

The Influence of Students' Pre-College Characteristics, High School Experiences, and  
Expectations about College on Persistence and Degree Attainment

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The present research examined the extent to which pre-college characteristics, high school experiences, and expectations about college were related to persistence and graduation. Data from admission applications, the *ACT Compass* survey, and initial enrollment measures for Fall 2004 and Fall 2005 first-time students were analyzed. Because almost one-third of the students had missing data, multiple imputation procedures were utilized. Results revealed that several measures of student characteristics, high school experiences, and college expectations and initial enrollment characteristics were consistently related to persistence and degree attainment measures. Other variables were related to single persistence or degree attainment measures. These results suggested that pre-matriculation data can be used to identify at-risk students, identify risk factors, and provide institution-specific benchmarks for evaluating efforts to improve persistence and degree attainment.

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Improving educational attainment in the United States has become a major policy initiative as a result of President Obama setting a goal that by 2020 the United States will have a higher proportion of adults with college degrees than any other country in the world (White House Office of the Press Secretary, 2009). The President's goal, sometimes referred to as the college completion agenda, has received support from influential foundations and policy groups, including the American Council on Education (2009), the Education Trust (2010), and the Lumina Foundation for Education (2009). In fact, the Lumina Foundation's (2009) "Big Goal" that 60% of the adult population will have high-quality degrees and credentials by 2025 pre-dates President Obama's declaration.

The push for increasing college completions has been extended to the states, with at least 17 states pledging to increase graduation rates (Nelson, 2010), and some states setting specific targets for improved degree completion (Moltz, 2010). The Indiana Higher Education Commission (2008, 2010), for example, has set goals for improving college completions and revised its performance funding system to reward increases in degrees awarded. For the current budget cycle, 5% of the funds for public high education in Indiana was reallocated among colleges and universities based on improvements in degree production, and the commission has proposed tripling that amount for the next budget cycle (Lubbers, 2010).

The rationale for improving educational attainment is primarily economic. During the current economic downturn, it has become apparent that unemployment is highest among those with the least education. In 2011, the unemployment rate was 14.1% for individuals with less

than a high school diploma, 9.4% for high school graduates, 7.9% for those with some college, and 4.3% for baccalaureate degree recipients (Bureau of Labor Statistics, 2012). Improved educational attainment has been shown to lead to higher wages and family incomes (Baum, Ma, & Payea, 2010; Bosworth, 2010; Card, 1993; Moretti, 2004), as well as higher tax revenues and lower expenditures for government services (Trostel, 2010). Postsecondary degrees and credentials will also be needed for jobs in the future. The Center for Education and the Workforce estimated that by 2018 the United States will need 22 million new workers with postsecondary degrees and 4.7 million new workers with certificates (Carnevale, Smith, & Strohl, 2010).

Achieving the President's goal will be a major undertaking. Despite projected increases in the number of degrees granted, the United States will need to add another 12 million degrees by 2020 (Carnevale & Rose, 2011). Hauptman (2011) noted that increasing degree attainment to the level required will necessitate increasing the number of high school graduates who attend college and substantially improving college completion rates. Unfortunately, college dropout rates have remained essentially unchanged for decades, despite numerous efforts to improve student success (Braxton, 2000; DeAngelo, Franke, Hurtado, Pryor, & Tran, 2011; Seidman, 2005). Moreover increasing the number of high school graduates who enroll in college will require increasing college attendance rates for underserved racial and ethnic minorities (Carnevale & Fry, 2000; Western Interstate Commission for Higher Education, 2008), and these groups traditionally have lower persistence and graduation rates than majority students (Seidman, 2007).

Experience clearly demonstrates that dramatically improving student success will not be accomplished using a business-as-usual model. Given the increasing number of underserved students who will need to be enrolled in higher education, improving educational attainment will

require accurately identifying students who are likely to be unsuccessful and identifying why they are likely to be unsuccessful. Improving static persistence and graduation rates will also require innovative programs that address the needs of at-risk students, and the effectiveness of these programs will need to be assessed so that they can be continuously improved. Also, program effectiveness will need to be tracked over time and across changing student populations to ensure progress in improving persistence and degree attainment.

Previous research has shown that students' pre-college characteristics, experiences in high school, and expectations about college are significantly related to persistence and graduation (Astin, 1993; Pascarella & Terenzini, 1991, 2005; Tinto, 1993). Research has also demonstrated that models of student success based on pre-matriculation measures can be used to identify at-risk students, identify risk factors, and assess the effectiveness of efforts to improve persistence and degree attainment (Astin & Oseguera, 2007; DeAngelo et al., 2011). However, the research by Astin, DeAngelo, and their colleagues was based on a single survey, the Cooperative Institutional Research Program (CIRP) *Freshman Survey*, and utilized a national dataset. As a consequence, it is difficult to apply the research findings to institutions that do not use the CIRP survey. Likewise, results based on national data may not be directly applicable to individual institutions (McCormick & McClenney, 2012).

The present research extends the findings of previous studies by examining the relationships between persistence and graduation and students' pre-college characteristics, high school experiences, expectations about college, and initial enrollment characteristics. Like previous studies, the present research is institution and survey specific. However, the current study provides a model, adapted from the CIRP survey research, that can be used with different

surveys and across institutions to guide, assess, and improve, programs designed to increase college completions.

### Background

Previous research has identified three clusters of pre-matriculation variables that are related to student success: (1) pre-college characteristics, (2) high school experiences, and (3) expectations about college and initial enrollment characteristics. Sex, being female, is a student characteristic that has been shown to be positively related to persistence and graduation (Astin & Oseguera, 2005; Cabrera, Barkum, & LaNasa, 2005; DeAngelo et al., 2011; DesJardins, McCall, Ahlburg, & Moye, 2002; Hoffman & Lowitzki, 2005; Hu & St. John, 2001; Ishitani, 2006; Kim & Conrad, 2006; Stratton, O'Toole, & Wetzel, 2007). Desjardins et al. (2002) found that the influence of sex increased with time, suggesting that sex would be more strongly related to graduation than persistence.

Research has shown that being a member of a historically underrepresented minority group is negatively related to persistence and degree attainment (Astin & Oseguera, 2005; Berger & Braxton, 1998; Berger & Milem, 1999; Cabrera et al., 2005; Carey, 2005; DeAngelo et al., 2011; Ishitani, 2006). A student's age at matriculation has also been found to be negatively related to persistence and graduation (Arbona & Nora, 2007; Hu & St. John, 2001; Radford, Berkner, Wheelless, & Shepherd, 2010). Several researchers have argued that the negative relationship between age and student success represents the negative effect of delayed entry into college (Arbona & Nora, 2007).

Parents' education is also related to student success. Specifically, being the first in one's family to attend college has been shown to be negatively related to persistence and graduation (Arbona & Nora, 2007; Astin & Oseguera, 2005; Braxton, Hirschy, & McClendon, 2004;

DeAngelo et al., 2011; Ishitani, 2006; Kim & Conrad, 2006; Stratton et al., 2007). Likewise, research has shown that family income is related to persistence and degree attainment, with students from higher-income families being more likely to persist in college and to graduate (Adelman, 2006; Astin & Oseguera, 2005; Cabrera et al., 2005; Desjardins et al., 2002; Hu & St. John, 2001; Ishitani, 2006). Studies have found that measures of students' entering qualifications (e.g., ACT and SAT scores) are positively related to persistence and graduation (Astin & Oseguera, 2005; Cragg, 2009; DeAngelo et al., 2011; DesJardins et al., 2002; Eimers & Pike, 1997; Kim & Conrad, 2006; Nora, Barlow, & Crisp, 2005). DesJardins et al. (2002) reported that the effect of students' entering qualifications diminished over time. As a consequence, it would be reasonable to expect that the effects of entering qualifications would be greater for persistence than for graduation.

Students' high school experiences have also been found to be related to student success in college. Specifically, research has shown that high school coursework, represented by academic intensity or rigor, is positively related to persistence and graduation (Adelman, 1999, 2006; Arbona & Nora, 2007; Cabrera et al., 2005; DesJardins et al., 2002; Ishitani, 2006; Nora et al., 2005). Adelman's (1999) research is a case in point. He analyzed High School and Beyond transcript files and developed a 40-point academic intensity index. Adelman (1999) found that academic intensity was among the factors that were most strongly and most consistently related to persistence and degree attainment. In addition, DesJardins et al (2002) found that the effects of high school coursework increased with time. As a result, it is reasonable to expect that academic intensity would be more strongly related to degree attainment than persistence.

High school performance, measured by cumulative grade point average and/or class percentile rank, has also been found to be positively related to persistence and graduation from

college (Astin & Oseguera, 2005; DeAngelo et al., 2011; DesJardins et al., 2002; Ishitani, 2006; Jones, 2010; Kin & Conrad, 2006; Nora et al., 2005). DesJardins et al. (2002) reported that the effects of high school performance decreased over time, so it would be reasonable to expect that the effects of students' performance in high school would be greater for persistence than graduation. Student engagement in high school has also been shown to be related to success in college. For example, Astin and Oseguera (2005) and DeAngelo et al. (2011) found that high school academic involvement (e.g., hours spent studying) and extracurricular involvement (e.g., participation in clubs and organizations) were positively related to graduation from college.

Previous research has indicated that students' initial enrollment characteristics and expectations about college are related to persistence and graduation. For example, initial full-time enrollment has been found to be positively related to both persistence and degree attainment (Arbona & Nora, 2007; Stratton et al., 2007). Likewise, planning to enroll in a first-year seminar or learning community has been found to be positively related to persistence and graduation (Braxton et al., 2005; Pike, Schroeder, & Berry, 1997). DeAngelo et al. (2011) also reported that students who intended to live on campus were more likely to persist and graduate. Regarding expectations about college, DeAngelo et al. (2011) found that attending college for positive academic, personal, or social reasons was related to degree attainment. They also found that students who expected to be academically engaged in college were more likely to succeed. Concerns about the ability to finance a college education have been shown to be negatively related to persistence and graduation (Cabrera, Nora, & Castañeda, 1992; Hu & St. John, 2001; Nora, Cabrera, Hagedorn, & Pascarella, 1996). In particular, planning to work full time while attending college has been found to be negatively related to persistence and graduation (Astin & Oseguera, 2005; Cragg, 2009; DeAngelo et al., 2011).

Based on the results of previous research, a single question guided the present research: *To what extent are measures of students' pre-college characteristics, high school experiences, and initial college enrollments and expectations about college related to persistence to the second year and degree attainment in four, five, and six years or less?*

### Research Methods

#### *Participants*

The participants in this study were 4006 baccalaureate degree seeking students who first enrolled at Indiana University-Purdue University-Indianapolis (IUPUI) in either the Fall 2004 or Fall 2005 and completed the *ACT Compass* survey. Students in the IUPUI honors program were not included in the study because they did not complete the survey. The characteristics of the students participating in the study are summarized in Table 1. Also included in the table are the numbers of students with missing data. Although relatively small numbers of students had missing data on any given variable, a total of 1278 students (31.9% of the total sample) had missing data on at least one variable.

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Insert Table 1 about here

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An examination of the means and percentages in Table 1 reveals that 41.8% of the participants were male, 21.8% were members of racial/ethnic minority groups (11.8% African American/Black, 3.2% Hispanic/Latino, 2.8% Asian, and 0.4% other races), 79.8% were White, and 1.9% were non-resident aliens. More than half (53.8%) of the students were classified as first-generation, 5.8% were 25 years of age or older, 4.8% reported that English was their second language, and 2.5% were veterans or members of the active military. Participants' average SAT

score (combined verbal and quantitative) was 994.3, and their mean high school class percentile rank was 61.6. Slightly less than two-thirds of the students in the study persisted for one year, 9.2% received a bachelor's degree in four years or less, 23.7% received a bachelor's degree in five years or less, and 31.1% received a bachelor's degree in six years or less.

### *Measures*

The variables used in the current research were taken from information on participants' admission applications, *ACT Compass* survey responses, and institutional records. Four outcome measures were included in the study. One-year persistence was a dichotomous variable indicating whether or not a student was enrolled the Fall semester after they began matriculating. Three additional dichotomous variables were included to represent whether students had graduated in four, five, or six years or less.

Twelve variables represented students' pre-college characteristics. Sex was a dichotomous variable indicating that a student was male (1), not female (0). A student's race/ethnicity was represented by five dichotomous dummy variables: African American/Black, Hispanic/Latino, Asian/Pacific Islander, non-resident alien, and other races. White students served as the reference group for the race/ethnicity measures. First-generation status was a dichotomous variable indicating that neither parent had graduated from college, and non-traditional age was a dichotomous variable indicating whether the student was 25 years of age or older. Both ESL status and veteran/military status were also dichotomous variables. The former indicated that English was a student's second language, and the latter indicated that the student was a veteran or currently in the armed forces. SAT score was a student's combined verbal and quantitative scores on the *Scholastic Aptitude Test*. Students who completed the *ACT Assessment*

examination had their scores equated to the SAT. To improve interpretability, SAT scores were divided by 100.

Four variables were used to represent students' high school experiences. High school class percentile rank was calculated using data provided by students' sending high schools. To improve interpretability, class percentile ranks were divided by 10. Students completing the *ACT Compass* survey responded to a series of questions about the courses they had taken in high school and their academic experiences in high school. Questions about high school coursework were used to construct an academic intensity measure similar to the measure developed by Adelman (1999). In the present study, the academic intensity index ranged from 1 to 30 and was modeled after the coursework requirements for "Regular," "Core40," and "Academic Honors" diplomas in Indiana. Appendix I displays the coding rules for the academic intensity index. Students' responses to questions about their high school experiences were used to construct two additional measures: (1) the amount of reading in high school and (2) whether students understood and completed class assignments. These composites should not be considered scales because they do not represent samples of items from larger universes of items that represent underlying constructs. The items comprising these and other composite indicators are presented in Appendix II. Because the items represent composite indicators, rather than scales, average inter-item correlations, rather than alpha reliability coefficients are reported in the appendix.

Institutional records provided three initial college enrollment measures: (1) whether the student was enrolled full-time in the fall, (2) whether the student had participated in a summer bridge program, and (3) whether the student was enrolled in a first-year seminar or learning community during their first semester. Several questions from the *ACT Compass* survey asked students about their expectations for college. Fourteen questions focused on various types of help

students might need in college. These questions ranged from needing help with financial aid to needing help with study skills or needing help with health problems. These questions were used to construct four composites representing whether students believed they would need help with finances, academic skills, disabilities or health concerns, and academic or personal counseling. Entering students were also asked to estimate how many hours they would spend in various activities while in college. The activities ranged from hours spent studying to hours spent working for pay. Responses to these questions formed two composites—hours spent in academic activities and hours spent in non-academic activities. Students also were asked to indicate how likely it was that they would transfer to another institution. This question was used to create a dichotomous measure indicating the students did not intend to transfer to another institution.

#### *Data Analysis*

Logistic regression was used to identify statistically significant relationships between the dichotomous outcome measures (persistence and degree attainment) and students' pre-college characteristics, high school experiences, initial enrollment characteristics and expectations about college. Separate analyses were conducted for the four persistence/degree-attainment variables. Because several dichotomous variables were included in the models as independent variables, delta-p statistics were not appropriate for interpreting effects coefficients (Cruce, 2009). Instead, odds ratios were used to interpret statistically significant effects (Menard, 2002; Pampel, 2000).

Missing data was a serious concern in this study, with more than three-in-ten students having missing data on one or more variables. There are a variety of methods for dealing with missing data, including listwise deletion, pairwise deletion, mean substitution, and simple imputation. Listwise deletion is the most conservative approach, but it involves sacrificing data from any student with missing data on a variable. Other approaches avoid the loss of data, but

produced biased standard errors for the effect parameters (Allison, 2002). More specifically, the standard errors for the effect parameters will be too small and can increase the likelihood of Type I error. Multiple imputation overcomes the problems associated with simple imputation and other substitution methods by replacing missing data with multiple imputed values. Statistical analyses are then conducted using all of the imputed values (Rubin, 1987; Schafer, 1999). For the present research, the Stata12 computer program was used for multiple imputation and the estimation of logistic regression parameters based on the multiply imputed data (StataCorp, 2011).

Multivariate normal imputation procedures were utilized because previous research has shown that this method is generally robust with respect to departures from multivariate normality for individual variables (Lee & Carlin, 2010). In this study, 30 imputations were conducted to ensure efficient estimation of logistic regression estimates (Graham, Olchowski, & Gilreath, 2007).

Because multiple imputation is a stochastic procedure that will produce different estimates each time an analysis is performed, it is important to assess the reproducibility of multiple imputation results. For the present research, Monte Carlo error estimates were calculated to assess the reproducibility of the logistic regression results (StataCorp, 2011). White, Royston, and Wood (2011) argue that the MCE coefficients should be less than 10% of the standard errors for the parameter estimates for every variable.

## Results

### *Persistence to the Second Year*

Results of the multiple imputation/logistic regression analysis indicated that persistence to the second year of college was significantly related to student characteristics, high school experiences, and initial college enrollment and expectations ( $F = 9.54$ ;  $df = 25, 595284.1$ ;  $p < 0.05$ ). In addition, the relative variance increase (RVI) was quite small (0.035), indicating

that the loss of information due to missing data was not a serious concern (StataCorp, 2011). Results of the logistic analysis are presented in Table 2. In addition to regression coefficients and standard errors, odds ratios are presented for statistically significant effects. Also included in the table are Monte Carlo Error (MCE) estimates and relative efficiency estimates for the effect parameters.

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Insert Table 2 about here

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An examination of the results presented in Table 2 shows that the multiple imputation procedures provided appropriate logistic regression estimates. The Monte Carlo Error (MCE) estimates were all less than 10% of the corresponding standard errors for the effect coefficients, and the relative efficiency of estimation was in excess of 0.99 for all variables. The effect coefficients presented in the table indicate that nine variables were significantly related to persistence to the second year. Of the student pre-college characteristics, SAT scores were significantly, and positively, related to persistence. The odds ratio for SAT scores indicated that each 100-point increase in SAT scores resulted in a greater likelihood of persisting to the second year (1.116). Being a first-generation student was negatively related to persistence, and the odds of persisting were 0.799 for a first-generation student, compared to the odds of persisting for a student who was not first-generation.

Three high school variables, class percentile rank, academic intensity, and understanding and completing assignments were significantly and positively related to persistence. Odds ratios revealed that a 10-point increase in class percentile rank was associated with improved odds of persisting (1.066), and a one-point increase in academic intensity was also associated with a

greater likelihood of persisting (1.010). A one-point increase in students' reports of the frequency with which they understood and completed assignments was associated with greater odds of persisting to the second year of college of 1.541. Three initial college enrollment variables were significantly and positively related to persistence. Being enrolled full-time in the fall, participating in a summer bridge program, and participating in a first-year seminar or learning community resulted in a greater likelihood of persisting to the second year of college (1.383, 1.484, and 1.201, respectively). Only one variable, the hours students' expected to spend in non-academic pursuits was negatively related to persistence. Each hour increase in the amount of time students intended to spend on non-academic activities was associated with a decrease in the odds of persisting (0.962).

#### *Degree Attainment in Four Years or Less*

Table 3 presents the logistic regression estimates for four-year degree attainment. Again, MCE estimates were substantially less than 10% of the standard errors for coefficients, and relative efficiency coefficients were all in excess of 0.99. An examination of the effect coefficients and odds ratios for the model revealed African American students were less than half as likely as White students to graduate in four years, whereas non-resident aliens were almost five times more likely than White students to graduate in four years. SAT scores were also positively related to degree attainment, and every 100-point increase in SAT scores was associated with a significant increase in the odds of obtaining a bachelor's degree in four years.

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Insert Table 3 about here

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High school class percentile rank, academic intensity, and understanding and completing assignments in high school were all positively and significantly related to obtaining a bachelor's degree in four years or less. In fact each one-point increase in students' reports of how frequently they understood and completed assignments was associated with more than a two-fold increase in the odds of receiving a bachelor's degree in four years. Students' reports of the hours they intended to spend on non-academic activities was negatively related to four-year degree attainment, whereas not intending to transfer and being enrolled full-time were positively related to degree attainment. In fact, students enrolled full-time in the fall semester were more than 2.5 times more likely to receive a degree in four years or less.

#### *Degree Attainment in Five Years or Less*

Table 4 displays the multiply imputed logistic regression estimates for five-year degree attainment. Once again, MCE and relative efficiency estimates were well within acceptable ranges. Two student background characteristics, being first-generation and/or being non-traditional age, were negatively related to degree attainment, with non-traditional age students being less than half as likely as their traditional-age counterparts to receive a degree in five years. In contrast, students' SAT scores were positively related to five-year degree attainment. As was the case for all of the previous models, high school class percentile rank, academic intensity, and understanding and completing high school assignments were positively related to receiving a bachelor's degree in five years or less. Consistent with the results for previous models, full-time enrollment was positively related to graduating in five years, and consistent with the results for persistence, participating in a summer bridge and/or first-year seminar was positively related to five-year degree attainment. As with previous models, increases in the amount of time students expected to spend on non-academic activities were negatively related to

the likelihood of obtaining a bachelor's degree in five years. In addition, students who reported they needed help with health and/or disability issues had significantly lower odds of graduating in five years or less.

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Insert Table 4 about here

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#### *Degree Attainment in Six Years or Less*

Table 5 displays the logistic regression estimates for baccalaureate degree attainment in six years or less. MCE and relative efficiency estimates were all within permissible ranges, indicating that the multiple imputation procedures used to obtain the logistic regression estimates were appropriate. Examining the coefficients and odds ratios in Table 5 reveals that first-generation and non-traditional age students had significantly lower odds of receiving a bachelor's degree in six years than did their counterparts who were not first-generation and/or were traditional-age students. As with all of the other models, increases in students' SAT scores were associated with an increased probability of graduating in six-years or less.

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Insert Table 5 about here

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Both high school class percentile rank and understanding and completing assignments on time were positively related to six-year degree attainment; however, the academic intensity of high school coursework was not related to graduating in six years. Consistent with all of the other models analyzed in this study, initial full-time enrollment was positively related to the likelihood of graduating in six years, whereas increases in the hours students reported they

intended to spend on non-academic pursuits decreased the likelihood that the students would receive a bachelor's degree in six years or less. Participating in a summer bridge program and/or initially enrolling in a first-year seminar or learning community was positively related to six year degree attainment.

### *Limitations*

Care should be taken to not over-generalize the results of the present research. This study focused on baccalaureate degree seeking students attending a single institution at a specific point in time. Had a different institution been selected, results might differ in unknown ways. Likewise, these findings may not apply to students who began their college careers at a different point in time. Many of the findings of this study are specific to the *ACT Compass* survey. As the research by Astin and Oseguera (2005) and DeAngelo et al. (2011) clearly demonstrated, using data from a different survey can produce different results.

The current research also relied on students' self-reports of their high school experiences, and it is reasonable to assume that these self-reports do not represent precise point estimates of course taking and involvement (Porter, 2011). Had the academic intensity measure been based on data from high school transcripts, different findings might have emerged. The presence of missing data is also a potential limitation of this research. The use of multiple imputation was based on the assumption that data were "missing at random." If this was not the case, multiple imputation may not have provided appropriate estimates for missing values. Finally, internal consistency measures for several composites were low. However, attenuation of relationships did not appear to be too serious of a problem because results using the composites were very similar to results obtaining using individual survey questions.

### Discussion

The principal findings of this study can be summarized as follows:

1. Of the student background characteristics included in the study, only two were consistently related to persistence and degree attainment. Entering ability, represented by SAT/ACT score, was positively related to all four outcome measures, whereas first-generation status was negatively related to all of the outcome measures, except graduating in four years or less. Being a non-traditional age student was not significantly related to persistence or four-year degree attainment, but it was negatively related to degree attainment in five or six years.
2. Three high school experience measures were consistently related to student success. High school academic intensity was positively related to persistence to the second year of college, as well as graduation in four or five years. The academic intensity measure was not related to six-year degree attainment. Performance in high school, measured by class percentile rank and students' reports of the extent to which they understood and completed assignments, was positively related to all four measures of student success in college.
3. Only one of the measures of students' expectations about college was consistently related to persistence and degree attainment. Students' estimates of the hours they expected to devote to non-academic activities was significantly, and negatively, related to the four measures of persistence and degree attainment.
4. All three initial enrollment variables were consistently related to student success. Being enrolled full-time during a student's first semester at college was positively related to all four outcome measures. Participating in a summer bridge program, as

well as being enrolled in a first-year seminar or learning community, was positively related to all of the outcome measures, except four-year degree attainment.

These findings have important implications for theory and practice as it relates to student persistence and degree attainment. Specifically, the results of the current study both confirm and disconfirm the results of previous research. In line with other studies (Astin & Oseguera, 2005; Cragg, 2009; DeAngelo et al., 2011; DesJardins et al., 2002; Eimers & Pike, 1997; Kim & Conrad, 2006; Nora, Barlow, & Crisp, 2005), the present research found that entering ability/aptitude is an important ingredient in persistence and degree attainment. Somewhat counter to the findings reported by DesJardins et al. (2002), the importance of ability/aptitude did not diminish over time. Also consistent with previous research, parents' education was significantly related to persistence and degree attainment (Arbona & Nora, 2007; Astin & Oseguera, 2005; Braxton, Hirschy, & McClendon, 2004; DeAngelo et al., 2011; Ishitani, 2006; Kim & Conrad, 2006; Stratton & O'Toole, 2007).

In contrast, results concerning age at the time of matriculation were ambiguous. Previous studies have shown that age is negatively related to both persistence and degree attainment (Arbona & Nora, 2007; Hu & St. John, 2001; Radford, Berkner, Wheelless, & Shepherd, 2010). The present research found that age at entry was negatively related to five- and six-year degree attainment, but not to persistence or four-year degree attainment. Given that age at entry is a proxy for delayed entry into college, it appears that delaying the start of college may have more serious consequences for longer-term outcomes, at least at IUPUI.

Unlike other studies showing links between student success and both sex (Astin & Oseguera, 2005; Cabrera, Barkum, & LaNasa, 2005; DeAngelo et al., 2011; Desjardins, McCall, Ahlburg, & Moye, 2002; Hoffman & Lowitzki, 2005; Hu & St. John, 2001; Ishitani, 2006; Kim

& Conrad, 2006; Stratton & O'Toole, 2007) and race/ethnicity (Astin & Oseguera, 2005; Berger & Braxton, 1998; Berger & Milem, 1999; Cabrera et al., 2005; Carey, 2005; DeAngelo et al., 2011; Ishitani, 2006), neither characteristic was consistently related to outcomes in the present research. Sex was not related to any of the student success measures in this study, and race/ethnicity was only related to the probability that a student would graduate in four years or less. Specifically, being African American/Black, as opposed to White, was negatively related to four year degree attainment. Being a non-resident alien, rather than White, was positively related to graduating in four years or less. The positive effect for non-resident aliens may reflect expectations and/or requirements on the part of the students' families or home countries that the students graduate in four years.

The findings of the present research strongly support previous studies indicating that students' high school performance is related to success in college. High school class percentile rank was positively related to all four outcome measures, a finding that is consistent with previous research (Astin & Oseguera, 2005; DeAngelo et al., 2011; DesJardins et al., 2002; Ishitani, 2006; Jones, 2010; Kin & Conrad, 2006; Nora et al., 2005). The relationship between class percentile rank and success was stable across the four outcome measures, a finding somewhat at odds with Desjardins et al. (2002) who reported a decreasing role for high school class rank. It is also interesting to note that the amount of reading in high school was not related to success in college, but comprehending what was read and completing assignments in a timely manner were positively related to persistence and degree attainment.

Also consistent with the results of previous studies (Adelman, 1999, 2006; Arbona & Nora, 2007; Cabrera et al., 2005; DesJardins et al., 2002; Ishitani, 2006; Nora et al., 2005), the intensity of high school coursework was positively related to student success. However, the high school

academic intensity measure used in the present research was not related to six-year degree attainment. This finding differs from results reported by Desjardins et al. (2002) showing that the strength of the relationship between academic intensity and success in college increased over time.

Unlike the results reported by Astin and Oseguera (2005) and by DeAngelo et al. (2011), the present research largely failed to find significant relationships between students' expectations about college and their persistence or degree attainment. Surprisingly, student reports about needing help with finances, academics, etc. were generally not related to the four outcome measures in the study. Unfortunately, it was not possible to determine why these composites were not related to persistence and degree attainment. It is possible that students were not able to accurately assess their needs. It is also possible that students who needed assistance had their needs met, and as a result, these needs were not a factor in persistence and degree attainment.

It is also noteworthy that students' estimates of the time they expected to spend on academic activities, such as attending class and studying, were not significantly related to persistence and degree attainment. In contrast, students' estimates of the amount of time they intended to spend in non-academic pursuits (e.g., working for pay and socializing with friends) were negatively related to persistence and graduation. Based on these findings, it appears that spending time on academic activities does not ensure academic success, but spending time on non-academic activities undermines positive educational outcomes, such as persistence and degree attainment.

All three of the initial enrollment measures in this study were related to measures of student success. Because students *choose* to be enrolled full-time and to participate in summer bridge programs or first-year seminars, it is not possible to make causal claims about the effectiveness of these programs (Pike, Hansen, & Lin, 2011). However, it is possible to say with some

certainty that students who choose to enroll part-time or choose not to participate in first-year programs are at risk of not persisting and not obtaining a baccalaureate degree.

These results also have important implications regarding risk factors for baccalaureate degree seekers at IUPUI, and perhaps elsewhere. As previously noted, national data indicate that underrepresented minority students are less likely to persist and graduate than majority students (Seidman, 2007). Similar results have been reported for IUPUI (Office of Diversity, Equity, and Inclusion, 2012). The findings of the present study suggest that a student's race/ethnicity is not directly related to success in college. Instead, risk factors that are more prevalent among underrepresented minority groups (first-generation status, delayed entry into college, lower SAT scores and class ranks, less rigorous high school coursework, and intending to spend time on non-academic activities outside of class, such as work working) are directly related to persistence and degree attainment.

The results of this study also have important implications for educational practice, particularly as they relate to improving persistence and graduation. First and foremost, the fact that pre-college characteristics, experiences, and expectations are related to persistence and degree attainment demonstrates that it is possible to identify students who are at risk of not being successful, even before they come to college. The fact that the risk factors identified in this study differed in important ways from the risk factors identified in other studies underscores the importance of conducting institution-specific research on student success. It appears that the factors related to student success are influenced to some extent by the types of students attending an institution, as well as by the institutional context.

The results of this study also provide a starting point for designing programs to improve student success. For example, the negative relationships between first-generation status and

persistence and degree attainment seem to indicate that much more needs to be done to orient students, and perhaps their parents, to the demands of college. Likewise, the negative relationships between time spent on non-academic pursuits, particularly working for pay, and the outcomes included in this study suggest that need for additional need-based aid, work study opportunities, and other forms of on-campus employment. Given the strong, consistent relationships between student success in college and high school preparation, the results of the current research point to the importance of colleges and universities building strong relationships with their “feeder” high schools and working with prospective students at an early age so that these prospects will follow a rigorous curriculum, be actively engaged, and excel academically in high school.

As colleges and universities work to ensure access and degree attainment for an increasingly diverse body of college students, addressing the question of how the university context affects students with different pre-college characteristics, experiences, and expectations is paramount. Improving persistence and graduation rates will likely require the implementation of innovative programs that address the needs of all students, particularly students with risk-factors. Early intervention programs such as summer bridge, first-year seminars, and learning communities have been designed on many campuses to address the transitional educational needs of a wide range of students. It is notable that we found that intention to participate in these programs was positively related to all of the outcome measures, except four-year degree attainment. Our results are fairly consistent with past research indicating that early interventions, such as learning communities (Baker & Pomerantz, 2000; Inkelas, Daver, Vogt, & Leonard, 2007; Knight, 2003; Pasque & Murphy, 2005; Pike, Schroder, & Berry, 1997; Zhao & Kuh, 2004), first-year seminars (Porter & Swing, 2006; Schnell & Doetkott, 2003) and summer bridge programs (Ackermann,

1991; Myers & Drevlow, 1982) are effective in helping students transition to and attain academic success in college.

Higher education scholars have also suggested that early intervention programs can effectively assist students in becoming academically and socially integrated into new and unfamiliar university environments and may serve as catalysts for improved retention and academic achievement (Jacobs, 1993; Fox, Zakely, Morris, & Jundt, 1993 ). Thus, colleges and universities should not only devote attention to predicting which factors put students at risk for not making successful transitions and ultimately attain degrees, but should also invest time into developing and evaluating programs designed to help students successfully adapt to the college environment. In doing so, the work of recruiting and retaining an increasingly diverse body of students will be fully realized and the question of how educational contexts affect students from different pre-college experiences will be addressed. Further, college and universities will be able to play a more pivotal role in creating environments that serve to counterbalance some of the pre-college experiences that place students at-risk for attrition. Additionally because students' pre-college characteristics, high school experiences, and expectations about college are related to student success, it is important that campus leaders take these factors into account when they evaluate the effectiveness of their student-success programs. One program may appear to be less successful than another, simply because it serves a high proportion of at-risk students. Similarly, the characteristics of students attending an institution can change over time, and these changes can confound longitudinal comparisons of persistence and degree attainment. Understanding the relationships between academic success and students' characteristics, experiences, and expectations can help account for changes in student populations. This will be increasingly important as colleges and universities enroll increasing numbers of students from underserved

groups in an effort to improve college completions. At the same time, student success is not a statistically derived phenomenon and efforts to assess program effectiveness must ultimately look at absolute rates of persistence and degree attainment if institutions are to contribute significantly to attaining the President's goal.

### Conclusion

President Obama set a goal for American higher education that will require colleges and universities to be more accessible and more effective in educating and credentialing students. Achieving the President's goal can provide the United States with a well-trained workforce that is capable of competing effectively in global markets. However, as several scholars of American higher education have pointed out, college completions must not come at the expense of student learning (Evenbeck & Johnson, 2012; Humphreys, 2012; Schneider, 2012). In fact, improving completions at the expense of student learning may prevent the United States from meeting the challenges that improvements in degree attainment are intended to address (Rhoades, 2012). The present research demonstrates that improving college student success requires attention to what happens to students before they come to college. It seems equally likely that students' pre-college characteristics, high school experiences, and expectations for college are critical elements in student learning.

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Table 1

*Characteristics of the Students Included in the Study*

Student Characteristic	Percentage	Number Missing
Male	41.8%	0
African American/Black	11.8%	118
Hispanic/Latino	3.2%	118
Asian/Pacific Islander	2.8%	118
Other Race/Ethnicity	0.4%	118
White	79.8%	118
Non-Resident Alien	1.9%	118
First-Generation Student	53.5%	109
25 Years of Age or Older	5.8%	231
English Second Language	4.8%	0
Veteran/Active Military	2.5%	28
Persist to Second Year	62.5%	0
Baccalaureate Degree in 4 Years	9.2%	0
Baccalaureate Degree in 5 Years	23.7%	0
Baccalaureate Degree in 6 Years	31.1%	0
Student Characteristic	Mean	Number Missing
SAT Combined Score	994.3	519
High School Class Percentile Rank	62.5	560

Table 2

*Logistic Regression Results for Persistence*

Variable	Coefficient	Std. Err.	Odds	MCE	RE
Male	-0.090	0.075		0.002	1.000
African American/Black	-0.198	0.114		0.002	1.000
Hispanic/Latino	-0.050	0.202		0.002	1.000
Asian/Pacific Islander	0.012	0.236		0.002	1.000
Non-Resident Alien	0.590	0.352		0.008	1.000
Other Race/Ethnicity	-0.236	0.186		0.002	1.000
First-Generation Student	-0.224*	0.072	0.799	0.002	1.000
Non-Traditional Age	-0.092	0.157		0.005	1.000
English Second Language	0.220	0.219		0.004	1.000
Veteran/Active Military	-0.345	0.222		0.005	1.000
SAT (100s)	0.109*	0.032	1.116	0.002	0.995
Class Percentile Rank (10s)	0.064*	0.020	1.066	0.001	0.996
Academic Intensity	0.010*	0.004	1.010	0.000	0.998
High School Reading	0.003	0.067		0.001	1.000
High School Assignments	0.432*	0.077	1.541	0.002	0.999
Help Finances	-0.058	0.079		0.004	0.997
Help Academics	0.064	0.079		0.004	0.997
Help Health/Disability	-0.040	0.140		0.009	0.996
Help Counseling	0.021	0.065		0.004	0.996
Hours Spent Academic	0.007	0.005		0.000	1.000
Hours Spent Non-Academic	-0.039*	0.008	0.962	0.000	1.000

Variable	Coefficient	Std. Err.	Odds	MCE	RE
No Intent to Transfer	0.041	0.071		0.001	1.000
Enrolled Full-Time	0.324*	0.112	1.383	0.002	1.000
Participate Summer Bridge	0.395*	0.136	1.484	0.001	1.000
First-Year Seminar	0.183*	0.091	1.201	0.001	1.000
Constant	-2.638*	0.514	0.071	0.027	0.997

\* $p < 0.05$

MCE = Monte Carlo Error estimate, RE = Relative Efficiency estimate

Table 3

*Logistic Regression Results for Four-Year Degree Attainment*

Variable	Coefficient	Std. Err.	Odds	MCE	RE
Male	-0.190	0.131		0.002	1.000
African American/Black	-0.823*	0.303	0.439	0.003	1.000
Hispanic/Latino	0.006	0.362		0.005	1.000
Asian/Pacific Islander	0.197	0.358		0.004	1.000
Non-Resident Alien	1.588*	0.447	4.896	0.020	0.998
Other Race/Ethnicity	-0.184	0.360		0.005	1.000
First-Generation Student	-0.161	0.122		0.003	1.000
Non-Traditional Age	-0.583	0.448		0.016	0.999
English Second Language	-0.371	0.395		0.010	0.999
Veteran/Active Military	0.705	0.417		0.011	0.999
SAT (100s)	0.305*	0.053	1.357	0.002	0.998
Class Percentile Rank (10s)	0.179*	0.041	1.196	0.003	0.993
Academic Intensity	0.026*	0.008	1.026	0.000	0.998
High School Reading	-0.149	0.118		0.002	1.000
High School Assignments	0.780*	0.169	2.181	0.004	0.999
Help Finances	0.182	0.134		0.006	0.998
Help Academics	-0.142	0.137		0.006	0.998
Help Health/Disability	-0.461	0.319		0.021	0.995
Help Counseling	-0.081	0.114		0.005	0.998
Hours Spent Academic	0.013	0.008		0.000	0.999
Hours Spent Non-Academic	-0.062*	0.015	0.940	1.200	0.999

Variable	Coefficient	Std. Err.	Odds	MCE	RE
No Intent to Transfer	0.326*	0.126	1.386	0.002	1.000
Enrolled Full-Time	0.947*	0.341	2.579	0.005	1.000
Participate Summer Bridge	0.205	0.184		0.005	1.000
First-Year Seminar	0.355	0.186		0.003	1.000
Constant	-9.723*	1.042	0.000	0.040	0.998

\* $p < 0.05$

MCE = Monte Carlo Error estimate, RE = Relative Efficiency estimate

Table 4

*Logistic Regression Results for Five-Year Degree Attainment*

Variable	Coefficient	Std. Err.	Odds	MCE	RE
Male	-0.063	0.088		0.002	1.000
African American/Black	-0.193	0.150		0.002	1.000
Hispanic/Latino	-0.323	0.257		0.004	1.000
Asian/Pacific Islander	0.004	0.257		0.003	1.000
Non-Resident Alien	0.616	0.343		0.016	0.998
Other Race/Ethnicity	-0.314	0.251		0.004	1.000
First-Generation Student	-0.272*	0.083	0.762	0.002	1.000
Non-Traditional Age	-0.868*	0.297	0.420	0.008	0.999
English Second Language	0.271	0.251		0.004	1.000
Veteran/Active Military	0.154	0.316		0.006	1.000
SAT (100s)	0.148*	0.037	1.160	0.002	0.996
Class Percentile Rank (10s)	0.174*	0.025	1.190	0.002	0.996
Academic Intensity	0.014*	0.005	1.014	0.000	0.998
High School Reading	-0.016	0.079		0.001	1.000
High School Assignments	0.599*	0.104	1.821	0.003	0.999
Help Finances	0.062	0.092		0.004	0.998
Help Academics	-0.106	0.093		0.005	0.997
Help Health/Disability	-0.381*	0.192	0.683	0.013	0.996
Help Counseling	0.059	0.075		0.004	0.998
Hours Spent Academic	0.006	0.006		0.000	1.000
Hours Spent Non-Academic	-0.050*	0.010	0.951	0.000	0.999

Variable	Coefficient	Std. Err.	Odds	MCE	RE
No Intent to Transfer	0.113	0.083		0.001	1.000
Enrolled Full-Time	1.012*	0.195	2.751	0.003	1.000
Participate Summer Bridge	0.378*	0.131	1.460	0.001	1.000
First-Year Seminar	0.306*	0.119	1.357	0.002	1.000
Constant	-6.421*	0.665	0.000	0.031	0.998

\* $p < 0.05$

MCE = Monte Carlo Error estimate, RE = Relative Efficiency estimate

Table 5

*Logistic Regression Results for Six-Year Degree Attainment*

Variable	Coefficient	Std. Err.	Odds	MCE	RE
Male	-0.074	0.080		0.002	1.000
African American/Black	-0.099	0.131		0.002	1.000
Hispanic/Latino	-0.157	0.222		0.003	1.000
Asian/Pacific Islander	-0.048	0.238		0.002	1.000
Non-Resident Alien	0.576	0.316		0.011	0.999
Other Race/Ethnicity	-0.214	0.218		0.002	1.000
First-Generation Student	-0.252*	0.076	0.778	0.002	0.999
Non-Traditional Age	-0.546*	0.226	0.579	0.006	0.999
English Second Language	0.381	0.224		0.005	1.000
Veteran/Active Military	-0.008	0.278		0.006	0.999
SAT (100s)	0.122*	0.033	1.129	0.002	0.997
Class Percentile Rank (10s)	0.123*	0.022	1.131	0.002	0.995
Academic Intensity	0.008	0.005		0.000	0.998
High School Reading	-0.020	0.072		0.001	1.000
High School Assignments	0.591*	0.092	1.807	0.002	0.999
Help Finances	0.010	0.084		0.004	0.998
Help Academics	-0.037	0.083		0.04	0.998
Help Health/Disability	-0.240	0.159		0.009	0.997
Help Counseling	0.064	0.068		0.003	0.998
Hours Spent Academic	0.005	0.005		0.000	1.000
Hours Spent Non-Academic	-0.055*	0.009	0.947	0.000	0.999

Variable	Coefficient	Std. Err.	Odds	MCE	RE
No Intent to Transfer	-0.039	0.076		0.001	1.000
Enrolled Full-Time	0.834*	0.155	2.302	0.002	1.000
Participate Summer Bridge	0.310*	0.124	1.363	0.001	1.000
First-Year Seminar	0.283*	0.106	1.327	0.001	1.000
Constant	-5.135*	0.580	0.006	0.024	0.998

\* $p < 0.05$

MCE = Monte Carlo Error estimate, RE = Relative Efficiency estimate

## Appendix I

*Coding Rules for the Academic Intensity Index*

Index Value	English	Math	Algebra	Science	Foreign Language	Calculus
30	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 4$	$\geq 4$	$\geq 1$
29	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 4$	$\geq 3$	$\geq 1$
28	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 4$	$\geq 4$	$\geq 0$
27	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 4$	$\geq 3$	$\geq 0$
26	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 4$	$\geq 2$	$\geq 0$
25	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 4$	$< 2$	$\geq 0$
24	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 3$	$\geq 4$	$\geq 0$
23	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 3$	$\geq 3$	$\geq 0$
22	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 3$	$\geq 2$	$\geq 0$
21	$\geq 4$	$\geq 4$	$\geq 2$	$\geq 3$	$< 2$	$\geq 0$
20	$\geq 4$	$\geq 3$	$\geq 2$	$\geq 4$	$\geq 4$	$\geq 0$
19	$\geq 4$	$\geq 3$	$\geq 2$	$\geq 4$	$\geq 3$	$\geq 0$
18	$\geq 4$	$\geq 3$	$\geq 2$	$\geq 4$	$\geq 2$	$\geq 0$
17	$\geq 4$	$\geq 3$	$\geq 2$	$\geq 4$	$< 2$	$\geq 0$
16	$\geq 4$	$\geq 3$	$\geq 2$	$\geq 3$	$\geq 4$	$\geq 0$
15	$\geq 4$	$\geq 3$	$\geq 2$	$\geq 3$	$\geq 3$	$\geq 0$
14	$\geq 4$	$\geq 3$	$\geq 2$	$\geq 3$	$\geq 2$	$\geq 0$
13	$\geq 4$	$\geq 3$	$\geq 2$	$\geq 3$	$< 2$	$\geq 0$



Appendix II

*Survey Items and Average Inter-Item Correlations for the Composite Measures*

*Student needs help with financial affairs (r = 0.26)*

- Need help with financial aid
- Need help finding work
- Need help with commuter problems
- Need help obtaining job experience

*Student needs help with academic skills (r = 0.44)*

- Need help with English
- Need help with reading skills
- Need help with study skills
- Need help with writing skills
- Need help with math skills

*Student needs help with disability and/or health issues (r = 0.41)*

- Need help with a learning disability
- Need help with a physical disability
- Need help with health concerns

*Student needs help with counseling issues (r = 0.28)*

- Need help selecting a major
- Need help with personal concerns

*Reading in high school (r = 0.30)*

Frequency reading the newspaper

Frequency completing reading assignments

*Comprehend and complete assignments in high school (r = 0.54)*

Frequency comprehend class reading assignments

Frequency completed assignments on time

*Hours plan to spend on academic activities (r = 0.26)*

Hours plan to spend in class

Hours plan to spend studying

*Hours plan to spend on non-academic activities (r = 0.24)*

Hours plan to spend working

Hours plan to spend with family

Hours plan to spend volunteering

Hours plan to spend socializing

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