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THE RELATIONSHIP BETWEEN ACADEMIC SELF-CONCEPT AND ACADEMIC ACHIEVEMENT IN COLLEGE STUDENTS: AN EXAMINATION OF GENDER DIFFERENCES

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ABSTRACT

THE RELATIONSHIP BETWEEN ACADEMIC SELF-CONCEPT AND ACADEMIC ACHIEVEMENT IN COLLEGE STUDENTS: AN EXAMINATION OF GENDER DIFFERENCES

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Academic self-concept is considered central to the identity and development of college students. Previous studies of academic self-concept of college students have largely relied on only two time points to study changes that occur during college. Additionally, prior studies have found a positive association between academic self-concept and academic achievement, but have employed data techniques that limit the conclusions drawn to correlational associations.

This study investigated the changes in academic self-concept over the four years of undergraduate education using a large but non-random sample of students at a highly selective institution. Additionally, using auto-regressive cross-lagged models, it explored the causal ordering of academic self-concept and academic achievement. Finally, the study explored whether changes in academic self-concept, and its relationship to academic achievement, were different for men and women.

The results suggested an initial decline in academic self-concept during the first year of college, consistent with the Big-Fish-Little-Pond-Effect, followed by an increase in academic self-concept at graduation. The study found men and women experienced similar patterns of change in academic self-concept through the college years, but that women's academic self-concept was consistently lower than men's academic self-concept. For men, higher academic achievement was followed by higher academic self-concept at all time points. Among women,

however, there was evidence of reciprocal effects between academic self-concept and academic achievement, especially in the first year of college. These findings indicate that lower academic self-concept in women could be academically disadvantaging them compared to men, particularly early in their collegiate experience.

The study also examines the measurement properties of CIRPs Academic Self-Concept scale and the adequacy of auto-regressive cross-lagged models in place of multi-level auto-regressive cross-lagged models.

Policy and research implications, as well as future directions for research, are discussed.

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Chapter I: Introduction and Problem Statement

Academic self-concept (ASC) has been conceptualized as a student's belief and perception about his or her academic abilities, relative to that of other students (Byrne, 1984; Pascarella & Terenzini, 1991). It is considered to be central to the identity and development of college students (Pascarella & Terenzini, 1991); however, there has been far less research dedicated to academic self-concept of college students than that of pre-college students (Pascarella et al., 1987). Additionally, there is renewed interest in academic self-concept of college students, as university leaders see improving it as a way to better prepare their students for life after college (Jensen & Jetten, 2016).

Academic self-concept is a facet of general self-concept, a trait which is theorized to be multifaceted and hierarchical (Shavelson et al., 1976). Multifaceted means that self-concept comprises different category groups (Shavelson et al., 1976), such as academic and social self-concepts. Hierarchical means that different facets of self-concept will form a hierarchy (Shavelson et al., 1976). For example, academic self-concept will fall under general self-concept, subject-specific self-concepts will fall under academic self-concept. The most commonly accepted model for self-concept, the Marsh-Shavelson model, captures both the multifaceted and hierarchical nature of academic self-concept, and includes two higher-order academic factors (math and verbal) nested under academic self-concept, which in turn is nested under general self-concept (see Figure 1.1) (H. Marsh & Shavelson, 1985). Marsh (2006) calls self-concept "one of the most important constructs in social sciences" (p. 6). Additionally, Bong and Skaalvik (2003) identify five key antecedents to self-concept:

1) Frames of reference – ASC is influenced by the standards against which one judges oneself

2) Causal attributions – ASC is influenced by the factors to which people attribute their successes and failures
3) Reflected appraisals from significant others – ASC is influenced by how one believes others view them
4) Mastery experiences – ASC is influenced by past academic experiences
5) Psychological centrality – ASC is influenced by how important one views academic ability

It has previously been established that academic self-concept is impacted by the experiences a student has during college (A. W. Astin, 1977), and that these college experiences continue to influence academic self-concept many years after graduation (Pascarella et al., 1987). The extant literature on academic self-concept of college students is limited in three ways.

First, it largely relies on only two time points when looking at changes in academic self-concept that occur during college (e.g., Astin, 1977). These studies, many of which examine growth in ASC by measuring it prior to entering college and upon graduation, generally agree that there is growth in ASC between entering college and leaving college (Pascarella & Terenzini, 1991). However, a separate set of studies, looking instead at the changes in ASC that occur during the first year of college, indicate that typically there is a statistically significant decline in academic self-concept over this year (Jackson, 2003; Pascarella & Terenzini, 1991). This would suggest that growth in ASC during college may not be monotone positive. Limited work has been done to establish the trends in academic self-concept in a more fine-grained manner (e.g., annually). Therefore, the study of academic self-concept development could be advanced by using a more fully longitudinal approach.

Second, there has been little progress in establishing the direction of the causal ordering of academic self-concept and academic achievement in college students. Studies that pertain to the causal predominance between academic self-concept and academic achievement almost exclusively use K-12 students as their subjects of interest (e.g., Byrne, 1986; Guay, Marsh, & Boivin, 2003; H. W. Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005; H. W. Marsh & Yeung, 1998), most of which rely on structural equation methodologies to make causal claims between the two constructs. Indeed, the study of academic self-concept in K-12 students has far outpaced that of academic self-concept in college students, with research questions becoming more nuanced and fine-grained. For example, Wang and Neihard (2015) look at the relationship between academic self-concept and academic self-efficacy as it pertains to twice-exceptional high school students. Thijs, Verkuyten, and Helmond (2010) study the interactions between academic self-concept, class rank, class size, and gender among early adolescents. Meanwhile, Peixoto and Almeia (2010) focus their attention on the relationship between academic self-concept and academic achievement in high schoolers experiencing academic failure. This degree of refinement in research questions at the K-12 level makes the dearth of progress at the college level even more apparent.

Three theories describe the ways the constructs of academic self-concept and academic achievement could be related. The self-enhancement hypothesis implies that academic self-concept is a determinant of subsequent academic achievement—higher academic self-concept leads to higher academic achievement. This relationship would place importance on enhancing or sustaining positive academic self-concept in order to help students succeed academically. Conversely, the skill-development hypothesis posits that academic achievement is a determinant of subsequent academic self-concept—higher academic achievement leads to higher levels of

academic self-concept (H. Marsh & Craven, 1997). This hypothesis implies that attempting to directly enhance academic self-concept in students is less powerful, as it typically will not have a significant impact on their academic success. A synthesis between these two hypotheses, the reciprocal-effects hypothesis, posits that prior academic self-concept affects subsequent academic achievement, and that prior academic achievement affects subsequent academic self-concept (Guay et al., 2003). Finding support for the direction of the relationship between academic self-concept and academic achievement would provide indications of the importance of supporting the development of positive academic self-concept among college students.

Third, gender differences with respect to aspects of academic self-concept, such as level of academic self-concept, changes in academic self-concept, and the causal ordering of academic self-concept and academic achievement, have not been given sufficient attention. There are a few studies suggesting that among college students, men have higher levels of ASC than women (Smith et al., 1994); however, the differences between men and women in the changes in ASC that occur during college merit further examination. Given ASC's positive association with aspects of a successful college experience, such as degree attainment (Pascarella et al., 1987), motivation (Ferla et al., 2010), and academic achievement (Cokley, 2000; Ferla et al., 2010; Gerardi, 1990; H. Marsh, 1987; Pascarella et al., 1987; Reynolds, 1988), it is important to further explore whether, and to what extent, gender differences exist. Additionally, given its potential to influence subsequent academic achievement, it also is important to examine whether the causal relationship between academic self-concept and academic achievement is different for men and women in college.

This study focused on the academic self-concept of college students at a highly selective university in the Northeast United States. Given ASC measured at three time points (prior to

entering college, beginning of the second year of college, and at graduation), I examined the changes in academic self-concept over the four years of undergraduate education. This study had a particular focus on the changes in academic self-concept that occur between adjacent time points. For example, if some students experience a decline in academic self-concept during the first year of college, and subsequently never recover from this decline, this could be negatively impacting their college experience (e.g., lower academic achievement, taking longer to graduate, lack of academic goal-setting).

Additionally, using an auto-regressive cross-lagged model, I explored whether changes in academic self-concept influence subsequent changes in academic achievement, whether prior academic achievement influences academic self-concept, and attempt to establish which of these relationships is stronger. Here, auto-regressive is defined as a directed regression path where the current value of a construct or variable predicts its value at the next measurement occasion. Cross-lagged is defined as a directed regression path where the current value of a construct predicts the value of a different construct at the next measurement occasion (Little & Card, 2013).

This model allowed me to look at the cross-lagged effects between academic achievement and academic self-concept, while controlling for prior levels of both constructs. Combined with theory, results from an auto-regressive cross-lagged model can be used to make an argument for causal direction (Hertzog & Nesselroade, 2003; Selig & Little, 2012). These findings will advance academic self-concept research as it pertains to college students, as well as inform policies and practices of college faculty, staff and administrators to better serve their students so they can succeed academically.

Finally, I explored whether changes in academic self-concept and the relationship between academic self-concept and academic achievement were different for men and women. While a multitude of student characteristics may impact a student's academic self-concept, and overall college experience, such as socio-economic status or race/ethnicity, campus trends at the study site suggested anecdotally that there were gender differences in academic self-concept that warranted a more in-depth investigation. For example, a 2013 article in the university student newspaper, the current Vice Provost for Faculty was reported speaking of "'the shock and horror on some faces of the women faculty'" (Fissinger, 2013) as they were presented with survey data suggesting female students at this institution leave school with lower overall self-confidence than they had as freshman.

Ideally, the college experience should be a positive one for students, regardless of gender, particularly in ways that are related to academic and post-college success. However, increasingly many institutions are reporting different college experiences for men and women, with some institutions implementing policy changes and creating initiatives to address these differing experiences. For example, faced with lower levels of engagement by its male students compared to female students, the University of Portland created League of Extraordinary Gentlemen to provide its male students a platform for talking about masculinity and to increase student engagement levels (Sander, 2012). Researchers from the University of Pittsburgh proposed that universities create interventions for professors, particularly as it comes to the messages they are (unknowingly) sending to student, after finding that women were dropping out of the premed track more often than men, even when the women were earning comparable grades to their male peers (Bauer-Wolf, 2019). Vanderbilt has launched a Women's Initiative Overview, with the

goal of developing solutions and practices to ensure that women have the opportunity to succeed (Vanderbilt University, n.d.).

If, at this institution, the college experience was found to be negatively impacting the academic self-concept of one gender more than the other, it is important for faculty and administrators to be aware of this phenomenon so that they can take steps to address it.

Background Literature

Academic self-concept.

A shift in the study of college student development occurred in the 1960s, when it became important to focus not only on the acquisition of information and the development of intellectual competence, but also on college students' "identity" (Chickering, 1969). Indeed, institutions are now held to goals not only related to their students' cognitive development, but also to their development with respect to an understanding of social and cultural institutions, of their value structures and moral sensibilities, and their personal growth and identity development (Pascarella & Terenzini, 1991). Multiple studies of college students have established that changes in aspects typically associated with identity, such as attitudes, interests, and values, occur during college (Chickering, 1969; Pascarella & Terenzini, 1991, 2005). Other studies have demonstrated that a student's stronger, positive sense of identity is associated with outcomes such as higher levels of persistence and greater academic achievement (Chickering & Reisser, 1993; Pascarella & Terenzini, 2005). This focus on student identity and non-cognitive attributes continues today, with undergraduate students being asked by their institutions to participate in a myriad of surveys and questionnaires that attempt to measure such attributes (e.g., Cooperative Institutional Research Program's Freshman Survey and College Senior Survey, National Survey of Student Engagement).

One aspect of college student identity is academic self-concept (Jensen & Jetten, 2016; Pascarella & Terenzini, 1991). Academic self-concept can be conceptualized as a student's belief and perception about his or her academic abilities, relative to that of other students (Byrne, 1984; Pascarella & Terenzini, 1991). It has long been thought of as a student characteristic that can be affected by the college experience (Pascarella & Terenzini, 1991). While some have described research relating to academic self-concept as a "somewhat ill-disciplined field," its importance in college student development (as well as K-12 student development) make it so that it "cannot be ignored" (Hansford & Hattie, 1982, p. 123). Indeed, the volume of literature related to self-concept, its centrality to identity and development, and "the value attached to it as an educational outcome in its own right" demand that attention be paid to the construct of academic self-concept (Pascarella & Terenzini, 1991, p. 171). Positive academic self-concept is considered both as a desirable outcome in itself, as well as an important influence on other outcomes of interest (such as academic achievement and motivation) (Bong & Skaalvik, 2003; H. W. Marsh, 2006), and as such, has been recognized as a variable central to the educational process (Pascarella et al., 1987).

The literature on academic self-concept of college students generally indicates that there is growth in ASC over the four years of college, but that this growth may be non-linear (Pascarella & Terenzini, 1991). While the evidence is mixed, there is generally a consensus that there is an initial decline in academic self-concept during the first year of college. However, the reasons behind this decline have not yet fully been established (Pascarella & Terenzini, 1991). Jackson (2003) suggests that this decline is due to the Big-Fish Little-Pond Effect (BFLPE), which attributes the decline in ASC to a change in students' frame of reference—students who were "big fishes" in high school may find themselves to be just average students in college.

Regardless of the drop in ASC that is expected to occur during the first year, by the end of college, academic self-concept is expected to be higher than entering levels of academic self-concept (A. W. Astin, 1977; Pascarella & Terenzini, 1991).

One limitation of the studies establishing greater levels of academic self-concept at the end of college than at the beginning, particularly Astin (1977), is that this trend is established using only those two time points, so it is unclear when the growth occurs (although, as previously indicated, it is likely not in the first year of college). Additionally, there are few conclusions drawn about the magnitude of the changes in academic self-concept that occur (Pascarella & Terenzini, 1991), or how much of this change in academic self-concept can be attributed to the college experience.

Interest in academic self-concept stems not just from it being a crucial aspect of student identity, and one that is affected by the college experience (A. W. Astin, 1977), but from its relationship with other important factors related to the college experience. Students' self-beliefs are thought to influence other cognitive, social, and emotional aspects of college development (Bong & Skaalvik, 2003). Positive associations have been found between academic self-concept and degree attainment (Pascarella et al., 1987), motivation (Ferla et al., 2010), academic achievement (Cokley, 2000; Ferla et al., 2010; Gerardi, 1990; H. Marsh, 1987; Pascarella et al., 1987; Reynolds, 1988), adoption of mastery and/or achievement goals (Ferla et al., 2010), persistence (Ferla et al., 2010), increased internal locus of control (Reynolds, 1988), and retention (Tinto, 1975).

However, these studies are limited to making claims about the contemporaneous correlations between academic self-concept and other constructs of interest; most studies lack the prerequisites required for supporting causal claims (e.g., experimental designs, longitudinal

studies paired with appropriate statistical techniques), particularly in academic self-concept studies concerning college students. For example, academic self-concept has only been shown to be positively correlated with academic achievement (e.g., Fenning & May, 2013; Ferla et al., 2010), while theory supports not simply a correlational relationship, but a causal relationship between these two constructs. While studies of elementary and secondary students have found evidence supporting both directions of this causal relationship (Guay et al., 2003; H. Marsh & Craven, 1997) there has been little work done to advance support for either the self-enhancement model or the skill development model in college students.

Auto-regressive cross-lagged models.

Auto-regressive cross-lagged modeling is a statistical technique that can be used to describe directional influences between two (or more) theoretical constructs across multiple time points. The constructs are represented in the models by using empirically measured variables, which serve to represent a measurable form of the theoretical constructs. These models are used to examine both the stability of variables across time and the relationship between the variables over time. The primary goal for the application of auto-regressive cross-lagged models is to find evidence of a causal relationship between two variables (Kearney, 2017; Newsom, 2015). Such models can also include covariates that may be seen as relevant to one or both variables of interest (e.g., race/ethnicity) (Newsom, 2015). Auto-regressive cross-lagged models have been used in multiple domains to study the causal relationship between two variables. They been used to answer such questions as: do changes in school climate lead to changes in academic performance (Benbenishty et al., 2016)? Do job resources have an impact on work engagement (Hakanen et al., 2008)? What is the effect of math teacher expectations on future student achievement (Jamil et al., 2018)? Do perceptions of scientific agreement play a causal role in

shaping beliefs about climate change (Kerr & Wilson, 2018)? Does taking selfies increase levels of narcissism, or do people take selfies because they are already narcissistic (Halpern et al., 2016)?

The "cross-lagged" paths in the model estimate the relationship between the two variables of interest in *both* directions, (between variable X and time one and variable Y at time two, and between variable Y at time one and variable X at time two), making these models an ideal measurement tool to compare the self-enhancement model and the skill development model of academic self-concept (see Figure 1.2).

More specifically, the self-enhancement hypothesis would be supported if there was found to be a strong relationship between academic self-concept at time one and academic achievement at Time 2 (controlling for academic achievement at time one), without also observing an equally strong relationship between academic achievement at time one and academic self-concept at time two (controlling for ASC at time one). Conversely, the skill development hypothesis would be supported if there was found to be a strong relationship between academic achievement at time one and ASC at time two (controlling for ASC at time one), without also observing an equally strong relationship between academic self-concept at time one and academic achievement at time two (controlling for academic achievement at time one). A reciprocal-effects hypothesis would be supported if the cross-lagged relationships were found to be significant in both directions.

Auto-regressive cross-lagged models have previously been used to estimate causal relationships between variables in a variety of settings, such as psychology (e.g., Cacioppo, Hawkley, & Thisted, 2010; Sher, Wood, Wood, & Raskin, 1996), and health (e.g., Christens, Peterson, & Speer, 2011; Hakanen, Schaufeli, & Ahola, 2008). In the field of education, such

models have been used to make causal claims regarding the relationships between such constructs as school climate and academic achievement (Benbenishty et al., 2016), teacher expectations and mathematics achievement (Jamil et al., 2018), and parent academic reinforcement and mathematics achievement (Hong et al., 2010). In the domain of academic self-concept, two studies were located that utilized auto-regressive cross-lagged models; one used these models to examine the causal relationship between math self-concept and English self-concept, and found little evidence for causal predominance between these two constructs (Parker et al., 2015). Similar to the study proposed here, Grygiel, Modzelewski, and Pisarek (2017) use auto-regressive cross-lagged models to examine the causal relationship between academic self-concept and academic achievement for a sample of Polish primary school students. They found evidence of a reciprocal relationship between academic self-concept and academic achievement; however, they concluded that the relationship between prior academic achievement on later academic self-concept was the stronger relationship, supporting the skill development hypothesis.

Significance of Study

This study could provide evidence regarding the changes in ASC across the four years of college. Given the prior literature on ASC of college students, as well as my experience in examining survey results of college students, I hypothesized that upon entering a highly selective institution, men and women, on average, will have similar levels of ASC, and that both genders will experience a decline in academic self-concept over the first year of college. I also hypothesized that this decline will be larger on average for women than for men, despite their equivalent, or even stronger, academic performance. Further, I hypothesized that academic self-concept will then increase for both genders, but that women will never "catch up" to the

academic self-concept levels of their male peers. Should this be the case, it would draw the attention of higher education faculty and administrators to the fact that the college experience is more negatively impacting women than men in this area. By evaluating students at multiple time points on the dimension of academic self-concept, environmental conditions can then be modified to further students' development along this dimension (Chickering, 1969) particularly with regard to women.

This study also informs the debate regarding the causal ordering between academic self-concept and academic achievement in college students. A positive and statistically significant relationship between prior academic self-concept and subsequent academic achievement would place additional emphasis on the enhancement and sustainment of positive academic self-concept in order to improve students' academic achievement. However, if there is little or no significant relationship found between prior academic self-concept and subsequent academic achievement, it would support lesser concern for the development of positive academic self-concept, as it would not strengthen academic achievement (though it still may be important for other reasons).

Research Questions

This study was guided by six research questions:

1a. Given measurements at three widely separated time points (prior to entering college, beginning of second year of college, and at graduation), how do mean levels of academic self-concept change during the four-year undergraduate experience?

1b. To what extent are the changes in levels of academic self-concept during the four-year undergraduate experience different for men and women college students?

2a. At each of the three time points, (i) how is academic self-concept related to student demographics and pre-matriculation characteristics (gender, admission rating, race,

college of enrollment)? (ii) Controlling for demographics and pre-matriculation characteristics, how is academic self-concept at later time-points related to academic self-concept at earlier time-points?

2b. At each of the three time points, (i) how is academic achievement related to student demographics and pre-matriculation characteristics (gender, admission rating, race, college of enrollment)? (ii) Controlling for demographics and pre-matriculation characteristics, how is academic achievement at later time-points related to academic achievement at earlier time points?

3. Controlling for previous academic achievement and pre-matriculation characteristics, (a) what is the cross-lagged relationship between academic self-concept at Time 1 (prior to entering college) and academic achievement at Time 2 (beginning of second year of college)? (b) what is the cross-lagged relationship between academic self-concept at Time 2 (beginning of second year of college) and academic achievement at Time 4 (at graduation)?
4. Controlling for previous academic self-concept and pre-matriculation characteristics, what is the cross-lagged relationship between academic achievement at Time 1 (prior to entering college) and academic self-concept at Time 2 (beginning of second year of college)? What is the cross-lagged relationship between academic achievement at Time 2 (beginning of second year of college) and academic self-concept at Time 4 (at graduation)?
5. Controlling for previous academic achievement and pre-matriculation characteristics, is the cross-lagged relationship between academic self-concept at Time 1 and academic achievement at Time 2 different for men and women in college? Is the cross-lagged

relationship between academic self-concept at Time 2 and academic achievement at Time 4 different for men and women in college?

6. Controlling for previous academic self-concept and pre-matriculation characteristics, is the cross-lagged relationship between academic achievement at Time 1 and academic self-concept at Time 2 different for men and women in college? Is the cross-lagged relationship between academic achievement at Time 2 and academic self-concept at Time 4 different for men and women in college?

Methodology

This study employed a variety of quantitative methodologies. In particular, descriptive statistics were used to explore the changes in academic self-concept that occurred during college (research questions #1a and #1b), and ordinary least squares regression was used to explore the relationship between academic self-concept/academic achievement and demographic/pre-matriculation variables, as well as the auto-regressive relationships of both constructs (research questions #2a and #2b). Auto-regressive cross-lagged models were used to examine the relationship between academic self-concept and academic achievement (research questions #3, and #4), with separate models for men and women being used to answer research questions #5, and #6. Academic self-concept was measured via a survey, and academic achievement was measured using institution-reported data. A visual representation of the types of data collected and when can be found in Appendix A.

Survey instrument.

The Higher Education Research Institute's (HERI) Cooperative Institutional Research Program (CIRP) has created several survey instruments for assessing the college experience, including The Freshman Survey (TFS) (administered prior to entering college) and the College

Senior Survey (CSS) (administered in the spring of senior year) (Higher Education Research Institute, n.d.). Included in these surveys is an Academic Self-Concept scale. The CIRP Academic Self-Concept scale is defined as "a unified measure of students' beliefs about their abilities and confidence in academic environments" and is measured using four items: self-rated academic ability; self-rated drive to achieve; self-rated mathematical ability; and self-rated self-confidence (intellectual) (Cooperative Instituional Research Program, 2011). Respondents are asked to rate themselves on each item compared with the average person their age, with response options: "highest 10%," "above average," "average," "below average," and "lowest 10%." Scale scores are then calculated using the average across all four items, with a score of one being low academic self-concept, and a score of five representing high academic self-concept.

Institution-reported data.

Academic achievement was measured using two separate measures: for the initial time point (prior to entering college), because college GPA was not available as the students had not received any grades, standardized test scores were used (SAT and ACT scores). ACT scores were converted to SAT scores using a concordance table so that all scores were approximately on the same metric. For subsequent time points, cumulative GPA was used to represent academic achievement. Both standardized test scores and cumulative GPA were extracted directly from institutional records.

Participants.

Students in the Class of 2017 at a private, sectarian, liberal arts university were the source of data for this study. The institution is located in the Northeast United States, and is an R1 research institution with over 9,000 undergraduate students across four undergraduate schools (Arts and Sciences, Business, Education, and Nursing). The CIRP Academic Self-Concept scale

was administered to this institution's Class of 2017 at four different time points—prior to entering college, as part of TFS (Time 1 or T1), fall of sophomore year (Time 2 or T2), fall of junior year (Time 3 or T3) and spring of senior year, as part of the CSS (Time 4 or T4). Due to low response rates at Time 3, these responses were not included in the analysis and design for this study was based on three time points—Time 1, Time 2, and Time 4 (Appendix B contains descriptive statistics for each of the four items on the Academic Self-Concept scale at all three time points). Upon graduation in 2017, there were 2,259 students in the Class of 2017. Of that cohort, 615 students completed the survey at Time 1, Time 2, and Time 4 (representing 27.2% of the graduating class) (see Table 1.1). While the three time-point sample of respondents was generally representative of the Class of 2017, there were a few statistically significant deviations. The three time-point sample was more female, white, and better academically credentialed than the population, as well as having a smaller proportion of students from Arts and Sciences.

Analysis plan.

Descriptive statistics and regression.

Using the scale scores derived from the four items that undergird the Academic Self-Concept Scale, box-plots summarizing the distributions and mean scores on the scale at all three time points were described, both for the full sample and by gender. This enabled the examination of the changes in academic self-concept across the four-year undergraduate experience. Additionally, effect size calculations were conducted at each time point, to determine if the differences between men and women were substantively important. While it is often typical to use inferential statistics, such as t-tests, to make claims as to the statistical significance of differences between groups, because the sample used in this study is not a random sample, the results of the t-tests can only be interpreted in qualitative terms, and the results of such tests

would only be suggestions, not claims of statistical significance. Regression coefficients and model fit statistics (e.g., Adjusted R^2) were then used to examine the relationships between the outcome variables of interest (academic self-concept scale scores, academic achievement) and demographic and pre-matriculation covariates, as well as the auto-regressive relationships of the outcome variables with themselves at earlier time points.

Tables 1.2, 1.3, and 1.4 present descriptive statistics at Time One. Table 1.2 illustrates the differences in ASC between men and women prior to matriculation, regardless of college of enrollment. Additionally, Figure 1.3 displays box plots of the Academic Self-Concept scale score distributions for both men and women, illustrating that the mean score for men is higher than for women. Tables 1.3 and 1.4 indicate that academic self-concept is positively and statistically significantly correlated with academic achievement as measured by standardized test scores.

Auto-regressive cross-lagged models.

Auto-regressive cross-lagged (ARCL) models fall under the umbrella of structural equation models. Also known as panel models, they can be used to examine the relationship between repeatedly measured variables (Selig & Little, 2012). Consider the following ARCL model:

$$X_2 = \beta_1 X_1 + \beta_2 Y_1 + \zeta_X$$

$$Y_2 = \beta_3 Y_1 + \beta_4 X_1 + \zeta_Y$$

This model relates two different variables, X and Y, both measured at two time points (time one and time two). The regression coefficients β_1 and β_3 denote the magnitudes of the (auto-regressive) relationships between the variable at time two and that same variable at time one, while taking into account the variance in the second variable (Y_1 and Y_3, respectively). A smaller

auto-regressive coefficient typically indicates more variance in the variable between the two time points—in other words, the rank-order of individual's standings on the variable is significantly different from time one to time two. A larger auto-regressive coefficient typically indicates less variance between the variable at time two and itself at time one—a larger coefficient would be a sign of more stability in the construct across time points (Selig & Little, 2012).

The regression coefficients β_2 and β_4 quantify the cross-lagged effects; that is, the magnitudes of the relationships between one variable at time one and the other variable at time two. The estimation of these cross-lagged effects takes into account the prior level of the variable being predicted (Selig & Little, 2012). For example, one can look at the relationship between academic self-concept at time one and academic achievement at time two, while controlling for that portion of the variance in academic achievement in time two that can be attributed to academic achievement at time one.

This study employed the use of an ARCL model with three time points, denoted: Time One (T1), Time Two (T2), and Time Four (T4). The model used for this study employed a simple Markov process, where T4 observations were dependent only on T2 (T1 and T4 are assumed to be conditionally independent, given T2). This model related academic self-concept and academic achievement (see Figure 1.4) using the subset of the sample that completed the Academic Self-Concept scale at all three time points (N=615). In order to examine how the causal relationships between academic achievement (cumulative GPA) and academic self-concept were different for men and women, separate models were run for each gender, and the sizes and statistical significance of the coefficients were compared. These models also included covariates to control for characteristics potentially related to academic achievement and academic self-concept, such as race/ethnicity, college of enrollment, and admission rating.

Race/ethnicity was reported using four categories—white, international, unknown, and AHANA (African, Hispanic, Asian, and Native American). School of enrollment was also reported using four categories—Arts and Sciences, Business, Education, and Nursing. Admission rating was a composite summary of a students' application, reported on a scale from one to ten, with one being the highest score, meant to denote the most attractive students in terms of qualifications for admission.

Limitations

One limitation of this study was the instrument used to collect quantitative data on academic self-concept. CIRP's Academic Self-Concept scale only contained four items measuring academic self-concept. Therefore, this scale may be missing items that measure important aspects of academic self-concept, leading to construct-underrepresentation. Because reliability is a function of the number of items in a scale (greater number of items typically leads to higher reliability) this scale may also possess lower reliability than desired.

A second limitation was that data was not collected at the beginning of the fourth year of college, meaning that conclusions cannot be drawn as to changes that occur in academic self-concept between junior and senior year. Additionally, while data was collected at the beginning of the third year of college, response rates were too low to include in this study. As a result, conclusions are only drawn about changes that occur in academic self-concept between beginning of sophomore year and end of senior year.

Another limitation was the use of standardized test scores as a measure of academic achievement at Time 1. There is arguably more to high school academic achievement than what can be summarized by these test scores, such as high school GPA and number of honors/AP classes students take. However, the use of such indicators to measure academic achievement

comes with its own limitations, such as different high schools calculating GPA in different ways, using different scales to calculate GPA, or different schools having different availabilities of AP and honors classes. Consequently, standardized test scores were selected as a plausible and credible alternative for this set of analyses.

Chapter II: Literature Review

This chapter begins with a brief overview of what previous literature reviews on academic self-concept of college students have found, and will briefly describe the measurement instruments most frequently used to measure academic self-concept. The next section reviews the literature on changes in academic self-concept that occur during college, with a particular focus on gender differences. Then follows a review of the literature on academic self-concept's relationships to other relevant constructs as they pertain to college students, with special attention to its relationship to academic achievement. Finally, a section is dedicated to auto-regressive cross-lagged models, and how they have been used in both educational and non-educational settings. The chapter concludes with a summary of the literature on academic self-concept of college students and its limitations, and an explanation of how this dissertation expands on what has already been done. Of note is that this chapter does not include any literature from the widely studied field of academic self-concept as it pertains to non-college students (e.g., K-12). Also, while previous literature reviews on academic self-concept (Pascarella & Terenzini, 1991, 2005) included studies on academic self-efficacy, more recent literature (Choi, 2005; Fenning & May, 2013) has established that these are two distinct concepts, and so only studies pertaining to the construct of academic self-concept are included in this review.

Background - Academic Self-Concept of College Students

Pascarella and Terenzini's (1991) comprehensive review of the literature concerning how college affects students dedicated an entire chapter to academic self-concept of college students. Their review concluded that there is growth in academic self-concept over the four-year undergraduate experience, but there was not enough evidence to characterize the nature of the

changes. This finding was confirmed in their 2005 literature review on the same topic— "the research indicates with modest consistency that students' evaluations of their academic abilities become more positive during their college years" but the path for these gains is "probably not linear" (p. 220).

They also concluded that what happens to students after they arrive on campus has a greater influence on academic self-concept than does the kind of institution attended. The most powerful forces acting on academic self-image were found to be students' involvement in the formal (e.g., classes, grades, academic rules and regulations) and informal (e.g., interactions with other students and faculty) academic and social systems of their institutions. With regard to the goals of this dissertation, the 2005 literature review found that "college's effects on academic and social self-concepts were general, being about the same for all students, rather than conditional and varying by gender" (p. 249).

The studies included in Pascarella and Terenzini's literature reviews, as well as the studies included in this literature review, measure college students' academic self-concept with one of three commonly-used instruments. Reynolds' Academic Self-Concept Scale (ASCS) is a 40-item instrument developed to measure the academic facet of general self-concept in college students (Reynolds et al., 1980). Marsh's Self-Description Questionnaire-III (SDQ-III) is a 136-item instrument developed to measure 13 different facets of self-concept in college students, including reading self-concept, math self-concept, and general academic self-concept (H. W. Marsh & O'Neill, 1984). Finally, CIRP's Academic Self-Concept Scale is, in its current iteration, a four-item scale serving as "a unified measure of students' beliefs about their abilities and confidence in academic environments" (Cooperative Instituional Research Program, 2011). Studies in this literature review that have relied on CIRP's measure of academic self-concept

have used the instrument in varying ways, with some reporting scores based on results from the four individual items, others using a scale score derived from three of the four items (a previous version of the scale did not include self-rated drive to achieve). The studies that did use the scale score calculated it in different ways, with some relying on the Item Response Theory-derived score calculated by CIRP, and others relying on an exploratory factor analysis version of the score.

Changes in Academic Self-Concept during College

While many studies examined gender differences in the changes in academic self-concept during college, only two of the studies considered changes in a general population. One cross-sectional study, using Reynold's ASCS and looking exclusively at honors students at a single university, found no differences in academic self-concept between freshmen and sophomores (Rinn, 2005). The same study found juniors had significantly higher levels of academic self-concept than seniors. However, the freshmen and sophomores could not be compared to the juniors and seniors because of substantial discrepancies in sample sizes. Thus, the conclusions that could be drawn were limited to the two comparisons: between the earlier and the later years. Armstrong and Kim (2016) looked at changes in academic self-concept from freshman year to senior year using CIRP's Academic Self-Concept Scale across different types of religiously-affiliated schools. The study included almost 14,000 students from six Southern Baptist universities, 11 Council of Christian Colleges & Universities institutions, 31 Catholic institutions, and 53 nonsectarian private or public institutions that participated in the 2009 College Senior Survey. They found that students at Catholic institutions, on average, reported small but significant declines in ASC from entry to graduation, whereas students at Southern

Baptist, other Christian Colleges and Universities, and non-sectarian institutions showed non-significant changes over the same time period.

Gender differences in changes in academic self-concept during college.

Recall that academic self-concept is theorized to have five antecedents (Bong & Skaalvik, 2003):

1) Frames of reference – ASC is influenced by the standards against which one judges oneself
2) Causal attributions – ASC is influenced by the factors to which people attribute their successes and failures
3) Reflected appraisals from significant others – ASC is influenced by how one believes others view them
4) Mastery experiences – ASC is influenced by past academic experiences
5) Psychological centrality – ASC is influenced by how important one views academic ability

In looking at the research on these five antecedents of self-concept, one finds several examples of gender differences across these five constructs. For example, Schwalbe and Staples (1991) found that, in terms of frames of reference, men attach greater importance to social comparison than women. In a meta-analysis of 36 studies of causal attributions in children, Ruble, Greulich, Pomerantz, and Gochberg (1993) found that boys are less likely to attribute failure to ability (or, inability), than girls. Among college students, Beyer (1999a) found men would attribute academic success to their ability, but their failures to lack of studying and low interest, whereas women were more likely to attribute academic success to studying and interest, and lack of ability was seen as the explanation for their failures. With regard to reflected

appraisals, Schwalbe and Staples (1991) found women place more importance on reflected appraisals than men do. Given these differences between men and women in the antecedents of self-concept, it could then be expected that there would be gender differences in academic self-concept.

All but one of the studies looking at gender differences in changes in academic self-concept during college used data collected by the Cooperative Institutional Research Program (CIRP). This program involves national samples of students from hundreds of higher education institutions across the United States surveyed as they enter college (point of entry) with The Freshman Survey (TFS), and as they graduate with the College Senior Survey (CSS). Both surveys include CIRP's Academic Self-Concept Scale. Some studies using CIRP rely on a post-college follow-up survey, four to five years after graduation, instead of the CSS as the second time point.

In the earliest of these studies, Astin and Kent (1983) looked at changes in self-concept on 1971 freshmen with a nine-year follow-up in 1980. Their sample included almost 4,000 white students from multiple institutions across the US, and their analysis focused on item-level changes. They found that over the 8-year span, the proportions of respondents rating themselves high (above average or highest 10%) across 10 self-rating traits from CIRP (including the four items that currently make up CIRP's Academic Self-Concept Scale, intellectual self-confidence, drive to achieve, academic ability, and math ability) increased by an average of 17 percentage points. And while they found that the self-ratings of women improved over the period, the proportion rating themselves high on the series of self-rating traits was lower than men as freshmen and also tended to lag behind men at the nine-year follow-up in 1980. Using the same survey administrations (1971 TFS and 1980 follow-up), Smart and Pascarella (1986) found

similar results—upon entering college, men had higher academic self-concept scale scores than women. Nine years later, while both men and women exhibited higher academic self-concept scale scores, the gap between men and women was even greater than it was upon entering college.

Using only one of the self-rating items, mathematical ability, Sax (1994a, 1994b) found that, for 15,000 students participating in the 1985 TFS and 1989 CSS, women exhibited initially lower self-ratings in math than men, and both genders experienced a decline in self-rated math ability from entry to graduation. Interestingly, the proportional loss of students rating themselves above average or highest 10% in math ability was greater among women. These studies also found the magnitude of decline was greater in more selective schools for both men and women, perhaps due to theory of relative deprivation—students who enroll in more selective colleges experience greater declines in the perception of their own abilities. This finding suggested women were more strongly affected than men by a sense of relative deprivation. These studies also found that underestimation of math abilities (as judged by self-reported SAT math scores) was least likely among men in math/science majors and most likely among women in non-math/science majors. Underestimation among students in non-math/science majors was alarming—among those who scored in the top 1% on SAT math, 57.1% of women and 46.8% of men did not consider themselves in the highest 10% in math abilities.

Smith, Morrison, and Wolf (1994) used the 1986 administration of TFS and the 1990 administration of the CSS to obtain a sample of 2,000 men and 2,000 women who participated at both time points. They found that gender was a predictor of 10 out of 12 of the self-rating items, including the four academic self-concept items, academic ability, drive to achieve, math ability, and intellectual self-confidence. T-tests indicated men and women started out significantly

different from each other, with men scoring higher than women on these items, and four years later, these gender differences persisted. Most recently, Armstrong and Kim's 2016 study using the 2005 TFS and 2009 CSS found that, after controlling for academic self-concept at point of entry, being female had a negative association with students' senior-year academic self-concept, regardless of the religious classification of institution.

In the only study that considered gender differences in changes in academic self-concept that did not use CIRP data, Jackson (2003) looked at academic self-concept (as measured by the SDQ-III) at the beginning of freshman year and the end of freshman year in a sample of 147 students from three institutions in the north of England. She found that men had higher academic self-concept than women at both time points. She also found no significant differences in academic self-concept in men between beginning and end of freshman year, but a significant decrease in academic self-concept for women over this period. Men were also more likely to rank themselves higher at both time points, and the difference in the proportions of men and women ranking themselves in the highest categories was bigger at the end of freshman year than at the beginning of freshman year. Interviews with a limited number of participants (3 women, 2 men) provided anecdotal evidence that the Big-Fish-Little-Pond Effect (BFLPE) operated during the transition into college for women but not men. That is to say, women who were "big fish" in high school were more likely to think of themselves as average students in college than men who were "big fish" in high school.

Additionally, a subset of studies looked at differences between men and women in levels of academic self-concept, but only at one point in time. Findings here are mixed—three of the studies found no difference in the academic self-concepts of men and women, while two studies found that academic self-concept was greater in men than in women. For example, Choi (2005)

found no differences in academic self-concept between male and female students in a sample of 230 undergraduate students from four general education classes at a single institution. Similarly, Lent, Brown, and Gore (1997) found, in a sample of 205 introductory psychology students (mostly underclassmen), that there was no significant correlation between gender and academic self-concept. Additionally, Cokley (2000) found no differences in Reynold's ASCS scores between 206 male and female students from five different southeast universities. Finally, in a large, nationally representative sample of 10,326 students, one study found 1980 academic self-concept (five years post-graduation) was different for men and women, with men having higher academic self-concept (Pascarella et al., 1987). Similarly, Astin and Kent (1983) found that men had higher academic self-concepts than women at time of graduation, and that attending a selective institution was associated with an increased academic ability and mathematical ability rating for men, but not women.

In general, these studies indicate that women enter college with lower academic self-concept than men, and that this gap remains through graduation. They provide mixed evidence as to the nature of the changes that occur during college, with some finding a decline in academic self-concept, and others finding it remains relatively stable or even increases. However, because all of these studies rely on only two time points, it is difficult to ascertain when a decline or increase might occur, or if the changes are monotonic. Additionally, using only point of entry and graduation data obscures fluctuations in academic self-concept that occur over those four years. If anything, Jackson's (2003) study indicates that there may indeed be fluctuations in academic self-concept of college students between point of entry and graduation.

Academic Self-Concept and its Relationship to Other Constructs

Much of the interest in academic self-concepts stems from its relationship to other constructs of interest. Unlike the literature on changes in academic self-concept during college, studies on academic self-concept's relationship to other constructs among college students largely involve single institution studies with convenience samples of students. These studies show that academic self-concept is statistically associated with learning goal orientation, academic motivation, and student-faculty interactions. The subset of studies detailing the relationship between academic self-concept and academic achievement will be discussed in the next section.

In a sample of 158 undergraduate students from lower-level psychology courses at one university, Albert and Dahling (2016) found that academic self-concept was statistically significantly and positively related to learning goal orientation and locus of control. Another study found that, among 170 nursing students, academic self-concept and academic motivation were positively correlated, and academic self-concept and test anxiety were negatively correlated (Khalaila, 2015). Michie, Glachan, and Bray (2001) found that among 112 undergraduate psychology students, academic self-concept was positively associated with self-efficacy and negatively associated with academic stress. Meanwhile, Komarraju, Musulkin, and Bhattacharya (2010), using a sample of 242 first and second year students, found that academic self-concept was significantly and positively associated with seven aspects of student-faculty interaction—career guidance, off-campus interactions, approachability, accessibility, respect, caring, and connectedness. Still another study found that, among 500 students across four institutions, academic self-concept was positively associated with quality of student interactions (Cokley, 2000).

Besides positive academic self-concept being related to desirable traits and characteristics of college students, one study also focused on negative academic self-concept being related to less desirable traits and characteristics. For example, Rinn, Boazman, Jackson and Barrio (2014) found that among 357 undergraduate students, negative or lowered beliefs about one's academic abilities were related to an increase in academically dishonest behavior.

There were a of handful studies that used nationally representative CIRP data to look at academic self-concept's relationship to other constructs. Pascarella (1985), using the 1977 CSS administration and a sample of 5,162 students from 74 four-year institutions, found that, after controlling for pre-enrollment and university structural characteristics, academic self-concept was significantly and positively correlated with academic integration and social integration. Using the 1971 TFS and 1980 follow-up, a clear and consistent relationship was established between development of more positive academic self-concept and degree attainment (Smart & Pascarella, 1986). And most recently, using a sample of 11,202 students from 95 institutions that participated in the 2003 TFS and 2007 CSS administrations, one study found that at graduation, academic self-concept significantly varied by major and institution type (Kim & Sax, 2014). Philosophy, English, and political science majors reported the highest levels of academic self-concept, whereas nursing, elementary education, and communications reported the lowest levels of academic self-concept. The hierarchical linear model used indicated that 5.9% of the variance in academic self-concept was due to differences among academic majors, while 2.9% was due to differences among institutions. This study also found that, after controlling for point of entry academic self-concept, student-faculty interaction measures were significantly and positively related to academic self-concept senior year. There was significant variation in the slope of "being a guest in a professor's home," meaning that the strength of the relationship between

having been a guest in a professor's home and academic self-concept varied significantly across majors. "Asking for a professor's advice outside of class" and "challenging a professor's ideas in class" were both found to be generally positively related to ASC, regardless of major.

Academic self-concept and its relationship to academic achievement.

Interest in academic self-concept stems from the hypothesis that it will have a strong and positive influence on academic achievement. As such, many studies have attempted to establish the direction and magnitude of the relationship between academic self-concept and academic achievement. The literature overwhelmingly suggests a positive relationship between academic self-concept and academic achievement, across a variety of samples and groups. However, only one study attempted to establish a causal relationship between the two.

This study, using structural equation modeling and the 1971 TFS and 1980 follow-up, found that point of entry academic self-concept had a unique, positive, and direct influence on collegiate academic achievement, even after controlling for high school achievement, degree aspirations, and the selectivity of institution (Pascarella et al., 1987). Additionally, the study found that collegiate academic integration (the extent to which a student is successful in the collegiate academic system) had a significant and direct effect on 1980 academic self-concept. "Such findings further underscore the potential importance of self-concept as an influence on educational behavior. How the student regarded his or her academic and social competencies prior to college appeared to be a significant determinant of subsequent level of integration or accomplishment" (Pascarella et al., 1987, p. 70).

The remaining studies reviewed here, while establishing a positive relationship between academic achievement and academic self-concept, use data analysis techniques that limit the conclusions drawn to correlational associations between the two constructs.

For example, one study of 230 undergraduate students found academic self-concept, as measured by Reynold's ASCS, was positively and significantly related to term grades (Choi, 2005). Another study found academic self-concept was related to overall grade point average, and domain-specific academic self-concept (e.g., math self-concept) was related to domain-specific grades (e.g., math grades) (Lent et al., 1997). Defreitas and Rinn (2013) found, among 167 first-generation students at a large, public university, that verbal academic self-concept and GPA were significantly and positively correlated, while math academic self-concept and GPA were not. However, after controlling for SES and ethnicity, linear regression showed that both verbal and math academic self-concept were significantly and positively associated with GPA. Finally, Khalaila (2015) found that, among nursing students, academic self-concept was positively correlated with academic achievement. This study also found a mediating effect, where academic self-concept was positively associated with intrinsic motivation, and in turn, intrinsic motivation was positively associated with academic achievement.

Studies have also looked at whether the relationship between academic achievement and academic self-concept is different for different groups of students, such as white vs. non-white and honors vs. non-honors. Cokley (2000) found that, overall, academic self-concept was positively correlated with GPA. He then went on to divide GPA into five ordered categories, and found that at historically black colleges and universities, there was no significant difference among GPA categories in mean academic self-concept scores. However, at primarily white colleges and universities, ANOVA indicated significant differences in academic self-concept among GPA categories. A follow-up study (Cokley, 2002) found a significant correlation between academic self-concept and GPA for both black and white students as underclassmen. However, for black upperclassmen, the correlation between academic self-concept and GPA

decreased, while it increased for white upperclassmen. Rinn (2007) looked at differences in academic self-concept between honors and gifted/non-honors students (students who met the grade requirements for the honors program but did not participate). The study showed that academic self-concept was higher among honors students than that of gifted/non-honors students. This finding supports a reflected-glory effect, whereby students in gifted programs bask in the reflected glory of successful others by joining highly valued social groups (Rinn, 2007). Academic self-concept was thought to be enhanced by virtue of being a member of a highly accomplished group. Conversely, this finding did not support the BFLPE—the study author was expecting to find that gifted students enrolled in an honors program would have lower academic self-concept by virtue of becoming "little fish."

While still correlational, two studies looked at the relationship between academic achievement and academic self-concept at different time points. For example, Albert and Dahling (2016), using OLS regression, found that, among 158 undergraduate students from lower-level psychology courses at a small, selective college in the US, academic self-concept had a positive and statistically significant relationship on GPA one year later. And Astin and Kent (1983), using the 1971 TFS and 1980 follow-up found that both men and women who had high GPAs were more likely to manifest greater academic self-concept in 1980 (8 years after freshman year) than those with lower GPAs.

There was only one study in this review that looked at differences between men and women in the relationship between academic self-concept and academic achievement; this study also looked at differences between white and black students in the relationship between academic self-concept and academic achievement. Cokley (2002) found that, as underclassmen, black male and female students showed a significant and positive correlation between academic

self-concept and GPA. The study found a significant decrease in the magnitude of correlation between academic self-concept and GPA for black male upperclassmen but not black female upperclassmen. White students were different—underclassmen men started with a significant correlation between ASC and GPA, which decreased as upperclassmen. Female underclassmen showed no significant correlation with ASC and GPA, however, there was a large increase in the correlation with ASC and GPA as upperclassmen. This led the author to conclude that "it has been suggested that throughout the college years European American female students remain psychologically vulnerable because of the pressures of being sexually active, attractive, and popular…perhaps white female underclassmen are more susceptible to social pressures to conform, which may then negatively impact their self-esteem and ASC. Then as they get older, they mature and develop a more stable and realistic sense of who they are and become more confident" (Cokley, 2002, p. 385).

Taken together, these findings seem to support the theory that academic ability and academic self-concept are related. However, there is little research that addresses the possible causal relationship between these two constructs. There also is evidence of a gender difference in the relationship between the two, a finding that certainly deserves more careful scrutiny.

Auto-Regressive Cross-Lagged Models

Causal inferences arise as a result of random assignment and carefully controlled experimental settings. However, in some settings, randomization and/or controlled environments can be difficult or impossible to establish. It may also be the case that the construct being studied is difficult to manipulate, especially when it is not directly observable (e.g., academic self-concept). In such cases, researchers instead turn to longitudinal research and cross-lagged analysis (Kearney, 2017). Longitudinal studies, in which repeated measures are taken of the

same construct (or constructs) on the same subjects, can be used to answer questions concerning change—this can range from growth over a time period to comparing trajectories across subject to examining the impact of an intervention (Raudenbush, 2001). The application of "cross-lagged" models allows one to use longitudinal panel data to examine putative causal relationships between two constructs.

Causal relationships between two constructs were originally examined using cross-lagged correlations (Harris, 1963). This type of analysis involved calculating two correlations: the correlation between variable X at time one and variable Y at time two, and the correlation between variable Y at time one and variable X at time two. Whichever correlation was larger in magnitude was assumed to determine the direction of the causal relationship between the two variables of interest. However, Rogosa (1980) showed that in several instances, cross-lagged correlations were not accurately capturing the nature of causal relationships. Some of the problems with cross-lagged correlations are that they are unable to control for contemporaneous relationships between the two variables, and that they do not control for the stability of each construct between time points (Kearney, 2017; Rogosa, 1980). In his critique of cross-lagged correlations, Rogosa concluded that "[cross-lagged correlation] is best forgotten" and "[cross-lagged correlations] should be set aside as a dead end" (Rogosa, 1980, p. 257).

Instead, the direction of the causal relationship between two constructs can be examined using auto-regressive cross-lagged (ARCL) models, which simultaneously control for stability across time and correlations within time-points, while estimating cross-lagged effects (Kearney, 2017). When paired with theory, a case for causal predominance is made when the (residual) effect of variable Y at time one on variable X at time two is large, while the (residual) effect of variable X at time one on variable Y at time two is small. Adequate statistical model fit for

ARCL models is typically measured using two indices: Confirmatory Fit Index (CFI) greater than 0.9, and Root Mean Square Error of Approximation (RMSEA) less than 0.08 (Little & Card, 2013).

In addition to being able to control for stability across time and within time-point correlations, ARCL models have many other benefits. They can include covariates, for when there are additional variables that are hypothesized to be at least partially responsible for the relationship between the two variables of interest (Newsom, 2015). They can also be used to model the relationship between variables across more than two time points.

It is important to note the limitations of using structural equation modeling techniques to make causal inferences. Structural equation modeling is a tool that takes causal assumptions and data as inputs, and produces causal claims and statistical measures of fit that are conditional on the causal assumptions (Bollen & Pearl, 2013; Pearl, 2012). The validity of the causal claims produced from the model relies on the credibility of the causal assumptions being made. Credible causal assumptions can be derived from, among other things, the research design, prior studies, and logical arguments (Bollen & Pearl, 2013). With regard to the research design of this study, there are two elements that strengthen the credibility of these assumptions. First and foremost is the longitudinal nature of the data—causal evidence minimally requires that a variable temporally precedes its effect (Bullock et al., 1994). By using multiple time points, evidence for directionality can be obtained. Second, the inclusion of covariates in the model attempts to rule out extraneous variables that could be seen as mediating mechanisms of the causal relationship.

Although ARCL models address some of the weaknesses of cross-lagged correlations, they are not without limitations—they make several assumptions that limit the conclusions that can be drawn. ARCL models assume synchronicity – measurements for each of the constructs

within each time point occur at the same time (Selig & Little, 2012). They also assume factorial invariance – the instrument is measuring the same construct at different time points (Selig & Little, 2012). Also known as measurement invariance, this assumption means that observed differences in the construct of interest between time points can be attributed to true differences and are not due to changes in the nature of the construct or how the construct is measured. The advantage to ARCL models is that that this assumption can be tested prior to analysis.

Finally, these models focus on individual differences between people, but are not sensitive to differences within people (Kearney, 2017; Selig & Little, 2012). Because the model parameters are not sensitive to individual-level change, parameter estimates at each measurement occasion do not account for any trait-like variability (or lack thereof). ARCL models assume that all variability is within persons, and are unable to take into account any between-person variability that endures across time points. This limitation of ARCL models can become particularly problematic when the constructs being examined are more trait-like (as opposed to state-like), in which case more sophisticated models that disentangle between-person and within-person differences, such as a multi-level ARCL model, are needed (Hamaker et al., 2015). Indeed, Burns, Crisp, & Burns (2019) were looking at the relationship between academic self-concept and academic achievement of first year psychology students, and compared the results of an ARCL and the multi-level ARCL proposed by Hamaker and colleagues. They found differences in the significance of the autoregressive and cross-lagged parameters between the two models—the ARCL model supported the reciprocal effects hypothesis, while the multi-level ARCL model supported the skill development hypothesis (academic achievement is a determinant of subsequent academic self-concept). In this setting, however, the data points were from seven two-week intervals. With such short windows between observations, one would

expect ASC to operate in a more trait-like manner, and as such, would want a model to accurately capture this. As the literature reviewed earlier in this chapter suggests, however, in a setting such as the one used in this study, with widely separated time points, ASC is theorized to be more state-like than trait-like—one expects to see changes in ASC over time. Given this, analysis will proceed using an ARCL model, however, exploratory analysis with a multi-level ARCL model is also conducted. Chapter V includes a discussion comparing the results from the ARCL model and a multi-level ARCL model.

Conclusions and Limitations

There are several plausible conclusions to draw from this review of literature on academic self-concept of college students. There seems to be growth in academic self-concept during college and afterward, but the patterns of growth are not necessarily strictly monotone, and may be different for men and women. In general, academic self-concept seems to be higher in men than in women, and changes in academic self-concept could depend on institutional characteristics, such as selectivity and religious affiliation.

Academic self-concept appears to be statistically associated with a variety of other educational constructs. It is positively related to learning goal orientation, academic motivation, and student-faculty interactions, and negatively related to academic dishonesty. In addition, many studies have linked academic self-concept to academic achievement, with findings strongly suggesting that higher academic self-concept is associated with higher academic achievement. However, these findings are not always consistent across gender.

There are many limitations to this literature, however. When looking at changes in academic self-concept, all the studies found for this review are limited to only two time points.

And sometimes, the second time point is many years after college, which means respondents are being asked to retrospectively recall their college experiences.

Many of the studies examining the relationship between academic self-concept and other constructs of interest rely on small samples, typically convenience samples taken from a single course within an institution (e.g., lower-level psychology or general education) so there is not a broad representation of grade levels and academic backgrounds

Finally, all but one of the studies examining the relationship between academic self-concept and academic achievement is correlational, meaning that the data and analysis techniques do not support causal conclusions on the relationship between the two constructs. Therefore, it is difficult to say whether higher academic self-concept contributed to higher academic achievement. This study aims to address this gap by employing an ARCL model with longitudinal data to examine the relationship between academic self-concept and academic achievement.

Chapter III: Methodology

Introduction

As presented in Chapter II, the literature on academic self-concept of college students lacks studies that employ more than two time points during the college experience. Consequently, little is known about the changes in academic self-concept that occur during the four years of college. Furthermore, the direction of the causal relationship between academic self-concept and academic achievement has not been sufficiently explored.

The purpose of this study was to document the changes that occur in academic self-concept during the four-year undergraduate experience, as well as to examine the extent to which academic self-concept is influenced by prior academic achievement and vice versa. This study also explored gender differences in academic self-concept, both in the changes that occur throughout college and in its relationship to academic achievement. To do so, a single cohort longitudinal study was conducted, with data collected at one university on the same cohort of undergraduate students at three different time points during their undergraduate years.

Research Questions

This study was guided by six research questions:

1a. Given measurements at three widely separated time points (prior to entering college, beginning of second year of college, and at graduation), how do mean levels of academic self-concept change during the four-year undergraduate experience?

1b. To what extent are the changes in levels of academic self-concept during the four-year undergraduate experience different for men and women college students?

2a. At each of the three time points, (i) how is academic self-concept related to student demographics and pre-matriculation characteristics (gender, admission rating, race,

college of enrollment)? (ii) Controlling for demographics and pre-matriculation characteristics, how is academic self-concept at later time-points related to academic self-concept at earlier time-points?

2b. At each of the three time points, (i) how is academic achievement related to student demographics and pre-matriculation characteristics (gender, admission rating, race, college of enrollment)? (ii) Controlling for demographics and pre-matriculation characteristics, how is academic achievement at later time-points related to academic achievement at earlier time points?

3. Controlling for previous academic achievement and pre-matriculation characteristics, (a) what is the cross-lagged relationship between academic self-concept at Time 1 (prior to entering college) and academic achievement at Time 2 (beginning of second year of college)? (b) what is the cross-lagged relationship between academic self-concept at Time 2 (beginning of second year of college) and academic achievement at Time 4 (at graduation)?
4. Controlling for previous academic self-concept and pre-matriculation characteristics, what is the cross-lagged relationship between academic achievement at Time 1 (prior to entering college) and academic self-concept at Time 2 (beginning of second year of college)? What is the cross-lagged relationship between academic achievement at Time 2 (beginning of second year of college) and academic self-concept at Time 4 (at graduation)?
5. Controlling for previous academic achievement and pre-matriculation characteristics, is the cross-lagged relationship between academic self-concept at Time 1 and academic achievement at Time 2 different for men and women in college? Is the cross-lagged

relationship between academic self-concept at Time 2 and academic achievement at Time 4 different for men and women in college?

6. Controlling for previous academic self-concept and pre-matriculation characteristics, is the cross-lagged relationship between academic achievement at Time 1 and academic self-concept at Time 2 different for men and women in college? Is the cross-lagged relationship between academic achievement at Time 2 and academic self-concept at Time 4 different for men and women in college?

Instrument and Variables

This study employed the Cooperative Institutional Research Program's (CIRP) Academic Self-Concept scale to measure academic self-concept of college students. The scale is composed of four items from a series of 15 items on which respondents are asked to rate themselves as compared to the typical person their age on the following traits: academic ability, drive to achieve, intellectual self-confidence, and math ability (see Table 3.1 for all 15 self-rating items). There are five response options for the self-rating items: lowest 10%, below average, average, above average, highest 10%. The 15 self-rating items were administered to the Class of 2017 at the site of this study at four different time points:

- Time 1 (T1) – prior to enrollment. All students participating in summer orientation sessions were required to complete self-rating items as part of the administration of the paper version of CIRP's The Freshman Survey during an orientation session (N=2,141, 90.4%)

- Time 2 (T2) – fall of sophomore year. All students in the Class of 2017 were invited via email to respond to an online survey that contained the series of 15 self-rating items (N=1,086, 46.1%)
- Time 4 (T4) – at graduation. All students in the Class of 2017 were invited via email to complete the self-rating items as part of the administration of CIRP's CSS. Students who did not complete the online survey were invited to fill out a paper version of the CSS during graduation activities (N=1,149, 50.9%)

Variables.

In addition to Academic Self-Concept, several other variables were used in this study. The second outcome variable, academic achievement, was measured using two variables—standardized test scores (as a proxy for academic achievement prior to entering college), and cumulative GPA (as a measure of academic achievement after entering college). Standardized test scores come in the form of either SAT scores or ACT scores—ACT scores were converted to SAT scores using a concordance table provided by College Board (The College Board, n.d.). Since SAT scores are on a scale (800-1600) that is proportionally different from ASC scores (1-5) or cumulative GPA (1-4), SAT scores were standardized to have a mean of zero and standard deviation of one. Given that the grades students earned in the first two semesters of college, used to calculate T2 cumulative GPA, would also be included in the calculation for T4 cumulative GPA, T2 cumulative GPA and T4 cumulative GPA were expected to be highly correlated. To address this, T4 cumulative GPA was amended in such a way as to disentangle students' GPA in their first two semesters from the GPA in the latter three semesters. Assuming a typical student takes four courses per semester, the T2 cumulative GPA was multiplied by eight to convert it to a course-unit GPA. The T4 cumulative GPA was similarly multiplied by 32, from which the T2

course-unit GPA was then subtracted, and T4 cumulative GPA was then converted back to its standard units. The resulting T4 amended cumulative GPA had a lower correlation to T2 cumulative GPA. It's worth noting that this resulting T4 amended cumulative GPA may be more representative of students' major-specific classes (classes typically taken in the later years of the collegiate experience), while the T2 cumulative GPA may be more representative of students' liberal arts classes (classes typically taken in the first year of the college experience).

Other covariates of interest from institution-reported data included gender, college of enrollment, race/ethnicity, and admission rating. Students were associated with their respective college of enrollment at each time point (e.g., a student who was in the school of Arts and Sciences at Time One, and the school of Business at Time Two, were grouped with Arts and Sciences for Time One analyses, and with Business for Time Two analyses).

Finally, one covariate of interest came from the series of 15 self-rating items administered at each time point. The Social Self-Concept scale is composed of three self-rating items: leadership ability, public-speaking ability, and social self-confidence (see Table 3.1).

Population and Sample

This study utilized data collected at one university at three different time points for the same cohort of undergraduate students. This university is a private, sectarian, liberal arts university located in the Northeast United States. It is an R1 research institution with over 9,000 undergraduate students across four undergraduate schools (Arts and Sciences, Business, Education, and Nursing). At graduation, there were 2,259 students in the Class of 2017, which will serve as the population for this study. Table 3.2 contains population demographics.

Non-institution-reported data were collected via survey. All students in the Class of 2017 at the study site were invited to participate in survey data collection at all three time points—

prior to classes starting (via TFS), at the beginning of sophomore year, and at graduation (via the CSS). Of the 2,259 students in the Class of 2017, 615 students completed the survey at all three time points, representing 27.2% of the graduating class. Table 3.3 contains demographics for this sample, and indicates for which demographic variables the sample is statistically significantly different than the population. As can be seen, there are no significant differences between the sample and population with respect to race, college of enrollment, or average SAT Writing or SAT Math scores. However, the sample that responded to the survey at all three time points was more female than the population, had higher average SAT Reading and ACT Composite scores, and had a better admission rating than the population.

Data Analysis Plan

The analyses employed a variety of quantitative methodologies, including descriptive statistics, regression, and longitudinal structural equation modeling (SEM) methodologies applied to a single-cohort longitudinal design. However, quantitative methodologies can only tell us so much about underlying processes, and qualitative data is often used to provide further insight. Although this is not a full mixed-methods study, six focus groups were conducted, three with men from the Class of 2017 and three with women from the Class of 2017. The results of from the focus groups will inform the discussion in Chapter V (for more details on how the focus groups were conducted, see Appendix C). While participants in the focus groups were from the same graduating class as the students who participated in the survey data collection, because they were invited to participate in the focus groups at random, the focus group participants were not necessarily students who completed the survey at all three time points.

Structural equation modeling is “an analytical approach that allows a researcher to build an elegant and parsimonious model of the processes that give rise to observed data” (Little &

Card, 2013, p. 2). Because of the longitudinal nature of the data being used to answer the research questions, the concern becomes measuring changes or differences in the "pure" true score/construct variance that is not attributable to variance from the method of measurement or occasion of measurement. The use of SEM facilitates exploration of the causal nature of the relationship between academic self-concept and academic achievement. In particular, ARCL models are a type of longitudinal SEM model. Before discussing the specific models and modeling techniques that will be used to answer each research question, first I discuss the process of building the baseline measurement model that will be used for the SEM analysis.

Establishing a baseline measurement model.

Every structural equation model has, at its core, a measurement model (also called a confirmatory factor analysis, or CFA, model). The measurement model "provides the basis for evaluating the adequacy of the measurement properties of each construct and the overall fit" of the model (Little & Card, 2013, p. 71). The goal of the measurement model is to represent the relationships (loadings) between the latent construct(s) and the indicators (items), the mean structures (intercepts), and the variances/covariances of the latent construct(s). The measurement model is also used to test the assumption of factorial invariance, also called measurement invariance. In the present context, measurement invariance holds when the properties (e.g., indicator loadings and means) of the latent construct are stable over time/measurement occasions/covariates; should the assumption of measurement invariance fail, changes that are attributed to the latent construct may actually arise from changes in the measurement properties of the instrument being used to measure the latent construct (Newsom, 2015). The limitation of the measurement model is that it cannot be used to model or evaluate directional relationships between latent constructs—that task is left for the structural equation model.

I relied on a single baseline measurement model to answer the research questions for this study, in particular, RQ3, RQ4, RQ5, and RQ6. This model related the latent construct academic self-concept to itself at the three different time points, as well as to academic achievement. At Time 2 and Time 4, academic achievement is measured by a single indicator, cumulative GPA. At Time 1, as students had not started taking classes yet and had no university GPA, standardized SAT scores were used as the single indicator for academic achievement. At all three time points, the latent construct academic self-concept was measured by the four scale items—academic achievement (AA), drive to achieve (DtA), mathematical ability (MA), and intellectual self-confidence (ISC).

Before any subsequent analysis related to the relationship between the latent constructs was done with the baseline model, it was first used to test the assumption of measurement invariance of the Academic Self-Concept Scale, and to establish a suitable baseline model that modeled the appropriate levels of measurement invariance. To do so, I followed the steps and recommendations put forth by Little and Card (2013).

There are five commonly accepted "degrees" of measurement invariance: configural invariance, weak factorial invariance, strong factorial invariance, partial strong factorial invariance, and strict factorial invariance. For studies such as this one, in which the research questions are related to the latent construct parameter estimates, Little and Card (2013) recommend only pursuing further analysis with data for which a strong factorial or partial strong factorial invariant baseline model can be established.

The Null Baseline Measurement Model, used to evaluate the five degrees of measurement invariance, is displayed in Figure 3.1. Note that in Figure 3.1,

$\psi_{k,k}$ denotes the variance of the k^{th} construct
$\psi_{k,l}$ denotes the covariance between the k^{th} construct and the l^{th} construct,

$\theta_{i,i}$ denotes the variance of the i[th] indicator,
$\theta_{i,j}$ denotes the covariance between the i[th] indicator and the j[th] indicator,
$\lambda_{i,k}$ denotes the loading of the k[th] construct on the i[th] indicator,
τ_i denotes the mean of the i[th] indicator,
a_k denotes the mean of the k[th] construct.

For clarity of the figures, the covariances of the corresponding indicators, (e.g., $\theta_{1,5}, \theta_{2,6}, \theta_{3,7}$), were included in the model but are not displayed in Figure 3.1. Because each indicator, or self-rating item, occurred at each of the three time points, the item-specific variances were expected to correlate with each other, and were thus specified in the model a priori. Model fit for the Null Baseline Measurement Model and subsequent invariant measurement models was evaluated by Confirmatory Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA) using model fit thresholds proposed by Little and Card (2013), with acceptable model fit achieved with CFI ≥ 0.9 and RMSEA ≤ .08.

In this baseline model, the fixed factor method of scaling (Little et al., 2006) was used; This method supposes an arbitrary metric of the latent variable (e.g., academic self-concept), and so fixes its variance (e.g., $\psi_{1,1}$) at one. Therefore, the latent factor relations were estimated in a standardized metric—having the advantage of also providing estimates for between-construct relationships as correlations (Little et al., 2006; Little & Card, 2013). The baseline model used in this study also included the mean structures, which used the means of the indicators (e.g., τ_i's) to estimate the means of the latent constructs (e.g., a_k's).

The criterion for configural invariance is that the loadings between the latent construct and the indicators have similar patterns at each time point (e.g., the loading for indicator 1 is largest and the loading for indicator 3 is smallest, across time points). Evaluating configural invariance involved a visual examination of the Null Baseline Measurement Model, and determining whether the model fit was adequate (e.g., was the CFI greater than .9? Was the

RMSEA lower than .08?). With appropriate patterns in the loadings of the four indicators observed, and a CFI of .98 ≥ .9 and RMSEA of .05 ≤ .08 (see Table 3.4), the Null Baseline Measurement Model met the criterion for configural invariance.

When a baseline model meets the criteria for configural invariance, one can then proceed to testing weak factorial invariance. Testing for weak factorial invariance involved constraining each corresponding loading on the indicators to be equal (e.g., $\lambda_{1,1} = \lambda_{5,2} = \lambda_{9,3}$). The assumption of weak factorial invariance is met if the change in CFI between the configural invariant model and the weak invariant model is less than .01 (Cheung & Rensvold, 2002; Little & Card, 2013). With the change in CFI between the configural invariant model and the weak invariant model being .98-.97 = .01, and the change in RMSEA being .05-.05<.01 (see Table 3.4), the baseline measurement model met the criterion for weak factorial invariance.

Should the baseline model meet the criteria for weak factorial invariance, one can then proceed to testing strong factorial invariance. Testing for strong factorial invariances involved adding the constraint that each corresponding indicator intercept (mean) is equivalent (e.g., $\tau_1 = \tau_5 = \tau_9$). The assumption of strong factorial invariance is met if the change in CFI between the weak invariant model and the strong invariant model is less than .01. If the model meets the criteria for strong factorial invariance, this is the baseline model used for subsequent analysis. Should the model fail to meet the criteria for strong factorial invariance, partial strong factorial invariance should be explored (Little & Card, 2013). With the indicators constrained to equality in the baseline measurement model, the change in CFI between the weak invariant and strong invariant model was .97-.80, which was not less than or equal to .01, nor was the change in RMSEA (.05-.12) (see Table 3.4), and so the baseline measurement model did not meet the

criterion for strong factorial invariance. Analysis continued with exploration of a partial strong invariant baseline measurement model.

Partial strong invariance occurs when one or more of the loadings and/or intercepts is no longer constrained to equality over time (Little & Card, 2013). To identify which non-invariant loadings or intercepts are most contributing to issues of fit, Little and Card (2013) recommend looking at the modification indices for each of the parameters. This index estimates the amount of change in the overall model chi-square that would occur if the parameter of interest is freely estimated—the parameters with the highest modification indices are the ones to let vary freely, and then change in CFI can again be examined. Using the modification indices to guide the process, numerous iterations of a partial strong invariant model were tested. The model that was eventually arrived at was reached by unconstraining the intercepts of T2 Academic Ability, T1 Drive to Achieve, and T1 Math (see Figure 3.2). This partial strong invariance baseline model had the highest CFI of all the partial strong invariant models tested, CFI = .911. This was still slightly outside the acceptable range of model fit hoped for. Additionally, the changes in CFI and RMSEA from the weak factorial invariance model and the partial strong invariance model were also outside the acceptable range of less than or equal to .01 (see Table 3.4). This could be an indicator of the adequacy (or, in fact, inadequacy) of the Academic Self-Concept Scale being used to evaluate academic self-concept (see Chapter V). Without the assumption of factorial invariance, there was no way to tell whether observed differences at the construct level could be attributed to changes in the construct itself. Any changes in the Academic Self-Concept construct observed in a model that is not factorially invariant cannot be attributed solely to changes in the construct itself, but could also be from changes in the relationships between the indicators and the construct. However, given the exploratory nature of this study, the partial strong invariance

baseline model was deemed adequate, and analysis proceeded with this model serving as the baseline measurement model for the succeeding structural equation modeling.

To arrive at the ARCL model needed for this analysis, the cross-time non-directional associations between academic self-concept measures and between academic achievement measures in the partial strong invariance baseline model were changed to directed regression relationships (e.g., $\psi_{2,1}$, $\psi_{6,5}$, $\psi_{6,1}$, $\psi_{5,2}$). The within-time associations remained as non-directional covariance relationships (e.g., $\psi_{5,1}$, $\psi_{7,2}$) (see Figure 3.3). In this model, auto-regressive refers to the paths that link a latent variable at Time 1 with itself at Time 2, while cross-lagged refers to the paths that link a latent variable at Time 1 to a different latent variable at Time 2.

Research question 1a and 1b.

To examine how the levels of academic self-concept change during the four-year undergraduate experience, and how these changes may be different for men and women, I used descriptive statistics such as mean scores and boxplots. ASC scale score means were calculated for each of the three time points, and Cohen's D effect sizes were calculated to evaluate the magnitude of the differences between the time points, with d=0.2 associated with a small effect size, d=0.5 associated with a medium effect size, and d=0.8 associated with a large effect size (Cohen, 1992). The ASC scale score means were also calculated for each gender at each of the three time points, and at each time point, again, Cohen's D effect size was used to evaluate the magnitude of difference in ASC between men and women. The use of effect sizes highlights that the focus of the interpretation of the results will be on *practical* significance, as opposed to *statistical* significance (where one would report p-values instead of effect sizes).

Research question 2a and 2b.

To explore how the two outcome variables (academic self-concept and academic achievement) were related to demographic variables and pre-matriculation characteristics, I estimated stagewise ordinary least squares (OLS) regressions. At each time point, both outcome variables were (separately) predicted by gender, admission rating, and race/ethnicity (dummy coded into four categories: white, AHANA, international, or unknown). At T2, academic self-concept was also predicted by academic self-concept at T1 (in addition to the demographic and pre-matriculation characteristics), while at T4, academic self-concept was predicted by academic self-concept at T2 (in addition to the demographic and pre-matriculation characteristics). Similarly, at T2, academic achievement was predicted by academic achievement at T1 and demographic and pre-matriculation characteristics, while at T4, academic achievement was predicted by academic achievement at T2 and demographic and pre-matriculation characteristics. To explore possible interactions and differences by college, parallel analyses were conducted by school for both academic self-concept and academic achievement. Due to sample size limitations however, this was only done for Arts and Sciences, and Business (too few men were enrolled in the schools of Nursing and Education to make meaningful comparisons).

Research question 3.

To answer research question 3, I employed the ARCL model that relied on the partial strong invariance baseline model (Figure 3.3). At this stage, interest focused on the directional relationships between academic self-concept and academic achievement.

This model also included covariates. To add covariates in the model, I separately regressed each of the constructs at Time One onto each of the four covariates—race/ethnicity, college of enrollment, admission rating, and Social Self-Concept scale scores.

Research question 3 was answered by looking at the standardized parameter estimates for the cross-lagged regression paths between academic self-concept at Time T and academic achievement at Time T+1 (e.g., $\psi_{6,1}, \psi_{7,2}$).

Research question 4.

Research question 4 relied on the same auto-regressive cross-lagged model with covariates used in RQ3, but instead, this question was concerned with the standardized parameter estimates for the cross-lagged regression paths between academic achievement at Time T and academic self-concept at Time T+1 (e.g., $\psi_{5,2}, \psi_{6,3}$).

Research question 5.

Research question 5 involved evaluating whether the significance and magnitudes of $\psi_{6,1}$ and $\psi_{7,2}$ were different for men and women. To do so, I ran the same ARCL model as previously used, but only using the data for males or females. In doing so, first I needed to check the Partial Strong Invariant Baseline Model for measurement invariance across time *and* across groups—in this case, across gender. The same steps were taken as was done to establish strong or partial strong factorial invariance, but this time, done separately for each gender (i.e., using only the data from the male respondents, and then using only the data for the female respondents). For both the male and female subsets of data, patterns were expected to be the same across (configural), loadings were equated across time (weak), and intercepts were equated across time (strong). As was the case with the full data set, the subsets of data corresponding to the male and female respondents did not satisfy the assumptions of strong invariance, and a partial strong invariance model was used for the baseline models for males and females.

Next, I looked for differences in the SEM models between the men and women; in particular, I looked at which covariates were statistically significant for which latent constructs at

which time points, and which directional paths were significant. Finally, I looked at whether the cross-lagged regression paths between academic self-concept at Time A and academic achievement at Time A+1 (e.g., $\psi_{6,1}, \psi_{7,2}$) were different for men and women.

Research question 6.

Research question 6 relied on the same by-gender, auto-regressive cross-lagged models with covariates as RQ5; however, here the focus was on the differences by gender in the cross-lagged regression paths between academic achievement at Time T and academic self-concept at Time T+1 (e.g., $\psi_{5,2}, \psi_{6,3}$).

Multi-Level ARCL Model

As discussed in Chapter II, a recent critique of ARCL models argues that they fail to adequately capture the trait-like, time-invariant nature of constructs. Because the auto-regressive coefficients in a traditional ARCL model only capture the stability of the rank-order of individuals between *adjacent* time points, the stability represented in the ARCL model can be thought of as *temporal*, and any trait-like characteristic may not endure between non-adjacent time points. Failing to adequately control for this could result in biased cross-lagged regression coefficients and lead to erroneous conclusions about the relationship between two constructs over time. To address this difficulty, Hamaker et al. (2015) developed a multi-level ARCL model, called a Random Intercepts ARCL (RI-ARCL), which distinguishes between the between-person and within-person variance. This allows for the trait-like nature of constructs to be captured in the between-person variance, while still capturing within-person differences.

To evaluate whether the use of the traditional ARCL model could have led to erroneous conclusions about the relationship between academic self-concept and academic achievement in college students, I estimated the RI-ARCL using my three time point sample. Due to the recency

of the development of the RI-ARCL model, as well as the lack of documentation on how to program this more complex model, I relied on a simplified model wherein I inputted the ASC scale scores at each of the three time points, instead of inputting the items making up the scale scores. Because I relied on this simplified model, for comparisons sake, I also re-ran my original ARCL model using this simplified structure, inputting the ASC scale scores at each of the three time points instead of the scale items.

Chapter IV: Results

The purpose of this study was to examine the changes in academic self-concept of college students across three time points, with a focus on how changes in academic self-concept during college years were different (if at all) for men and women. The study then continued by looking at the relationship between academic self-concept and academic achievement for men and women. All analyses were conducted on the subset of students who participated in the study at all three time points.

This study was guided by six research questions:

1a. Given measurements at three widely separated time points (prior to entering college, beginning of second year of college, and at graduation), how do mean levels of academic self-concept change during the four-year undergraduate experience?

1b. To what extent are the changes in levels of academic self-concept during the four-year undergraduate experience different for men and women college students?

2a. At each of the three time points, (i) how is academic self-concept related to student demographics and pre-matriculation characteristics (gender, admission rating, race, college of enrollment)? (ii) Controlling for demographics and pre-matriculation characteristics, how is academic self-concept at later time-points related to academic self-concept at earlier time-points?

2b. At each of the three time points, (i) how is academic achievement related to student demographics and pre-matriculation characteristics (gender, admission rating, race, college of enrollment)? (ii) Controlling for demographics and pre-matriculation characteristics, how is academic achievement at later time-points related to academic achievement at earlier time points?

3. Controlling for previous academic achievement and pre-matriculation characteristics, (a) what is the cross-lagged relationship between academic self-concept at Time 1 (prior to entering college) and academic achievement at Time 2 (beginning of second year of college)? (b) what is the cross-lagged relationship between academic self-concept at Time 2 (beginning of second year of college) and academic achievement at Time 4 (at graduation)?
4. Controlling for previous academic self-concept and pre-matriculation characteristics, what is the cross-lagged relationship between academic achievement at Time 1 (prior to entering college) and academic self-concept at Time 2 (beginning of second year of college)? What is the cross-lagged relationship between academic achievement at Time 2 (beginning of second year of college) and academic self-concept at Time 4 (at graduation)?
5. Controlling for previous academic achievement and pre-matriculation characteristics, is the cross-lagged relationship between academic self-concept at Time 1 and academic achievement at Time 2 different for men and women in college? Is the cross-lagged relationship between academic self-concept at Time 2 and academic achievement at Time 4 different for men and women in college?
6. Controlling for previous academic self-concept and pre-matriculation characteristics, is the cross-lagged relationship between academic achievement at Time 1 and academic self-concept at Time 2 different for men and women in college? Is the cross-lagged relationship between academic achievement at Time 2 and academic self-concept at Time 4 different for men and women in college?

Research Question 1a & 1b: Differences over Time Overall and Between Genders in Mean Levels of Academic Self Concept

Research questions 1a and 1b were related to how mean levels of academic self-concept changed across three widely separated time points in college, and how the changes in mean levels of academic self-concept were different for men and women college students. To answer these questions, descriptive statistics, complemented by effect size calculations, were employed.

Changes in ASC over time

Across all three time points, the Academic Self-Concept scale scores ranged from one (low academic self-concept) to five (high academic self-concept). As can be seen in Table 4.1, across the three time-point sample (N=615), Academic Self-Concept scale scores were highest at Time One (prior to entering college); the mean scale score was 4.06 (s.d. = 0.50). At the beginning of the second year of college (T2), the mean score had decreased to 3.67 (s.d. = 0.59. The Cohen's D effect size (defined in this paired-samples t-test context as $= \frac{mean_D}{SD_D}$) for this difference was .75, which is associated with a medium-large effect size.

Mean scores on the Academic Self-Concept scale increased to 3.92 (s.d. = 0.59) by the end of college (T4); this change was also statistically significant ($p<.001$). The Cohen's D effect size for this difference was .51, which is associated with a medium effect size.

It can be seen in Figure 4.1 that, across the three time points, the median Academic Self-Concept scale score follows a similar pattern, whereas it is higher at time one, decreased at Time Two, and then increased by Time Four.

Changes in ASC over time by gender

The patterns observed for the sample as a whole are replicated by the patterns in the Academic Self-Concept scale scores by gender. For women, average Academic Self-Concept

scale scores were highest prior to entering college, with a mean score of 3.97 (s.d. = 0.49) (see Table 4.2). The mean Academic Self-Concept scale score then drops to 3.58 (s.d. = 0.56) at the beginning of year two (T2), and this decrease is statistically significant ($p<.001$). The Cohen's D effect size for this difference was .76, associated with a medium-large effect size.

By the end of year four (T4), mean Academic Self-Concept scale score had increased to 3.82 (s.d. = 0.56). The Cohen's D effect size for this difference was .54, associated with a medium effect size. These patterns were mostly replicated in the boxplot of Academic Self-Concept for women (see Figure 4.2). Median ASC scores in women dropped from Time One to Time Two, and then remained the same from Time Two to Time Four. However, at Time Four, the minimum, first quartile, and third quartile scores were higher than they were at Time Two.

Similarly, for men, average Academic Self-Concept scale scores were highest prior to entering college (T1), with a mean score of 4.25 (s.d. = 0.49) (see Table 4.3). By the beginning of year two (T2), mean Academic Self-Concept scale score had decreased to 3.85 (s.d. = 0.62). The Cohen's D effect size for this difference was .74, associated with a medium-large effect size. The mean Academic Self-concept scale score then increased to 4.12 (s.d. = 0.59) by the end of year four. The Cohen's D effect size for this difference was .51, associated with a medium effect size. The boxplot of the ASC scale scores for men reflects this pattern as well, with median scores decreasing from Time One to Time Two, before increasing again at Time Four (see Figure 4.3).

When looking at differences between genders within time points, the same phenomenon holds across all three time points (see Table 4.4): average Academic Self-Concept scale scores are higher for men than for women, with the difference being largest at Time Four, and smallest at Time Two. At each of the three time points, this difference is statistically significant ($p<.001$).

The Cohen's D effect size (defined in this independent-samples t-test context as $= \frac{M_1 - M_2}{SD_P}$) for the difference between men and women at T1 is 0.59, at T2 is 0.46, and at T4 is 0.44, all associated with a medium effect size.

Research Question 2a & 2b: Relationship Between Outcome Variables and Demographics/Pre-Matriculation Characteristics

Research questions 2a and 2b were concerned with the relationships between the two outcome variables (academic self-concept and academic achievement) and the demographic variables and pre-matriculation characteristics. To answer these questions, ordinary least square (OLS) regression techniques were employed.

Academic Self-Concept and demographics/pre-matriculation characteristics

The stagewise OLS regression results indicate that, for the full sample, gender and admission rating were related to academic self-concept at each of the three time points (see Table 4.5a). At Time One, ASC scale scores were statistically significantly related to gender, admission rating, and race: being female was associated with lower ASC scale scores, "higher" admissions rating was associated with higher ASC scale scores, and being an AHANA student was associated with lower ASC scale scores compared to white students. The standardized beta coefficients show that, of these three, admission rating and gender have a stronger association with T1 ASC than race. At Time Two, similar patterns held, with being male and "higher" admissions rating both associated with higher ASC scale scores, even after accounting for ASC scale scores at Time One. Noteworthy is that the adjusted R-square value for time two ASC more than doubled, from .152 to .335, with the inclusion of Time One ASC, indicating that prior academic self-concept is an important factor in explaining the variance in current academic self-concept.

To further explore the proportion of variance in T2 ASC explained by T1 ASC, compared to the proportion of variance in T2 ASC explained by pre-matriculation characteristics, the same regressions were conducted, but with the stages reversed: T2 ASC was regressed on T1 ASC, then T1 ASC and the pre-matriculation characteristics. As can be seen in Table 4.5b, at T2, the inclusion of pre-matriculation characteristics was associated with only a nominal (2.6%) gain in variance explained in T2 ASC.

At time four, being male was still associated with statistically significant higher scores on the ASC scale, even with the inclusion of time two ASC. However, after including time two ASC to predict time four ASC, admission rating was no longer a statistically significant predictor of ASC at time four, suggesting that students' pre-matriculation characteristics have less of an impact over time on academic self-concept after accounting for prior academic self-concept. Looking at the "reverse" stagewise OLS regression at T4, again, the inclusion of pre-matriculation characteristics accounted for only 1.2% of the variance explained in T4 ASC, above and beyond the variance explained by T2 ASC. This suggests that by T4 there is little additional explanatory power in ASC from the pre-matriculation characteristics.

As can be seen in Table 4.6a, similar results were found when looking at the results for students in the school of Arts and Sciences. Gender and admissions rating were statistically significant predictors of ASC at Time One and Time Two. However, departing from results found for the full sample, at Time Four, after controlling for time two ASC, neither gender nor admission rating was statistically significant in explaining Time Four ASC. The "reverse" stagewise regression results again demonstrate that the majority of the variance explained in ASC scores comes from prior ASC scores, with pre-matriculation characteristics adding little explanatory power (see Table 4.6b).

Table 4.7a shows the results for the Business school. Unlike Arts and Sciences, the results from looking at students in this school did not mirror the patterns found for the sample as a whole. In fact, gender and admission rating were statistically significant predictors of academic self-concept only at Time One. At Time Two and Time Four, the only statistically significant predictor of academic self-concept was prior academic self-concept. This suggests there may be differences in the relationship between gender and academic self-concept across schools.

Academic achievement and demographics/pre-matriculation characteristics

When examining the relationship between academic achievement and demographics/pre-matriculation characteristics, several notable patterns emerged. First, for the full sample, similar to academic self-concept, at Time One, higher academic achievement was statistically significantly associated with being male and a higher admission rating, with the standardized beta coefficient for Admission Rating several times larger than the coefficient for gender (see Table 4.8a). At Time Two, however, gender was no longer statistically significantly associated with academic achievement, only admission rating. At Time Four, after controlling for previous academic achievement, gender was again statistically significantly related to academic achievement, however this time the gender advantage was with the females—being female was associated with higher academic achievement at Time Four, after controlling for prior academic achievement. Similar to what was seen in academic self-concept, at Time Four, after controlling for prior academic achievement, admission rating was no longer a statistically significant predictor of academic achievement, again suggesting that over time pre-matriculation characteristics are more weakly associated with academic achievement, once more proximal predictors are accounted for. At Time Four, after controlling for prior academic achievement, the regression results indicated an association between race/ethnicity and GPA, with international

and race/ethnicity "unknown" students associated with higher cumulative GPAs compared to their white peers. The "reverse" stagewise regression results show negligible gains in variance explained in cumulative GPA by pre-matriculation characteristics, after controlling for prior achievement.

Looking at the subsample of Arts and Sciences students (Table 4.9a), we again see that, at Time One, being male and a higher admission rating was associated with higher academic achievement, after controlling for race/ethnicity. At Time Two, gender was no longer a significant predictor of academic achievement, while higher admission rating remained associated with higher academic achievement. Finally, at Time Four, similar to the full sample, being female was now associated with higher academic achievement, both before and after controlling for prior academic achievement. Again, after controlling for prior academic achievement, admission rating was no longer statistically significantly related to academic achievement at Time Four, and being an international student was associated with higher cumulative GPAs compared to white students.

For business school students, across all three time points, gender was not statistically significantly associated with academic achievement. Higher admission rating was associated with higher academic achievement at Time One and Time Two, however after controlling for prior academic achievement, admission rating was, again, no longer statistically significantly related to academic achievement at Time Four. And the "reverse" stagewise regression results show a substantial decrease in variance explained by pre-matriculation characteristics in Time Four amended cumulative GPA, after controlling for Time Two GPA.

Research Question 3: Cross-Lagged Relationship Between Prior Academic Self-Concept and Academic Achievement

Research question 3 was concerned with the relationship between prior academic self-concept and later academic achievement (e.g., relationship between academic self-concept at T1 and academic achievement at T2). To answer these questions, an auto-regressive cross-lagged (ARCL) model using the partial strong invariance baseline model (Figure 3.3) was employed.

After controlling for pre-matriculation characteristics (college of enrollment, ethnicity, Admission Rating, and Social Self-Concept Scale score), the cross-lagged relationship between academic self-concept at T1 and academic achievement at T2 was positive and not significant. The cross-lagged relationship between academic self-concept at T2 and academic achievement at T4 was negative and not significant (see Figure 4.4).

Research Question 4: Cross-Lagged Relationship Between Prior Academic Achievement and Academic Self-Concept

Research question 4 was concerned with the relationship between prior academic achievement and later academic self-concept (e.g., relationship between academic achievement at T1 and academic self-concept at T2). To answer this question, the same auto-regressive cross-lagged (ARCL) model used for research question 3 was employed.

The fitted model showed that, after controlling for pre-matriculation characteristics, the cross-lagged relationship between academic achievement at T1 and academic self-concept at T2 was positive and significant. The relationship between academic achievement at T2 and academic self-concept at T4 was also positive and significant (see Figure 4.4), though the magnitude of this cross-lagged parameter was attenuated.

Research Question 5: Cross-Lagged Relationship by Gender between Prior Academic Self-Concept and Academic Achievement

Research question 5 was concerned with the difference in the cross-lagged relationship between prior academic self-concept and academic achievement between men and women in college. To answer this question, the same ARCL model previously employed (including covariates) was used, but separate models were run for the male and female respondents. As was the case with the previous ARCL model, a Partial Strong Invariance Baseline Model was used for both male and female respondents. Change in model fit statistics (CFI and RMSEA) from the weak invariant model to the strong invariant model again failed to meet the thresholds proposed by Little and Card (2013) for both the male and female model (see Table 3.4). Additionally, the overall model fit statistics of the Partial Strong Invariance Baseline Model for estimated model for males failed to meet the thresholds proposed by Card and Little (2013)—the best fitting partial strong invariance model had RMSEA > .08 and CFI < .9. The overall model fit statistics for the Partial Strong Invariance Baseline Model for the estimated model for females met the adequate thresholds. Given the exploratory nature of the study, analysis proceeded, however, results from the models estimated by gender should be interpreted with caution.

The estimated model for males shows that the relationship between academic self-concept at T1 and academic achievement at T2 is negative and non-significant (see Figure 4.5). However, the estimated model for females indicates that the relationship between academic self-concept at T1 and academic achievement at T2 is positive and significant (see Figure 4.6). This suggests the initial relationship between academic self-concept and future academic achievement may well be different for men and women—specifically, that academic self-concept may have an influence on future academic achievement for women, but not for men.

When examining the relationship between academic self-concept at T2 and academic achievement at T4, the estimated model for males indicates that this relationship is positive and

not significant (see Figure 4.5), and the estimated model for females finds this relationship to be negative and not significant (see Figure 4.6). This suggests that any association academic self-concept has with future academic achievement weakens over time, regardless of gender.

Research Question 6: Cross-Lagged Relationship by Gender Between Prior Academic Achievement and Academic Self-Concept

Research question 6 was concerned with the difference in the cross-lagged relationship between prior academic achievement and academic self-concept between men and women in college. The separate male and female ARCL models that were used for research question 5 were also used for research question 6.

The estimated model for males (see Figure 4.5) shows that the relationship between academic achievement at T1 and academic self-concept at T2 is positive and significant. Similarly, the estimated model for females (see Figure 4.6) finds that the relationship between academic achievement at T1 and academic self-concept at T2 is positive and significant. This suggests a positive initial relationship between academic achievement and future academic self-concept, regardless of gender.

When looking at the relationship between academic achievement at T2 and academic self-concept at T4, this relationship is positive and significant in the estimated model for males. However, this relationship is positive but not significant in the model estimated for females, indicating that by the end of college, academic achievement continues to have a positive relationship with future academic self-concept in male students, but this relationship no longer exists for female students. For female students, the influence of academic achievement on academic self-concept seems to diminish over time.

Multi-Level ARCL Model

Estimated coefficients from the simplified RI-ARCL model fit to all respondents are almost identical in significance and direction of the cross-lagged (and auto-regressive) parameter estimates of the original ARCL model (see Figure 4.7). In particular, the RI-ARCL model estimated for all respondents yielded non-significant relationships between prior academic self-concept and academic achievement at Time Two and Time Four, and yielded positive and significant relationships between prior academic achievement and academic self-concept at Time Two and Time Four.

When comparing the estimated parameters of the original ARCL and RI-ARCL models for males, there are small differences between the two models. Similar to the ARCL model, the RI-ARCL model (see Figure 4.8) found non-significant relationships between prior academic self-concept and academic achievement both at Time Two and Time Four. However, whereas the ARCL model found positive and significant relationships between prior academic achievement and academic self-concept at Time Two and Time Four, the RI-ARCL found these cross-lagged parameters to be positive but non-significant.

The RI-ARCL model estimated for females closely matched the ARCL model (see Figure 4.9)—the RI-ARCL model also found both cross-lagged parameters (prior academic self-concept to academic achievement, and prior academic achievement to academic self-concept) from Time One to Time Two to be positive and significant. Results diverge from Time Two to Time Four, however, as the RI-ARCL model found the relationship between T2 Academic Achievement and T4 Academic Self-concept to be positive and significant (recall that the ARCL model found no significance in the cross-lagged parameters between Time Two and Time Four). As with the

ARCL model, the RI-ARCL model found the relationship between T2 Academic Self-Concept and T4 Academic Achievement to be positive but non-significant.

Results from the simplified ARCL model (the original ARCL model run using scale scores only), add credibility as to the adequacy of using the simplified RI-ARCL model to explore the importance of using a model that can account for both the between and within person variance in this particular study . As can be seen in Figure 4.10, compared to the original ARCL model (Figure 4.4), the relationship between prior academic self-concept and future academic achievement remains positive but not significant from T1 to T2, and negative but not significant from T2 to T4. Similarly, the relationship between T1 academic achievement and T2 academic self-concept remains positive and significant in both the original, indicator-specific ARCL model and the simplified, scale score ARCL model. The only difference in the cross-lagged parameters between the two models is in the estimated relationship between T2 academic achievement and T4 academic self-concept. In the original ARCL model, this cross-lagged parameter is positive and non-significant, in the simplified ARCL model, this parameter is negative and non-significant. Autoregressive parameter estimates in both models are also similar—specifically, all autoregressive parameter estimates are positive and significant in both models. Results from all three models can be compared in Figure 4.11.

Chapter V: Discussion, Implications, and Conclusion

The purpose of this study was three-fold. First, it sought to examine the changes in academic self-concept of college students over the four years of undergraduate education at a highly selective university, with a particular focus on changes that occur between adjacent time points. Second, using an auto-regressive cross-lagged model, it aimed to determine whether prior academic self-concept influenced subsequent academic achievement and whether prior academic achievement influenced subsequent academic self-concept, as well as to establish which of these relationships was stronger. Third, it sought to explore whether changes over time in academic self-concept, as well as the relationship between academic self-concept and academic achievement, were different for men and women. This chapter discusses the findings of the study, guided by the following six research questions:

1a. Given measurements at three widely separated time points (prior to entering college, beginning of second year of college, and at graduation), how do mean levels of academic self-concept change during the four-year undergraduate experience?

1b. To what extent are the changes in levels of academic self-concept during the four-year undergraduate experience different for men and women college students?

2a. At each of the three time points, (i) how is academic self-concept related to student demographics and pre-matriculation characteristics (gender, admission rating, race, college of enrollment)? (ii) Controlling for demographics and pre-matriculation characteristics, how is academic self-concept at later time-points related to academic self-concept at earlier time-points?

2b. At each of the three time points, (i) how is academic achievement related to student demographics and pre-matriculation characteristics (gender, admission rating, race, college of

enrollment)? (ii) Controlling for demographics and pre-matriculation characteristics, how is academic achievement at later time-points related to academic achievement at earlier time points?

3. Controlling for previous academic achievement and pre-matriculation characteristics, (a) what is the cross-lagged relationship between academic self-concept at Time 1 (prior to entering college) and academic achievement at Time 2 (beginning of second year of college)? (b) what is the cross-lagged relationship between academic self-concept at Time 2 (beginning of second year of college) and academic achievement at Time 4 (at graduation)?
4. Controlling for previous academic self-concept and pre-matriculation characteristics, what is the cross-lagged relationship between academic achievement at Time 1 (prior to entering college) and academic self-concept at Time 2 (beginning of second year of college)? What is the cross-lagged relationship between academic achievement at Time 2 (beginning of second year of college) and academic self-concept at Time 4 (at graduation)?
5. Controlling for previous academic achievement, previous academic self-concept, and pre-matriculation characteristics, is the cross-lagged relationship between academic self-concept at Time 1 and academic achievement at Time 2 different for men and women in college? Is the cross-lagged relationship between academic self-concept at Time 2 and academic achievement at Time 4 different for men and women in college?
6. Controlling for previous academic achievement, previous academic self-concept, and pre-matriculation characteristics, is the cross-lagged relationship between academic achievement at Time 1 and academic self-concept at Time 2 different for men and women in college? Is the cross-lagged relationship between academic achievement at Time 2 and academic self-concept at Time 4 different for men and women in college?

Research Question 1a & 1b: Differences over Time Overall and Between Genders in Mean Levels of Academic Self Concept

Descriptive statistics paired with effect size calculations demonstrated that students at this highly selective R1 institution underwent changes in academic self-concept during their four years of college. Regardless of gender, students arrived at college with relatively high academic self-concept, before experiencing a drop in academic self-concept before the start of their second year. This decline is consistent with Jackson's (2003) Big-Fish Little-Pond Effect (BFLPE), whereby students arriving at college experience a change in their frames of reference—exceptional high school students ("big fishes") find themselves surrounded by other exceptional high school students, and so compared to their college peers, these students now consider themselves average instead of exceptional. This change from "exceptional" to "average" would be associated with a decrease in academic self-concept. The BFPLE may be particularly pronounced at a highly selective R1 institution such as this study site.

This finding is also consistent with sentiments expressed in the focus groups with students from the Class of 2017. When asked about a time they struggled academically, many students cited particular courses or experiences from their first year of college. Students spoke about coming from a high school where they were at the top of their class, and their first year at college being a "reality check." One student spoke about experiencing imposter syndrome during her first year—her experiences in the classroom led her to feeling as if she didn't deserve to be at this college.

Although academic self-concept then increased on average by the end of senior year, it did not reach the average at matriculation. This is contrary to Astin's (1977) and Pascarella and Terenzini's (1991) findings, which showed that students leave college with higher levels of

academic self-concept than those with which they entered. However, this finding is consistent with Armstrong and Kim's (2016) finding that students at Catholic institutions report small declines in academic self-concept from entry to graduation.

These findings beg the question as to the role of institution type in college students' academic self-concept. While Pascarella and Terenzini (1991) conclude that what happens to students after they arrive on campus has a greater influence on academic self-concept than does the kind of institution attended, these results from one highly selective R1 institution suggest that a larger study could focus on exploring possible interactions between type of institution and students' on-campus experiences.

Although men and women experience similar patterns of change in academic self-concept through the college years, this study shows that, on average, women's academic self-concept is consistently lower than men's academic self-concept. This contributes to the body of literature that finds academic self-concept is greater in men than in women. This differential is aligned with the views expressed by the Class of 2017 focus groups with women participants. Women cited examples of how men appeared more confident in the classroom, such as men "dominating" the discussion in a classroom, whereas women will preface comments in the classroom with "I don't know, but…" or "This could be wrong but…". One woman spoke of always being surprised that her grade was "above the curve" and theorized it was because she wasn't very confident in her own abilities.

The participants in the male focus groups did not share these sentiments. While the men cited hypothetical situations that might lead to discrepancies in academic self-concept between men and women, most often they attributed this to gender/power dynamics between a male professor and female students (e.g., "I would never feel uncomfortable going to any professors'

office hours, but I could see how girls might be uncomfortable"). The men in the focus groups did not cite any actual experiences of women having lower academic self-concept than men. In fact, contrary to the findings from the focus groups with women, many men cited being in courses in which women participated more than men in class discussions.

While this study clearly demonstrates that women have lower academic self-concept than men throughout the college experience, the interpretation of these differences is complicated because this measure of academic self-concept is *self-rated*. Multiple studies have demonstrated that men often rate themselves more highly than women on a variety of self-rating measures, including academic performance measures, and that often these high self-ratings from men can be overestimations of their abilities (whereas women are more likely to accurately assess or underestimate their abilities) (Beyer, 1990, 1999b; Beyer & Bowden, 1997; Furnham, 2001).

It is beyond the scope of this study to determine the extent to which the difference between men and women in self-rated academic self-concept is due to actual differences in academic self-concept, or whether it is attributable in part to this male positive bias. The data suggests, however, that this may play some role in the difference. For example, looking at those in the top 10% of academic ability at T1, 46.9% of men, compared to 25.0% of women rated themselves in the top 10% of academic self-concept (see Table 5.1). This pattern holds across all three time points, with a higher proportion of men in the top 10% of academic ability rating themselves in the top 10% of academic self-concept, suggesting women are more frequently underestimating their abilities compared to men. Conversely, looking at those in the top 10% of academic self-concept, at T2 and T4, a greater percentage of women than men are in the top 10% of academic ability, suggesting women are better at accurately assessing their abilities compared to men, while also suggesting the men may be overrating their abilities more than women (see

Table 5.2). The differences are particularly striking at T2, with 80.4% of the men in the top 10% of academic self-concept having an academic ability below the top 10%, and 43.5% of the women in the top 10% of academic self-concept having academic ability below the top 10%. This suggests, in this sample, that women are more often either more accurately assessing their abilities or underestimating their abilities.

This underestimation of abilities was certainly hinted at in the focus groups, with multiple women speaking of being more self-critical than their male peers. “If I got a bad grade the same as a guy, I’m harder on myself about it, while men would just wave it off” said one woman. Another said of one class she was having difficulty in “I’m more worried about how I’m not doing well than my male friend, and we’re getting the same grade.”

Research Question 2a & 2b: Relationship Between Outcome Variables and Demographics/Pre-Matriculation Characteristics

Stagewise OLS regression results in this study indicate that academic self-concept is consistently associated with pre-matriculation characteristics, specifically, gender and, to some extent, admission rating, but was typically not associated with race/ethnicity. For the analytical sample of students who participated in the survey at all three time points, gender was significantly related to academic self-concept at all three time points, with being male consistently associated with higher levels of academic self-concept. This mirrors the findings for research question 1b.

Admissions Rating, a summary score based on a student’s application, was positively related to academic self-concept at T1 and T2. While an operational definition of Admission Rating was not provided for this study, this indicates that pre-college experiences influenced students’ academic self-concept: students with better qualifications for admittance (a higher

Admissions Rating) also had higher levels of academic self-concept. By T4, after including T2 academic self-concept, Admissions Rating was no longer a significant predictor of academic self-concept. This seems to indicate that by the end of college, once more proximal measures are included, pre-college academic experiences are no longer correlated with academic self-concept. This supports Pascarella and Terenzini's (1991) finding that academic self-concept is influenced by a student's experiences *after* they arrive on campus.

By T4, race/ethnicity was not a significant predictor of academic self-concept. However, sub-group sample size limitations forced all non-white, non-international race/ethnicity groups to be aggregated into one group—AHANA. Further exploratory analysis could be done in larger, future studies to examine differences by race/ethnicity.

By reversing the order by which the predictor variables were entered (first enter prior-time ASC, then enter remaining pre-matriculation characteristics), I was able to capture how much variance in the outcome (T2 ASC and T4 ASC) was predicted by pre-matriculation characteristics, after accounting for prior academic self-concept. These gains were small in comparison to the variance explained by ASC (2.6% at T2 and 1.2% at T4), suggesting that there is little explanatory power in academic self-concept from pre-matriculation characteristics, after the inclusion of prior academic self-concept.

Regression results from the Arts and Sciences students generally followed the same patterns observed in the full analytic sample, with Admission Rating being a significant predictor of ASC at T1 and T2, but no longer significant at T4, after accounting for prior academic self-concept. One interesting difference that emerged was that, among the Arts and Sciences students, by end of senior year, after accounting for prior academic self-concept, gender was no longer a significant predictor of academic self-concept. Being an international student, however, was

associated with lower academic self-concept than that of U.S. white students. Similar to the whole sample results, we see nominal gains in variance explained in academic self-concept by pre-matriculation characteristics after accounting for prior academic self-concept—2.7% at T2 and 0.9% at T4.

Contrary to the results found for Arts and Sciences students, among Business students, gender and Admission Rating were the only significant predictors of academic self-concept at T1, and race/ethnicity remained not-significant across all three time points. Additionally, the changes in variance explained in academic self-concept by pre-matriculation characteristics after accounting for prior academic self-concept were small and/or negative— -2.1% at T2 and 0.9% at T4, again indicating that for Business students, these pre-matriculation characteristics were not related to their academic self-concept after entering college.

Together, these finding suggest the possibility of an interaction between academic program type and academic self-concept. This may be attributable, in part, to differences in grading practices between program type/academic departments. Further investigation would be needed to determine how the differences in the college experiences between Arts and Sciences and Business students could lead to differences in the relationship between academic self-concept and pre-matriculation characteristics.

Students in the focus groups often spoke about different academic experiences based on school of enrollment and department. One student noted that the standards for students were very different between the Business school and the Arts and Sciences school. Men and women both spoke of differences in faculty and student makeup between the Business school and the Arts and Science school—namely, that proportionately there were more male professors and more male students in Business than in Arts and Science. In the focus groups with men participants, it often

came up that the environment in the Business school, which often tends to be have more male students, proportionally, than the Arts and Sciences school, was more competitive, but also that students were more confident—"People in [the Business school] if they don't know the answer they have to pretend they do. People in [the Arts and Sciences school] will know they have the answer but will talk about it less confidently." One student also theorized that Business students were more confident by senior year because they often had a post-graduation job lined up by the beginning of senior year, in part due to program requirements for summer internships.

Results from the stagewise OLS regressions of academic achievement on pre-matriculation characteristics demonstrate that, as a whole, being male is associated with higher academic achievement at Time One, while being female is associated with higher academic achievement by Time Four. This could be due to differences in gender distribution by major (and different grade distributions by major). Indeed, when looking at the results by school, being female was associated with a higher cumulative GPA at time four for students in the school of Arts and Sciences, but not for students in the school of Business. Again, this could be due to the fact that, typically, the school of Business has more male students than the Arts and Sciences school, and so gender dynamics among students within the schools could be very different.

Of interest was that, after including T2 academic achievement, Admissions Rating was no longer a significant predictor of academic achievement at T4. This seems to suggest that, by the end of college, pre-college academic experiences are no longer correlated with academic achievement in college, once accounting for prior academic achievement. This finding has implications for admissions, enrollment management, and student affairs professionals, in that it indicates that by the end of college, students can be academically successful regardless of their academic performance in high school.

Similar to what was found with academic self-concept, the "reverse" stagewise regressions found negligible gains in variance explained in academic achievement by pre-matriculation characteristics, after controlling for prior academic achievement. This held true both for the whole sample, and for the analyses by school.

Research Question 3: Cross-Lagged Relationship Between Prior Academic Self-Concept and Academic Achievement

Before discussing the results of the cross-lagged relationships in the ARCL model, it will be helpful to review the findings from the establishment of the baseline measurement model in Chapter III. That set of analyses revealed not only that the properties of the items making up the Academic Self-Concept scale failed to meet the assumption of strong factorial invariance, but that they also failed to meet the assumptions of partial strong invariance in the strictest sense. The failure to meet these assumptions suggests that the Academic Self-Concept scale may not be invariant across measurement occasions in this study.

In the absence of a credible assumption of measurement invariance, there is no way to tell whether observed differences over time at the construct level might be attributable, at least to some degree, to changes in the construct itself; that is, any changes observed in the Academic Self-Concept construct could also be from changes in the relationships between the indicators and the construct. This could be due to the scale development process, or lack thereof. Instead of operationally defining the construct one might be interested in measuring, and then developing and testing items to measure that construct, the constructs measured in the CIRP survey were defined retrospectively (i.e., established *after* the questionnaire was built) (Sharkness et al., 2010). Thus, researchers were limited to the items that already existed when determining which items would measure academic self-concept. New items could not be added and existing items could not be modified. The resulting scale was then built from items that may not adequately

represent the construct of academic self-concept or, more importantly, not be capable of adequately capturing changes in academic self-concept across measurement occasions. These are legitimate concerns, even though the inclusion of the items for the Academic Self-Concept scale, and the reporting of the resulting scale scores, in both The Freshman Survey and the College Senior Survey imply that it is meant to be used across measurement occasions.

Given the exploratory nature of the study, it was decided that although the baseline measurement model did not fully meet the assumptions of partial strong invariance, it was adequate for further analysis. Looking at the results of the estimated ARCL model with all respondents (Figure 4.4), the relationship between prior academic self-concept and academic achievement was not significant either at Time 2 or at Time 4. This implies that prior academic self-concept is not a primary influence on future academic achievement.

Although sample size limitations prevented the inclusion of the data from the Time 3 data collection, I conducted a parallel analysis of the ARCL model used for RQ3, but using T3 Academic Self-Concept scale scores and T3 cumulative GPA (amended) instead of T4 measures, to see if the same patterns held with this separate three-time point analysis. (It should be noted that this model also failed to meet the assumption of strong or partial strong invariance.) As can be seen in Figure 5.1, the relationship between prior academic self-concept and academic achievement was still not significant at Time 2 or Time 3, again supporting the claim that prior academic self-concept is not a primary influence on future academic achievement. This is contrary to the self-enhancement model, which implies that higher academic self-concept leads to higher academic achievement (H. Marsh & Craven, 1997). If this finding proves to be robust, one implication is that attempting to directly enhance academic self-concept in students will not have a strong, direct impact on their future academic success.

Research Question 4: Cross-Lagged Relationship Between Prior Academic Achievement and Academic Self-Concept

Recall Bong and Skaalvik's (2003) proposal that mastery experiences (e.g., past academic experiences) are one of five key antecedents to academic self-concept. Looking at the results of the ARCL model with all respondents (Figure 4.4), the relationship between prior academic achievement and academic self-concept was positive and significant at Time 2 and Time 4, though this cross-lagged parameter was much smaller between T2 and T4 than it was between T1 and T2. This implies that prior academic achievement can be seen to have a positive influence on future academic self-concept, particularly over the first year of college. This finding also supports the skill-development hypothesis, which posits that higher academic achievement leads to higher levels of academic self-concept (H. Marsh & Craven, 1997).

The parallel analysis done using T3 measures instead of T4 measures again confirms this finding, with the relationship between prior academic achievement and academic self-concept positive and significant at Time 2 and Time 3 (see Figure 5.1).

The findings from RQ3 and RQ4 are particularly illuminating when considering prior research on the relationship between these two constructs. As discussed in Chapter II, studies on the relationship between academic self-concept and academic achievement have largely been correlational in nature. And so while numerous prior studies have established that these two constructs may be related, the longitudinal design of this study provides evidence as to the nature of the direction of the relationship between these constructs. Namely, that future academic self-concept is influenced by prior academic achievement, but that future academic achievement is not, in turn, directly influenced by prior academic self-concept.

Research Question 5: Cross-Lagged Relationship by Gender between Prior Academic Self-Concept and Academic Achievement

Results from ARCL models estimated separately for male and female respondents yield similar, but not identical, results by gender. The model estimated for males mirrored the results for all respondents, which is to say, the relationship between prior academic self-concept and academic achievement was not significant, regardless of point in time. However, the model estimated for females found that, at Time 2, the relationship between prior academic self-concept and academic achievement was significant and positive. By Time 4, this relationship was not significant (matching the results of the overall sample and the male sample). This finding supports the self-enhancement hypothesis—academic self-concept is a determinant of subsequent academic achievement, for females. The model suggests, however, that any impact academic self-concept has on future academic achievement weakens as a female student continues through college, so that by the end of senior year, prior academic self-concept is no longer a primary influence on future academic achievement.

In comparing the coefficients from the overall model to the gender-specific models, it is evident that the cross-lagged coefficients between prior academic self-concept and later academic achievement are larger in magnitude, across both time frames, in the gender specific models than the overall model. This could possibly be indicating more homogeneous behavior within genders, and/or could signal substantial differences between genders.

Research Question 6: Cross-Lagged Relationship by Gender Between Prior Academic Achievement and Academic Self-Concept

When looking at the relationship between prior academic achievement and academic self-concept, it was again found that the model estimated for males mirrored the results of all respondents—the relationship between prior academic achievement and academic self-concept

was positive and significant at Time 2 and at Time 4. For males, taken together with the findings from RQ5, this finding supports the skill development hypothesis.

Results from the model estimated for females found that the relationship between prior academic achievement and academic self-concept was positive and significant at Time Two, however, was not significant at Time Four. Taken together with the results from RQ5, this finding supports the reciprocal-effects hypothesis (Guay et al., 2015), where for females, prior academic self-concept affects subsequent academic achievement, and prior academic achievement affects subsequent academic self-concept, at least, early in the college experience. By Time Four, the model suggests prior academic achievement is a primary driver of future academic self-concept, particularly among male students. For female students, by the end of college, prior academic self-concept no longer has as strong of an influence on academic achievement as was present during the first year of college.

Again, when looking at the coefficients from the overall model to the gender-specific models, it can be seen that the cross-lagged coefficients between prior academic achievement and later academic self-concept are larger in magnitude, across both time frames, in the gender specific models than the overall model. This evidence could again be pointing toward more homogeneous behavior within genders.

Multi-Level ARCL Model

Critiques of the traditional ARCL model (e.g. Hamaker et al., 2015) regarding biased cross-lagged coefficients due to the temporal nature of the stability captured by such models, led to an additional goal for this study. Specifically, one goal of this study evolved to be whether the use of the traditional ARCL model could lead to erroneous conclusions about the relationship

between academic self-concept and academic achievement in college students. I estimated the RI-ARCL using the three time point sample (see Figure 4.7). I relied on a simplified RI-ARCL model, wherein I inputted the ASC scale scores at each of the three time points, instead of inputting the items making up the scale scores. Results from the simplified ARCL (see Figure 4.10) confirm the adequacy of using such a model in this study.

The parameter estimates from the RI-ARCL model estimated for all respondents are almost identical in significance and direction of the cross-lagged (and auto-regressive) parameter estimates of the original ARCL model (see Figure 4.7 and Figure 4.11). The RI-ARCL model for all respondents found non-significant relationships between prior academic self-concept and academic achievement at Time Two and Time Four, and found positive and significant relationships between prior academic achievement and academic self-concept at Time Two and Time Four, yet again providing evidence of the skill development hypothesis.

In comparing the ARCL and RI-ARCL models estimated for males, there are small differences between the two models. Similar to the ARCL model, the RI-ARCL model (see Figure 4.8) found non-significant relationships between prior academic self-concept and academic achievement both at Time Two and Time Four. However, where the ARCL found positive and significant relationships between prior academic achievement and academic self-concept at Time Two and Time Four, the RI-ARCL found these cross-lagged parameters to be non-significant.

The RI-ARCL model estimated for females closely matched the ARCL model—the RI-ARCL model also found both cross-lagged parameters (prior academic self-concept to academic achievement, and prior academic achievement to academic self-concept) from Time One to Time Two to be positive and significant, also supporting the reciprocal effects hypothesis early in a

female student's college career. Results diverge from Time Two to Time Four, however, as the RI-ARCL model found the relationship between T2 Academic Achievement and T4 Academic Self-concept to be positive and significant (recall that the ARCL model found no significance in the cross-lagged parameters between Time Two and Time Four). As with the ARCL model, the RI-ARCL model found the relationship between T2 Academic Self-Concept and T4 Academic achievement to be non-significant.

Taken together, these comparisons suggest that the application of the ARCL model did not result in biased estimates of the cross-lagged regression coefficients. Both analyses confirm the skill-development hypothesis for the relationship between academic achievement and academic self-concept for this sample of college students. When focusing on female students, both models confirm the reciprocal effects hypothesis early in their college experience, with prior academic achievement positively impacting future academic self-concept, and vice-versa.

As noted earlier, given the design of the study, the finding that the ARCL model did not bias the cross-lagged regression coefficients was expected. Since ASC was theorized here to be more state-like than trait-like, and the study time points were widely spaced, stability in the constructs was not anticipated. Consequently, there was marginal added value of employing a model to capture construct stability across time.

Implications

The implications of this study follow from examining the relationship between academic self-concept and academic achievement among a large, non-random sample of students at a highly selective, R1 research institution. Certainly, the differences between men and women in the levels of academic self-concept, and differences in the relationship between academic self-

concept and academic achievement over the first year of college indicate that women are experiencing college differently than men during this first year.

For these students, higher academic achievement is typically followed by higher academic self-concept, but higher academic self-concept is not necessarily followed by higher academic achievement, especially among male students. Among female students, however, there is evidence of reciprocal effects between academic achievement and academic self-concept, especially in the first year of college—higher academic self-concept is followed by higher academic achievement. One can conclude from this study that increasing academic self-concept could be seen as a method for increasing subsequent academic achievement for female students. And conversely, due to the reciprocal effects found in the estimated model, a mechanism for increasing female academic self-concept could be putting resources in place to improve academic/classroom performance. This conclusion certainly warrants further study, and could be the basis of future work.

The presence of reciprocal effects between academic achievement and academic self-concept among female students is particularly noteworthy when combined with the findings from RQ1—namely, that female students had lower levels of academic self-concept than male students across all time points. Taken together, these findings indicate that lower academic self-concept in females could be academically disadvantaging them compared to their male counterparts, particularly early in their collegiate experience. Since, as this study suggests, future academic performance is not as influenced by prior academic self-concept in males as it is among female students (i.e., lack of reciprocal effects found in the estimated male model). If prior academic self-concept influences future academic achievement among females, what level of academic achievement could be achieved by females, were they to have similar levels of

academic self-concept as their male peers? To be clear, this study already established (in research questions 2a and 2b) that, by graduation, being female was associated with higher academic achievement, and so this finding does not imply that as a whole, female students are performing poorly academically compared to male students. However, this study does suggest that female academic performance could be negatively affected in ways that male academic performance is not.

This finding of reciprocal effects among female students, but not among male students, between Time One and Time Two indicate that interventions meant to address differences between male and female students in academic self-concept may well be most effective during the earlier years of the collegiate experience. Interventions aimed at enhancing academic self-concept in college students could address one or more of the five antecedents of academic self-concept (frames of reference, causal attributions, reflected appraisal from significant others, mastery experiences, and psychological centrality) (Bong & Skaalvik, 2003). The academic experiences of college students in these early years are most typically comprise required liberal arts courses, whereas in later years the coursework predominantly comprises course requirements of the major —following a curriculum that students choose to pursue. Students taking required courses across a variety of content areas may need more support than students taking courses in a field in which they have purposely declared an interest.

There are also research implications from this study. First, any pre/post analysis using the CIRP Academic Self-Concept Scale should be done with caution, especially analyses done to measure changes in the construct directly (e.g., gain scores). The study done with this sample found the scale was not invariant across measurement occasions, perhaps due to the nature of the

construction of the scale, and the lack of construct coverage across the four items that make up the scale.

Second, the findings of this study suggest that, in cases where the constructs are theorized to be state-like, and when the measurement occasions are widely spaced, the use of an ARCL model, instead of an RI-ARCL model, should not bias the cross-lagged coefficients. Additionally, given the differences in the interpretations of the coefficients from the two models, caution is in order when using RI-ARCL models to answer questions posed in an ARCL framework. For example, with an RI-ARCL model, the cross-lagged parameters represent the extent to which an individual's expected score on a construct, such as academic self-concept, at T2 can be predicted from their deviation from their expected score on academic achievement at T1, while controlling for their deviation from their expected score on academic self-concept at T1. In this framework, the importance shifts from overall levels on a construct to individual deviations on a construct, and so these models cannot be used interchangeably to answer the same research questions.

Limitations and Future Work

There are four main limitations to this study, each which leads to a strand of work to pursue beyond this study. First, as established in this study, properties of CIRP's Academic Self-Concept scale suggest it may not adequately represent changes in academic self-concept of college students over widely spaced time periods. Any further work done examining changes in academic self-concept of college students should utilize a more appropriate measure of academic self-concept. Future work could include the construction of a new academic self-concept scale, utilizing appropriate scale development techniques (i.e., operationally defining the construct, developing and testing items to measure that construct).

Second, sample size limitations led to the use of only three time points of data. This study determined that there was an increase in academic self-concept in college students from the beginning of sophomore year to the end of senior year, but the inclusion of additional time-points would allow for a more refined mapping of its trajectory. A replication of this study using a four, or even five time-point sample (e.g., beginning of freshman year, beginning of sophomore year, beginning of junior year, beginning of senior year, and end of senior year) would allow for further study of the changes in academic self-concept over the four year college experience. Paired with qualitative analysis, it may be possible to draw conclusions regarding why the changes occur. Perhaps academic self-concept increases as students move more deeply into their major or, perhaps, only when their academic achievement results in successful post-graduation plans, such as receiving a job offer or acceptance to graduate school. Additionally, the findings from this study clearly identify a drop in academic self-concept, regardless of gender, from freshman to sophomore year. Future work could also focus more specifically on the sophomore year experience—there are several aspects of both the social and academic experience that make sophomore year unique from a students' first year (e.g., selecting a major, choosing where and with whom to live, instead of by random assignment). It would be interesting to examine the changes in academic self-concept and it's relation to other collegiate experiences during this critical time period.

Third, this study was limited to a non-random sample of students at one study site. A replication of this study at other types of institutions—institutions that are not highly selective, R1 research institutions, would enable examination of the interaction between changes in academic self-concept and institution type. Focus group findings indicated there was a Big-Fish-Little-Pond Effect occurring at the institution studied here, a natural consequence of enrolling at

a highly selective university. It would be interesting to study the changes in academic self-concept, and its impact on academic achievement, at other types of institutions, such as small liberal arts colleges, less selective state schools, and/or community colleges.

Finally, the recency of the RI-ARCL models and the lack of documentation related to programming these more complex models meant that this study did not include a RI-ARCL model that used individual items as inputs (instead of scale scores). Although the results of this study found no bias in the cross-lagged coefficients as a result of using the ARCL model instead of the RI-ARCL model, it would be instructive to expand the analysis by using the item-specific RI-ARCL model. Such an analysis would further contribute to the body of literature that most recently has focused on the more advanced RI-ARCL model as a means of examining the relationship between two constructs across multiple time points.

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Tables and Figures

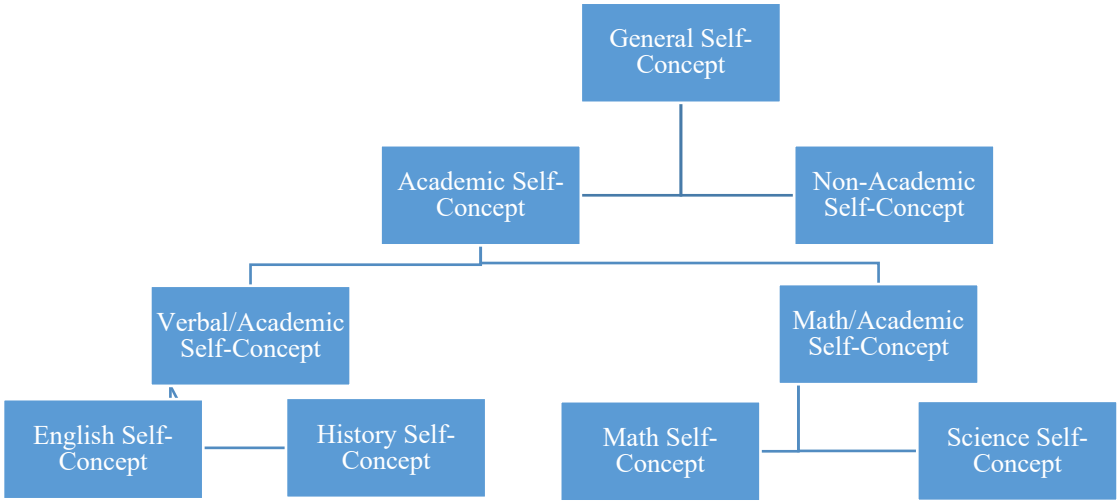


Figure 1.1 *- Marsh-Shavelson model of self-concept. Recreated from Marsh (1990)*

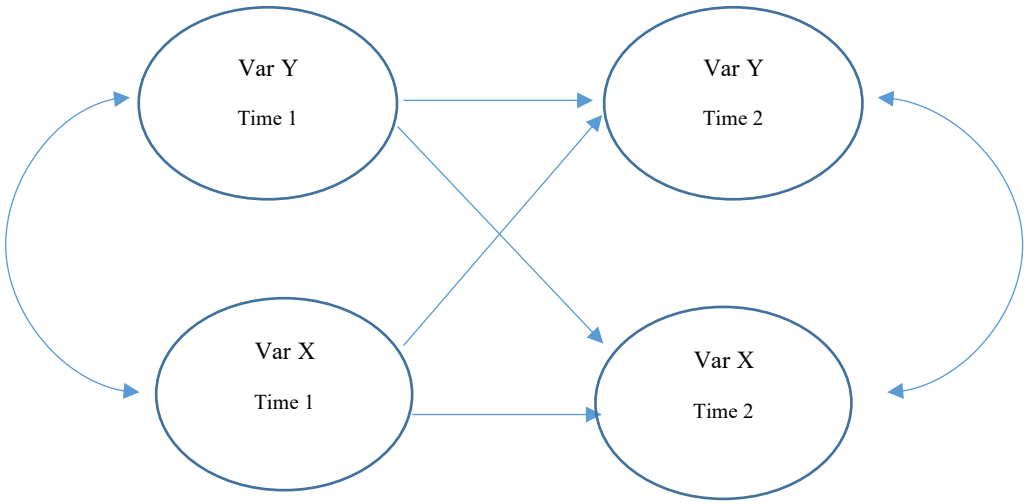


Figure 1.2 *- Example of an auto-regressive cross-lagged model relating academic achievement and academic self-concept at two time points*

Table 1.1

Population and Sample Descriptive Statistics

	Time 1 (N=2,141)	Time 2 (N=1,086)	Time 4 (N=1,149)	Three Time-Point Sample (N=615)	Population (N=2,259)
Female	53.3%	63.0%	60.1%	65.4%	54.4%
Race					
White	63.2%	62.2%	65.4%	65.7%	62.5%
AHANA	26.3%	27.1%	25.7%	25.7%	25.9%
International	5.6%	5.7%	4.1%	3.6%	6.3%
Unknown	5.0%	5.1%	4.9%	5.0%	5.4%
SAT Reading (mean)	657.5	662.4	662.1	662.1	656.6
SAT Writing (mean)				682.1	675.3
SAT Math (mean)	679.3	680.9	683.0	683.0	680.3
ACT (mean)	30.4	30.7	30.7	30.8	30.3
Avg Cumulative GPA	-	3.34	3.46	3.49	3.40
Admission Rating	4.71	-	-	4.28	4.63
College of Enrollment					
Arts and Sciences	65.3%	64.3%	61.3%	60.8%	64.1%
Business	25.1%	22.4%	24.4%	22.8%	23.9%
Education	5.7%	7.6%	8.9%	10.1%	7.4%
Nursing	3.9%	5.7%	5.5%	6.3%	4.6%

Table 1.2

Average Academic Self-Concept Scale Score – Time One (prior to entering college)

	All Respondents		Three Time-Point Sample	
	Men (N=981)	Women (N=1124)	Men (N=206)	Women (N=399)
Average ASC Score***	4.15***	3.99	4.19***	4.00
College of Enrollment				
Arts and Sciences	4.13***	3.99	4.17***	4.00
Business	4.19***	4.06	4.23*	4.10
Education	4.01	3.89	4.21	3.91
Nursing	3.97	3.97	4.39***	3.95

* Gender difference is statistically significant, p<.05
**Gender difference is statistically significant, p<.01
***Gender difference is statistically significant, p<.001

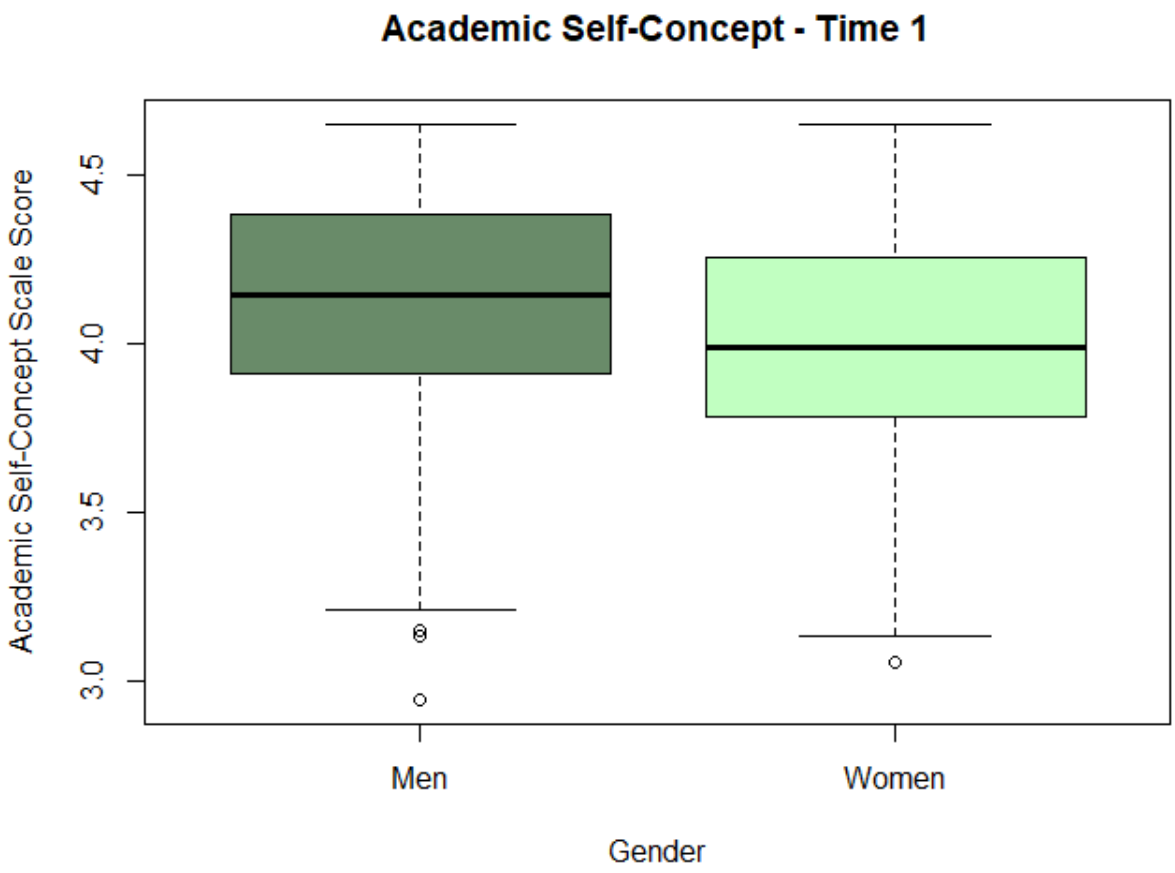


Figure 1.3 *- Academic Self Concept scale score distribution by gender*

Table 1.3

Correlations (All Respondents) – Time One (prior to entering college) (N=2141)

	1	2	3	4
1. Academic Self-Concept	-			
2. ACT Composite	.38**	-		
3. SAT Critical Reading	.25**	.70**	-	
4. SAT Math	.33**	.63**	.43**	-

**Correlation significant at p<.01 level

Table 1.4

Correlations (Three Time-Point Sample) – Time One (prior to entering college) (N=615)

	1	2	3	4
1. Academic Self-Concept	-			
2. ACT Composite	.29**	-		
3. SAT Critical Reading	.28**	.63**	-	
4. SAT Math	.37**	.54**	.36**	-

**Correlation significant at p<.01 level

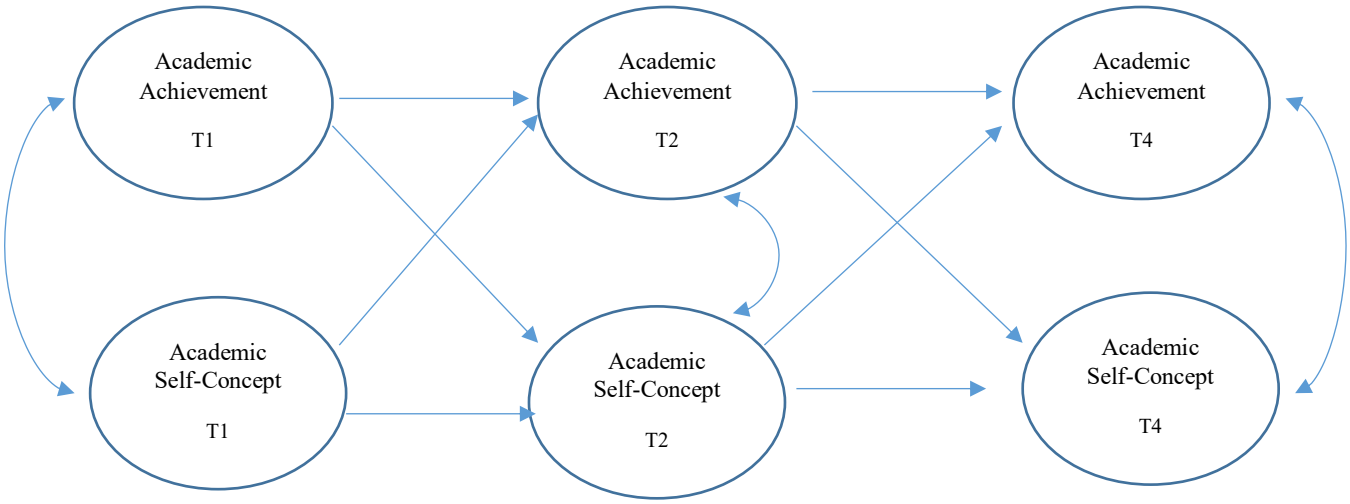


Figure 1.4 *- Auto-regressive Cross-Lagged Model relating Academic Achievement and Academic Self-Concept*

Table 3.1

CIRP Self-Rating Items
Academic ability*
Artistic ability
Creativity
Computer skills
Drive to achieve*
Emotional health
Leadership ability†
Mathematical ability*
Physical health
Public speaking ability†
Self-confidence (intellectual)*
Self-confidence (social) †
Spirituality
Understanding of others
Writing ability

* Item is part of Academic Self-Concept scale
† Item is part of Social Self-Concept scale

Table 3.2

Population Demographics (N=2,259)	
Female	54.4%
Race	
White	62.5%
AHANA	25.9%
International	6.3%
Unknown	5.4%
SAT Reading (mean)	656.6
SAT Writing (mean)	675.3
SAT Math (mean)	680.3
ACT Composite (mean)	30.3
Cumulative GPA (mean)	3.40
Admission Rating (mean)	4.63
College of Enrollment	
Arts and Sciences	64.1%
Business	23.9%
Education	7.4%
Nursing	4.6%

Table 3.3

Sample Demographics (N=615)	
Female*	65.4%
Race	
White	65.7%
AHANA	25.7%
International	3.6%
Unknown	5.0%
SAT Reading (mean)*	662.1
SAT Writing (mean)	682.1
SAT Math (mean)	683.0
ACT Composite (mean)*	30.8
Cumulative GPA (mean)	3.49
Admission Rating (mean)*	4.28
College of Enrollment	
Arts and Sciences	60.8%
Business	22.8%
Education	10.1%
Nursing	6.3%

* Sample characteristic is statistically significantly different from population characteristic

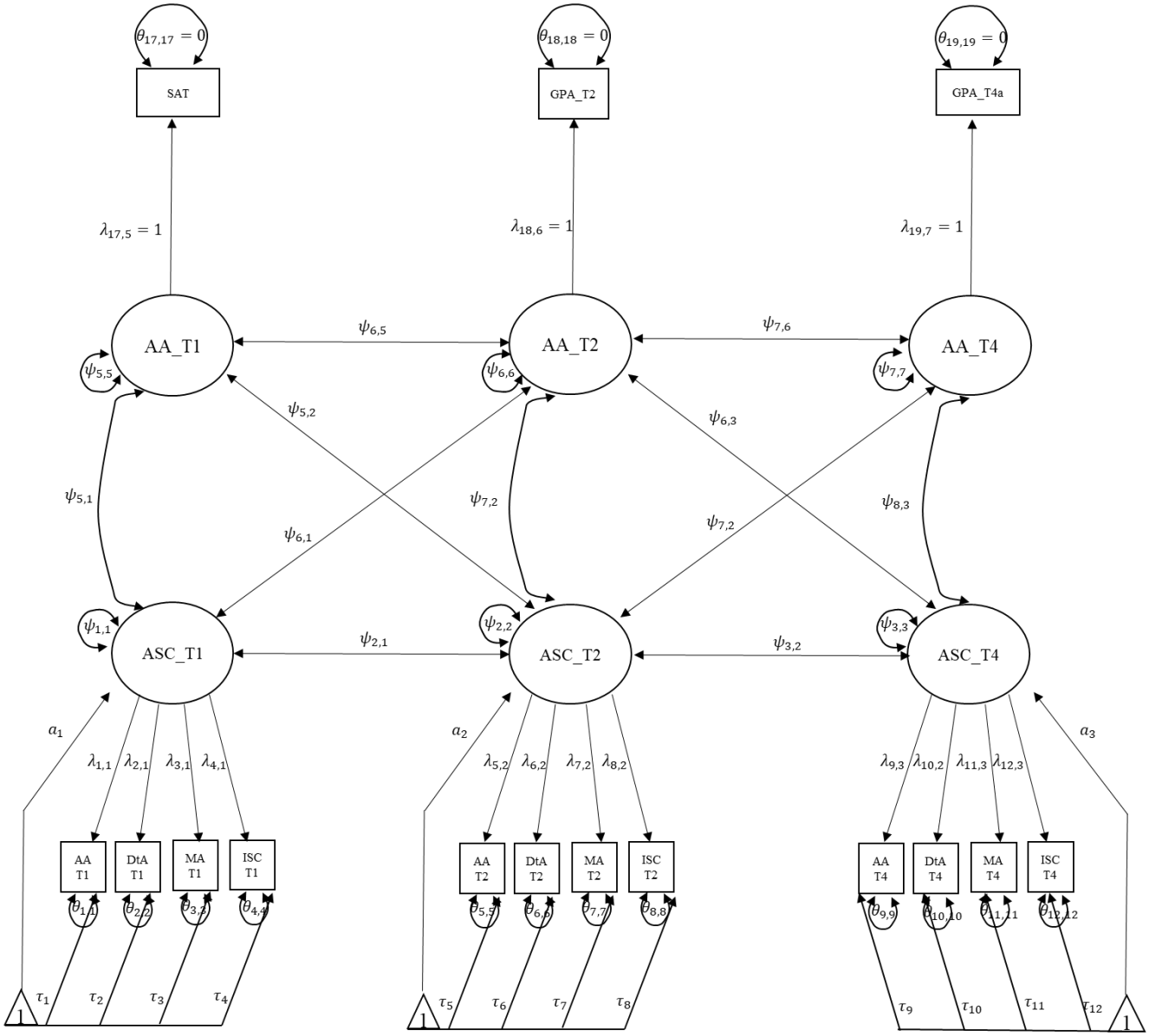


Figure 3.1 – *Null Baseline Measurement Model*

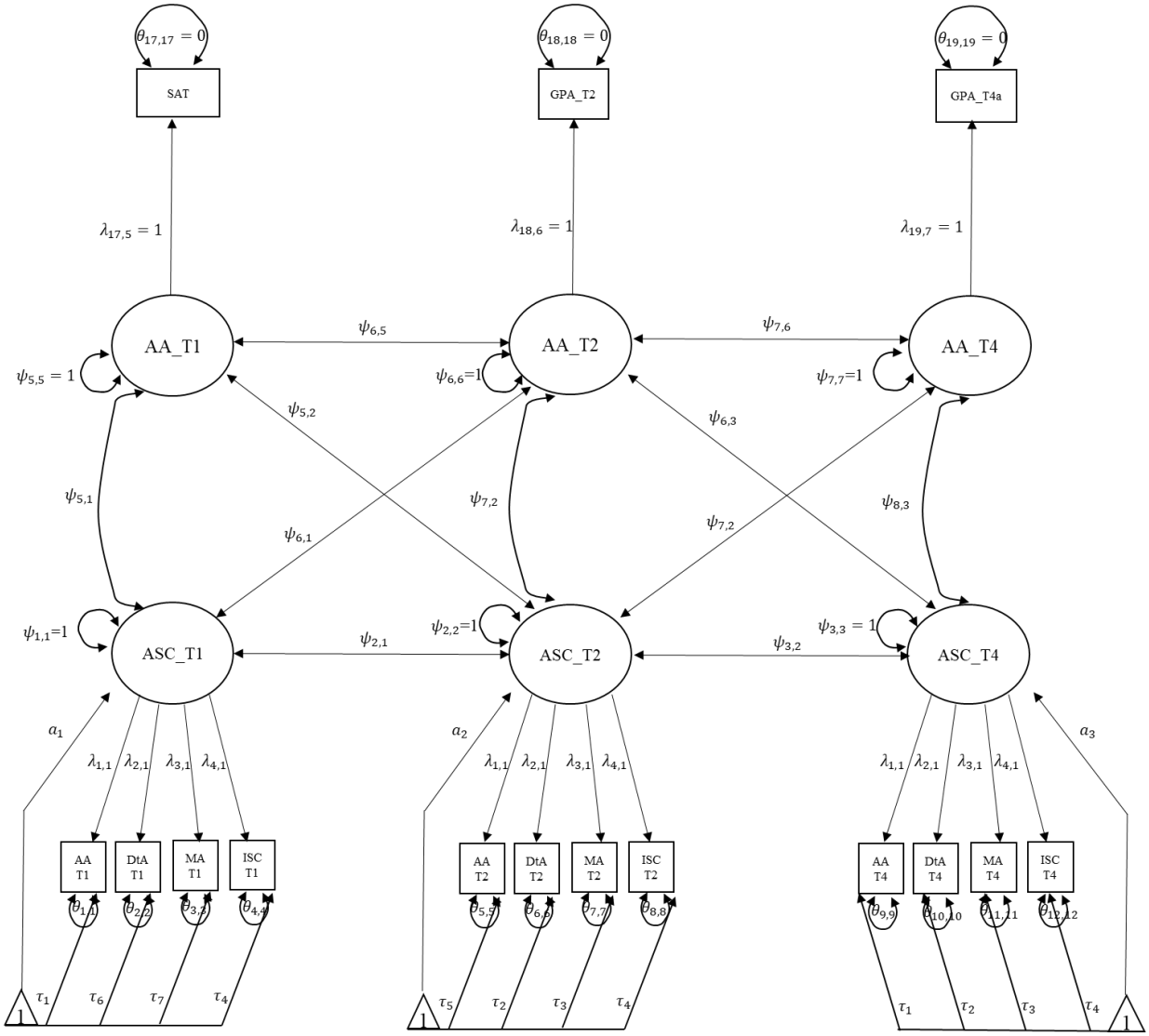


Figure 3.2 – *Partial Strong Invariant Baseline Model*

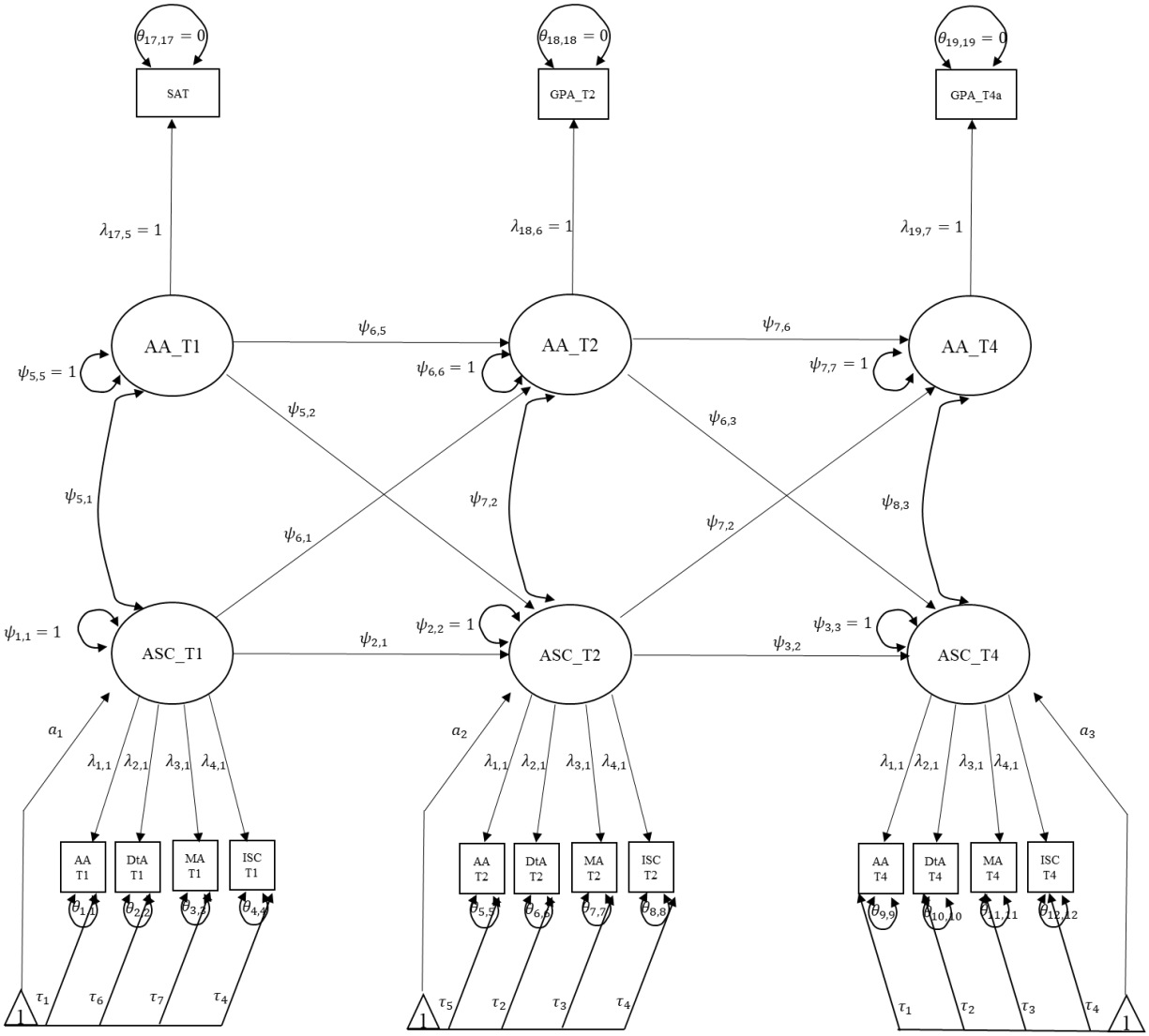


Figure 3.3 – *Full ARCL Model*

Table 3.4

Measurement Invariance Metrics

Model Tested	χ^2	df	p	RMSEA	Δ RMSEA	CFI	Δ CFI	Pass?
All								
Null model	2204.53	66	<.001	---	---	---	---	---
Conf. invariance	78.91	39	<.001	.05	---	.98	---	Yes
Weak invariance	111.72	47	<.001	.05	<.01	.97	.01	Yes
Strong invariance	467.39	55	<.001	.12	.07	.81	.16	No
Prtl. str. invariance	243.17	52	<.001	.09	.04	.91	.06	No
Male								
Null model	757.29	66	<.001	---	---	---	---	---
Conf. invariance	50.23	39	0.107	.04	---	.98	---	Yes
Weak invariance	82.08	47	0.001	.07	.03	.95	.03	No
Strong invariance	757.29	55	<.001	.12	.05	.82	.13	No
Prtl. str. invariance	134.62	52	<.001	.09	.02	.88	.07	No
Female								
Null model	1386.37	66	<.001	---	---	---	---	---
Conf. invariance	74.56	39	0.001	.05	---	.97	---	Yes
Weak invariance	92.90	47	<.001	.05	<.01	.97	<.01	Yes
Strong invariance	349.86	55	<.001	.13	.08	.78	.19	No
Prtl. str. invariance	173.99	52	<.001	.08	.03	.91	.06	No

Table 4.1

Average Academic Self-Concept Scale Scores across Time Points

	Mean	SD	$Mean_D$	SD_D	p-value	Cohen's D
T1	4.06	0.50				
T2	3.67	0.59	-0.39	.52	<.001	.75
T4	3.92	0.59	0.25	.49	<.001	.51

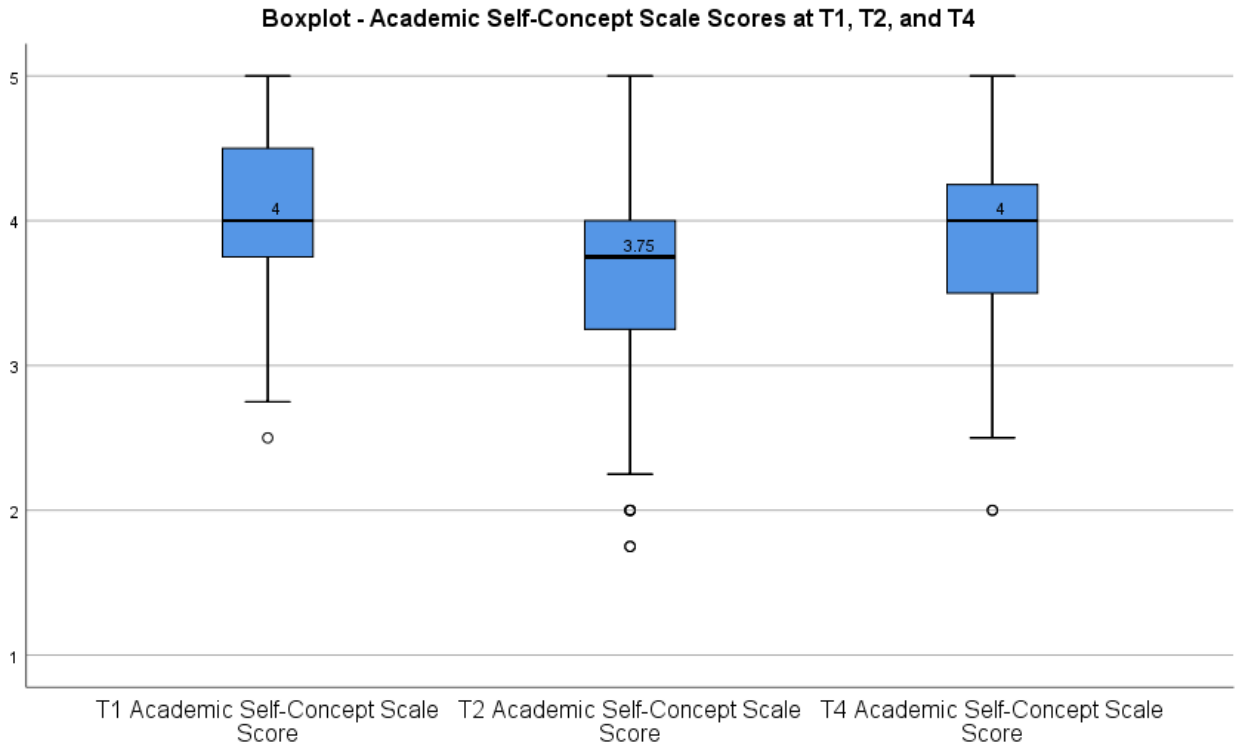


Figure 4.1 – *Boxplot of Academic Self-Concept Scale Scores at T1, T2, and T4*

Table 4.2

Average Academic Self-Concept Scale Scores across Time - Women

	Mean	SD	$Mean_D$	SD_D	p-value	Cohen's D
T1	3.97	0.49				
T2	3.58	0.56	-0.39	0.52	<.001	0.76
T4	3.82	0.56	0.25	0.46	<.001	0.54

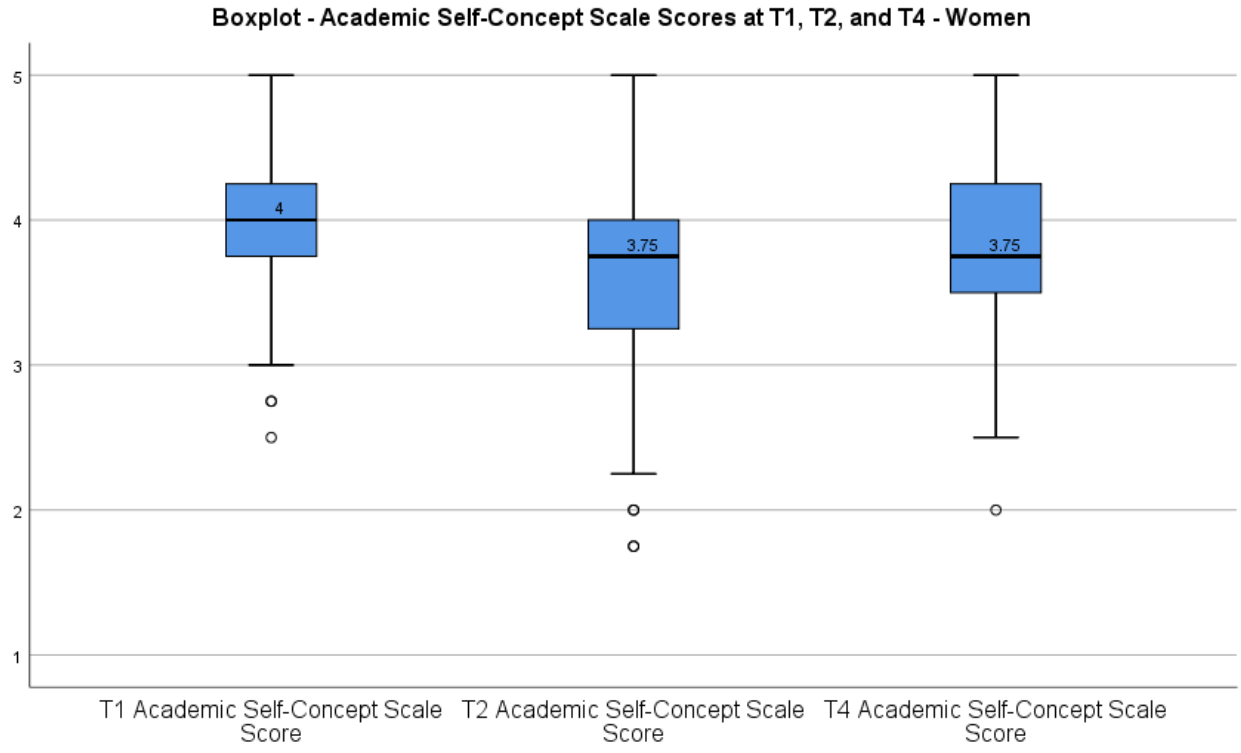


Figure 4.2 – *Boxplot of Academic Self-Concept Scale Scores at T1, T2, and T4 - Women*

Table 4.3

Average Academic Self-Concept Scale Scores across Time - Men

	Mean	SD	$Mean_D$	SD_D	p-value	Cohen's D
T1	4.25	0.49				
T2	3.85	0.62	-0.39	0.53	<.001	0.74
T4	4.12	0.59	0.28	0.55	<.001	0.51

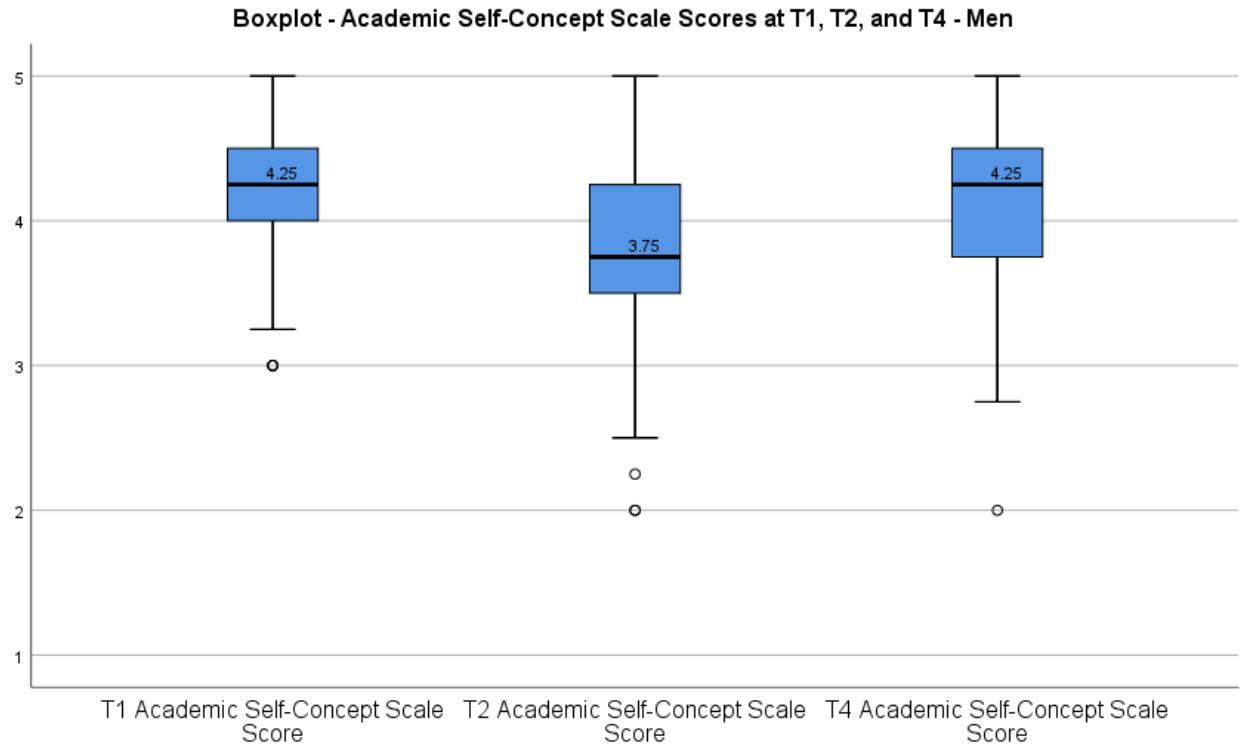


Figure 4.3 – *Boxplot of Academic Self-Concept Scale Scores at T1, T2, and T4 - Men*

Table 4.4

Differences in Average Academic Self-Concept Scale Scores across Time Points by Gender

	Mean (SD)		$Mean_D$	SD_D	p-value	Cohen's D
	Women	Men				
T1	3.97 (0.5)	4.25 (0.48)	-0.28	0.48	<.001	0.59
T2	3.58 (0.6)	3.85 (0.62)	-0.27	0.59	<.001	0.46
T4	3.82 (0.6)	4.12 (0.59)	-0.30	0.57	<.001	0.44

Table 4.5a

Stagewise Regression Results – Academic Self-Concept and Demographics/Pre-Matriculation Characteristics – All Schools (N=615)

	Outcome Variable				
	T1_ASC	T2_ASC		T4_ASC	
R-Square	*.204*	*.159*	*.341*	*.139*	*.434*
Adj. R-Square	*.197*	*.152*	*.335*	*.131*	*.427*
Female	-.270***	-.224***	-.095**	-.251***	-.105**
Admissions Rating	-.339***	-.304***	-.140***	-.265***	-.064
AHANA	-.099**	-.076*	-.028	-.064	-.003
International	-.028	.031	.045	-.011	-.059
Unknown	-.010	-.077*	-.072*	-.056	-.000
T1_ASC			.479***		
T2_ASC					.605***

* Results are reported as standardized coefficients
** The reference group for race was "White"
*** Admissions rating is coded so that 1 is "highest" (most likely to offer admission to), and 10 is "lowest (least likely to offer admission to).
* p<.05
**p<.01
***p<.001

Table 4.5b

"Reverse" Stagewise Regression Results – Academic Self-Concept and Demographics/Pre-Matriculation Characteristics – All Schools (N=615)

	Outcome Variable				
	T1_ASC	T2_ASC		T4_ASC	
		Prior ASC	*Prior ASC, Pre-Matric*	*Prior ASC*	*Prior ASC, Pre-Matric*
R-Square	*.204*	*.310*	*.341*	*.416*	*.434*
Adj. R-Square	*.197*	*.309*	*.335*	*.415*	*.427*

Table 4.6a

Stagewise Regression Results – Academic Self-Concept and Demographics/Pre-Matriculation Characteristics – Arts and Sciences

	Outcome Variable				
	T1_ASC (N=391)	T2_ASC (N=384)		T4_ASC (N=374)	
R-Square	*.176*	*.143*	*.330*	*.082*	*.440*
Adj. R-Square	*.165*	*.131*	*.320*	*.067*	*.429*
Female	-.255***	-.221***	-.097*	-.229***	-.072
Admissions Rating	-.327***	-.308***	-.149**	-.190*	.034
AHANA	-.084	-.064	-.026	-.041	.010
International	-.052	.042	.068	-.037	-.097*
Unknown	.040	-.060	-.078	-.022	.025
T1_ASC			.478***		
T2_ASC					.658***

* Results are reported as standardized coefficients

** The reference group for race was "White"

*** Admissions rating is coded so that 1 is "highest" (most likely to offer admission to), and 10 is "lowest (least likely to offer admission to).

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

Table 4.6b

"Reverse" Stagewise Regression Results – Academic Self-Concept and Demographics/Pre-Matriculation Characteristics – Arts and Sciences

	Outcome Variable				
	T1_ASC (N=391)	T2_ASC (N=384)		T4_ASC (N=374)	
		Prior ASC	*Prior ASC, Pre-Matric*	*Prior ASC*	*Prior ASC, Pre-Matric*
R-Square	*.176*	*.295*	*.330*	*.422*	*.440*
Adj. R-Square	*.165*	*.293*	*.320*	*.420*	*.429*

Table 4.7a

Stagewise Regression Results – Academic Self-Concept and Demographics/Pre-Matriculation Characteristics – Business

	Outcome Variable				
	T1_ASC (N=142)		T2_ASC (N=140)		T4_ASC (N=140)
R-Square	*.173*	*.049*	*.234*	*.102*	*.403*
Adj. R-Square	*.142*	*.013*	*.199*	*.061*	*.370*
Female	-.261**	-.087	.029	-.170	-.112
Admissions Rating	-.318***	-.150	-.035	-.209*	-.109
AHANA	-.120	-.059	-.002	-.142	-.095
International	-.022	-.029	-.016	-.043	-.077
Unknown	-.085	-.123	-.077	-.149	-.053
T1_ASC			.462***		
T2_ASC					.570***

* Results are reported as standardized coefficients

** The reference group for race was "White"

*** Admissions rating is coded so that 1 is "highest" (most likely to offer admission to), and 10 is "lowest (least likely to offer admission to).

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

Table 4.7b

"Reverse" Stagewise Regression Results – Academic Self-Concept and Demographics/Pre-Matriculation Characteristics – Business

	Outcome Variable				
	T1_ASC (N=142)	T2_ASC (N=140)		T4_ASC (N=140)	
		Prior ASC	*Prior ASC, Pre-Matric*	*Prior ASC*	*Prior ASC, Pre-Matric*
R-Square	*.173*	*.225*	*.234*	*.367*	*.403*
Adj. R-Square	*.142*	*.220*	*.199*	*.361*	*.370*

Table 4.8a

Stagewise Regression Results – Academic Achievement and Demographics/Pre-Matriculation Characteristics – All (N=615)

	Outcome Variable				
	T1_SAT Composite	T2_Cumulative GPA		T4_Amended GPA	
R-Square	*.516*	*.233*	*.255*	*.093*	*.180*
Adj. R-Square	*.512*	*.226*	*.248*	*.085*	*.172*
Female	-.128***	-.009	.018	.097*	.100**
Admissions Rating	-.704***	-.476***	-.325***	-.229***	-.068
AHANA	-.026	-.031	-.026	-.070	-.060
International	-.013	.026	.029	.097*	.088*
Unknown	-.037	.018	.026	.084*	.078*
T1_SAT Composite			.215***		
T2_ Cumulative GPA					.337***

* Results are reported as standardized coefficients
** The reference group for race was "White"
*** Admissions rating is coded so that 1 is "highest" (most likely to offer admission to), and 10 is "lowest (least likely to offer admission to).
**** Dependent variables were standardized
* p<.05, **p<.01, ***p<.001

Table 4.8b

"Reverse" Stagewise Regression Results – Academic Achievement and Demographics/Pre-Matriculation Characteristics – All (N=615)

	Outcome Variable				
	T1_SAT Composite	T2_Cumulative GPA		T4_Amended GPA	
		Prior AA	*Prior AA, Pre-Matric*	*Prior AA*	*Prior AA, Pre-Matric*
R-Square	*.516*	*.196*	*.255*	*.144*	*.180*
Adj. R-Square	*.512*	*.195*	*.248*	*.143*	*.172*

Table 4.9a

Stagewise Regression Results – Academic Achievement and Demographics/Pre-Matriculation Characteristics – Arts and Sciences

	Outcome Variable				
	T1_SAT Composite (N=391)	T2_Cumulative GPA (N=384)		T4_Amended GPA (N=374)	
R-Square	*.521*	*.248*	*.268*	*.119*	*.186*
Adj. R-Square	*.514*	*.238*	*.256*	*.107*	*.172*
Female	-.151***	-.008	.024	.119*	.121*
Admissions Rating	-.718***	-.481***	-.330***	-.234***	-.097
AHANA	-.036	-.070	-.061	-.101*	-.083
International	-.009	.031	.034	.106*	.096*
Unknown	-.032	.005	.012	.078	.075
T1_SAT Composite			.208**		
T2_Cumulative GPA					.297***

* Results are reported as standardized coefficients
** The reference group for race was "White"
*** Admissions rating is coded so that 1 is "highest" (most likely to offer admission to), and 10 is "lowest (least likely to offer admission to).
**** Dependent variables were standardized
* p<.05, **p<.01, ***p<.001

Table 4.9b

"Reverse" Stagewise Regression Results – Academic Achievement and Demographics/Pre-Matriculation Characteristics – Arts and Sciences

	Outcome Variable				
	T1_SAT Composite (N=391)	T2_Cumulative GPA (N=384)		T4_Amended GPA (N=374)	
		Prior AA	*Prior AA, Pre-Matric*	*Prior AA*	*Prior AA, Pre-Matric*
R-Square	*.521*	*.203*	*.268*	*.135*	*.186*
Adj. R-Square	*.514*	*.201*	*.256*	*.133*	*.172*

Table 4.10a

Stagewise Regression Results – Academic Achievement and Demographics/Pre-Matriculation Characteristics – Business

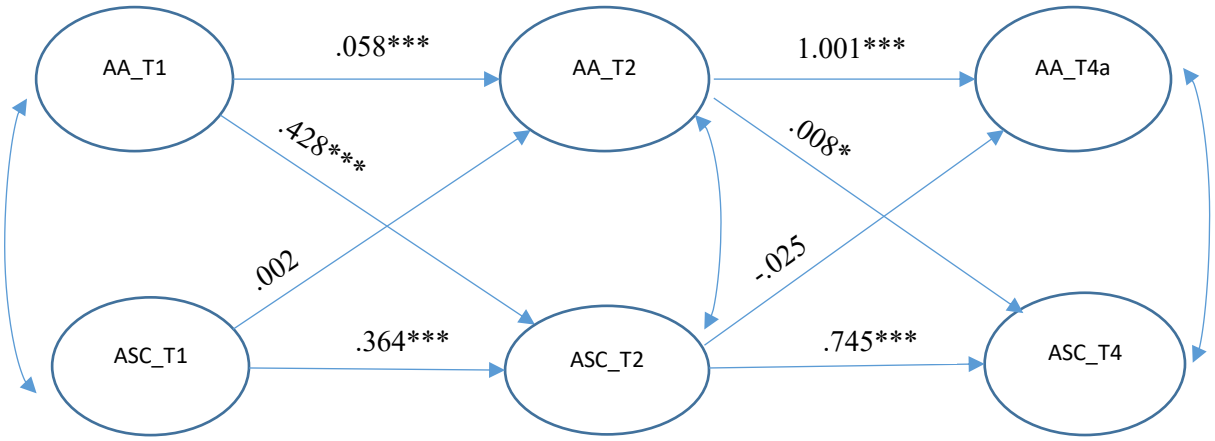
	Outcome Variable				
	T1_SAT Composite (N=142)	T2_Cumulative GPA (N=140)		T4_Amended GPA (N=140)	
R-Square	*.374*	*.265*	*.273*	*.060*	*.149*
Adj. R-Square	*.351*	*.238*	*.240*	*.025*	*.111*
Female	-.071	-.099	-.092	-.032	.002
Admissions Rating	-.609***	-.524***	-.465***	-.233*	-.050
AHANA	-.017	.096	.098	.065	.032
International	-.041	.028	.033	.105	.096
Unknown	-.057	-.040	-.033	.069	.083
T1_SAT Composite			.105		
T2_Cumulative GPA					.349***

* Results are reported as standardized coefficients
** The reference group for race was "White"
*** Admissions rating is coded so that 1 is "highest" (most likely to offer admission to), and 10 is "lowest (least likely to offer admission to).
**** Dependent variables were standardized
* p<.05, **p<.01, ***p<.001

Table 4.10b

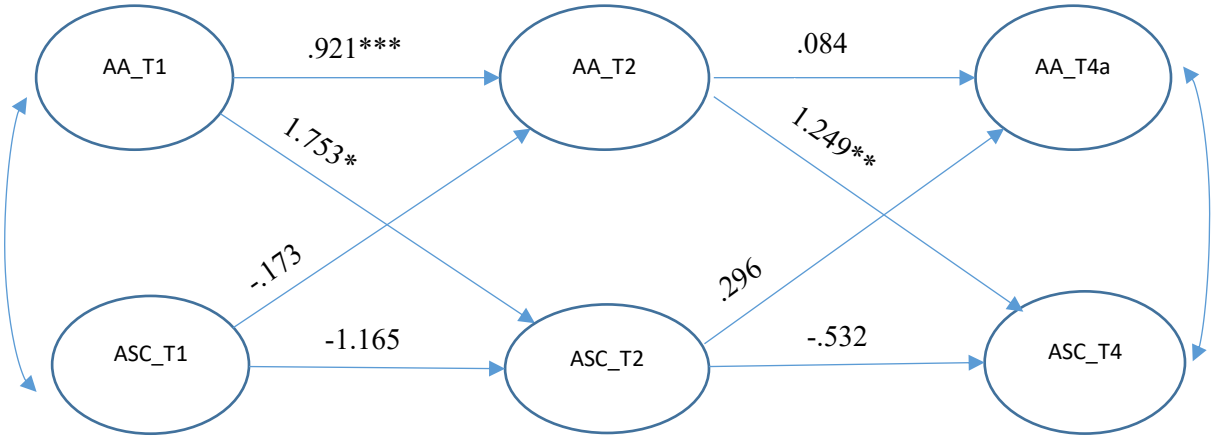
"Reverse" Stagewise Regression Results – Academic Achievement and Demographics/Pre-Matriculation Characteristics – Business

	Outcome Variable				
	T1_SAT Composite (N=142)	T2_Cumulative GPA (N=140)		T4_Amended GPA (N=140)	
		Prior AA	*Prior AA, Pre-Matric*	*Prior AA*	*Prior AA, Pre-Matric*
R-Square	*.374*	*.126*	*.273*	*.133*	*.149*
Adj. R-Square	*.351*	*.120*	*.240*	*.127*	*.111*



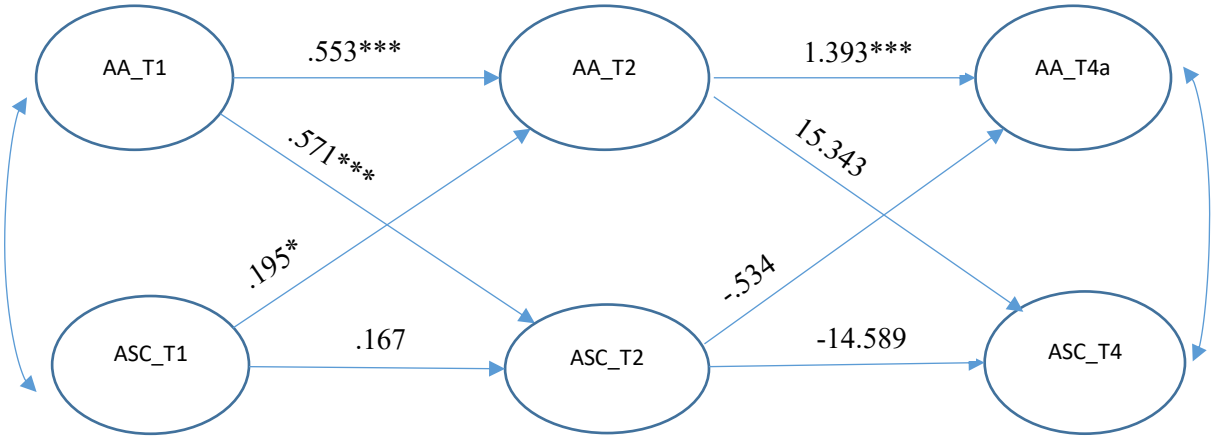
CFI = .814
RMSEA = .084
Iterations to convergence: 222

Figure 4.4 – *ARCL Model – All Respondents – standardized coefficients*



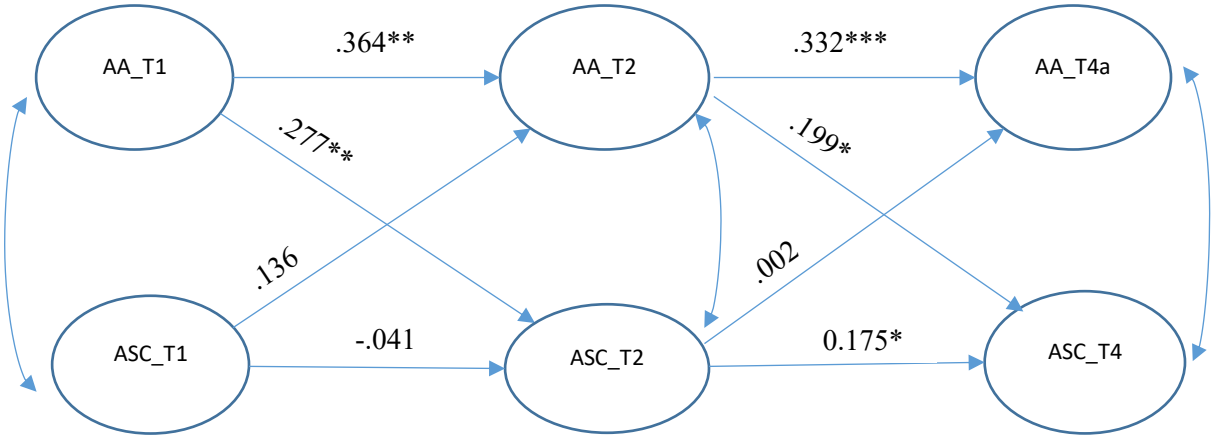
CFI = .782
RMSEA = .086
Iterations to convergence: 162

Figure 4.5 – *ARCL Model – Male Respondents*



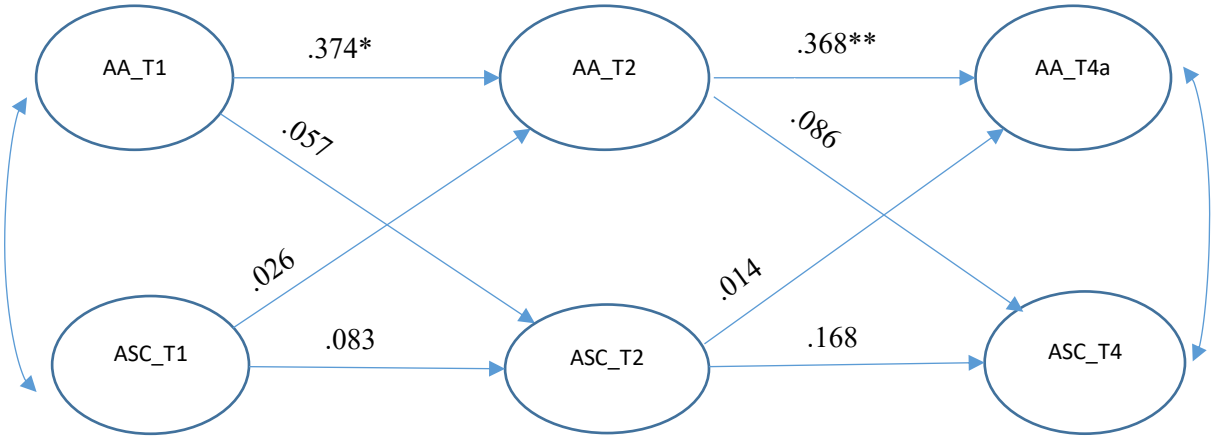
CFI = .781
RMSEA = .085
Iterations to convergence: 256

Figure 4.6 – *ARCL Model – Female Respondents*



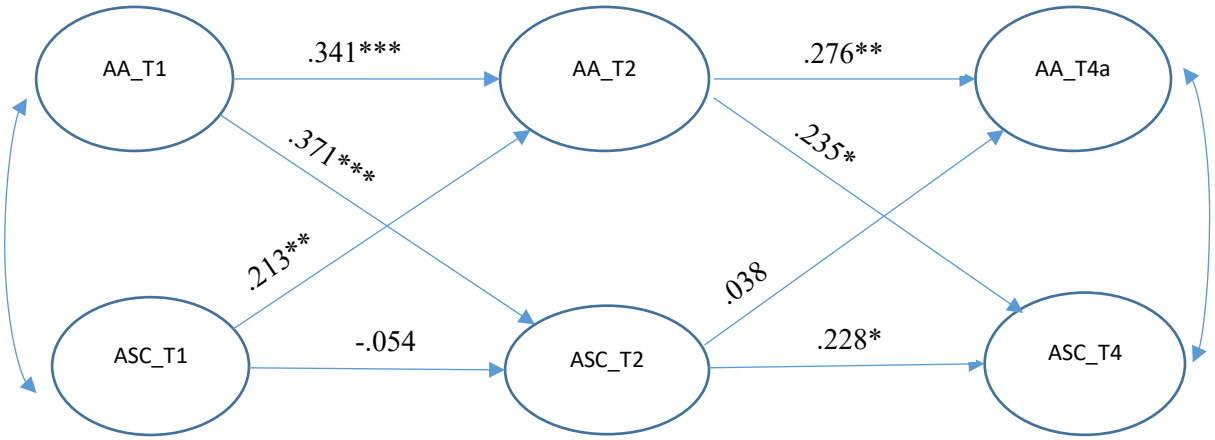
CFI = .993
RMSEA = .099
Iterations to convergence: 42

Figure 4.7 – *RI-ARCL Model – All Respondents – standardized coefficients*



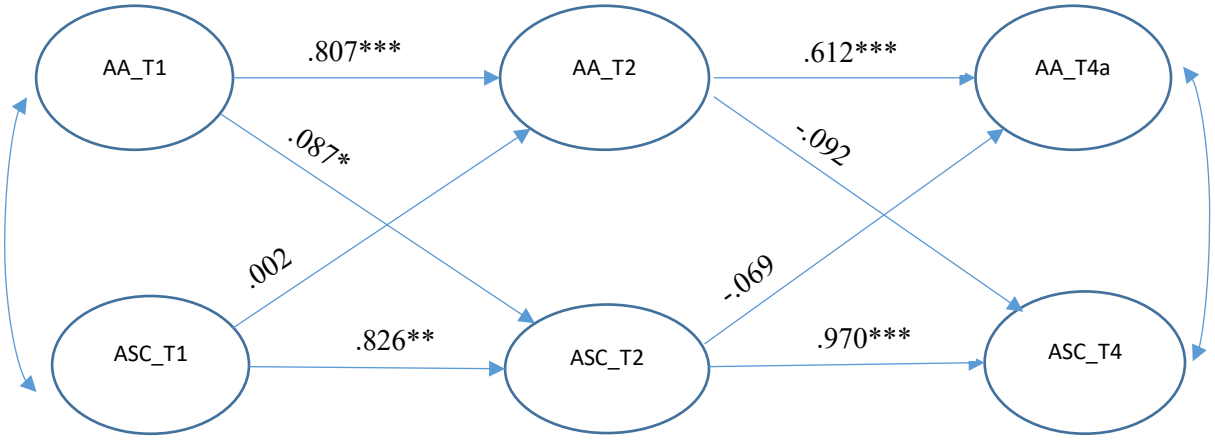
CFI = 1.00
RMSEA = 0.00
Iterations to convergence: 42

Figure 4.8 – *RI-ARCL Model – Male Respondents*



CFI = .994
RMSEA = .088
Iterations to convergence: 40

Figure 4.9 – *RI-ARCL Model – Female Respondents*



CFI = .781
RMSEA = .126
Iterations to convergence: 64

Figure 4.10 – *Simplified ARCL Model (Scale Score Inputs) – All Respondents*

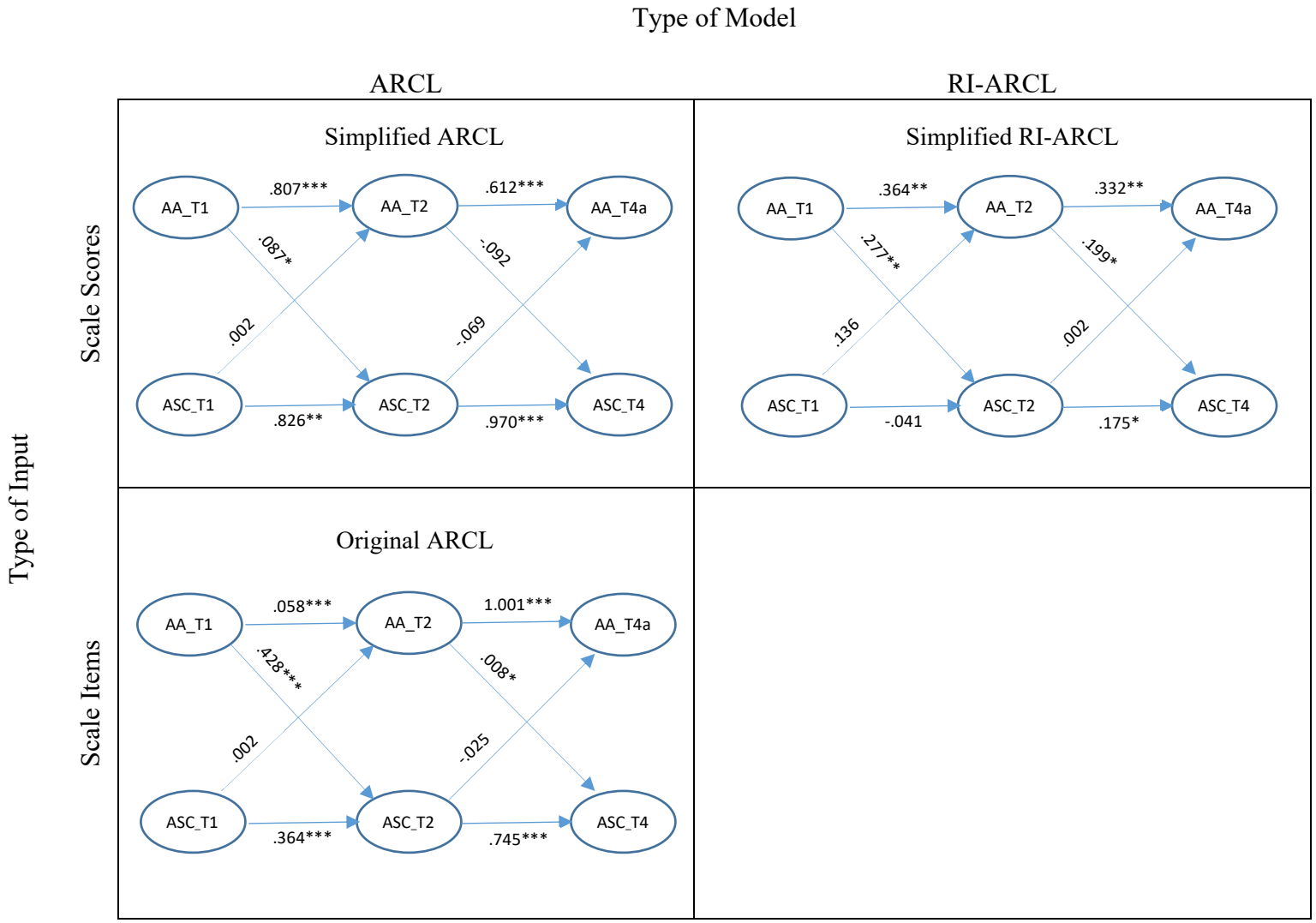


Figure 4.11 – *Model Matrix*

Table 5.1

Distribution of Top 10% Academic Ability Across Academic Self Concept Percentile Groups

	T1 (N=64)	T2 (N=69)	T4 (N=182)
Men			
Top 10% ASC	46.9%	39.1%	56.0%
Above Average ASC	31.3%	39.1%	34.0%
Average ASC	9.4%	8.7%	2.0%
Below Average ASC	6.3%	13.0%	8.0%
Bottom 10% ASC	3.6%	-	-
Women			
Top 10% ASC	25.0%	28.3%	27.1%
Above Average ASC	31.3%	47.8%	44.9%
Average ASC	15.6%	8.7%	12.1%
Below Average ASC	25.0%	13.0%	15.0%
Bottom 10% ASC	3.1%	2.2%	0.9%

* Percentiles are calculated from the entire Class of 2017

** Above Average = top 11% to top 40%, Average = top 41% to top 60%, Below Average = top 61% to top 90%

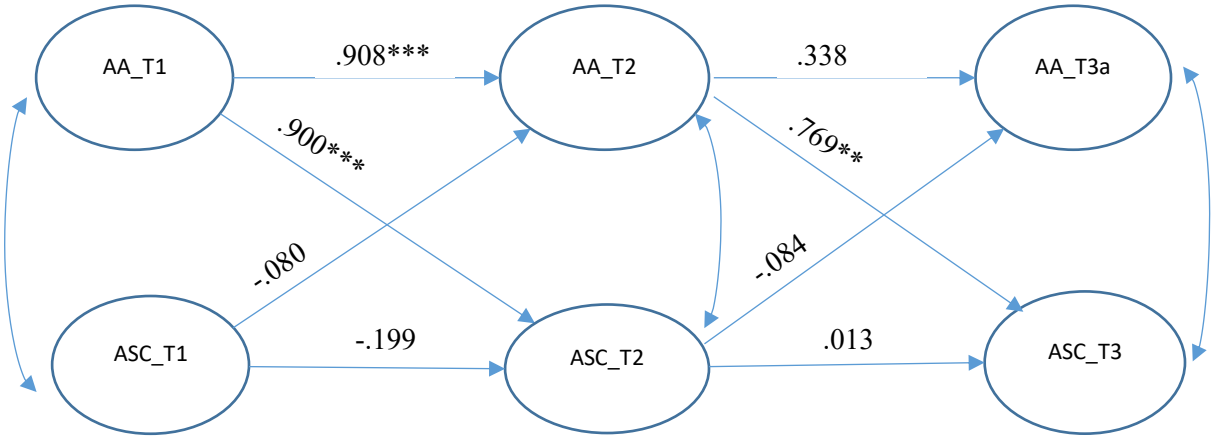
Table 5.2

Distribution of Top 10% Academic Self-Concept Across Academic Ability Percentile Groups

	T1 (N=87)	T2 (N=69)	T4 (N=127)
Men			
Top 10% AA	30.6%	19.6%	42.4%
Above Average AA	49.0%	41.3%	30.3%
Average AA	6.1%	23.9%	13.6%
Below Average AA	12.2%	15.2%	12.1%
Bottom 10% AA	2.0%	-	1.5%
Women			
Top 10% AA	21.1%	56.5%	47.5%
Above Average AA	42.1%	21.7%	29.5%
Average AA	13.2%	17.4%	16.4%
Below Average AA	21.1%	4.3%	6.6%
Bottom 10% AA	2.6%	-	-

* Percentiles are calculated from all respondents from Class of 2017 at each time point

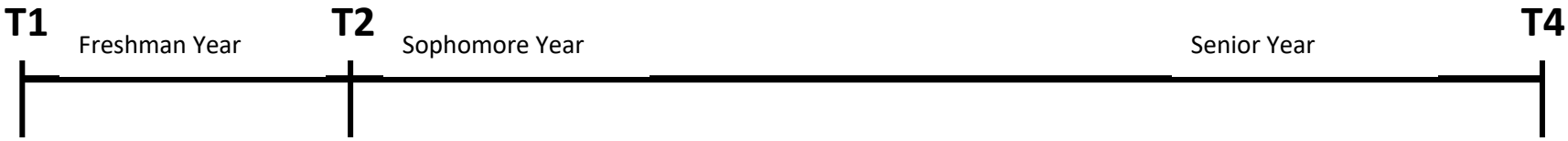
** Above Average = top 11% to top 40%, Average = top 41% to top 60%, Below Average = top 61% to top 90%



CFI = .799
RMSEA = .087
Iterations to convergence: 127

Figure 5.1– *ARCL Model – All Respondents – standardized coefficients – T3*

Appendix A



When	Summer 2013 (prior to entering freshman year)	Fall 2014 (start of sophomore year)	Spring 2017 (end of senior year)
N	2141	1086	1149
Vars	Academic Self-Concept Social Self-Concept College of enrollment Admission Rating TFS items/scales	Academic Self-Concept Social Self-Concept College of enrollment Cumulative GPA	Academic Self-Concept Social Self-Concept College of enrollment Cumulative GPA CSS items/scales
Demos	Race Gender SAT/ACT scores	Race Gender SAT/ACT scores	Race Gender SAT/ACT scores

Appendix B

Table A

Academic Ability - distribution by gender

	Time 1		Time 2		Time 4	
	Men (N=985)	Women (N=1127)	Men (N=402)	Women (N=684)	Men (N=350)	Women (N=563)
Lowest 10%	-	-	0.7%	0.3%	0.3%	0.2%
Below average	0.1%	0.2%	4.7%	5.7%	0.9%	0.7%
Average	5.5%	9.8%	17.4%	30.1%	10.6%	14.0%
Above average	48.8%	61.2%	51.7%	52.8%	41.4%	54.4%
Highest 10%	45.6%	28.8%	25.4%	11.1%	46.9%	30.7%

Table B

Drive to Achieve - distribution by gender

	Time 1		Time 2		Time 4	
	Men (N=984)	Women (N=1128)	Men (N=401)	Women (N=683)	Men (N=350)	Women (N=562)
Lowest 10%	0.1%	-	1.5%	0.4%	0.6%	0.2%
Below average	1.1%	0.1%%	3.5%	2.8%	1.7%	1.4%
Average	11.6%	8.4%	17.2%	19.0%	12.6%	15.7%
Above average	39.3%	43.2%	42.6%	48.9%	40.3%	44.3%
Highest 10%	47.9%	48.3%	35.2%	28.8%	44.9%	38.4%

Table C

Intellectual Self-Confidence - distribution by gender

	Time 1		Time 2		Time 4	
	Men (N=983)	Women (N=1129)	Men (N=402)	Women (N=683)	Men (N=350)	Women (N=563)
Lowest 10%	0.1%	0.1%	1.2%	1.3%	0.6%	0.7%
Below average	1.4%	3.7%	8.5%	15.5%	2.3%	8.0%
Average	17.6%	36.1%	25.1%	39.4%	16.9%	28.8%
Above average	49.4%	45.2%	44.5%	37.0%	44.0%	49.4%
Highest 10%	31.4%	14.9%	20.6%	6.7%	36.3%	13.1%

Table D

Mathematical Ability - distribution by gender

	Time 1		Time 2		Time 4	
	Men (N=984)	Women (N=1128)	Men (N=401)	Women (N=683)	Men (N=350)	Women (N=562)
Lowest 10%	0.4%	0.9%	2.5%	3.8%	1.7%	2.1%
Below average	6.2%	10.5%	10.2%	17.4%	6.9%	19.9%
Average	23.0%	35.4%	31.4%	40.7%	30.6%	37.5%
Above average	42.8%	40.9%	39.4%	32.2%	42.3%	32.7%
Highest 10%	27.6%	12.3%	16.5%	5.9%	18.6%	7.7%

Appendix C

Findings from focus groups inform the discussion of this study in Chapter V. In total, six focus groups were conducted across two weeks in the spring of 2017, three with men and three with women. All participants were seniors (Class of 2017), and on track to graduate in May of that year.

Students were invited to participate in the focus groups via email, and students sent the invitation email were selected at random from the senior class. Because students were invited at random from the Class of 2017, the resulting participants were not necessarily students who were included in the data sample used for the main part of this study. Students were incentivized to participate with two $50 Amazon Gift Cards, one for each gender. The goal was to have between five and seven participants in each focus group; after no-shows, each focus group had between four and six participants.

Focus groups were one hour each. The focus groups with male students were moderated by a male, and the focus groups with female students were moderated by a female. Focus groups followed a semi-structured protocol, with five questions and additional probes for each question:

- What evidence do you use to judge how well you're doing, academically?
  - Probe: grades, participation in class, comparison to other students
  - Probe: is it different for different classes/subjects
- Tell me about a time you excelled academically
  - Probe: type of work (e.g., written, oral presentation, timed test) and subject
- Has there been a time when you struggled academically?

        - Probe: type of work (e.g., written, oral presentation, timed test) and subject
    - Analysis of secondary data shows that at Boston College, men have higher academic self-concept (are more confident in their academic abilities) than women – what do you think of that?
        - Probe: do you believe it? Does it surprise you? Does that match your experiences in the classroom?
    - Are there any times you feel like you have an advantage over the opposite gender in classes?
        - Probe: subject
        - Probe: seminar/discussion-based classes, written work

Focus groups were recorded and then transcribed and tagged by gender for use in this study. The transcriptions were used to code for themes in content, across focus groups and within gender.