.

Additionally, academic major satisfaction is part of a larger concept of career well-being, which is influenced by perceptions of volitional autonomy, competence, and relatedness. For college students, choosing an academic major and engaging in the tasks of that major constitute the developmentally appropriate tasks that contribute to career well-being, since what major one chooses, how well one does in that major, and how satisfied one is in that major will contribute to a person's career path. One study has suggested that perceived volitional autonomy and perceived competence partially mediate the relation between environmental supports—namely, parental volitional autonomy support—and career well-being (Pesch, Larson, & Surapaneni, 2015). Additionally, perceptions of volitional autonomy, competence, and relatedness have been found to predict job satisfaction (which is conceptually related to major satisfaction; Boezeman & Ellemers, 2009; Gillet, Colombat, Michinov, Pronost, & Fouquereau, 2013).

The foregoing studies provide strong evidence that the extent to which needs (as defined by self-determination theory) are perceived to be met is a strong predictor of satisfaction in areas that are closely related to academic major satisfaction.

Environmental Supports for Academic Major Satisfaction

Even if we assume that college students' major satisfaction will be predicted by the extent to which they perceive their needs as being met, it is not enough to simply understand whether or not students perceive their needs as being met. A complete model of satisfaction also requires an understanding of the circumstances under which students perceive their needs as

being met. That is, we must understand which environmental factors contribute to the perception of needs being met.

There is some research that addresses environmental supports in academic major satisfaction. Some research suggests that the proportion of men and women in classes and in the major can affect satisfaction. Women tend to be more satisfied in science, technology, engineering, and math (STEM) majors when fewer men are in their classes, possibly because they feel a greater sense of belonging (Deemer, 2015). There is also evidence that a greater proportion of women in a department leads to increased major satisfaction within that department (Umbach & Porter, 2002). However, there is also evidence that the relation between proportion of women and student outcomes may be better accounted for by factors such as characteristics of students, aspects of the college environment, and effects of the major field (Sax, 1996). Data also suggests that departmental characteristics such as amount of faculty contact with students and emphasis on research can increase major satisfaction (Umbach & Porter, 2002).

Literature that seems relevant for understanding what environmental factors might predict major satisfaction includes that which uses environmental factors to predict college student outcomes, such as student retention. Some of this literature comes from the field of vocational psychology, and some of it comes from the field of education. Predicting these outcomes is not the same as predicting major satisfaction, but the outcomes are related. Major satisfaction has been linked to higher retention rates among college students (Nauta, 2007). If these environmental factors and major satisfaction have been shown to predict similar outcomes, then it is not illogical to conclude that environmental factors and major satisfaction will be related.

As discussed above, very few authors have examined the environment and major satisfaction. In identifying a way to conceptualize the college environment, a measure was located that has been conceptualized as institutional integration but is synonymous for the purposes of this study with campus environment. This measure is conceptualized as operationalizing the construct, institutional integration, and is embedded in a model developed by Vincent Tinto (1993). The model was originally developed with the purpose of predicting which students would drop out of college, and was intended to be comprehensive, including both individual differences and environmental factors. Within Tinto's model, environmental factors are conceptualized as institutional integration, which is essentially a student's perceptions of their academic and social environments, including both faculty and students. Tinto's model conceptualizes the reasons for student dropouts in an accurate and practical way, incorporating both individual differences and students' experiences of environmental factors. Tinto categorizes these experiences of environmental factors (or institutional experiences) as happening in two domains—the academic system and the social system.

The academic system includes support for academic growth and informal faculty/staff interactions. The social system includes extracurricular activities and informal peer group interactions. Since developing the model, Tinto has argued that academic integration (which is built through institutional experiences) is one of the most predictive factors of student retention (Tinto, 2007). Additionally, Tinto's model has been used extensively, and there is significant evidence that it can be used to effectively predict retention (e.g., Robbins et al., 2004; Chemers, Hu, & Garcia, 2001), as well as other student outcomes such as GPA (e.g., Richardson, Abraham, & Bond, 2012). Although Tinto's model conceptualizes environmental factors as falling into two categories (social and academic integration), recent research suggests that

environmental factors Tinto proposes as important might better be categorized as faculty integration and student integration (French & Oakes, 2004).

From the strong support for Tinto's model in the literature, we can conclude that the environmental factors Tinto proposes as useful for predicting retention (which have also been shown to be an effective predictor for other outcomes) might be useful in predicting other student outcomes—such as major satisfaction.

Considering the research on major satisfaction and its relations to the environment and to perceived autonomy, perceived competence, and perceived relatedness, I proposed that perceptions of volitional autonomy, competence, and relatedness would mediate the relation between academic environmental factors and academic major satisfaction. That is, environmental factors would directly predict perceptions of volitional autonomy, competence, and relatedness, which would predict academic major satisfaction. Additionally, environmental factors would directly predict major satisfaction. This led to the following prediction:

Hypothesis 1: A partially mediated model (Figure 1) presents a significantly better fit to the data than a fully mediated model (Figure 2).

Hypothesis 2: Major satisfaction is directly predicted by faculty integration (path b), student integration (path g), perceived autonomy (path i), perceived competence (path j), and perceived relatedness (path k), as seen in Figure 1.

Hypothesis 3: Perceived volitional autonomy is directly predicted by faculty integration (path a) and student integration (path e). Perceived competence is directly predicted by faculty integration (path c) and student integration (path f). Perceived relatedness is directly predicted by faculty integration (path d) and student integration (path h).

Hypothesis 4: Perceived autonomy mediates the relation between faculty integration and major satisfaction (path a, path i), and the relation between student integration and major satisfaction (path e, path i). Perceived competence mediates the relation between faculty integration and major satisfaction (path c, path j), and the relation between student integration and major satisfaction (path f, path j). Perceived relatedness mediates the relation between faculty integration and major satisfaction (path d, path k), and the relation between student integration and major satisfaction (path h, path k).

CHAPTER 2. LITERATURE REVIEW

The following literature review is intended to present a comprehensive overview of the research that is relevant to the present study. First, the theoretical framework for understanding the relationship between academic major satisfaction and environmental factors will be presented. Next, a review of the research on academic major satisfaction will be reported. Finally, the strategy this study will use to measure environmental factors will be discussed.

Self-Determination Theory

Self-determination theory (SDT) is a theory of motivation that may be useful for understanding how environmental factors relate to major satisfaction (Deci & Ryan, 1980, 1991; Baumeister, 1994). SDT is a multifaceted theory of motivation, but the piece that is most relevant for understanding the relation between the environment and major satisfaction is basic psychological needs theory (BPNT; Ryan & Deci, 2000). BPNT describes the relation between three needs (perceived volitional autonomy, perceived competence, and perceived relatedness) and well-being. In self-determination theory, perceived autonomy, perceived competence, and perceived relatedness are necessary for well-being; if any one of these needs is not met, well-being suffers. In the context of this theory, perceived autonomy is defined as the feeling that one is in charge of one's own actions and decisions; perceived competence is defined as the feeling that one is able to accomplish important tasks, even if they are difficult; and perceived relatedness is defined as the feeling that one is connected to important people in one's life. For these needs to be satisfied, the environment a person is in must support them. In the context of a major, for example, a student's autonomy need might not be met if the student were not allowed to choose which classes to take; his competence need might not be met if he felt unable to

succeed in his classes; and his relatedness need might not be met if he felt isolated from the other students in his classes.

There are conceptual reasons, supported by empirical evidence, to believe that SDT might predict academic major satisfaction. One aspect of well-being is career well-being, which has been operationalized as the presence of career satisfaction and the absence of career distress. For students in college, career well-being and major satisfaction are linked. The career tasks of a college student are choosing a major and succeeding in that major. This means that for students, career well-being is major well-being, and major well-being can be operationalized as the presence of academic major satisfaction and the absence of academic major distress. Since perceived autonomy, perceived competence, and perceived relatedness predict well-being, they should predict career well-being, and since they predict career well-being, they should predict major satisfaction. In one study, perceived autonomy ($\beta = .22$) and perceived competence ($\beta = .26$) partially mediated the relation between environmental supports—namely, parental autonomy support—and career well-being (Pesch et al., 2015). This suggests that perceived autonomy and perceived competence are related to career well-being and, therefore, major satisfaction. Approaching this topic through the lens of SDT, it is likely that if perceived autonomy and perceived competence are related to career well-being, perceived relatedness would be, too.

Basic psychological needs and academic major satisfaction. The research addressing the relation between SDT and major satisfaction focuses on the three basic psychological needs (perceived autonomy, perceived competence, and perceived relatedness). Correlations have been found between academic major satisfaction and perceived autonomy with rs of .33 and .38 (Leach, & Patall, 2013; Pesch et al., 2015). Perceived autonomy may also directly and indirectly

predict major satisfaction. In a mediation model, perceived volitional autonomy predicted academic major satisfaction directly ($\beta = .27$) and fully mediated the relation between mother's autonomy support and academic major satisfaction (Pesch et al., 2015), and in a regression predicting student's satisfaction with courses, perceived autonomy was a significant predictor ($\beta = .17$; Filak & Sheldon, 2003). Major satisfaction has also been related to constructs which are conceptually similar to volitional autonomy. Academic major satisfaction has been correlated with work volition ($r = .35$) and work locus of control $r = .35$, and in a mediation model, work volition predicted major satisfaction (with a coefficient of .23), and work locus of control predicted academic major satisfaction (with a coefficient of .23; Jadidian & Duffy, 2012).

Significant correlations have also been found between perceived competence and academic major satisfaction with rs of .32 and .45 (Leach & Patall, 2013; Pesch et al., 2015). In a mediation model, perceived competence directly predicted academic major satisfaction ($\beta = .22$; Pesch et al., 2015). Perceived competence also mediated the relation between father's autonomy support and academic major satisfaction, with father's autonomy support predicting perceived academic competence ($\beta = .29$; Pesch et al., 2015). In a regression predicting students' satisfaction with courses, perceived competence was a significant predictor ($\beta = .59$; Filak & Sheldon, 2003).

Self-efficacy (the belief that one can accomplish a task despite potential barriers) is conceptually related to perceived competence (the belief that one can be successful at a task, even if it is challenging), so the evidence that supports a link between self-efficacy and major satisfaction can also be considered as evidence to support a link between perceived competence and major satisfaction.

There is evidence that self-efficacy and major satisfaction are related. Academic major satisfaction and career decision-making self-efficacy have been correlated, with rs ranging from .24 to .47 (Jadidian & Duffy, 2012; Komarraju, Swanson, & Nadler, 2013; Nauta, 2007; Sovet et al., 2014). Career decision self-efficacy has also predicted major satisfaction in a regression (β = .23; Komarraju et al., 2013). Additionally, major satisfaction has been correlated with general self-efficacy ($r = .21$; McIlveen et al., 2013).

Major satisfaction has also been related to constructs that are conceptually similar to self-efficacy. Academic major satisfaction has been correlated with work volition ($r = .35$) and work locus of control ($r = .35$), and in a mediation model, work volition predicted major satisfaction (with a coefficient of .23), and work locus of control predicted academic major satisfaction (with a coefficient of .23; Jadidian & Duffy, 2012).

Although relatively little research has been done on the relations between perceived autonomy, perceived competence, and major satisfaction, even less has been done on the relation between perceived relatedness and major satisfaction. This may be because perceived relatedness is not seen as important by researchers in this area. It is also possible that some researchers have included relatedness in their initial data collection but have not published their results about relatedness because those results were not significant.

Although I was unable to find any articles directly linking perceived relatedness with major satisfaction, there were some articles that link perceived relatedness to other student outcome variables. One of these studies predicts students' satisfaction with classes and students' satisfaction with instructors in a regression. There was no significant relation between perceived relatedness and students' satisfaction with courses; however, perceived relatedness did predict students' satisfaction with instructors ($\beta = .17$; Filak & Sheldon, 2003). Additionally, in a meta-

analysis, social support (which is conceptually related to relatedness) was significantly related to retention of college students ($r = .20$, $k = 26$; Robbins et al., 2004). Students' perceptions of affiliation in a classroom, or their sense that the classroom is supportive, cooperative, and student focused (attributes that are similar to relatedness), also are positively correlated with major satisfaction ($r = .13$), and in a moderated mediation model, perceptions of affiliation predicted major satisfaction ($\beta = .58$; Deemer, 2015).

Taken as a whole, the research connecting perceived autonomy, perceived competence, and perceived relatedness with major satisfaction and other academic outcomes supports the proposition of the present study that SDT will provide a good theoretical framework for understanding the relation between environmental factors and major satisfaction. However, given the limited research connecting perceived autonomy, perceived competence, and perceived relatedness and major satisfaction, the following research connecting perceived autonomy, perceived competence, and perceived relatedness with job satisfaction is presented, in order to make a stronger case for the use of SDT in a vocational context.

Basic psychological needs and job satisfaction. Not much research has been done relating SDT to major satisfaction, but there has been a significant amount of research connecting major satisfaction and job satisfaction. Major satisfaction and job satisfaction are conceptually related, so evidence that supports a relation between basic psychological needs and job satisfaction can also be used to support the idea that there will be a relation between basic psychological needs and major satisfaction.

For the most part, perceived autonomy, perceived competence, and perceived relatedness have been considered as separate constructs in the research on job satisfaction. In one study, however, they were considered together as basic psychological needs. In this study, higher

perceptions of these needs being met predicted higher work satisfaction in a structural equation model (β = .30; Gillet et al., 2013).

Perceived autonomy has been correlated with job satisfaction, with *r*s between .17 and .45 (Boezeman & Ellemers, 2009; Gillet et al., 2013; Guntert, 2015), and in a multiple mediation analysis predicting job satisfaction, the total effect of autonomy-supportive leadership on job satisfaction was significant (β = .31; Guntert, 2015). Moreover, in a stepwise regression predicting job satisfaction using perceived autonomy, relatedness, and competence, perceived autonomy was a significant predictor of job satisfaction for volunteer workers (β = .31; Boezeman & Ellemers, 2009).

Perceived competence has been shown to be related to job satisfaction. In a meta-analysis, the mean correlation between job satisfaction and self-efficacy was r = .38 (k = 12; Judge & Bono, 2001). However, in one study, perceived competence did not predict job satisfaction among volunteer workers (Boezeman & Ellemers, 2009).

Perceived relatedness also seems to be related to job satisfaction. A meta-analysis found consistent positive relations between social integration (a dynamic and structured process that is intended to bring people together as a social group) at work and job satisfaction; across eight types of social integration, r ranged from .14 to .40, with ks ranging from 10 to 14 (Saks, Uggerslev, & Fassina, 2006). It is likely that social integration would foster relatedness in a group, increasing a group's sense of relatedness and job satisfaction. Perceived relatedness has also been correlated with job satisfaction among volunteers (r = .60; Boezeman & Ellemers, 2009). Additionally, in a stepwise regression predicting job satisfaction using perceived autonomy, perceived relatedness, and perceived competence, perceived relatedness was a significant predictor of job satisfaction for volunteers (β = .44; Boezeman & Ellemers, 2009).

Moderate effect sizes connecting perceived autonomy, perceived competence, and perceived relatedness with job satisfaction show that the three basic psychological needs predict job satisfaction. Given that they predict job satisfaction, major satisfaction, and other academic outcome variables, it seems reasonable to view SDT as an appropriate lens for approaching the relation between environmental factors and academic major satisfaction. Following is a review of the literature that addresses major satisfaction, including a review of the literature connecting major satisfaction and environmental factors.

Academic Major Satisfaction

Outcomes. Academic major satisfaction has been shown to be related to important outcomes, including grade point average (GPA) and persistence in a major. Major satisfaction was significantly correlated with GPA, with rs between .11 and .35 (Leach & Patall, 2013; McIlveen et al., 2013; Nauta, 2007). These correlations are not large, but they are consistently significant across studies. Major satisfaction may also predict student persistence; in one study, major satisfaction was significantly higher for those who remained in their majors than for those who didn't ($t[102] = 3.44$, $p = .001$, $d = .74$), and each item in the measure of major satisfaction had an effect size of .50 to .70 in differentiating between those who stayed in their major and those who didn't (Nauta, 2007).

Additionally, major satisfaction is related to other positive outcomes for students. In a Korean sample, academic major satisfaction was correlated with life satisfaction ($r = .39$) and positive affect ($r = .21$; Sovet et al., 2014). Major satisfaction has also been negatively correlated with negative affect in two different samples, resulting in rs of $-.25$ and $-.23$ (Dahling & Thompson, 2012; Sovet et al., 2014). In a mediation model, negative affect had a direct effect on major satisfaction ($b = -.17$), and negative affect also fully mediated the relation between

maximization (focusing on making the best possible decision) and academic major satisfaction, as can be seen through the change in *b* with the addition of negative affect as a mediator from significant to nonsignificant ($b = -.21$ to $b = -.16$; Dahling & Thompson, 2012). Major satisfaction predicted intrinsic motivation to learn science in a moderated mediation model ($b = .44$; Deemer, 2015). Finally, academic major satisfaction has also been correlated with career choice satisfaction ($r = .43$; McIlveen, Burton, & Beccaria, 2013). Overall, effect sizes between major satisfaction and positive outcomes for students are moderate, suggesting a positive relation between major satisfaction and positive student outcomes.

Demographic variables. Demographics have been shown to relate to major satisfaction in some studies. Gender and ethnicity and grade point average (GPA) differentially affected major satisfaction in one study. Identifying as female and identifying as Asian both predicted lower academic major satisfaction scores in a multilevel model (with slope coefficients of $-.13$ and $-.18$, respectively), while a higher cumulative GPA predicted higher major satisfaction scores (with a slope coefficient of .21; Umbach & Porter, 2002).

In a comparison of major satisfaction between a Korean sample and an American sample, the Korean sample had a significantly lower mean major satisfaction than the American sample ($t[523] = 8.19$, $p < .001$, $\eta^2 = .11$; Nauta, 2007; Sovet et al., 2014). There may also be differences in average satisfaction across schools. In one study, significant differences were found in satisfaction between a suburban liberal arts college and a large state university ($F = 30.77$; Nadziger et al., 1975).

Time in school also may be related to major satisfaction. In a paired samples *t*-test comparing students' satisfaction scores across a year, academic major satisfaction was higher at the end of the year than at the beginning of the year ($t[44] = 2.07$, $p = .04$), both for students who

stayed in their majors and for students who switched majors (Nauta, 2007). Overall, the effect sizes relating major satisfaction and demographics are low.

Individual differences. The majority of the research that has been done in the academic major satisfaction literature has examined individual differences. That is, most of the research about academic major satisfaction has been about what intrapersonal factors are related to or can be used to predict academic major satisfaction.

There has also been a significant amount of research done identifying links between personality and academic major satisfaction. Several studies have examined relations between academic major satisfaction and Big 5 personality variables. Openness has been modestly correlated with major satisfaction in one study ($r = .14$; McIlveen et al., 2013). Relatively consistent correlations have been found between conscientiousness and academic major satisfaction, with rs between .13 and .24 (Logue et al., 2007; McIlveen et al., 2013; Pozzebon, Ashton, & Visser, 2014). Correlations have been found for extraversion and major satisfaction (rs between .15 and .27), and in a multiple regression, extraversion predicted major satisfaction ($\beta = .16$; Logue et al., 2007; Pozzebon, Ashton, & Visser, 2014). Correlations have also been found between agreeableness and major satisfaction, with rs between .12 and .14 (McIlveen et al., 2013; Pozzebon, Ashton, & Visser, 2014), and between neuroticism and major satisfaction, with rs between .14 and .21 (Logue et al., 2007; McIlveen et al., 2013). Additionally, assertiveness (a subfactor of extraversion) has been correlated with major satisfaction ($r = .24$; Logue et al., 2007). Finally, a stepwise regression predicting major satisfaction with optimism, conscientiousness, and extraversion has a multiple R of .384 (Logue et al., 2007). In summary, there is evidence that major satisfaction and the Big 5 variables are related; however, the effect sizes are consistently small.

There has also been research connecting the personality traits of optimism, flexibility, emotionality, and indecisiveness with major satisfaction. Career optimism has been correlated with major satisfaction, with rs between .21 and .28 (Logue et al., 2007; McIlveen et al., 2013), and in a path model, academic major satisfaction was predicted by career optimism, with a standardized regression weight of .29 (McIlveen et al., 2013). Career adaptability (a measure of flexibility) has been correlated with major satisfaction ($r = .35$; McIlveen et al., 2013). An analysis of variance comparing social science majors and natural science majors in terms of flexibility and major satisfaction found that social science majors who were more, as opposed to less, flexible were also more satisfied, but that natural science majors who were less, as opposed to more, flexible were more satisfied ($F = 4.56$, df = 2,112, $p < .05$; Sherrick, Davenport, & Colina, 1971). In a multiple regression, the personality trait emotionality was found to predict major satisfaction ($\beta = -.12$; Pozzebon, Ashton, & Visser, 2014). Finally, major satisfaction was found to negatively correlate with generalized indecisiveness ($r = -.30$; Nauta, 2007).

Holland's theory of vocational choice is another area where a significant amount of research about major satisfaction has been done (Holland, 1985; 1996). The theory posits that people will be more satisfied with their vocations if they work in environments that allow them to express their interests. Most of the research in this area has focused on congruence, or how well someone's interests match up with the environment the person works in. Some studies have found that there is not a significant relation between congruence and major satisfaction. A 1993 meta-analysis found that across five studies looking at congruence and major satisfaction, the mean r was .095, which was not significant (Tranberg et al., 1993). Since that meta-analysis, another study has found that in a multiple regression, congruence was not predictive of major satisfaction ($\beta = -.10$; Pozzebon, Ashton, & Visser, 2014).

However, there have also been recent studies that have found significant relations between congruence and major satisfaction. In one study, a significant correlation was found between congruence and major satisfaction among music therapy majors ($r = .37$; Allen, 1996). Additionally, among business majors, major satisfaction was negatively correlated with realistic interests ($r = -.26$), investigative interests ($r = -.16$), and artistic interests ($r = -.18$), which provides support for the hypothesis that congruence and major satisfaction are related, since those themes would not be expected to be congruent with a business major (Logue et al., 2007). Additionally, a regression predicting major satisfaction among the same business major sample found that when realistic interest was added to a stepwise regression predicting major satisfaction using Big 5 personality factors, the resulting multiple R was .492, and adding the realistic interest theme into the regression resulted in a change in R^2 of .065 (Logue et al., 2007).

Finally, identity (the extent to which a student has a clear and stable sense of his or her interests, goals, and abilities) is another construct important in Holland's vocational theory that has been related to major satisfaction. Among a sample of music therapy majors, major satisfaction was correlated with identity ($r = .56$). And in a multiple regression predicting major satisfaction with identity, consistency, congruence, and differentiation as predictors ($R^2 = .36$), the only significant predictor in the model was identity ($\beta = .554$; Allen, 1996).

Other research has addressed the relation between different patterns of thinking and major satisfaction. Maximizing (focusing on making the single best possible decision, making doubt and regret about decisions more likely) has been negatively correlated with academic major satisfaction, with rs of $-.23$ and $-.25$ (Dahling & Thompson, 2012; Leach & Patall, 2013). However, as noted above, in a mediation model, negative affect fully mediated the relationship between maximizing and major satisfaction (Dahling & Thompson, 2012). There was also a

strong negative correlation between major satisfaction and counterfactual thinking, or thinking about other possible decisions/outcomes after a decision has been made ($r = -.71$; Leach & Patall, 2013). In a hierarchical regression, counterfactual thinking predicted major satisfaction ($\beta = -.70$) and was the only significant predictor of major satisfaction, after maximizing and major college were accounted for, in a model in which $R^2 = .50$ (Leach & Patall, 2013). The strength of the relation between counterfactual thinking and major satisfaction suggests that the two constructs may be very similar. Conceptually, this is not surprising, since being satisfied with your major might mean that you do not ruminate about whether another major would have been better, while a tendency to engage in counterfactual thinking might mean that you often ruminate about whether another major might have been better.

There have been several other career-related variables that have been shown to relate to major satisfaction. In a mediation analysis, perceived career information knowledge gain after taking a Careers in Psychology course fully mediated the relation between career decision self-efficacy and major satisfaction ($\beta = .40$), which can be see through the decrease in β for career decision self-efficacy from .23 (significant) to .10 (nonsignificant) with the addition of perceived career information knowledge gain (Komarraju et al., 2013). Likewise, perceived career knowledge has been correlated with major satisfaction ($r = .11$; McIlveen et al., 2013). Academic major satisfaction has also been negatively correlated with career choice anxiety ($r = -.50$; Nauta, 2007). In a hierarchical multiple regression, occupational engagement, defined as both gathering information to make a specific occupational decision and gathering information to make potential future occupational decisions, predicted major satisfaction ($\beta = .25$; Cox, Krieshok, Bjornsen, & Zumbo, 2015).

In short, academic major satisfaction has been shown to have small to moderate relations with student outcomes such as GPA and student persistence, as well as with demographics. Major satisfaction has also been shown to be moderately related to individual differences, including some personality variables, but not the Big 5. There may also be a relation between major satisfaction and congruence (as defined by Holland), but if there is, its effect is small. Cognitive behaviors have also been found to have a moderate to large relation with major satisfaction. Taken together, this indicates that while individual differences are related to and do predict major satisfaction, they do not account for all the variance in major satisfaction.

Environmental factors. Although most of the research done about academic major satisfaction has focused on individual differences, some research has addressed the relation between environmental factors and major satisfaction.

Factors that differ across departments and classrooms may be related to major satisfaction. In a survey of alumni, grant dollars per full-time instructional faculty predicted major satisfaction in a multilevel model (slope coefficient: .06 (.02), $p < .01$; Umbach & Porter, 2002). Additionally, satisfaction with the types of classes and the availability of classes within a department predicted major satisfaction in a regression model (R^2s of .52 and .55, respectively; Corts, Lounsbury, Surdargas, & Tatum, 2000). Additionally, the classroom environment itself may be related to major satisfaction.

Differences in gender composition across departments may be related to major satisfaction. In one study, the correlation between women's major satisfaction and the proportion of women in that major was $r = .05$, which, while very small, was significant (Sax, 1996). However, in that same study, in a blocked stepwise regression, the beta for the proportion of women predicting women's major satisfaction was reduced from $\beta = .06$ to $\beta = .02$ with the

addition of institutional gender composition (Sax, 1996). A 2002 study found that in a multilevel model, the proportion of female undergraduates in a department trended toward positively predicting academic major satisfaction in that department, although that trend was not significant (slope coefficient: .37 (.21), $p < .10$; Umbach & Porter, 2002).

Perceptions of barriers have also been negatively related to major satisfaction. In a Lithuanian sample, perception of internal barriers was negatively correlated with major satisfaction ($r = -.35$). Additionally, in a regression predicting major satisfaction, higher perceptions of internal barriers predicted lower major satisfaction ($\beta = -.27$; Urbanaviciute, Pociute, Kairys, & Liniauskaite, 2016).

Together, these results indicate that some environmental factors have a relation with major satisfaction. The relation of some environmental factors (gender composition in the department, amount of grant funds in the department) to major satisfaction is smaller, while the relation of others (type and availability of classes, positive interpersonal experiences in classes, perceptions of internal barriers) is larger. The dearth of research done about the academic environment and the positive findings in the research that has been done suggest that there is a need for more research about the academic environment. This research is needed particularly in the context of exploring more fully which environmental factors are predictive of major satisfaction and the extent to which those variables are predictive. It is also important for this research to be intentional about measuring environmental factors, making sure to approach the issue from a theoretical perspective.

Measuring Environmental Factors

As discussed above, very few authors have examined the environment and major satisfaction. In identifying a way to conceptualize the college environment, a measure was

located that has been conceptualized as institutional integration but is synonymous, for the purposes of this study, with campus environment. This measure is conceptualized as operationalizing the construct of institutional integration and is embedded in a model developed by Vincent Tinto (1993). The model was originally developed with the purpose of predicting which students would drop out of college, and was intended to be comprehensive, including both individual differences and environmental factors. Within Tinto's model, environmental factors are conceptualized as institutional integration, which is essentially a student's perceptions of her academic and social environments, including both faculty and students.

The research that has been done about institutional integration overall provided some evidence that it was related to student retention, although there is no evidence directly linking institutional integration and major satisfaction. Authors of a conceptual review of six studies that used institutional integration as a predictor variable showed that in all six studies, institutional integration made a significant contribution to explaining variance in retention (Terenzini & Pascarella, 1980). Additionally, institutional integration has been correlated with academic motivation ($r = .46$) and intention to stay and graduate at a student's current institution ($r = .31$; Isacco & Morse, 2015). However, some results suggest that institutional integration may not be related to GPA. In a meta-analysis that focused on studies predicting GPA and included 18 institutional integration studies, the authors found no significant correlations of institutional integration and GPA ($r = .04$, $k = 18$; Richardson et al., 2012). Further evidence offered about the connections between academic outcomes and institutional integration is further subdivided into academic integration (perceptions of experiences in the academic environment at college) and social integration (perceptions of experiences in the social environment at college).

Academic integration. Academic integration has not been directly related to major

satisfaction but has been related to other student outcomes that are related (either conceptually or

empirically) to major satisfaction. Academic integration has been correlated with university

satisfaction ($r = .16$; Barry & Okun, 2012) and with first-year GPA ($r = .34$; Clark, Middleton,

Nguyen, & Zwick, 2014). However, in a 2012 meta-analysis, the overall correlation between

GPA and academic integration was nonsignificant ($r = .07$, $k = 11$; Richardson, Abraham, &

Bond, 2012). Additionally, in a multinomial logistic regression, academic integration predicted

persistence, relative to nonpersistence ($B = .089$ (.043); Wald = 4.367; Mamiseishvili & Deggs,

2014).

Social integration. Like academic integration, social integration has not been directly

related to major satisfaction but has been related to other student outcomes that are related to

major satisfaction. Social integration has been correlated with goals commitment ($r = .25$) and

university satisfaction ($r = .35$; Barry & Okun, 2012). Additionally, in meta-analyses, social

support—conceptually related to social integration—was significantly related to college student

retention ($r = .20$, $k = 26$; Robbins et al., 2004). In contrast, in a 2012 meta-analysis, the overall

correlation between social integration and GPA was nonsignificant ($r = .04$, $k = 15$; Richardson,

Abraham, & Bond, 2012).

Psychometric properties of measure. The scale that will be used as a measure of

environmental factors in this study—the Institutional Integration Scale (IIS)—was originally

developed by Pascarella & Ternzini (1980) and revised by French & Oakes (2004). The original

IIS contains 30 items and five subscales: Peer-Group Interactions, Interactions with Faculty,

Faculty Concern for Student Development and Teaching, Academic and Intellectual

Development, and Institutional and Goal Commitment. French & Oakes (2004) revised the scale

by examining internal consistency, using item analysis, examining intercorrelations among the subscales, and using confirmatory factor analysis. During this process, researchers reworded negatively worded items to be positive, rewrote items for readability, and added back four items that had been removed in initial scale development. The revised scale contains five subscales, and the scale comprises two factors that are measured using the five subscales: faculty integration and student integration.

The reliability of the revised scale ($\alpha = .92$) was markedly better than the reliability of the original scale ($\alpha = .83$). Additionally, the reliabilities of the subscales improved from the original subscale to the revised subscale: reliabilities for the original subscale ranged from $\alpha = .61$ to $\alpha = .86$, while for the revised subscales, the αs are .84, .89, .88, .82, and .76, respectively. Item analysis was used to compare item discrimination indices, and the revised scale showed better discrimination indices (M = .50, SD = .10) when compared with the original scale (M = .36, SD = .12), which suggests that the revised scale discriminated between those with low and high levels of integration better than the original scale did. Intercorrelations for the original scale ranged from .19 to .33, and for the second scale from .57 to .70. This suggests that the revised scale measures constructs that are more related than those measured by the original scale; however, the intercorrelations for the revised scale are high enough to suggest that some of the subscales may be measuring the same construct instead of related but similar constructs. Finally, confirmatory factor analysis found that a model with two latent factors of faculty integration and student integration was a good fit (S-B $\chi^2[4] = 9.08$, $p > .05$, RMSEA = .06, GFI = .99, CFI = .99), with faculty integration comprising the Interactions with Faculty and Faculty Concern for Student Development and Teaching subscales, and student integration comprising Academic and Intellectual Development, Peer-Group Interactions, and Institutional and Goal Commitment. The

revised IIS as a whole has been correlated with student intentions to stay at and graduate from the student's current institution ($r = .31$; Isacco & Morse, 2015). Overall, these findings suggest that the revised version of the Institutional Integration Scale is reliable and valid enough to be used in the present study.

Basic Psychological Needs and the Environment

Finally, it is important to review the research that we can use to draw links between environmental factors (especially academic and social integration, but other environmental factors as well) and SDT in order to support the hypotheses that environmental factors will predict perceived autonomy, perceived competence, and perceived relatedness, and that SDT will mediate the relation between environmental factors and major satisfaction.

Class size has been correlated with perceived autonomy ($r = -.39$), perceived competence ($r = -.36$), and perceived relatedness ($r = -.18$; Filak & Sheldon, 2003). Teacher characteristics also have been correlated with basic psychological needs in a classroom context. Instructor's experience teaching a course was correlated with perceived autonomy ($r = -.61$), and perceived relatedness ($r = -.75$; Filak & Sheldon, 2003). This suggests that environmental variables in the classroom are related to student perceptions of autonomy, competence, and relatedness.

The Present Study

The goal of the present study was to begin filling the gaps in knowledge about major satisfaction that exist especially in the context of environmental factors. Although research has found that individual differences account for some of the variance in major satisfaction, they do not account for all of it, and the current research examining environmental factors does not do an adequate job of filling the gaps in knowledge. The theoretical framework that was used in this study to understand the relations between environmental factors and major satisfaction is self-

determination theory, in which perceived autonomy, perceived competence, and perceived relatedness predict well-being and are predicted in turn by environmental factors. There is very little research connecting perceived autonomy, perceived competence, and perceived relatedness to major satisfaction. However, in the research that exists on this relation, and on the relation between basic psychological needs and job satisfaction, the effect sizes are consistently moderate, which suggests that perceived autonomy, perceived competence, and perceived relatedness will predict major satisfaction. Finally, there is research suggesting that Tinto's conceptualization of the academic environment, as measured by French & Oakes (2004), is related to academic outcomes and to perceived autonomy, perceived competence, and perceived relatedness. As a whole, the findings in the above literature support the following hypotheses:

Hypothesis 1: A partially mediated model presents a better fit to the data than a fully mediated model.

Hypothesis 2: Environmental factors (faculty factors and student factors) and the three psychological needs (perceptions of volitional autonomy, competence, and relatedness) directly predict major satisfaction.

Hypothesis 3: Perceptions of volitional autonomy, competence and relatedness are predicted by environmental factors (both faculty and student factors).

Hypothesis 4: Perceptions of volitional autonomy, competence, and relatedness mediate the relations between environmental factors (both faculty and student factors) and major satisfaction.

CHAPTER 3. METHODS

Design

The design is a cross-sectional correlational design. The predictor variables are faculty

integration, peer-group integration, academic and intellectual development, institutional goal

commitment, perceived volitional autonomy, perceived competence, and perceived relatedness.

The main criterion variable is academic major satisfaction, and the mediator variables are basic

psychological needs—perceived volitional autonomy, perceived competence, and perceived

relatedness. Figure 2 shows the predicted relations between variables.

Participants

The target population for this study is undergraduate college students. The sample is

college students in introductory psychology courses who are receiving extra credit for taking the

survey. The sample was collected in the fall semester of 2016 from undergraduates in

introductory psychology courses at Iowa State University. The study was offered along with

other research studies on Sona and participants had the opportunity to earn one credit for every

30 minutes they spend on a study (based on the Department of Psychology's research

participation program).

To find a medium effect at a power of .80 and $p < .05$ for structural equation modeling,

sample size varies from 20 per observed variable (Mueller, 1997) to at least 200 (Chou and

Bentler, 1995). Given that the present study involved six observed variables, the minimum

sample size needed is 120. The expected participation rate for the present study was 50%, so we

sampled 300 participants.

Participants are 332 college students from a large Midwestern university. The age range

is 18–41, of which 36.1% are 18, 27.4% are 19, 17.5% are 20, and 9.6% are 21. The other 8.8%

are 22–41. Self-reported racial and ethnic groups are 5.1% African American, 5.4% Asian

American/Pacific Islander, 74.7% Caucasian/White, 4.2% Hispanic or Latino/a, 0.3% Native

American, and 9% other; 1.2% preferred not to answer. By year in school, 41.3% are first years,

29.8% are second years, 17.8% are juniors, and 9.6% are seniors; another 1.5% identified as

other. Participants also indicated whether they had declared a major: 80.1% had declared a

major, 19.3% had not, and 0.6% preferred not to answer. By sex, 69% of participants are female,

and 31% are male.

Measures

      Faculty integration. Faculty integration was measured by combining two subscales of

the Institutional Integration Scale (IIS), which measures students' experiences in the college

environment (French & Oakes, 2004; Pascarella & Terenzini, 1983). These two scales were

combined to create a faculty integration scale based on work by French and Oakes (2004), who

demonstrated through confirmatory factor analysis (CFA) that the best model that was consistent

with theory was combining the two faculty scales into one scale. The first subscale used to

measure faculty integration was Interactions with Faculty, which measures students' experiences

of interacting with faculty in formal and informal contexts. The scale is five items and uses a

five-point Likert scale, which ranges from 1 (strongly disagree) to 5 (strongly agree), where a

higher score indicates more positive experiences of interacting with faculty in formal and

informal contexts. The internal consistency for this subscale was $\alpha = .89$ (French & Oakes,

2004). This subscale was correlated with other measures on the IIS: peer-group interaction ($r =$

.42), academic and intellectual development ($r = .50$), and institutional and goal commitment (r

$= .23$; French & Oakes, 2004).

The second subscale used to measure faculty integration was Faculty Concerns for Student Development and Teaching, which measures students' experiences of faculty's concern for their academic growth. The scale is five items and uses a five-point Likert scale, which ranges from 1 (strongly disagree) to 5 (strongly agree), where a higher score indicates a more positive experience of faculty concern for student academic growth. The internal consistency for this subscale was $\alpha = .88$ (French & Oakes, 2004). This subscale is correlated with the Interactions with Faculty subscale ($r = .66$), which suggests that it makes sense to use them together to measure one construct. This subscale was correlated with other measures on the IIS: peer-group interaction ($r = .41$), academic and intellectual development ($r = .49$), and institutional and goal commitment ($r = .44$; French & Oakes, 2004). Both sets of items are presented in Appendix A. The reliability for the two subscales combined in this sample was .90.

Student integration. Student integration was measured by combining three subscales of the Institutional Integration Scale (IIS), which measures students' experiences in the college environment (French & Oakes, 2004; Pascarella & Terenzini, 1983). As stated above, the CFA performed by French & Oakes demonstrated that the three student scales fit best into a two-factor model with faculty integration as one factor and student integration as the second factor. These three scales were combined to create a faculty integration scale as suggested by the factor analysis conducted when developing the subscales (French & Oakes, 2004). The first subscale used to measure student integration was Peer-Group Interaction (French & Oakes, 2004; Pascarella & Terenzini, 1983). This subscale measures students' experiences of their peers in college. It consists of 10 items and uses a five-point Likert scale, which ranges from 1 (strongly disagree) to 5 (strongly agree), where a higher score indicates a more positive experience of interacting with peers in college. The internal consistency was $\alpha = .84$ (French & Oakes, 2004).

This subscale was correlated with other measures on the IIS: interactions with faculty ($r = .42$), faculty concerns for student development and teaching ($r = .41$), academic and intellectual development ($r = .52$), and institutional and goal commitment ($r = .45$; French & Oakes, 2004).

Next, the Academic and Intellectual Development subscale of the ISS was used (French & Oakes, 2004; Pascarella & Terenzini, 1983). This subscale measures students' experiences of support for their academic and intellectual growth in college. It consists of eight items and uses a five-point Likert scale, which ranges from 1 (strongly disagree) to 5 (strongly agree), where a higher score indicates a more positive experience of support for student academic and intellectual growth. The internal consistency for this subscale was $\alpha = .82$ (French & Oakes, 2004). This subscale was correlated with other measures on the IIS: interactions with faculty ($r = .50$), faculty concerns for student development and teaching ($r = .49$), peer-group interaction ($r = .52$), and institutional and goal commitment ($r = .44$; French & Oakes, 2004).

Finally, the Institutional and Goal Commitment subscale of the ISS was used (French & Oakes, 2004; Pascarella & Terenzini, 1983). This subscale measures students' experiences of their academic institution as a whole. It consists of eight items and uses a five-point Likert scale, which ranges from 1 (strongly disagree) to 5 (strongly agree). The internal consistency was $\alpha = .76$ (French & Oakes, 2004). This subscale was correlated with other measures on the IIS: interactions with faculty ($r = .23$), faculty concerns for student development and teaching ($r = .31$), academic and intellectual development ($r = .44$), and peer-group interaction ($r = .45$; French & Oakes, 2004). Items for the three subscales appear in Appendix B. The reliability for the three subscales combined in this sample was .91.

Perceived volitional autonomy. Perceived volitional autonomy was measured using the Volitional Autonomy subscale of the Balanced Measure of Psychological Needs (BMPN) scale

(Sheldon & Hilpert, 2012). The Volitional Autonomy subscale consists of six items—three items measuring whether the volitional autonomy need is met (e.g., I was free to do things my own way) and three items measuring whether the volitional autonomy need is unmet (e.g., there were people telling me what I had to do). After negatively worded items are reverse scored, the items can be averaged so that a higher score means more perceived volitional autonomy. Positively worded items can be averaged so that a higher score means more satisfaction with perceived volitional autonomy, and negatively worded items can be averaged so that a higher score means more dissatisfaction with perceived volitional autonomy. The subscale of Volitional Autonomy was found to have an overall internal consistency of $\alpha = .78$ (Sheldon & Hilpert, 2012); the positively worded volitional autonomy items had an internal consistency of $\alpha = .69$, and the negatively worded items an internal consistency of $\alpha = .72$. In a regression predicting subjective well-being, volitional autonomy predicted subjective well-being ($\beta = .22$, $p < .01$; Litalien & Guay, 2012). The full subscale appears in Appendix C. In this sample, the reliability for the Volitional Autonomy subscale as a whole was .69. The reliability for the positively worded items was .80, and for the negatively items was .75. Because the positively and negatively worded items produced higher reliabilities than the subscale as a whole, all analyses were conducted using the positively and negatively worded items separately.

Perceived competence. Perceived competence was measured using the competence subscale of the BMPN (Sheldon & Hilpert, 2012). The competence subscale consists of six items—three items measuring whether the competence need is met (e.g., I took on and mastered hard challenges) and three items measuring whether the competence need is unmet (e.g., I struggled doing something I should be good at). After negatively worded items are reverse scored, the items can be averaged so that a higher score means more perceived competence.

Positively worded items can be averaged so that a higher score means more satisfaction with perceived competence, and negatively worded items can be averaged so that a higher score means more dissatisfaction with perceived competence. The Competence subscale was found to have an overall internal consistency of α = .79; the positively worded competence items had an internal consistency of α = .71, and the negatively worded items an internal consistency of α = .70 (Sheldon & Hilpert, 2012). In a regression predicting subjective well-being, competence predicted subjective well-being (β = .46, p < .01; Litalien & Guay, 2012). The full subscale appears in Appendix D. In this sample, the reliability for the Competence subscale as a whole was .69. The reliability for the positively worded items was .80, and for the negatively items was .75. Because the positively and negatively worded items produced higher reliabilities than the subscale as a whole, all analyses were conducted using the positively and negatively worded items separately.

An additional measure was used to measure perceived competence: the academic self-efficacy subscale of the Coping with Career Indecision Scale (Larson, Toulouse, Ngumba, Fitzpatrick, & Heppner, 1994) was used to measure perceived academic competence, or beliefs about one's ability to succeed academically. The academic self-efficacy subscale is a four-item Likert scale, where higher scores indicate greater perceptions of academic competence. The scale has an internal consistency of α = .71 and appears to be moderately positively related to GPA, aptitude and investigative interests, career certainty, and vocational identity, and negatively related to career indecision (Larson et al., 1994). The subscale appears to be stable over a two-week period (r = .84, p < .01; Litalien & Guay, 2012). The full subscale appears in Appendix E. The reliability for this sample for this scale was .67. Since the reliability of this subscale was

relatively low, especially when compared with the other measures of perceived competence, it was not used in further analyses.

Perceived relatedness. Perceived relatedness was measured using the relatedness subscale of the BMPN (Sheldon & Hilpert, 2012). The Relatedness subscale consists of six items—three items measuring whether the relatedness need is met (e.g., I felt a sense of contact with people who care for me) and three items measuring whether the relatedness need is unmet (e.g., I felt unappreciated by one or more important people). After negatively worded items are reverse scored, the items can be averaged so that a higher score means more perceived relatedness. Positively worded items can be averaged so that a higher score means more satisfaction with perceived relatedness, and negatively worded items can be averaged so that a higher score means more dissatisfaction with perceived relatedness. The Relatedness subscale was found to have an overall internal consistency of $\alpha = .78$; the positively worded relatedness items had an internal consistency of $\alpha = .71$, and the negatively worded items an internal consistency of $\alpha = .85$ (Sheldon & Hilpert, 2012). In a regression predicting subjective well-being, relatedness predicted subjective well-being ($\beta = .24$, $p < .01$; Litalien & Guay, 2012). The subscale appears in Appendix F. In this sample, the reliability for the relatedness subscale as a whole was .68. The reliability for the positively worded items was .87, and for the negatively items was .79. Because the positively and negatively worded items produced higher reliabilities than the subscale as a whole, all analyses were conducted using the positively and negatively worded items separately.

Academic major satisfaction. The Academic Major Satisfaction Scale (AMSS; Nauta, 2007) is a unidimensional scale consisting of six Likert-scaled questions from 1 (strongly disagree) to 5 (strongly agree), where a higher score indicates greater satisfaction with a major.

In the two samples used to develop the AMSS, the internal consistencies were $\alpha = .94$ and $\alpha = .90$. Each item in the measure has an effect size of .5 or higher for predicting which students remain in their majors versus change their majors over a two-year period. Convergent validity estimates reveal a positive association with career decision self-efficacy ($r = .45$, $p < .001$), and divergent validity estimates reveal a negative association with career choice anxiety and generalized career indecisiveness, with rs of $-.50$ and $-.30$, respectively ($p < .001$). The scale appears in Appendix G. The reliability for this scale in this sample is .91.

Demographics. The demographic measures are age, ethnicity, gender, year in school, certainty of major choice, and academic major, as shown in Appendix H.

Procedure

Before the study was disseminated to participants, approval was obtained from Iowa State University's Institutional Review Board. Participants were recruited using the Department of Psychology's online research participation system, which manages undergraduate students' participation in department-associated research projects.

Undergraduate students who chose to participate received extra credit. Prior to completing the survey, students were presented with an informed-consent statement, shown in Appendix J. Students were then presented with demographic questions, the Academic Major Satisfaction Scale, the Balanced Measure of Psychological Needs subscales presented above, the Institutional Integration subscales presented above, and the academic self-efficacy subscale of the Coping with Career Indecision Scale. Upon completing the survey, participants were debriefed regarding the purpose of the study.

Hypotheses

Hypothesis 1: A partially mediated model (Figure 1) will be a significantly better fit to the data than a fully mediated model (Figure 2).

The following hypotheses all pertain to Figure 2.

Hypothesis 2: Major satisfaction will be directly predicted by faculty integration (path b), student integration (path g), perceived autonomy (path i), perceived competence (path j), and perceived relatedness (path k).

Hypothesis 3: Perceived volitional autonomy will be directly predicted by faculty integration (path a) and student integration (path e). Perceived competence will be directly predicted by faculty integration (path c) and student integration (path f). Perceived relatedness will be directly predicted by faculty integration (path d) and student integration (path h).

Hypothesis 4: Perceived autonomy will mediate the relation between faculty integration and major satisfaction (path a, path i), and the relation between student integration and major satisfaction (path e, path i). Perceived competence will mediate the relation between faculty integration and major satisfaction (path c, path j), and the relation between student integration and major satisfaction (path f, path j). Perceived relatedness will mediate the relation between faculty integration and major satisfaction (path d, path k), and the relation between student integration and major satisfaction (path h, path k).

CHAPTER 4: RESULTS

Preliminary Analysis

Missing data. First, items in which 80% or more of data was missing were omitted. Items were checked for missing data, and no items met criteria. Participants who did not complete at least 80% of the items were dropped from the sample; 25 participants were dropped from the sample for this reason. Mean scale scores were created if at least 50% of the items were completed. Finally, full information maximum likelihood (FIML; Arbuckle, 1996), estimating casewise parameters, was used to estimate the remaining missed items. The mean scale scores were generated by FIML for those participants where less than 50% of items were completed.

Change of measure. The intent was to create three subscales from the BMPN (for perceived volitional autonomy, perceived competence, and perceived relatedness) by combining the satisfaction and dissatisfaction items for each subscale. However, the internal consistency estimates were too low (perceived volitional autonomy: .69, perceived competence: .65, perceived relatedness: .68). A decision was made to create satisfaction and dissatisfaction subscales for each of the three constructs. Other studies which have adapted the BMPN for use in a German sample and a Portuguese sample, when analyzing the structure of the scale, have found that satisfaction and dissatisfaction are structurally distinct from each other within each psychological need (Cordeiro, Paixão, Lens, Lacante, & Sheldon, 2016; Neubauer & Voss, 2016). Additionally, one other group of researchers has developed a scale that measures psychological need satisfaction and frustration (the equivalent of dissatisfaction) separately (Chen et al., 2015). They validated this scale in four culturally diverse samples, including in the United States, and found that satisfaction and frustration of psychological needs uniquely predicted variables such as well-being and sleep quality.

This supports the hypothesis of the creators of the BMPN (Sheldon & Hilpert, 2012) that their scale should measure satisfaction and dissatisfaction of the needs separately, and supports the decision made here to create satisfaction and dissatisfaction subscales for each construct. In this sample, the correlation among satisfaction and dissatisfaction subscales of the same construct were minimal, ranging from $-.17$ to $.07$, as can be seen by Table 1. The partially mediated and fully mediated models with these adjustments can be seen in Figure 3 and Figure 4.

Preliminary analyses. The means, standard deviations, and correlations of the variables of interest are presented in Table 1. Academic major satisfaction meaningfully correlated with all other variables at $p < .001$, as can be seen by Table 1.

Faculty integration correlated strongly with student integration and perceived relatedness satisfaction (rs = .55, 53). It correlated moderately with perceived volitional autonomy satisfaction and perceived competence satisfaction at rs = .41, .45. It did not correlate significantly with the three need dissatisfaction variables as seen by Table 1 (ps > .05).

In addition, student integration correlated strongly positive with perceived volitional autonomy satisfaction and perceived relatedness satisfaction (rs = .60), moderately positive with perceived competence satisfaction (r = .45), and modestly negative with perceived relatedness dissatisfaction ($r = -.17$). It did not correlate with the two remaining need dissatisfaction variables, as seen in Table 1.

The three need satisfaction variables correlated moderately with each other, with rs ranging from .40 to .49, while the three dissatisfaction variables correlated moderately to strongly with each other, with rs ranging from .41 to .53. The autonomy, competence, and relatedness satisfaction/dissatisfaction correlations were minimal, with correlations ranging from .07 to $-.17$.

Gender differences. Table 2 presents the correlations by gender. The correlations by gender were examined using a *z*-test for significance of difference between correlation coefficients. A Bonferonni correction of *p* < .0014 was used to control for type I error. None of the correlations were significantly different at *p* = .0014.

Mean differences by gender were also examined and are shown in Table 2. Mean differences between genders were examined using an independent samples *t*-test. Men had significantly higher mean scores for perceived volitional autonomy disatisfaction (*p* = .002), and for perceived relatedness dissatsifaction (*p* = .002). These differences are significant even with a Bonferonni correction of *p* < .015 to control for type I error. No other significant differences were found. These differences were not considered to indicate a meaningful difference between the male and female samples, because only two variables displayed a meaningful difference and because the sample sizes of males and females in this study are fairly different.

Normative comparisons. To determine if this sample's means were comparable to other similar samples, means of this sample were compared with relevant means from other samples. A decision was made to consider this sample's means within ½ of standard deviation (SD) of other sample means. The mean for academic major satisfaction in this sample was compared with the mean for academic major satisfaction in the sample used to develop the scale to measure academic major satisfaction (Nauta, 2007). Although the mean for academic major satsifaction in this sample (M = 3.93, SD =.89) was significantly different from the mean in the Nauta (2007) sample (M = 4.27, SD =.88), *t*(574) = –4.55, *p* = .0001, they are within ½ of a standard deviation of one another, so the difference is not meaningful.

No comparisons for the means of faculty intergration or student integration are presented here. This is because no other published studies have used the scales in the same way this study

did. All other studies which have used the French & Oakes (2004) subscales have arranged them to measure academic and social integration instead of to meausre faculty and student integration, even though the evidence gathered when developing these scales suggests they are more psychometrically sound when arranged as faculty and student integration.

The means for self-determination factors from this study were compared with means from an older German sample in a study that validated the Balanced Measure of Psychological Needs (BMPN) in a German sample (Neubauer & Voss, 2016). They were compared with this sample because there are only two published studies which use the BMPN in the way this study did (addressing satisfaction and dissatisfaction separately). Of those studies (one a Portugese sample and one a German sample), it was determined that the German sample was likely to be more similar to this sample.

The mean for perceived volitional autonomy satisfaction in this sample ($M = 3.90$, $SD = .92$) was significantly lower than the mean in the Neubauer & Voss (2016) sample ($M = 4.70$, $SD = 1.3$), $t(581) = -8.70$, $p < .0001$. With a Cohen's (1992) d of .71, this is a medium effect. The mean for perceived volitional autonomy dissatisfaction in this sample ($M = 2.58$, $SD = 1.08$) was significantly lower than the mean in the Neubauer & Voss (2016) sample ($M = 4.00$, $SD = 1.4$), $t(581) = -13.83$, $p < .0001$. With a Cohen's d of 1.14, this is a strong effect. The mean for perceived competence satisfaction in this sample ($M = 3.69$, $SD = .91$) is significantly lower than the mean in the Neubauer & Voss (2016) sample ($M = 4.30$, $SD = 1.6$), $t(581) = -5.81$, $p < .0001$. With a Cohen's d of .47, this is a small effect. The mean for perceived competence dissatisfaction in this sample ($M = 3.30$, $SD = 1.14$) was significantly lower than the mean in the Neubauer & Voss (2016) sample ($M = 3.70$, $SD = 1.6$), $t(581) = -3.52$, $p < .0005$. With a Cohen's d of .29, this is a small effect. The mean for perceived relatedness satisfaction in this sample

(M = 3.30, SD = 1.13) was significantly lower than the mean in the Neubauer & Voss (2016)

sample (M = 5.50, SD =1.2), $t(581) = -22.66$, $p < .0001$. With a Cohen's d of 1.89, this is a large

effect. The mean for perceived relatedness dissatisfaction in this sample (M = 2.09, SD = 1.06) is

significantly lower than the mean in the Neubauer & Voss (2016) sample (M = 3.60, SD = 1.5),

$t(581) = -14.24$, $p < .0001$. With a Cohen's d of 1.42, this is a large effect.

It is likely that the differences in the samples are due to the tranlation of the measure into

German, cultural differences between this American sample and the German sample, and the fact

that in this sample, the focus was specific to college major, rather than more general need

satisfaction. Additionally, the mean age in the Neubauer & Voss (2016) sample was 26.2, which

is higher than the mean age in this sample.

Main Analyses

Path analyses were used to examine both the partially mediated model and the fully

mediated model using MPlus version 7.2 (Muthén & Muthén, 2012). The paths for these

variables can be found in Figures 3 and 4. The partially mediated model that includes the BMPN

need satisfaction and need dissatisfaction variables is presented in Figure 3. The criterion

variable was academic major satisfaction. The exogenous variables in this study were faculty

integration and student integration. The SDT needs (perceived volitional autonomy satisfaction,

perceived volitional autonomy dissatisfaction, perceived competence satisfaction, perceived

competence dissatisfaction, perceived relatedness satisfaction, and perceived relatedness

dissatisfaction) served as the mediators.

Hypothesis 1: A partially mediated model will present a significantly better fit to the data

than a fully mediated model. A fully mediated model was tested against a partially mediated

model using a chi-square difference test to see if the saturated model was a better fit for the data

(Satorra & Bentler, 2010). Goodness of fit for the fully mediated model was assessed using the guidelines of Hu and Bentler (1999), including a comparative fit index (CFI) of .95 or greater, a root-mean-square error of approximation (RMSEA) of .06 or less, and a standardized root-mean-square residual (SRMR) of .08 or less.

First the path analysis for the saturated model was run using MPlus (Muthén & Muthén, 2012). Because it is fully saturated, it represented a perfect fit. Figure 3 shows the saturated model. The path coefficients are shown in Figure 5 as solid lines, and the insignificant paths as dotted lines. Academic major satisfaction was significantly predicted in the model, with a large effect (R^2 = .40). Perceived autonomy, perceived competence, and perceived relatedness satisfaction were significantly predicted by faculty and student integration with large effects (R^2s = .26–.42). Perceived autonomy, perceived competence, and perceived relatedness dissatisfaction were not significantly predicted by faculty and student integration (R^2s = .01–.04).

Next the path analysis for the full mediation hypothesis was examined. Figure 4 shows the fully mediated model. The path coefficients are shown in Figure 6 as solid lines, and the insignificant paths as dotted lines.

Results indicated the fully mediated model was a good fit, χ^2 (2, N = 332) = 2.531, p = .28, CFI = .99, RMSEA < .05, SRMR = .01. According to the guidelines of Hu and Bentler (1999), this is a good fit because the model has a comparative fit index (CFI) of .95 or greater, a root-mean-square error of approximation (RMSEA) of .06 or less, and a standardized root-mean-square residual (SRMR) of .08 or less.

Academic major satisfaction was significantly predicted in the model with a large effect (R^2 = .40). Perceived autonomy, perceived competence, and perceived relatedness satisfaction were significantly predicted by faculty and student integration with large effects (R^2s = .26–.42).

Perceived autonomy, perceived competence, and perceived relatedness dissatisfaction were not significantly predicted by faculty and student integration (R^2s = .01–.04).

The fully mediated model was compared with the partially mediated model using a chi-square difference test. Results indicated that the fully saturated model was not a better fit for the data than the fully mediated model χ^2 (4) = 6.45, p = .17. Therefore the fully mediated model is considered a more parsimonious fit to the data. Given these results, the first hypothesis was not supported.

Hypothesis 2: For Hypothesis 2, as shown in Figure 3, the partial mediation model was examined to determine if the following paths were significant: (a) paths m and n going from the exogenous variables to academic major satisfaction, and (b) paths o, p, q, r, s, and t going from the three psychological needs (satisfaction and dissatisfaction) to major satisfaction. (Note: The paths from Figure 1 have been revised in Figure 3 to reflect the addition of the BMPN need satisfaction and need dissatisfaction variables.)

As can be seen by Figure 5, for the saturated model, the direct paths from the exogenous variables to academic major satisfaction were null. For the direct paths going from the three psychological satisfaction/dissatisfaction variables, several paths were significant, as can be seen by Figure 5. Academic major satisfaction was directly predicted by perceived autonomy satisfaction, perceived competence satisfaction, perceived competence dissatisfaction, and perceived relatedness dissatisfaction.

In short, Hypothesis 2 was partially supported. Environmental factors did not directly predict academic major satisfaction, but four of the six basic psychological satisfaction/dissatisfaction needs predicted academic major satisfaction. Therefore the second hypothesis was partially supported.

Hypothesis 3: For Hypothesis 3, the saturated model and the full mediation model were examined to determine if the following paths were significant: paths going from: (a) faculty integration to the three psychological satisfaction/dissatisfaction needs (paths a, b, e, f, i, and j), and (b) student integration to the three psychological satisfaction/dissatisfaction needs (paths c, d, g, h, k, and l).

Regarding the saturated model, faculty integration directly predicted four of the six basic psychological satisfaction/dissatisfaction needs, namely, perceived autonomy satisfaction, perceived competence satisfaction, perceived relatedness satisfaction, and perceived competence dissatisfaction. Two of the paths were nonsignificant: perceived autonomy dissatisfaction and perceived relatedness dissatisfaction.

Student integration directly predicted five of the six basic psychological satisfaction/dissatisfaction needs, namely, perceived autonomy satisfaction, perceived competence satisfaction, perceived relatedness satisfaction, perceived competence dissatisfaction, and perceived relatedness dissatisfaction. One path was null: perceived autonomy dissatisfaction.

Faculty and student integration accounted for a significant percentage of the variance in perceived autonomy satisfaction, perceived competence satisfaction, and perceived relatedness satisfaction, with large effects for each variable. Faculty and student integration did not predict a significant percentage of the variance in perceived autonomy dissatisfaction, perceived competence dissatisfaction, or perceived relatedness dissatisfaction.

Regarding the fully mediated model, faculty integration directly predicted four of the six basic psychological satisfaction/dissatisfaction needs, namely, perceived autonomy satisfaction, perceived competence satisfaction, perceived relatedness satisfaction, and perceived competence

dissatisfaction. Two of the paths were nonsignificant: perceived autonomy dissatisfaction and perceived relatedness dissatisfaction.

Student integration directly predicted five of the six basic psychological satisfaction/dissatisfaction needs, namely, perceived autonomy satisfaction, perceived competence satisfaction, perceived relatedness satisfaction, perceived competence dissatisfaction, and perceived relatedness dissatisfaction. One path was null: perceived autonomy dissatisfaction.

Faculty and student integration accounted for a significant percentage of the variance in perceived autonomy satisfaction, perceived competence satisfaction, and perceived relatedness satisfaction, with large effects for each variable. Faculty and student integration did not predict a significant percentage of the variance in perceived autonomy dissatisfaction, perceived competence dissatisfaction, or perceived relatedness dissatisfaction. Therefore Hypothesis 3 was partially supported.

Hypothesis 4: Perceptions of volitional autonomy, competence, and relatedness were expected to significantly mediate the relations between environmental factors (both faculty and student factors) and academic major satisfaction. For Hypothesis 4, bootstrapping was used to determine if the indirect paths (paths a and o, paths b and o, paths c and p, paths d and p, paths e and q, paths f and q, paths g and r, paths h and r, paths i and s, paths j and s, paths k and t, and paths l and t) in the fully mediated model (Figure 6) were significant. The fully mediated model was chosen since it was the most parsimonious model. Bootstrap tests using bias-corrected 95% confidence intervals were used to test the statistical significance of the mean indirect effects. The calculation was repeated with 1,000 samples to yield parameter estimates for total and specific indirect effects. A confidence interval not containing 0 indicated that the mean indirect effect

across the samples was significant at an alpha with $p < .05$ (Preacher & Hayes, 2008). Bootstrap analysis provided greater statistical power and did not make any assumptions regarding multivariate normality (Preacher & Hayes, 2008).

Table 3 presents the magnitude and statistical significance of the specific and total indirect effects of faculty integration and student integration on academic major satisfaction through the three satisfaction needs (perceived volitional autonomy, perceived competence, perceived relatedness) and the three dissatisfaction needs (perceived volitional autonomy, perceived competence, perceived relatedness), using the bootstrapping procedure in the fully mediated model.

The first six indirect effects listed in Table 3 (1a through 1f) concern faculty integration. Of those six potential indirect effects examined, three of the indirect effects were significant. Faculty integration indirectly related to academic major satisfaction through perceived volitional autonomy satisfaction (path 1a) and perceived competence satisfaction/dissatisfaction (paths 1b and 1e). This is evidenced by the 95% bias-corrected confidence intervals (BC CI) for these four specific mean indirect effects not including 0.

The next six indirect effects listed in Table 3 (2a through 2f) concern student integration. Of those six potential indirect effects, four of the indirect effects were significant. Student integration indirectly related to academic major satisfaction through perceived volitional autonomy satisfaction (path 2a), perceived competence satisfaction/dissatisfaction (paths 2b and 2e), and perceived relatedness dissatisfaction (path 2f). This is evidenced by the 95% BC CIs for these four specific mean indirect effects not including 0. Therefore Hypothesis 4 was partially supported.

Additional Analyses

      Original model with three BMPN subscales as mediators. Path analyses were also

conducted with the satisfaction/dissatisfaction subscales of the self-determination constructs

combined, and are shown in Figure 7. The path coefficients are shown as solid lines, and the

insignificant paths as dotted lines.

      In the fully saturated model, it was found that academic major satisfaction was directly

related to perceived autonomy, perceived competence, and perceived relatedness, and was not

directly related to faculty integration or student integration. However, academic major

satisfaction was indirectly related to faculty integration through perceived autonomy and

indirectly related to student integration through all three of the BMPN subscales.

      Academic major satisfaction was significantly predicted in the model, with a large effect

($R^2 = .38$). Perceived autonomy and perceived competence were predicted by faculty and student

integration with a medium effect (R^2s = .14). Perceived relatedness was predicted by faculty and

student integration with a large effect ($R^2 = .32$).

      Results indicated the fully saturated model was a perfect fit, χ^2 (0, $N = 332$) = 0.00, $p =$

0.00, CFI = 1.00, RMSEA < .05, SRMR = 0.00. According to the guidelines of Hu and Bentler

(1999), a good fit would have a comparative fit index (CFI) of .95 or greater, a root-mean-square

error of approximation (RMSEA) of .06 or less, and a standardized root-mean-square residual

(SRMR) of .08 or less.

      The fully mediated model was also examined and can be seen in Figure 8. The path

coefficients are shown as solid lines, and the insignificant paths as dotted lines. Academic major

satisfaction was significantly predicted in the model, with a large effect ($R^2 = .37$). Perceived

autonomy and perceived competence were predicted by faculty and student integration with a

medium effect (R^2s = .14). Perceived relatedness was predicted by faculty and student integration with a large effect (R^2 = .32).

Results indicated the fully mediated model was a good fit, χ^2 (2, N = 332) = 2.054, p = .36, CFI = 1.00, RMSEA < .05, SRMR = .01. According to the guidelines of Hu and Bentler (1999), this is a good fit because the model has a comparative fit index (CFI) of .95 or greater, a root-mean-square error of approximation (RMSEA) of .06 or less, and a standardized root-mean-square residual (SRMR) of .08 or less.

The fully mediated model was compared with the partially mediated model using a chi-square difference test. Results indicated that the fully saturated model was not a better fit for the data than the fully mediated model χ^2 (2) = 1.62, p = .43. Therefore the fully mediated model is considered a more parsimonious fit to the data.

In the fully mediated model, as shown in Figure 8, it was found that academic major satisfaction was directly related to perceived autonomy, perceived competence, and perceived relatedness. Academic major satisfaction was indirectly related to faculty integration through perceived relatedness and indirectly related to student integration through the three BMPN needs.

Given that the fully mediated model was the more parsimonious of the two models, I examined whether the three BMPN needs significantly mediated the relation of faculty integration and student integration with academic satisfaction. Bootstrap tests using bias corrected 95% confidence intervals were used to test the statistical significance of the mean indirect effects. The calculation was repeated with 1,000 samples to yield parameter estimates for total and specific indirect effects. A confidence interval not containing 0 indicated that the mean indirect effect across the samples was significant at an alpha of p < .05 (Preacher & Hayes,

2008). Bootstrap analysis provided greater statistical power and did not make any assumptions regarding multivariate normality (Preacher & Hayes, 2008).

Table 4 presents the magnitude and statistical significance of the specific and total indirect effects of faculty integration and student integration on academic major satisfaction through the three BMPN needs (perceived volitional autonomy, perceived competence, perceived relatedness), using the bootstrapping procedure in the fully mediated model.

The first three indirect effects listed in Table 4 (1a through 1c) concern faculty integration. Of those three potential indirect effects examined, one of the indirect effects was significant. Faculty integration indirectly related to academic major satisfaction through perceived relatedness (path 1c). This is evidenced by the 95% bias-corrected confidence intervals (BC CI) for this specific mean indirect effect not including 0.

The next three indirect effects listed in Table 4 (2a through 2c) concern student integration. Of those three potential indirect effects, all three of the indirect effects were significant. Student integration indirectly related to academic major satisfaction through perceived volitional autonomy (path 2a), perceived competence (paths 2b), and perceived relatedness (path 2c). This is evidenced by the 95% BC CIs for these three specific mean indirect effects not including 0.

Suppression effects. In the adjusted fully mediated model (Figure 9), there were significant paths between faculty integration and perceived competence dissatisfaction, as well as significant paths from student integration to perceived competence dissatisfaction. However, the Pearson product moment correlations for both of these were nominal, as can be seen by Table 1 (rs = .08 and

−.08). This would suggest that the exogenous variables were potentially acting as a suppressor variable on each other. A suppression effect is when there is a change from nonsignificant to significant relation, or vice versa (Cohen, Cohen, West, & Aiken, 2003). To test for possible suppression effects, two additional models were tested by first removing faculty integration from the fully mediated model (Figure 9) and then removing student integration from the fully mediated model (Figure 10).

Regarding the removal of faculty integration, the path from student integration to perceived competence dissatisfaction became null, suggesting there was a suppression effect, as expected. Suppression effects by student integration were also tested by removing student integration from the fully mediated model, as can be seen by Figure 10. Likewise, the path from faculty integration to perceived competence dissatisfaction became null, suggesting there was a suppression effect.

CHAPTER 5: DISCUSSION

Hypotheses

Hypothesis 1 was not supported. The direct paths from the environmental variables (faculty and student integration) were not significant predictors of academic major satisfaction. Additionally, the saturated model was not significantly different from the fully mediated model. This contradicts Tinto's model, which suggests that environmental factors should be a direct predictor of academic success. However, this is in line with self-determination theory, which suggests that perceived autonomy, perceived competence, and perceived relatedness should mediate the relationship between the environment and satisfaction.

These results suggest the possibility that past studies that have fund the environment to be predictive of major satisfaction (e.g., Deemer, 2015; Umbach & Porter, 2002) may have been seeing the impact of need satisfaction on major satisfaction, instead of the direct effect of the environment on satisfaction. It is also possible that the types of environmental factors measured in this study are not the type of factors that have a direct impact on major satisfaction. Deemer (2015) and Umbach & Porter (2002) both address environmental factors relating to gender proportions in the classroom, and Umbach & Porter (2002) addresses specific environmental characteristics. The environmental measures in this study were focused on how integrated a student feels with faculty and peers. It is possible that this piece of the environment is not as directly predictive of academic major satisfaction as other pieces of the environment.

Hypothesis 2 was partially supported. It is important to note here that, given that the scales for autonomy, competence, and relatedness scales were more reliable when they were split into satisfaction and dissatisfaction subscales, and given that the correlations between the satisfaction and dissatisfaction subscales were as small as they were, Hypothesis 2 was modified. In Hypothesis 2, instead of autonomy, competence, and relatedness predicting major satisfaction,

perceived autonomy satisfaction/dissatisfaction, perceived competence

satisfaction/dissatisfaction, and perceived relatedness satisfaction/dissatisfaction predicted major

satisfaction. The fact that these self-determination factors functioned better as

satisfaction/dissatisfaction measures is an interesting finding in and of itself, and is discussed

further in the implications section.

Environmental factors did not directly relate to academic major satisfaction. However,

perceived autonomy satisfaction, perceived competence satisfaction, perceived competence

dissatisfaction, and perceived relatedness dissatisfaction did directly relate to major satisfaction

(meaning perceived relatedness satisfaction and perceived autonomy dissatisfaction did not

directly relate to major satisfaction). Self-determination theory, supported by previous research

findings (e.g., Jadidian & Duffy, 2012), suggests that major satisfaction should be related to

perceived volitional autonomy, perceived competence, and perceived relatedness. Broadly, the

results of this study are in line with those findings. Academic major satisfaction was predicted by

either satisfaction or dissatisfaction of perceived autonomy and perceived relatedness, and by

perceived competence satisfaction and dissatisfaction. All three needs predicted major

satisfaction in at least one way. Additionally, when the satisfaction and dissatisfaction scales

were combined, major satisfaction directly related to perceived volitional autonomy, perceived

competence, and perceived relatedness.

However, major satisfaction was not predicted by autonomy dissatisfaction or relatedness

satisfaction. This is difficult to explain according to self-determination theory or in comparison

to previous research (e.g., Jadidian & Duffy, 2012; Larson et al., 1994). Measuring perceived

autonomy, perceived competence, and perceived relatedness satisfaction and dissatisfaction

separately was not suggested by self-determination theory originally and has been explored very

little in other research. It is possible that in this sample, autonomy dissatisfaction and relatedness satisfaction were unrelated to major satisfaction because they were not salient to students. It is possible that in the relatively structured environment expected in school, students who feel particularly autonomous in a major would be likely to notice, and appreciate, the autonomy, while students without much autonomy might be less likely to notice. That is, autonomy satisfaction might be noticed and appreciated because it is unexpected, whereas autonomy dissatisfaction might not be noticed, and therefore not be salient, because autonomy dissatisfaction is expected. In terms of relatedness satisfaction not being related to major satisfaction in this sample, it is possible that it does not affect students in a salient way when they have positive relationships within their major (they don't notice themselves getting better grades or feeling more confident in their choice of major), but that it does affect students in a salient way when they have negative relationships within their major (they may feel that their instructors are giving them worse grades, or difficulty getting along with other students may give them the impression they don't belong in their major).

Hypothesis 3 was partially supported. Faculty integration and student integration both directly related to at least satisfaction or dissatisfaction of perceived autonomy, perceived competence, and perceived relatedness. However, autonomy, competence, and relatedness satisfaction and dissatisfaction were not consistently related to both faculty and student integration. Faculty integration related to perceived autonomy satisfaction, perceived competence satisfaction, perceived relatedness satisfaction, and perceived competence dissatisfaction. Student integration related to perceived autonomy satisfaction, perceived competence satisfaction, perceived competence dissatisfaction, perceived relatedness satisfaction, and perceived relatedness dissatisfaction.

Additionally, faculty and student integration accounted for a significant percentage of the variance in perceived autonomy satisfaction, perceived competence satisfaction, and perceived relatedness satisfaction, but it did not account for a significant percentage of the variance in perceived autonomy dissatisfaction, perceived competence dissatisfaction, or perceived relatedness dissatisfaction. This can be seen in the R^2 values in the adjusted fully mediated model (Figure 6). A significant percentage of perceived autonomy satisfaction, perceived competence satisfaction, and perceived relatedness satisfaction were accounted for by faculty and student integration with a large effect. However, this was not the case for perceived autonomy dissatisfaction, perceived competence dissatisfaction and perceived relatedness dissatisfaction, which were not significantly predicted by faculty and student integration.

It is important to note that both environmental factors were more effective at predicting satisfaction of psychological needs than dissatisfaction of psychological needs. One possible reason for this is that these environmental factors are more related to satisfaction than to dissatisfaction, and it is possible that individual factors such as personality or interest are more related to need dissatisfaction. It is also possible that the environmental factors used in this study are not the ones that are related to need dissatisfaction, but that other environmental factors are.

Hypothesis 4 was partially supported. Faculty and student environmental factors were mediated by some, but not all, of the self-determination variables.

In the fully mediated model, perceived competence satisfaction and dissatisfaction mediated the relation between faculty integration and major satisfaction. Perceived autonomy satisfaction, perceived competence satisfaction, perceived competence dissatisfaction, and perceived relatedness dissatisfaction mediated the relation between student integration and major satisfaction.

Additionally, a significant percentage of the variance in academic major satisfaction was accounted for by SDT variables, and a significant percentage of the variance in SDT variables was accounted for by environmental variables.

This suggests that, in line with Tinto's model and self-determination theory, environmental factors added to our ability to explain variance in academic major satisfaction. Although environmental factors did not predict major satisfaction directly, they did so indirectly, which fits with the view presented in self-determination theory that environmental factors predict need satisfaction, and that need satisfaction predicts satisfaction and well-being in other domains.

Additionally, it was found that faculty integration and student integration were both causing suppression effects to occur, causing the relations between faculty integration and perceived competence dissatisfaction, and between student integration and perceived competence dissatisfaction to be significant. When faculty integration and student integration, respectively, were removed from the model, the relation between faculty integration and perceived competence dissatisfaction, and the relation between student integration and perceived competence dissatisfaction became nonsignificant. This suggests that in this sample, these two environmental variables were interfering with each other in terms of their relations with perceived competence dissatisfaction.

Implications

This study has several implications. At the most basic level, this study provides evidence that the environment is an important part of understanding academic major satisfaction, as well as evidence that self-determination theory provides a useful lens for understanding how the environment may predict major satisfaction.

The results of this study indicate that major satisfaction was not directly related to the environment, but that it was related to major satisfaction through self-determination factors. Therefore, it will be important for those studying academic major satisfaction to begin integrating more environmental variables into research, while bearing in mind that there is a good chance the effects of those environmental variables may be mediated by self-determination factors.

Additionally, this study suggests that some self-determination factors may be useful in mediating the relation between the academic environment and major satisfaction. Perceived competence was the only self-determination factor in this study where both its satisfaction and dissatisfaction related to major satisfaction. This implies that when students feels competent in their major, they are more satisfied with it, and when they feel incompetent in their major, they are less satisfied with it. This is in contrast to autonomy, where only autonomy satisfaction related to major satisfaction in this study, and relatedness, where only relatedness dissatisfaction predicted major satisfaction. When students feel autonomous in their major, they may be more likely to be satisfied with it, but when they do not feel autonomous, they may not be less satisfied with it. When students feel a sense of connection with others in their major, they may not be more satisfied with it, but when they feel disconnected from others, they may be less satisfied with it. As this is the first study addressing the relation between self-determination factors and academic major satisfaction, more research will need to be done to fully understand which self-determination factors are related to academic major satisfaction and what the difference between satisfaction and dissatisfaction of these factors is.

It is interesting to note that although all three of the self-determination factors directly related to academic major satisfaction, autonomy satisfaction alone directly related to major

satisfaction, and relatedness dissatisfaction alone predicted major satisfaction. In contrast, both competence satisfaction and competence dissatisfaction directly related to major satisfaction. This suggests that in this sample, when students were dissatisfied with their level of autonomy, it did not affect their major satisfaction; however, when they were satisfied with their level of autonomy, it did affect their major satisfaction. Conversely, in this sample, when students were satisfied with their relatedness, it did not appear to relate to their major satisfaction; however, when they were dissatisfied with their relatedness, it did relate to their major satisfaction. In this study, levels of competence seemed to relate to major satisfaction whether the students were satisfied or dissatisfied. This is in line with research that emphasizes the importance of self-efficacy in contributing to satisfaction (Larson, Toulouse, Ngumba, Fitzpatrick, & Heppner, 1994).

It makes sense that perceived competence would be particularly important in predicting major satisfaction, because in many ways, the purpose of being in a major is to become competent in that major. Competence in a major is constantly evaluated and emphasized; it affects students' ability to stay in the major and to get a job in their major field when they graduate. It would be very unlikely for a student not to have a clear sense of competence satisfaction or dissatisfaction within their major, so this factor may be particularly salient for students.

Finally, this study presents more evidence to support the idea, presented by French & Oakes (2004), that self-determination needs might be more appropriately measured as need satisfaction and need dissatisfaction. The suggestion is that the effects of feeling good about something (feeling competent) and the effects of feeling bad about something (feeling incompetent) are different. This study joins several others (Chen et al., 2015; Cordeiro et al.,

2016; Neubauer & Voss, 2016) which presented analyses of the structure of the BMPN and

empirical evidence that satisfaction and dissatisfaction scores on the same need are, at most,

minimally correlated and do not predict outcomes in the same ways.

Limitations

One of the largest limitations of this study is that grade point average (GPA) was not

included as a predictor variable. It is likely that satisfaction with major would be affected by

performance in that major (which GPA measures). GPA is also likely to confound the effect that

perceived competence satisfaction and dissatisfaction has on major satisfaction, since actual

competence may have a similar or different effect on major satisfaction than perceived

competence does, and actual competence may affect perceived competence. This is particularly

important considering that competence is the only self-determination factor that related to major

satisfaction both in terms of satisfaction and in terms of dissatisfaction, so a more comprehensive

understanding of how actual versus perceived competence affects major satisfaction might be

useful.

This study is also limited in that it is cross-sectional and therefore is not able to make any

claims about causality. Although it is clear that in this study, environmental factors were related

to self-determination factors, which were related to major satisfaction, it is not clear what the

cause of this relationship is or what the direction is this relationship is. It could be that feeling an

autonomy need is satisfied causes a student to feel satisfied with his major, but it could also be

that feeling satisfied in his major caused that student to feel satisfied with his level of autonomy.

Another limitation on interpreting and generalizing this study is that the sample is fairly

homogeneous. The sample is predominantly white and comprises mostly younger college-aged

students (the sample was skewed toward 18 rather than 22 year olds). It is unclear whether the

relations found in this study would be the same in groups with members that are predominantly from other racial/ethnic groups or other age groups.

Additionally, it is possible that the way environment was measured in this study simply did not get at the environmental factors that are important to students. The environmental measures used in this study are fairly limited. They also focus on relationships with faculty and peers, ignoring other, more concrete, environmental factors (are the facilities adequate, is there adequate faculty and funding within the department, what are gender ratios of students, does the departmental structure attend to the needs of undergraduates, etc.). There are many environmental factors which could predict major satisfaction or could predict self-determination need satisfaction.

Future Directions

There are several compelling future directions to explore within this field of study. First, although it seems that environmental factors have some influence on major satisfaction (influence that may be mediated by self-determination factors), it is not clear which specific environmental factors are the most important beyond the fact that integration with faculty seems to have slightly less impact on students than integration with their peers does. It would be useful to explore this line of questioning further in order to understand better what it is specifically about the environment that contributes or doesn't contribute to major satisfaction, and whether there are any environmental factors that have a direct impact on major satisfaction.

In order to fully understand how perceived competence predicts major satisfaction, it will be important to include GPA in future studies of major satisfaction. Even for studies where perceived competence is not a variable, it would likely be useful to include GPA as a predictor

variable, simply because grades are such a potent form of feedback for students as to how well they fit in a major.

Going forward, it will be important to begin to explore how intrapersonal factors contribute to academic major satisfaction on top of and in conjunction with the environment and self-determination factors. Most of the research in the area of major satisfaction has focused on how individual differences predict major satisfaction differentially. These individual differences—especially some personality variables and some cognitive behaviors—appear to be moderately related to major satisfaction (Dahling & Thompson, 2012; Leach & Patall, 2013; Logue et al., 2007; McIlveen et al., 2013; Pozzebon, Ashton, & Visser, 2014). In order to fully understand how to predict major satisfaction, it will be important to incorporate intrapersonal variables as well as environmental variables.

Finally, we have new evidence that in some samples, it may be appropriate to split self-determination needs into satisfaction and dissatisfaction of needs. It is possible that satisfaction or dissatisfaction of needs may have more predictive use in some samples or when predicting some variables. It will be important for more researchers to incorporate this question into their research about SDT in order to understand in what contexts separating satisfaction and dissatisfaction of needs is a useful approach to using SDT.

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Tables

Table 1.

Summary of Means, Standard Deviations, Variances, and Correlations for All Variables under Examination for All Participants

	1	2	3	4	5	6	7	8	9
1. Academic Major Satisfaction	.91								
2. Faculty Academic and Social Integration	.28	.90							
3. Student Academic and Social Integration	.37	.55	.91						
4. Perceived Volitional Autonomy Sat.	.47	.41	.60	.80					
5. Perceived Volitional Autonomy Dis.	-.32	.04	-.02	-.17	.75				
6. Perceived Competence Sat.	.27	.45	.45	.40	.14	.82			
7. Perceived Competence Dis.	-.31	.08	-.08	-.12	.41	.07	.82		
8. Perceived Relatedness Sat.	.29	.53	.60	.49	.05	.43	.08	.87	
9. Perceived Relatedness Dis.	-.42	-.01	-.17	-.16	.53	.05	.41	-.03	.79
M	3.93	3.59	3.95	3.90	2.58	3.69	3.30	3.30	2.09
SD	.89	.89	.68	.92	1.08	.91	1.14	1.13	1.06
Variance	.80	.78	.46	.84	1.17	.83	1.31	1.29	1.12

Note. $N = 332$. All correlations above .14 are significant at $p < .01$; all correlations above .27 are significant at the $p < .001$. Cronbach's alphas are presented in the diagonal.

Table 2.
Summary of Means, Standard Deviations, and Correlations for All Variables under Examination for Males and Females

	1	2	3	4	5	6	7	8	9	M	SD
1. Academic Major Satisfaction	-	.28*	.40*	.48*	-.29*	.28*	-.31*	.33*	-.44*	3.98	.89
2. Faculty Academic and Social Integration	.27*	-	.53*	.36*	.10	.44*	.08	.50*	-.05	3.60	.88
3. Student Academic and Social Integration	.29*	.57*	-	.63*	-.00	.48*	-.11	.64*	-.24*	3.99	.66
4. Perceived Volitional Autonomy Sat.	.44*	.50*	.53*	-	-.17	.40*	-.19	.48*	-.25	3.94	.90
5. Perceived Volitional Autonomy Dis.	-.35*	-.06	-.01	-.17	-	.11	.41*	.06	.46*	2.46	1.05ᵃ
6. Perceived Competence Sat.	.24	.46*	.40*	.39*	.22	-	.05	.46*	-.07	3.71	.89
7. Perceived Competence Dis.	-.31*	.07	-.02	.06	.43*	.13	-	.03	.37*	3.29	1.17
8. Perceived Relatedness Sat.	.18	.60*	.52*	.51*	.10	.37*	.21	-	-.12	3.35	1.14
9. Perceived Relatedness Dis.	-.37*	.07	-.00	.02	.59*	.27*	.52*	.19	-	1.97ᵃ	.99
M	3.83	3.56	3.86	3.81	2.86ᵃ	3.66	3.33	3.17	2.36ᵃ		
SD	.90	.90	.71	.96	1.12	.95	1.08	1.12	1.16		

Note. Men $n = 103$. Women n $= 229$. *$p < .01$. Men are below the diagonal, and women are above the diagonal. ᵃ Significant mean difference between men and women. Means for women are presented down the side; means for men are presented across the bottom.

Table 3
Bootstrap Analysis of Magnitude and Statistical Significance of Indirect Effects of Faculty and Student Integration on Academic Major Satisfaction through Perceived Volitional Autonomy, Perceived Competence, and Perceived Relatedness (Satisfaction and Dissatisfaction) in the Adjusted Fully Mediated Model

Indirect Effects			β and product	Mean Indirect Effect $(b)^{a}$	SE of Mean[a]	95% BC CI Lower, Upper[a]
1a. Faculty Integration	Perceived Volitional Autonomy Satisfaction	Academic Major Satisfaction	$(.12) \times (.28) = .03$	.03	.02	.004, .08**
1b. Faculty Integration	Perceived Competence Satisfaction	Academic Major Satisfaction	$(.28) \times (.16) = .04$	.05	.02	.01, .08**
1c. Faculty Integration	Perceived Relatedness Satisfaction	Academic Major Satisfaction	$(.29) \times (.09) = .03$	.03	.02	-.01, .07
1d. Faculty Integration	Perceived Volitional Autonomy Dissatisfaction	Academic Major Satisfaction	$(.08) \times (-.10) = -.008$	-.01	.01	-.04, .01
1e. Faculty Integration	Perceived Competence Dissatisfaction	Academic Major Satisfaction	$(.18) \times (-.14) = -.03$	-.03	.01	-.06, -.01**
1f. Faculty Integration	Perceived Relatedness Dissatisfaction	Academic Major Satisfaction	$(.11) \times (-.27) = -.03$	-.03	.02	-.07, .002
2a. Student Integration	Perceived Volitional Autonomy Satisfaction	Academic Major Satisfaction	$(.54) \times (.28) = .15$	.20	.05	.12, .31**
2b. Student Integration	Perceived Competence Satisfaction	Academic Major Satisfaction	$(.30) \times (.16) = .05$	.06	.03	.01, .12**
2c. Student Integration	Perceived Relatedness Satisfaction	Academic Major Satisfaction	$(.45) \times (.09) = .04$	.06	.04	-.02, .13
2d. Student Integration	Perceived Volitional Autonomy Dissatisfaction	Academic Major Satisfaction	$(-.06) \times (-.10) = .01$	.01	.01	-.01, .05
2e. Student Integration	Perceived Competence Dissatisfaction	Academic Major Satisfaction	$(-.18) \times (-.14) = .03$	.03	.02	.01, .08**
2f. Student Integration	Perceived Relatedness Dissatisfaction	Academic Major Satisfaction	$(-.22) \times (-.27) = .06$	.08	.03	.04, .15**

Note. $N = 332$. BC CI = bias-corrected confidence interval. [a]These values are based on the unstandardized path coefficients. **95% confidence interval does not include 0 and therefore is significant at $p < .05$.

Table 4

Bootstrap Analysis of Magnitude and Statistical Significance of Indirect Effects of Faculty and Student Integration on Academic Major Satisfaction through Perceived Volitional Autonomy, Perceived Competence and Perceived Relatedness (Satisfaction and Dissatisfaction) in the fully mediated model

	Indirect Effects			β and product	Mean Indirect Effect (b)[a]	SE of Mean[a]	95% BC CI Lower, Upper[a]
1a. Faculty Integration	Perceived Volitional Autonomy	Academic Major Satisfaction		(.12) X (.33) = .04	.004	.02	-.03, .05
1b. Faculty Integration	Perceived Competence	Academic Major Satisfaction		(.28) X (.17) = .05	.01	.01	-.01, .04
1c. Faculty Integration	Perceived Relatedness	Academic Major Satisfaction		(.13) X (-.16) = -.02	.04	.02	.01, .08**
2a. Student Integration	Perceived Volitional Autonomy	Academic Major Satisfaction		(.53) X (.33) = .17	.14	.04	.07, .23**
2b. Student Integration	Perceived Competence	Academic Major Satisfaction		(.30) X (.17) = .05	.10	.03	.05, .17**
2c. Student Integration	Perceived Relatedness	Academic Major Satisfaction		(-.14) X (-.16) = .02	.17	.04	.11, .25**

Note. $N = 332$. BC CI = bias-corrected confidence interval. [a]These values are based on the unstandardized path coefficients. **95% confidence interval does not include 0 and therefore is significant at $p < .05$.

Figures
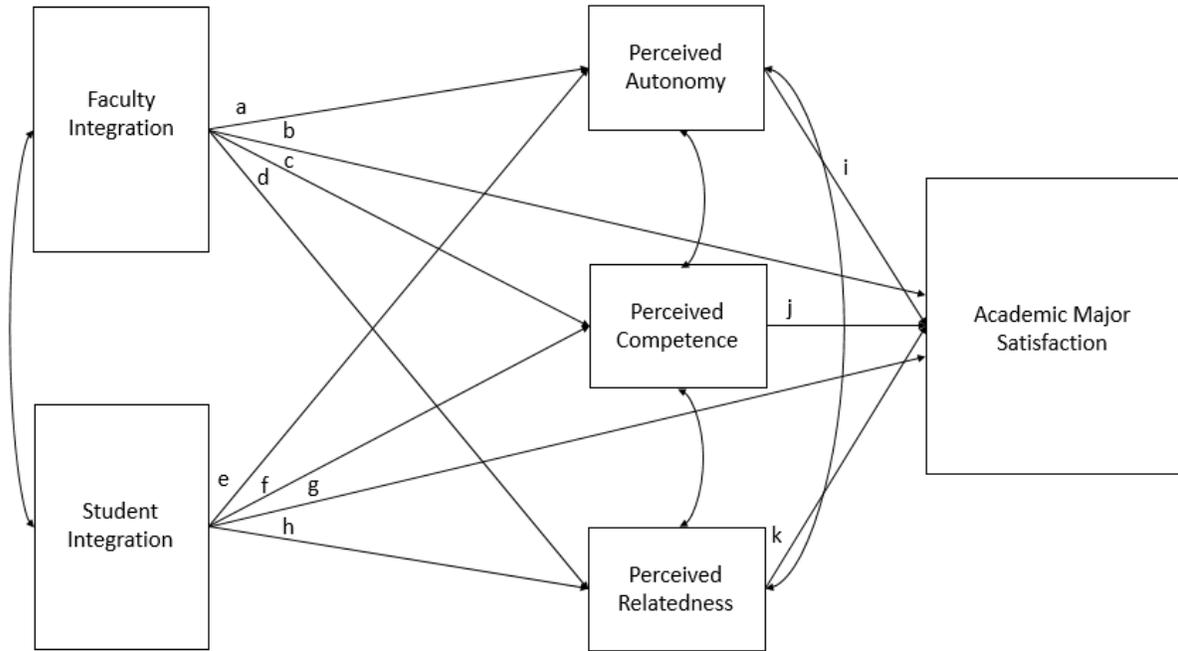
*Figure 1:* The Hypothesized Partially Mediated Model
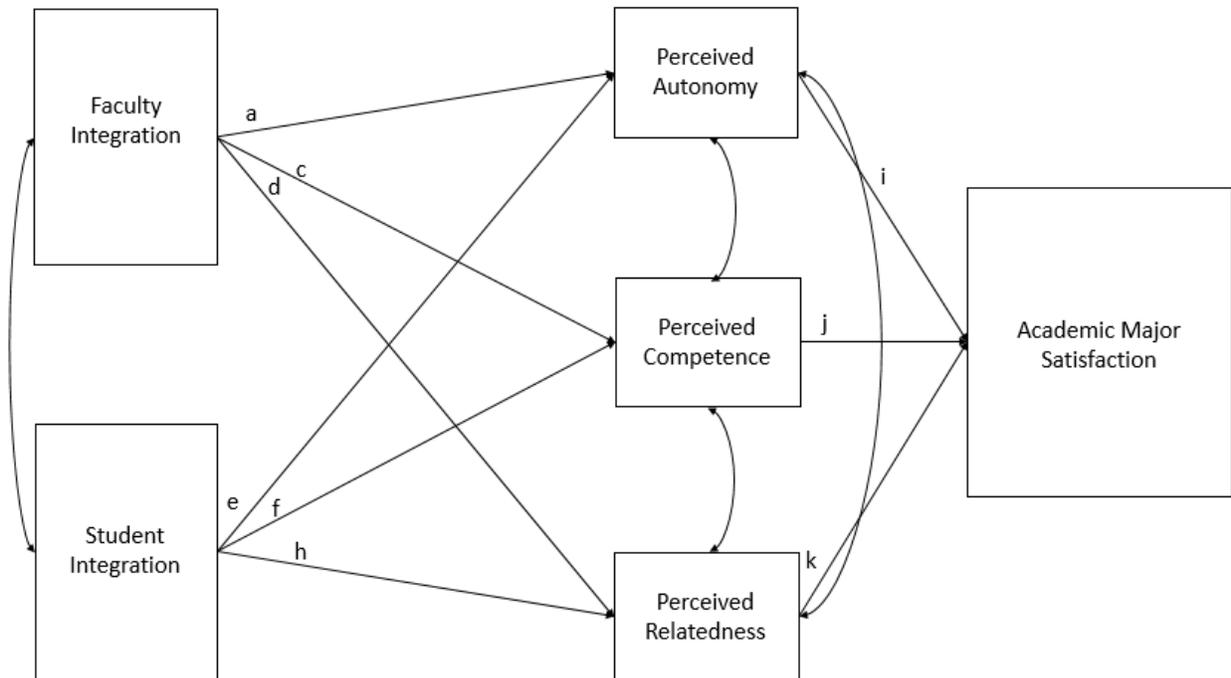
*Figure 2:* The Hypothesized Fully Mediated Model
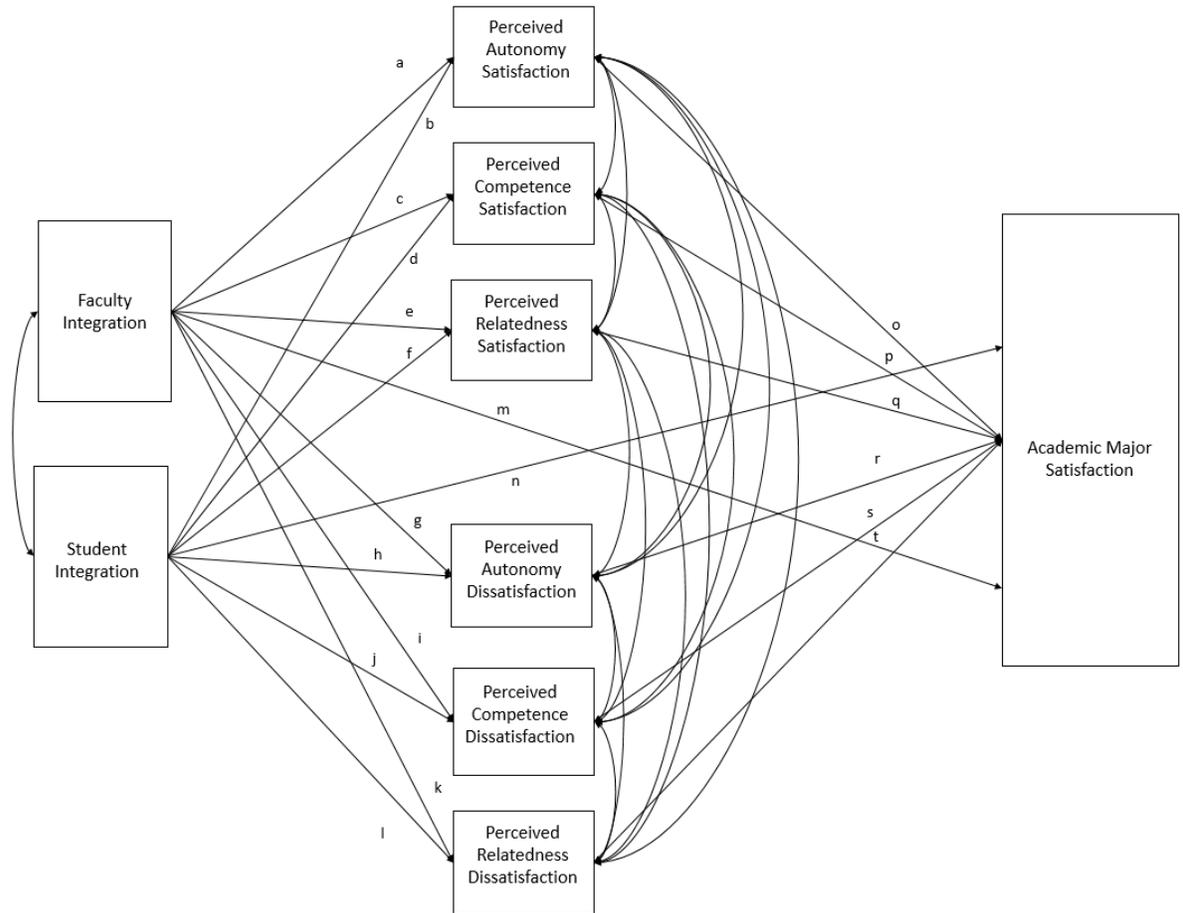
*Figure 3:* The Adjusted Hypothesized Partially Mediated Model
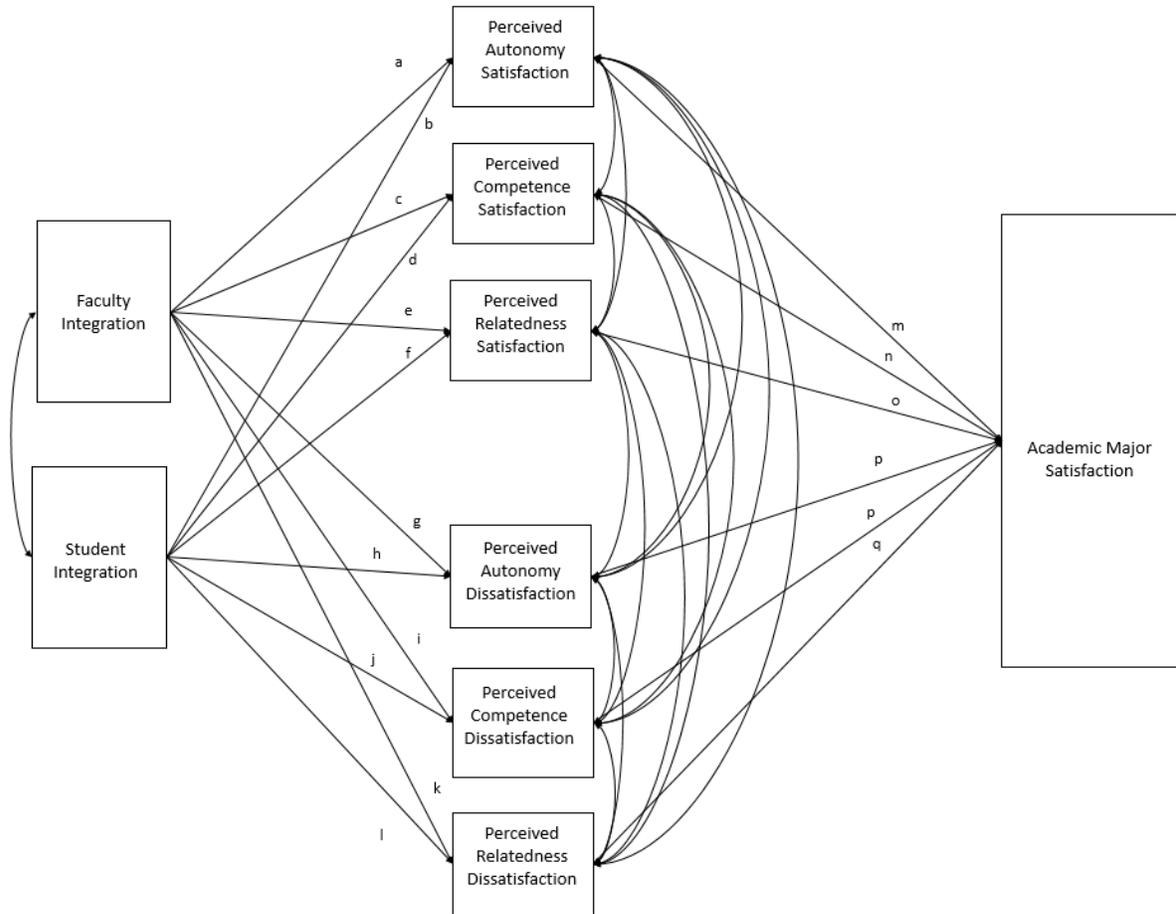
*Figure 4*: The Adjusted Hypothesized Fully Mediated Model
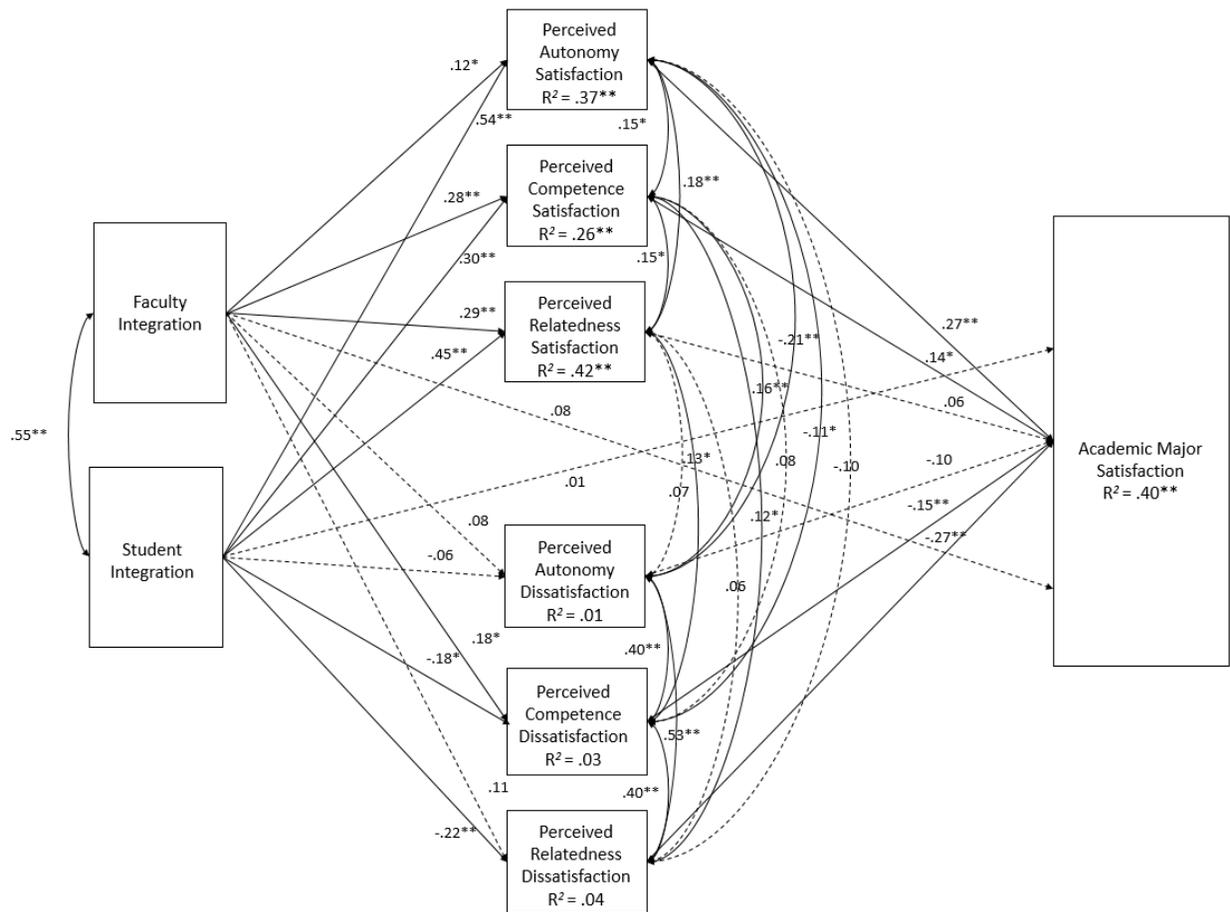
Figure 5: The Adjusted Partially Mediated Model
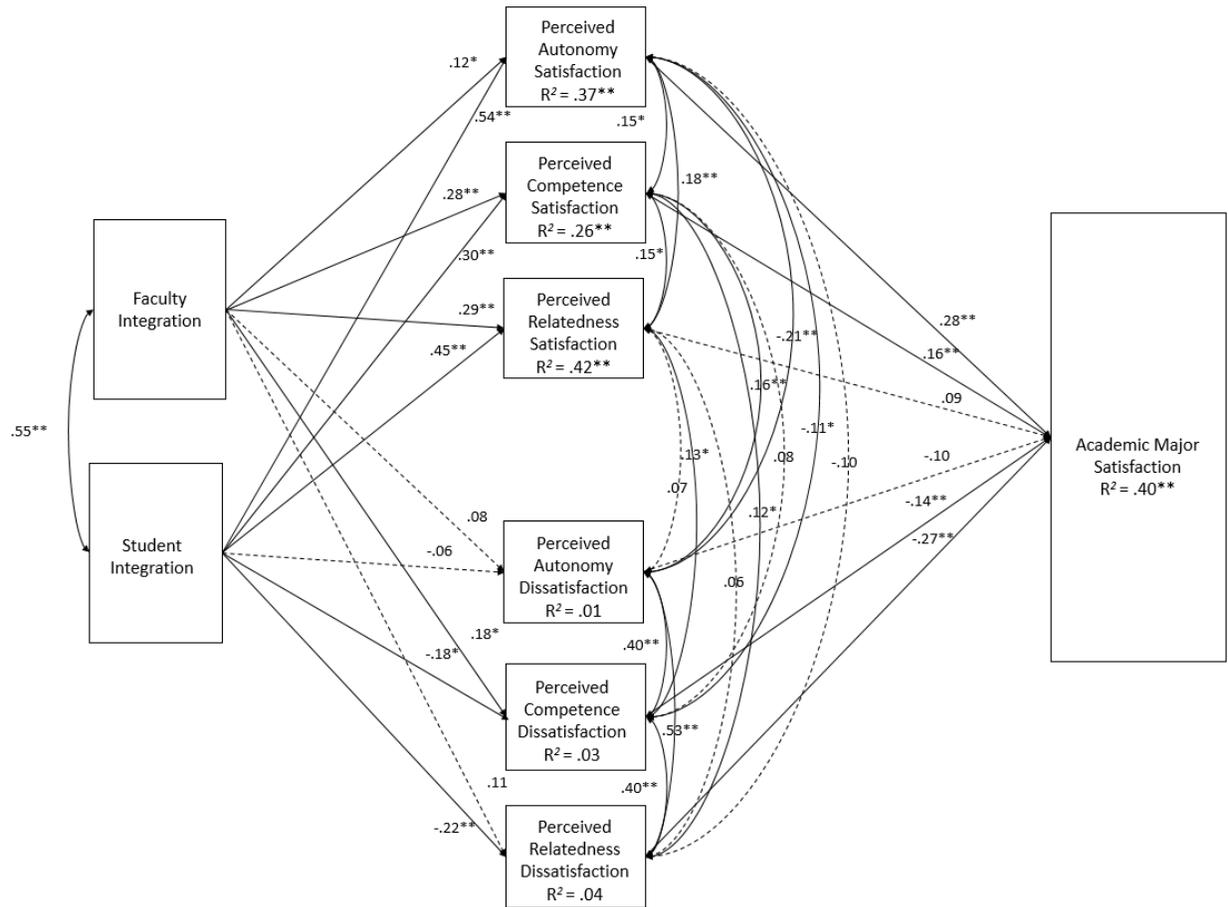
Note. N = 332 **p* < .05 ***p* < .01.

Figure 6: The Adjusted Fully Mediated Model
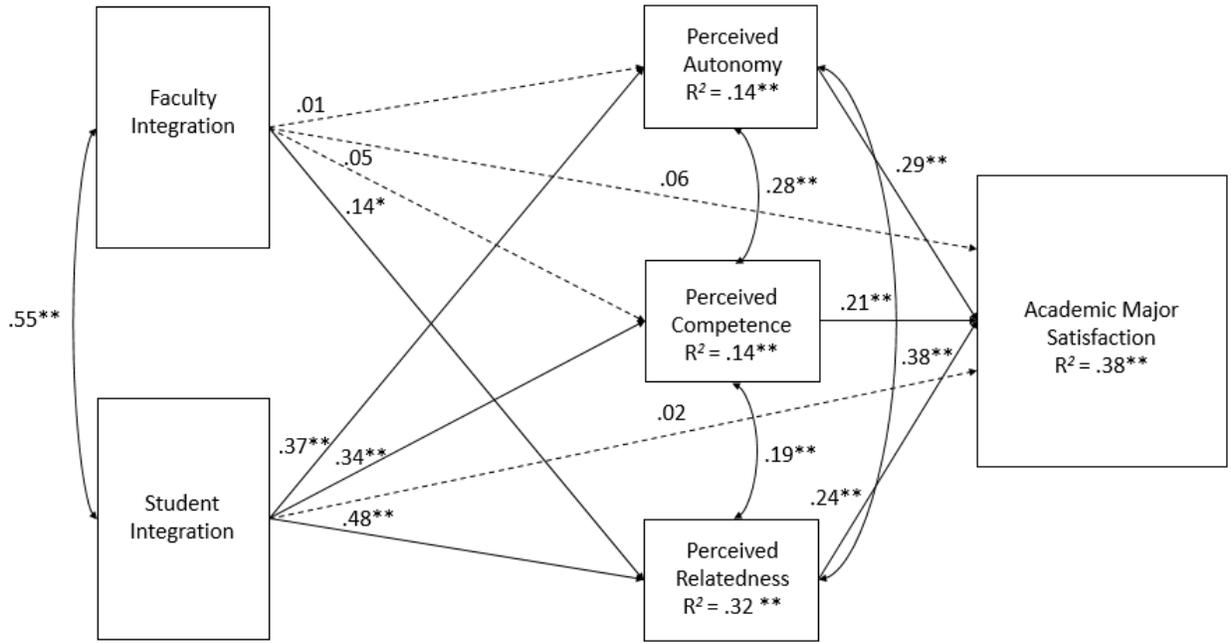
Note. N = 332 **p* < .05 ***p* < .01.

Figure 7: The Partially Mediated Model
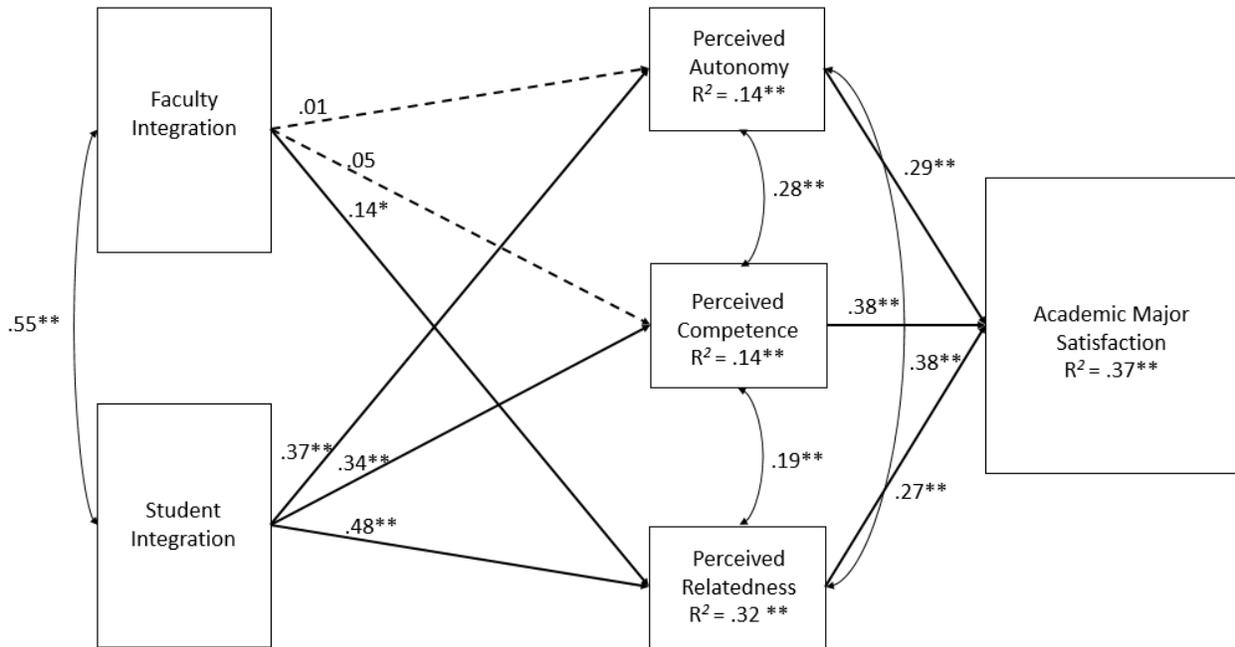
Note. N = 332 **p* < .05 ***p* < .01.

Figure 8: The Fully Mediated Model
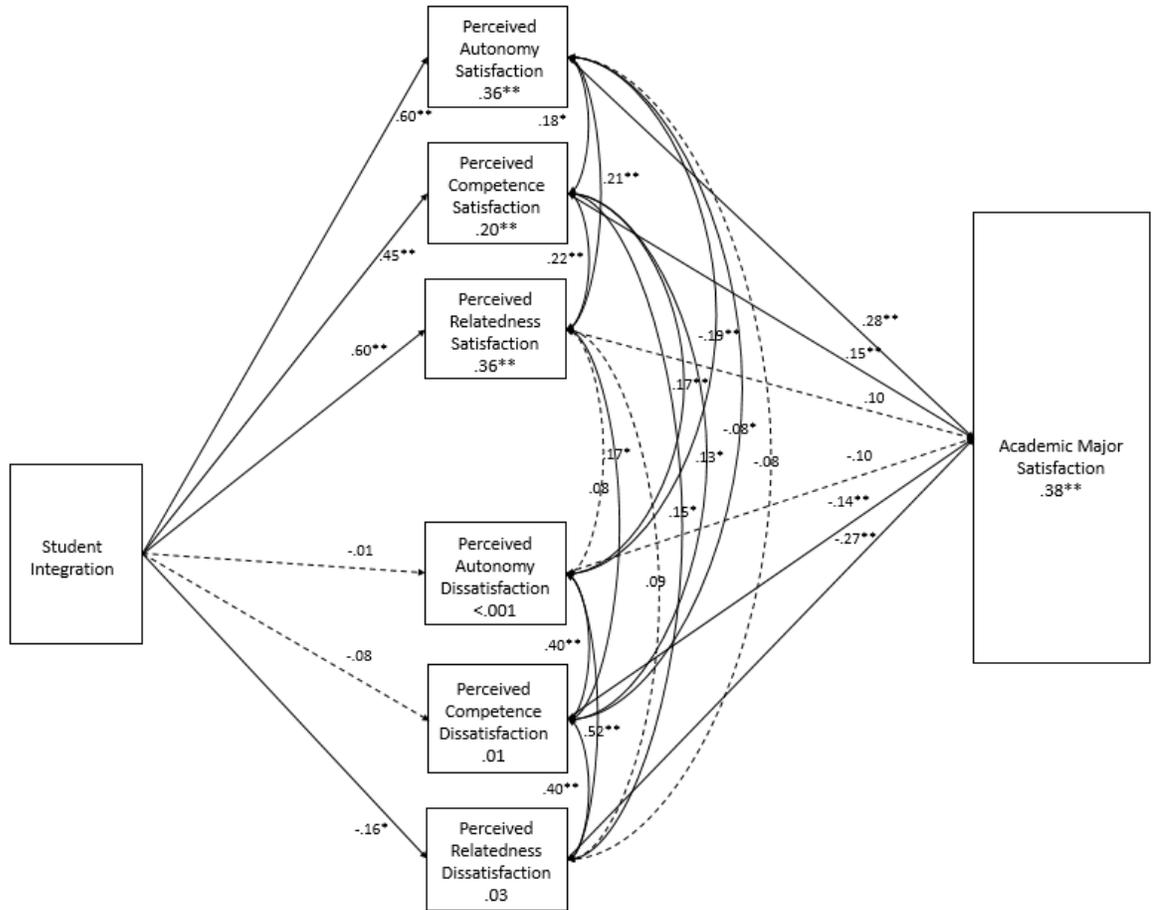
Note. N = 332 **p* < .05 ***p* < .01.

Figure 9: The Adjusted Fully Mediated Model without Faculty Integration

*Note. N* = 332 **p* < .05 ***p* < .01.
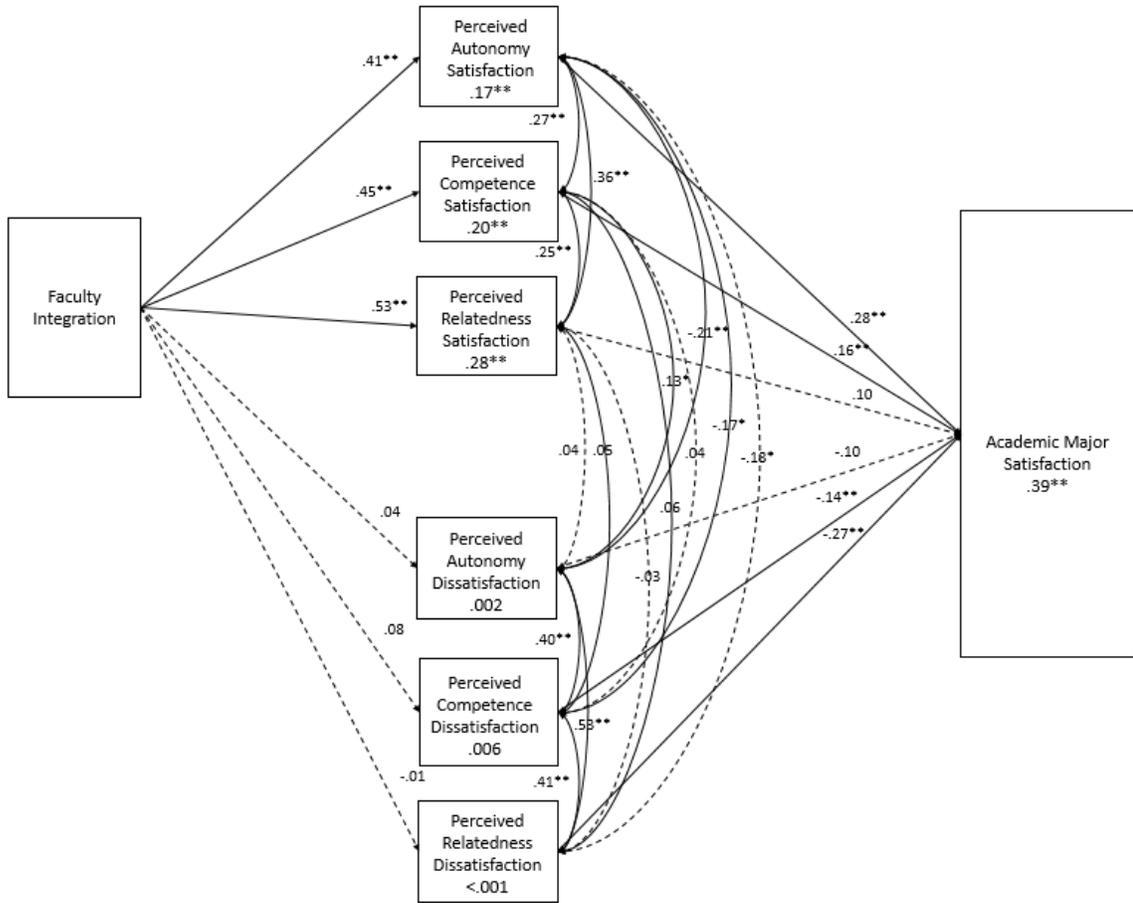
Figure 10: The Adjusted Fully Mediated Model without Student Integration

Note. N = 332 **p* < .05 ***p* < .01.

APPENDIX A. FACULTY INTEGRATION

(French & Oakes, 2004)

No agreement		Some agreement		Much agreement
1	2	3	4	5

1. I am satisfied with my opportunities to meet and interact informally with faculty members.
2. Many faculty members I have had contact with are willing to spend time outside of class to discuss issues of interest and importance to students.
3. I have developed a close, personal relationship with at least one faculty member.
4. My non-classroom interactions with faculty members have positively influenced my intellectual growth and interest in ideas.
5. My non-classroom interactions with faculty members have positively influenced my personal growth, values, and attitudes.
6. My non-classroom interactions with faculty members have positively influenced my career goals and aspirations.
7. Many faculty members I have had contact with are genuinely outstanding or superior teachers.
8. Many faculty members I have had contact with are genuinely interested in students.
9. Many faculty members I have had contact with are genuinely interested in teaching.
10. Many faculty members I have had contact with are interested in helping students grow in more than just academic areas.

APPENDIX B. STUDENT INTEGRATION

(French & Oakes, 2004)

No agreement		Some agreement		Much agreement
1	2	3	4	5

1. Most of my courses have been intellectually stimulating.
2. I am satisfied with my academic experience at this University.
3. I am more likely to attend a cultural event (e.g., a concert, lecture, or art show) now compared to a few months ago.
4. I am satisfied with the extent of my intellectual development.
5. In addition to required reading assignments, I read many of the recommended books in my courses.
6. My interest in ideas and intellectual matters has increased since starting classes.
7. I have an idea about what I want to major in.
8. This year my academic experience has positively influenced my intellectual growth and interest in ideas.
9. Getting good grades is important to me.
10. I have performed academically as well as I anticipated.
11. My interpersonal relationships with students have positively influenced my intellectual growth and interest in ideas.
12. I have developed close personal relationships with other students.
13. The student friendships I have developed have been personally satisfying.
14. My personal relationships with other students have positively influenced my personal growth, values, and attitudes.
15. It has been easy for me to meet and make friends with students.
16. I am satisfied with my dating relationships.
17. Many students I know would be willing to listen and help me if I had a personal problem.
18. Most students at this University have values and attitudes similar to mine.
19. I am satisfied with the opportunities to participate in organized extra-curricular activities at this University.
20. I am happy with my living/residence arrangement.
21. It is important to me to graduate from college.
22. It is important to me to graduate from this University.
23. I am confident that I made the right decision in choosing to attend this University.
24. I will most likely register at this University next fall.

APPENDIX C. PERCEIVED VOLITIONAL AUTONOMY

(Sheldon & Hilpert, 2012)

Please read each of the following statements carefully, thinking about how true it is for you.

No agreement		Some agreement		Much agreement
1	2	3	4	5

Satisfaction

I was free to do things my own way

My choices expressed my "true self"

I was really doing what interest me

Dissatisfaction

I had a lot of pressures I could do without

There were people telling me what I had to do

I had to do things against my will

APPENDIX D. PERCEIVED COMPETENCE

(Sheldon & Hilpert, 2012)

Please read each of the following statements carefully, thinking about how true it is for you.

No agreement		Some agreement		Much agreement
1	2	3	4	5

Satisfaction

I was successfully competing difficult tasks

I took on and mastered hard challenges

I did well even at the hard things

Dissatisfaction

I experienced some kind of failure

I did something that made me feel incompetent

I struggled doing something I should be good at

APPENDIX E. ACADEMIC SELF-EFFICACY

(Larson, et al., 1994)

Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
1	2	3	4	5	6

1. I have a high degree of academic ability

2. I am confident in my ability to succeed academically in the courses necessary to enter my chosen career

3. If graduate school were necessary for pursuing a career, I am confident that I would be accepted and do well

4. I have a high degree of math ability

APPENDIX F. PERCEIVED RELATEDNESS SUBSCALE

(Sheldon & Hilpert, 2012)

Please read each of the following statements carefully, thinking about how true it is for you.

No agreement		Some agreement		Much agreement
1	2	3	4	5

Satisfaction

I felt a sense of contact with people who care for me

I felt close and connected with other people

I felt a strong sense of intimacy with people

Dissatisfaction

I was lonely

I felt unappreciated by one or more important people

I had disagreements of conflicts with people

APPENDIX G. THE ACADEMIC MAJOR SATISFACTION SCALE

(Nauta, 2007)

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

1. I often wish I hadn't gotten into this major.

2. I wish I was happier with my choice of an academic major.

3. I am strongly considering changing to another major.

4. Overall, I am happy with the major I've chosen.

5. I feel good about the major I've selected.

6. I would like to talk to someone about changing my major.

APPENDIX H. DEMOGRAPHICS QUESTIONNAIRE

Age: _____

Gender: Male
                    Female
                    Other

Ethnicity: African American
                    Asian American/Pacific Islander
                    Caucasian/White
                    Hispanic or Latino/a
                    Native American
                    Other: _____

Year in School: Freshman
                            Sophomore
                            Junior
                            Senior
                            Other: _____
Academic Major: _____

Academic Major Certainty

Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
1	2	3	4	5	6

1. I am completely certain about what major I want to graduate with.
2. I have some doubts about which major is right for me. (R)
3. I might be making a mistake with the major I'm considering. (R)
4. I definitely know which major is the best choice for me.

APPENDIX I. ACADEMIC MAJOR CERTAINTY SCALE

Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree
1	2	3	4	5	6

1. I am completely certain about what major I want to graduate with.
2. I have some doubts about which major is right for me. (R)
3. I might be making a mistake with the major I'm considering. (R)
4. I definitely know which major is the best choice for me.

APPENDIX J. INFORMED CONSENT

Title of Study: **Academic Major Satisfaction**
Investigators: Mary Schenkenfelder, Principal Investigator
Lisa Larson, Ph.D., Study Supervisor

This is a research study. Please take your time in deciding if you would like to participate.

INTRODUCTION
The purpose of this study is to learn more about undergraduate students' academic major satisfaction.

DESCRIPTION OF PROCEDURES
If you agree to participate, you will be asked to complete several surveys. First you will be asked to fill out some demographic information, you will then be asked to answer questions relating to your experience within your major, and about your satisfaction with your major.

The whole survey will take about 20 minutes to complete. You will not be able to save your responses and finish at another time. If you intend to complete the survey you must finish it within a few hours of opening the survey.

RISKS
There are no foreseeable risks to participating in this survey. However, if you should feel uncomfortable or have concerns regarding the survey, please contact the primary investigator, Mary Schenkenfelder, (email: marysch@iastate.edu) or the study supervisor, Lisa Larson, Ph.D. (email: lmlarson@iastate.edu).

BENEFITS
If you decide to participate in this study there may be no direct benefit to you. It is hoped that the information gained in this study will contribute to the understanding of academic major satisfaction in college students.

COSTS AND COMPENSATION
You will not have any costs from participating in this study. You will receive one (1) research credit for participating. There are alternatives to completing this particular study if you wish to receive research credit such as participating in other studies, writing a research paper, etc. Please consult with your course instructor to learn about the difference ways you can earn research credit.

PARTICIPANT RIGHTS
Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decide to not participate in the study or leave the study early, it will not result in any penalty or loss of benefits to which you are otherwise entitled. You can skip any questions that you do not wish to answer.

CONFIDENTIALITY
Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies**,** auditing departments of Iowa State University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken:
-   Once your survey responses are uploaded to our secure data file, your name will be replaced with an ID code.
-   All data will be kept on a password-protected desktop computer within a locked room.
-   If the results are published, your identity will remain confidential.

QUESTIONS OR PROBLEMS
You are encouraged to contact the principal investigator with questions at any time during this survey.
-   For further information about the study, contact the primary investigator, Mary Schenkenfelder (email: marysch@iastate.edu) or the lab supervisor, Lisa Larson, Ph.D. (email: lmlarson@iastate.edu).
-   If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

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PARTICIPANT CONSENT
By clicking the icon next to "I understand this information" you are indicating that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document, and that your questions have been satisfactorily answered. After clicking "Consent" you will be led to a page with the study information and your consent information.

I understand this information.

APPENDIX K. IRB APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 6/21/2016

To: Mary Schenkenfelder   **CC:** Lisa Larson
W112 Lagomarcino Hall   W216 Lagomarcino Hall

From: Office for Responsible Research

Title: Predicting academic major satisfaction using environmental factors and Self-Determination Theory

IRB ID: 16-304

Study Review Date: 6/21/2016

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:
- **You do not need to submit an application for annual continuing review.**

- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption,** even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.