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Effects of Interest–Major Congruence, Motivation, and Academic Performance on Timely Degree Attainment

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Using longitudinal student data from 15 four-year ($n = 3,072$) and 13 ($n = 788$) two-year postsecondary institutions, the authors tested the effects of interest–major congruence, motivation, and 1st-year academic performance on timely degree completion. Findings suggest that interest–major congruence has a direct effect on timely degree completion at both institutional settings and that motivation has indirect effects (via 1st-year academic performance). The total effects of both interest–major congruence and motivation on timely degree completion underscore the importance of both constructs in understanding student adjustment and postsecondary success. Implications for theory and counseling practice are discussed.

Keywords: degree attainment, interest–major congruence, motivation, academic performance, person–environment fit

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Few college students in the United States are obtaining degrees in a timely fashion. Among students who began at a 4-year institution in 1995–1996, 58% had obtained a bachelor's degree by 2001, and among students who began at a 2-year institution, 38% had obtained an associate's degree, bachelor's degree, or certificate by 2001 (National Center for Education Statistics [NCES], 2008). Among a sample of 253 two-year public institutions, the average 3-year associate's degree attainment rate was 27%; among a sample of 36 four-year public institutions, the average 5-year bachelor's degree attainment rate was 40.5% (ACT, 2008). Among those who do obtain a bachelor's degree, many take longer than 4 years. For first-time bachelor's degree recipients of 1999–2000 who did not stop attending college for 6 months or more, the average number of months between entry and completion was 55 months (U.S. Department of Education, 2003). The majority of students who enter 2- and 4-year institutional settings do not obtain degrees within the customary 2- or 4-year time frames.

Students who do graduate in a timely fashion are likely to reap large financial benefits. For the 2006–2007 year, the average tuition and fees at 4-year and 2-year institutions was $10,913 and $2,511, respectively (NCES, 2008). In 2001, the average annual earnings of bachelor's degree recipients 1 year after graduation was $35,400 (NCES, 2008). And, among workers at least 25 years old, the median annual earnings of individuals with some college or an associate's degree was approximately $36,600 (U.S. Depart-

ment of Labor, 2008). Thus, in 2008 dollars, bachelor's degree aspirants lose at least $46,000, on average, for each additional year of pursuing their bachelor's degree; students seeking an associate's degree or certificate also pay heavily for prolonging their degree attainment. With the already high costs of college, the expectation that degree completion will require more than 4 years (2 years) for bachelor's (associate's) degree aspirants can only decrease access to postsecondary education for low-income students. Thus, timely degree attainment is an important outcome, both for the sake of individual students' financial well-being and to promote equality of postsecondary access.

To improve timely degree attainment rates, the causes of delays in degree attainment must first be understood. In the present article, we report on a study of the simultaneous effects of academic preparation, motivation, and interest–major congruence on first-year academic performance and timely degree attainment. Because these constructs may all affect postsecondary outcomes but may not operate independently, we think it is important to study their effects within the same model. Although not of primary interest in this study, we also estimate the paths from selected sociodemographic factors (first-generation status, family income, gender, and race/ethnicity) to first-year academic performance and timely degree attainment.

Holland's Theory and Interest–Major Congruence

Holland's (1997) theory of careers suggests that six interest types (RIASEC; Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) can be used to characterize work environments and individuals' interests. Holland proposed that the six types are organized as a hexagon, ordered as R-I-A-S-E-C. Several studies have shown empirical support for this structure (Day, Rounds, & Swaney, 1998; Tracey & Darcey, 2002; Tracey & Rounds, 1993). For example, in a sample of college students, the RIASEC structure fit most students, and level of adherence to the

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structure predicted greater career certainty (Tracey & Darcey, 2002). Furthermore, changes in adherence to the RIASEC structure after taking a career class were associated with changes in career certainty and career decision-making self-efficacy (Tracey, 2008). Recent work has even suggested that Holland's interest types, due to their contextual nature, can provide a starting point for creating a complete "atlas" for integrating individual differences (Armstrong, Day, McVay, & Rounds, 2008).

Important to the present study, Holland's theory provides a basis for measuring the similarity, or *congruence*, of individuals' interests and their work environments. It suggests that level of congruence affects continuity in occupational decisions as well as success and satisfaction on the job (Holland, 1997). When applied to students in postsecondary education, Holland's theory suggests that students are more likely to be satisfied and succeed when their interests are congruent with their academic environments (Smart, Feldman, & Ethington, 2000). In this study, we refer to the level of congruence between a student's interests and his or her major's environment as *interest–major congruence*.

Interest–major congruence can be considered a special case of the construct person–environment fit, which has been used extensively in studies of organizational psychology, human resource management, and vocational behavior. Several studies, many using Holland's framework, have shown relationships of person–environment fit and work satisfaction and other work outcomes (cf. Donohue, 2006; Kiefer, Schinka, & Curtiss, 2004; Lyons & O'Brien, 2006; Wolniak & Pascarella, 2005). Researchers in industrial-organization psychology have also sought to integrate personality and interest constructs to better predict work performance and satisfaction with work environment (Hough, Barge, & Kamp, 2001).

The person–environment fit construct has also been used to predict college outcomes, where students' environments are determined by their academic major (Smart et al., 2000). Many of these studies have used measures of Holland types as the basis of measuring interest–major congruence. For example, a measure of interest–major congruence was positively related to cumulative grade-point average (GPA) and third-year retention after controlling for precollege academic achievement (Tracey & Robbins, 2006). In another study, first-year GPA and a measure of interest–major congruence both had relatively large effects on whether students changed major, suggesting that students with greater interest–major congruence are (a) more satisfied with their academic program and (b) more likely to graduate in a timely fashion due to not changing majors (Allen & Robbins, 2008). Measures of Holland types also predict choice of college major (Porter & Umbach, 2006).

Motivation and College Outcomes

Most studies of postsecondary outcomes are limited to first-year GPA and persistence, with the idea that these early outcomes have a strong bearing on final outcomes, such as degree attainment. Prior academic performance (high school grades or high school rank) and standardized achievement test scores are consistently predictive of college GPA and persistence, and recent studies have also demonstrated that measures of motivation can be used to improve prediction. Results of a large-scale meta-analysis suggest that achievement motivation carries significant weight ($\beta = 0.151$)

in determining college GPA, even after controlling for prior academic achievement and socioeconomic status (Robbins et al., 2004). More recently, a measure of academic motivation was predictive of first-year GPA and persistence in both institutional settings (2-year and 4-year), after controlling for prior academic achievement and sociodemographic characteristics (Robbins, Allen, Casillas, Peterson, & Le, 2006). The measure of academic motivation in the aforementioned study was found to be strongly related to conscientiousness, measured by the Big Five Inventory (Peterson, Casillas, & Robbins, 2006). Another recent meta-analysis found that conscientiousness consistently predicted higher grades (Trapmann, Hell, Hirn, & Schuler, 2007).

Integrating Interests, Motivation, and Academic Preparation

Clearly, interests, motivation, and academic preparation all have roles in understanding postsecondary adjustment, success, and timely degree attainment. Yet, few studies have integrated these three constructs in studies of college outcomes. We now review a sample of these studies as well as work that has addressed the overlapping development of personality and interests.

For a sample of postsecondary students who took an introductory psychology course, the effects of interest in psychology and different types of achievement goals on course performance and subsequent course choices were studied (Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008). Situational interest ("interests that emerge spontaneously in response to features of the environment") in the course predicted subsequent course choices, independently of individual interest ("interests that reside in an individual over time"). In another postsecondary sample, a measure of academic fit predicted academic satisfaction and GPA (Schmitt, Oswald, Friede, Imus, & Merritt, 2008). A direct measure of academic fit was used, in which ratings of academic fit are obtained from items whose content specifically addresses how well individual characteristics match the academic environment (e.g., "I am able to use my talents, skills, and competencies in my current courses"). As we discuss later, the measure of interest–major congruence used in the present study is an *indirect* measure of fit.

Other work has considered the overlapping development of intelligence, personality, and interests. One proposal is that ability and personality affect success in particular tasks and that interests affect motivation to attempt the task. Furthermore, unsuccessful attempts may decrease interest in the task (Ackerman & Heggestad, 1997). In the present study, we do not address the reciprocal development of personality or psychosocial factors (e.g., motivation), interests, and academic achievement in college. Rather, we measure these factors before postsecondary entry and estimate their effects on timely degree attainment. However, as we later discuss, understanding the reciprocal development of these factors may have important implications for counseling practice.

The primary research questions addressed in this study are: (a) Does interest–major congruence affect first-year academic performance? (b) Beyond its effect on academic performance, does interest–major congruence affect timely degree attainment? (c) Beyond its effect on first-year academic performance, does motivation measured at the onset of college affect timely degree attainment? (d) Beyond their effects on first-year academic per-

formance, do sociodemographic characteristics affect timely degree attainment? We now describe our hypotheses related to these questions.

Study Hypotheses

Our hypotheses for how interest–major congruence, motivation, academic preparation, and sociodemographic factors affect first-year academic performance and timely degree attainment are depicted in Figure 1; our hypotheses were identical for the 4-year and 2-year samples. In Figure 1, we present the paths that have already been established through prior analyses involving these samples (see solid lines in Figure 1), as well as the hypothesized paths that are the focus of this article (see stippled lines in Figure 1). The paths suggest indirect effects on timely degree attainment (working through first-year academic performance) as well as direct effects. Prior analyses involving these samples have revealed that measures of motivation, precollege academic performance, precollege educational achievement, socioeconomic status, gender, and race/ethnicity are all predictive of first-year GPA (Allen, Robbins, Casillas, & Oh, 2008; Robbins et al., 2006). Thus, the paths from each of these constructs to first-year academic performance have already been established.

Holland's (1997) theory suggests that students will be more satisfied and will perform better academically if they choose a major environment that is congruent with their interests. Thus, we hypothesize that higher interest–major congruence has a positive effect on first-year academic performance. By virtue of having greater satisfaction with students' major, Holland's theory also suggests that greater interest–major congruence will lead to students satisfying their degree requirements earlier. This effect may exist because students with greater interest–major congruence are less likely to change majors (and thus avoid taking coursework that is not required for graduation) and perhaps more likely to accumulate credit hours more quickly due to greater satisfaction with coursework. Thus, our second hypothesis is that interest–major congruence has a positive direct affect on timely degree attainment (beyond the effects of first-year academic performance).

Although several studies suggest that personality and motivation constructs affect first-year college outcomes (Robbins et al., 2006; Sedlacek, 2004; Sternberg, 2006), few have addressed whether these constructs have persistent effects on college outcomes (i.e., whether the effects go beyond the first year). Because greater motivation suggests a greater willingness to undergo the tasks necessary for academic success and degree completion, our third hypothesis is that motivation affects timely degree attainment directly (i.e., beyond the effect that is partially mediated by first-year academic performance).

Prior studies have shown that sociodemographic factors are predictive of bachelor's degree attainment. For example, among students who attend 4-year institutions, male, first-generation, lower income, and racial/ethnic minority students are all less likely to earn a bachelor's degree (Adelman, 2006). However, most studies have not addressed whether these relationships persist once first-year academic performance is accounted for. Because we expect that the sociodemographic factors related to lower first-year academic performance (male gender, first-generation status, lower family income, and racial/ethnic minority; Robbins et al., 2006) will continue to operate beyond the first year of college, our fourth hypothesis is that these factors will have direct paths to timely degree attainment.

Method

Participants

In fall 2003, a study of 14,464 first-time enrolled students at 25 four-year and 23 two-year postsecondary institutions in the United States was begun. The primary purpose of the study was to estimate the effects of psychosocial constructs, measured at the onset of the freshman year, on postsecondary outcomes. A measure of psychosocial constructs, the Student Readiness Inventory (SRI; Le, Casillas, Robbins, & Langley, 2005), was administered to first-year students prior to or within the first 6 weeks of the fall 2003 semester. Institutions solicited student participation during summer and fall orientation programs and courses with heavy freshmen enrollment. Student participation was voluntary, but institutions reported that most students who were asked to participate did so. Data from the participating postsecondary institutions have been collected in four waves: spring 2004, fall 2004, fall 2005, and summer 2007. At each wave, institutions reported stu-
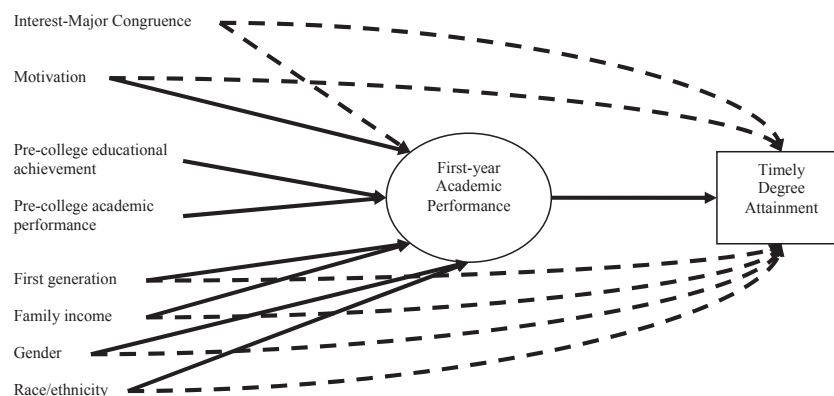

Figure 1. Expected and hypothesized paths to outcomes. Established paths represented by solid lines; hypothesized paths represented by stippled lines.

dents' cumulative GPA, cumulative credit hours earned, enrollment status (enrolled, graduated, or not enrolled and not graduated), and academic major. The present study requires data through the fourth year for the 4-year sample; 15 of the 25 institutions provided degree attainment and academic major data in summer 2007. The 2-year sample requires data through the second year; 13 of the 23 institutions provided degree attainment and academic major data in the fall 2005 data collection.

Inclusion criteria for students. To be included in the study sample, students must (a) have taken the ACT tests of educational achievement and completed the Unisex Edition of the ACT Interest Inventory (UNIACT; ACT, 1995) when registering for the ACT; (b) have data available on enrollment, graduation status, and academic major other than "undeclared" or "undecided"; (c) have began as a full-time student in fall 2003; (d) have had expectations of obtaining at least a bachelor's degree (4-year sample) or certificate (2-year sample); and (e) have nonmissing data on other variables of interest (gender, family income, parent's education level, race/ethnicity, and high school GPA). Of the original sample of 14,464 students, 9,422 (65%) had taken the ACT while in high school and were matched to ACT archival data. Of these, 8,922 (95%) completed the UNIACT. Of the 8,922 students with UNIACT scores, 5,283 (59%) were from the 28 participating institutions, and 4,166 (79%) of these had a known academic major (as opposed to missing data or undecided/undeclared major) at or before the last wave of data collection. Furthermore, 3,860 (3,072 four-year and 788 two-year) of these students began as full-time students with expectations of earning at least a bachelor's (4-year) or certificate (2-year) degree. This is the sample of students on which this study is based.

Description of institutions. The 15 four-year institutions are located in 10 states, including Colorado, Kentucky, Minnesota, Missouri, Ohio, Oklahoma, South Dakota, Tennessee, Texas, and West Virginia. The mean full-time undergraduate enrollment among the 15 institutions is 9,923, with a standard deviation of 11,159 and a median of 4,808. The admissions policies of the institutions in this study are classified according to the high school class ranks of their accepted freshmen: The majority of freshmen at "highly selective" institutions were in the top 10%, "traditional" in the top 50%, and "liberal" in the top 75% of their high school class. Institutions with "open" admissions policies accept all high school graduates, to limit of capacity. Of the 15 four-year institutions, 12 are classified as having a "traditional" admissions policy, 2 have a "liberal" admissions policy, and 1 is "highly selective." The 13 two-year institutions are located in nine states, including Arkansas, Iowa, Kentucky, Louisianan, Ohio, South Carolina, Tennessee, Virginia, and Wisconsin. The mean full-time undergraduate enrollment among the 13 institutions is 4,688, with a standard deviation of 2,456 and a median of 5,162. Of the 13 two-year institutions, 12 are classified as "open," and 1 has a "liberal" admissions policy.

Description of students. The sample of students entering 4-year institutions was predominantly female (60%) and Caucasian (76%); African American (9%), Hispanic (10%), Asian (2%), and students of other race/ethnicities (3%) were also represented. First-generation students comprised 45% of the 4-year sample. By virtue of the inclusion criteria, all students entered as full time with expectations of earning at least a bachelor's degree. By comparison, in 2005, 68% of all students enrolled at 4-year institutions in the United States were Caucasian, 12% were African American, 8% were Hispanic, and 6% were Asian. Moreover, 55% of all full-time students were women (NCES, 2008). Thus, relative to the population of students enrolled at 4-year institutions, the present sample had relatively more female, Caucasian, and Hispanic students but fewer African American and Asian students. Students ranged in age from 17 to 32 years old; the median age was 18, and 99% were age 20 or younger at entry. The mean ACT composite score was 21.2, and the mean high school GPA was 3.31. With respect to both ACT scores and high school GPA, the sample is similar to the nationwide group of ACT-tested high school graduates of 2003, which had a mean ACT composite score of 20.8 and mean self-reported high school GPA of 3.20 (ACT, 2003, 2006).

The sample of students who entered 2-year institutions was 56% female, 84% Caucasian, 12% African American, 1% Hispanic, 1% Asian, and 2% other race/ethnicity. First-generation students comprised 58% of the 2-year sample. By virtue of the inclusion criteria, all students entered as full time with expectations of earning at least a certificate from a business or technical program. By comparison, in 2005, 62% of all students enrolled at 2-year institutions in the United States were Caucasian, 14% were African American, 15% were Hispanic, and 7% were Asian. Moreover, 56% of all full-time students at 2-year institutions were women (NCES, 2008). Thus, relative to the population of students enrolled at 2-year institutions, the present sample had a much larger concentration of Caucasian students and fewer Hispanic and Asian students. Ages at entry ranged from 17 to 35 years old, with a median of 18 years old; 14% of the 2-year students were age 21 or older. The mean ACT composite score was 18.8, and the mean high school GPA was 2.86. Thus, the 2-year sample was less prepared academically than both the 4-year sample and the nationwide group of ACT-tested high school graduates of 2003.

Instruments and Measures

The UNIACT and a measure of interest–major congruence. The UNIACT reports results for six basic types of vocational interests corresponding to the six interest types in Holland's theory of careers (ACT, 2009). The six UNIACT scales (and the corresponding Holland type) are Technical (Realistic), Science and Technology (Investigative), Arts (Artistic), Social Service (Social), Business Administration and Sales (Enterprising), and Business Operations (Conventional). There have been several editions of UNIACT over the years, and approximately 100 million people have completed UNIACT since its introduction in 1977, making it one of the most used psychological instruments in the world (ACT, 2009). The edition of UNIACT used in this study has 90 items (15 per scale) that describe work-relevant activities that are familiar to people either through participation or observation. For each item, students indicate whether they would dislike doing the activity, are indifferent (do not care one way or the other), or would like doing the activity. Raw scores are derived after summing over the 15 item responses (scores of 1, 2, or 3 correspond to the three response options); raw scores are then transformed to standard scores that have approximate means of 50 and standard deviations of 10. Sample items for each UNIACT scale include Build furniture, Pack things into boxes (Technical); Measure chemicals in a test tube, Explore a science museum (Science and Technology); Sketch and draw pictures, Write short stories (Arts);

Give first aid to an injured person, Help settle an argument between friends (Social Service); Plan work for other people, Present information before a group (Business Administration and Sales); and Count and sort money, Balance a checkbook (Business Operations). Estimates of test–retest reliabilities of the UNIACT standard scores (with a testing interval of 4–7 days) are .82 for Technical, .87 for Science and Technology, .90 for Arts, .81 for Social Service, .78 for Business Administration and Sales, and .82 for Business Operations (Staples & Luzzo, 1999).

Several different approaches have been used to measure person–environment fit (for discussions, see Brown & Gore, 1994; Edwards, 1993; Tracey & Robbins, 2006). Many of these approaches can be classified as profile similarity indices (PSIs), which, as the name implies, measure the similarity of a person and his or her environment. One example of a PSI is the profile correlation, which measures the linear relationship between an individual's profile and that of the environment. Specific to the present study, the simple correlation of student and major profiles was used as a measure of interest–major congruence. A student's interest profile is captured by their six UNIACT standard scores. The environment's profile is captured by the Holland-type profile of each academic major. What now follows is a description of how the Holland-type profile for each academic major was established.

To establish each major's Holland-type profile, a large sample ($N = 21,298$) of postsecondary students who had taken the UNIACT when registering for the ACT as high school students between 1990 and 2003 was used. This sample, hereafter referred to as the *major profile data set*, does not overlap with the present study sample and was only used to develop Holland-type profiles for each major. The major profile data set includes students from 83 postsecondary institutions (45 four-year, 38 two-year; 74 public, 9 private) who persisted into their sophomore year with a cumulative GPA of at least 2.00. Thus, the sample is intended to represent "successful and persistent" students. Within the major profile data set, students are grouped by their last academic major, given by their Classification of Instructional Programs (CIP) code. CIP codes can have up to six digits; the first two digits represent the most general grouping of related programs, the first four digits representing intermediate groupings of programs that have comparable content and objectives, and the full six digits representing the specific instructional programs (NCES, 2002).

For majors with at least 50 students in the major profile data set, the Holland-type profile was defined to be the means of the six UNIACT scores. There were 79 majors (represented by six-digit CIP codes) that had at least 50 students. For these majors, the standard deviation of the six means was calculated as a measure of how well the major *differentiates* the Holland types. In an online supplement to this article, we give the profiles (six UNIACT mean sores) for the 15 most differentiating (i.e., larger standard deviations) and the 15 least differentiating majors. Examples of highly differentiating majors are biochemistry ($SD = 5.3$), which had an especially large investigative mean of 64.2; accounting ($SD = 5.3$), which had a large conventional mean of 60.4; and drama and dramatics/theatre arts ($SD = 5.8$), which had a large artistic mean of 63.2. Examples of majors with less differentiation of Holland-types are liberal arts and sciences/liberal studies ($SD = 0.8$), geography ($SD = 0.9$), and general studies ($SD = 1.5$). For these majors, the six means are relatively similar, and so the Holland-type profiles are flat.

Again, the data set used to develop the major profiles did not overlap with the present study's data set. For each student in the present study, interest–major congruence was measured as the simple correlation of the student's six UNIACT scores and his or her major's Holland-type profile. For students who changed majors, the mean across their interest–major correlations was used as the measure of interest–major congruence. Recall that it was hypothesized that interest–major congruence would affect first-year academic performance. The measure of interest–major congruence reflects majors beyond the first year, which could confound the conceptualized temporal relationship of interest–major congruence and first-year academic performance. The correlation of the mean interest–major correlation (spanning up to 4 years) and the first-year-only interest–major correlation was .95; thus, it was believed to be reasonable to use a single measure of interest–major congruence for purposes of testing the study hypotheses.

In some cases, the CIP code data provided by institutions in the present study were not available at the six-digit level, but only at the four-digit or two-digit level. In other cases, the major profile data set did not contain at least 50 students for a CIP code at the six-digit level, but did at the four-digit or two-digit levels. Therefore, major profiles at the six-digit level (see the supplemental material) were developed, as well as at the four-digit and two-digit levels. For the students in the samples, the interest–major correlation was calculated using the CIP code profile, with six digits for 2,826 students (73%), four digits for 518 students (16%), and two digits for 416 students (11%). Among the students in the 4-year sample, the mean interest–major correlation was 0.22, with a standard deviation of 0.46. Among the students in the 2-year sample, the mean interest–major correlation was 0.14, with a standard deviation of 0.50. Thus, on average, the students chose an academic major whose profile was positively correlated with their own interest profile.

The interest–major correlation clearly is measured with error, as both the student and major profiles are measured with error. For purposes of estimating the reliability of the interest–major correlation, the major profiles were viewed as fixed quantities (i.e., as if the major's means were measured without error). This assumption is partly justified by the high degree of precision with which the profile means were estimated: The median standard error of measurement across the means for the six-digit CIP codes was less than 0.09 standard deviation units. With this assumption, the reliability of the interest–major profile is affected only by the aforementioned test–retest reliabilities of the six UNIACT standard scores. The test–retest reliability of the interest–major correlation was estimated to be .76; for analyses, interest–major congruence is treated as a latent variable that is measured by the interest–major correlation with reliability .76.

A measure of motivation. The SRI (Le et al., 2005; Robbins et al., 2006) was designed to measure psychosocial factors predictive of college outcomes and is composed of 108 items and 10 scales. A factor analysis of the 10 scales (Le et al., 2005) suggested a three-factor solution, with the scale Academic Discipline loading heavily on motivation ($\gamma = .80$). Academic Discipline measures students' perceptions of the amount of effort they put into school work and the degree to which they are hardworking and conscientious. There are 10 items; sample items are "I turn in my assignments on time" and "I take good notes in class." Response options are 1 = *strongly agree*, 2 = *moderately disagree*, 3 =

slightly disagree, 4 = *slightly agree*, 5 = *moderately agree*, and 6 = *strongly agree*. The Academic Discipline score is computed as the sum of the 10 responses. The reliability of Academic Discipline is estimated to be .83 (Le et al., 2005). Motivation is treated as a latent variable that is measured by Academic Discipline with reliability .83.

Academic preparation and sociodemographic measures. Traditionally, academic preparation has been measured with high school GPA and standardized achievement scores (such as the ACT composite score), and these measures are often used for making college admissions decisions. The present measure of high school GPA is based on students' self-reported high school grades. In the present analyses, ACT composite score and high school GPA are treated as measures of the constructs *precollege educational achievement* and *precollege academic performance*, respectively. These measures are viewed as separate, yet correlated constructs. The ACT composite score is designed to measure the academic skills important for success in postsecondary education and that are acquired in secondary education (ACT, 2006). High school GPA, however, is a measure of performance in high school courses and is a reflection of students' work ethic and academic mastery, as well as difficulty of courses and grading standards. In a prior study (Allen et al., 2008), the reliability of high school GPA was estimated at .90; the ACT composite score has a typical reliability of .96 (ACT, 2006).

Sociodemographic data, including gender, race/ethnicity, parent/guardian income, and parent/guardian highest educational level completed, was collected when students took the SRI.

Five racial/ethnic groups were considered: African American, Asian, Hispanic, other race/ethnicities (includes American Indian and students of two or more races), and Caucasian. For the 4-year sample, four dummy-coded variables (coded as 0 or 1) were used with Caucasian as the reference group. Because the 2-year sample had very few Asian, Hispanic, and students of other racial/ethnic groups, a single dummy-coded racial/ethnic minority variable was used with Caucasian as the reference group. For gender, a dummy variable was used with female as the reference group. Parent/guardian education levels and income were reported on ordinal scales, with eight levels for education and six levels for income. Students were coded as first generation if neither parent had obtained at least an associate's degree. The natural logarithm of family income was used as a continuous variable. We assumed that the sociodemographic data were collected without error (reliabilities of 1.00).

Dependent Variables

First-year academic performance. It was hypothesized that first-year academic performance would partially mediate the effects of all independent variables on timely degree attainment (see Figure 1). First-year academic performance was measured by first-year cumulative GPA. For students who dropped out after the first semester, first-year fall GPA was carried forward. In a prior study (Allen et al., 2008), the reliability of first-year cumulative GPA was estimated at .85.

Timely degree attainment. The present sample includes 3,072 students who began college at a 4-year college or university and 788 students who began at a 2-year or community college. For students who began at a 4-year institution, timely degree attainment was defined as attainment of a bachelor's degree by the summer 2007 term, which would have followed the end of the fourth year for students who were continuously enrolled. Because there was a specific interest in factors that affect *timely* degree attainment, it was believed to be more meaningful to define the criterion as having earned a bachelor's degree within 4 years, rather than the customary 5 or 6 years used for reporting national degree attainment statistics. For students who began at a 2-year institution, timely degree attainment was defined as attainment of an associate's degree or completion of a certificate program by the summer 2005 term, which would follow the end of the second year for students who were continuously enrolled.

In addition to degree attainment status, data on cumulative credit hours earned from each institution were also obtained. Generally, 4-year students who had earned 120 or more credit hours after 4 years were awarded degrees. Inspection of the data and academic catalogs revealed that for some majors at some institutions, more cumulative hours were needed for degree completion. Seventy-two 4-year students were identified out of the sample of 3,072 who appeared to have earned a sufficient number of credit hours, yet were not awarded a bachelor's degree. Many of these students were enrolled in health professions fields, most notably prepharmacy and nursing. Because we did not want to classify students as having not obtained a degree due to their choice of an academic major that required more than 4 years to complete, these 72 students were treated as having earned a degree.

For students who dropped out or who transferred from their original institution (before earning a degree or certificate), the institution-provided data did not provide information about whether the student earned a degree from another institution. For this reason, the institution-provided data was supplemented with degree data from the National Student Clearinghouse (NSC). Over 3,300 postsecondary institutions in the United States provide the NSC with degree and enrollment information.[1] The NSC data include term-by-term enrollments at postsecondary institutions, type of degree earned, and graduation date.

Statistical Analyses

Path models, one for each institutional setting, were used to test the hypotheses depicted in Figure 1. First-year academic performance was viewed as a partial mediator, and all independent variables were hypothesized to have indirect effects (through first-year academic performance) on timely degree attainment. All independent variables, with the exception of precollege academic achievement and precollege academic performance, were also hypothesized to have direct effects on timely degree attainment. Because first-year GPA is approximately continuous and students are nested within their initial institution, a hierarchical linear model with institution-specific intercepts was used to estimate the paths to first-year academic performance. Predictors of first-year academic performance included interest–major congruence (measured by the interest–major correlation), motivation (measured by the Academic Discipline scale), precollege academic performance (measured by high school GPA), precollege educational achievement (measured by the ACT composite score), first-generation status, gender, and race/ethnicity.

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[1] Please see www.studentclearinghouse.org

A hierarchical logistic regression model was used to estimate the path coefficients to timely degree attainment. Similar to the model for first-year academic performance, the model's intercepts varied across institutions. Predictors of timely degree attainment included first-year academic performance, interest–major congruence, motivation, first-generation status, gender, and race/ethnicity.

To ease interpretation and comparability of path coefficients, the continuous variables were scaled to have a standard deviation of one. Thus, each resulting coefficient is an estimate of the change in the dependent variable associated with a one standard deviation change in the independent variable. The categorical variables (first generation, gender, race/ethnicity) were represented with dummy-coded variables and were not standardized. The path models were fit separately for the 2- and 4-year samples using WinBUGS Version 1.4 (Lunn, Thomas, Best, & Spiegelhalter, 2000). WinBUGS enabled the modeling of both first-year academic performance and the dichotomous timely degree attainment outcome, while treating first-year academic performance as a partial mediator. The software permits hierarchical modeling to account for the nesting of students within institutions as well as measurement error modeling of the constructs of interest. More important, WinBUGS also permits inference for *functions* of path coefficients, such as the indirect and total effects of predictors on timely degree attainment. The indirect effects are defined using the usual path multiplication rule (Wright, 1934; e.g., the indirect effect of X on Z is equal to the path from X to Y multiplied by the path from Y to Z). (Please see the supplemental material for the model's syntax.)

WinBUGS uses Markov-Chain Monte Carlo methods to fit Bayesian models and requires specification of prior distributions for the model's parameters. By specifying noninformative prior distributions for all parameters, the posterior distributions of interest will not be measurably affected by the prior distribution. WinBUGS output includes the posterior means, which are analogous to parameter estimates derived using conventional methods such as maximum-likelihood estimation, and posterior standard deviations, which are analogous to standard errors of the parameter estimates. The parameter estimates and standard errors are reported, with which confidence intervals can be constructed. T values (estimate/standard error) greater than 1.96 (or less than 1.96) correspond to p values less than .05, and values greater than 2.58 (or less than −2.58) correspond to p values less than .01.

Results

Of the 3,072 students who entered a 4-year institution, 1,011 (33%) were classified as having earned a timely degree after the fourth year (31% had earned a bachelor's degree, and 2% had accumulated at least 120 credit hours but appeared to be enrolled in a program that required more than 4 years). Among the students classified as having earned a timely degree, 90% earned the degree at their original institution, and 10% earned a bachelor's degree after transferring. Many other students (19%) transferred but had not yet earned a degree, appeared to have dropped out and not transferred (31%), or were still enrolled at their original institution (17%). For the 4-year sample, the mean first-year GPA was 2.73, with a standard deviation of 0.90.

Of the 788 students who entered a 2-year institution, only 96 (12%) obtained an associate's degree or certificate within 2 years. Of those who earned a timely degree, 81% earned the degree or certificate at their original institution, and 19% earned the degree or certificate after transferring. Others (14%) transferred but had not yet earned a degree or certificate, appeared to have dropped out and not transferred (48%), or were still enrolled at their original institution (26%). For the 2-year sample, the mean first-year GPA was 2.47, with a standard deviation of 1.01. We now report the results of the statistical analyses.

Correlations

In Tables 1 and 2, we present the correlations among the variables of interest for the 4- and 2-year samples, respectively. In the 4-year sample, the interest–major correlation had small correlations with the other predictor variables; observed correlations were .04, .07, and .02 with ACT composite score, high school GPA, and first-generation status, respectively. We observed slightly larger correlations with Academic Discipline ($r = .09$) and gender ($r = −.12$), suggesting that women and students with greater motivation are likely to choose an academic major that is congruent with their interests. The interest–major correlation was related to first-year GPA ($r = .06$) and the dichotomous timely degree attainment outcome ($r = .10$). ACT composite score ($r = .26$), high school GPA ($r = .27$), first-generation status ($r = −.11$), gender ($r = −.12$), Academic Discipline ($r = .18$), and first-year GPA ($r = .37$) were also related to timely degree attainment.

Table 1

Correlation Matrix: 4-Year Sample

Variable	1	2	3	4	5	6	7	8	9
1. ACT composite score	.96								
2. High school GPA	.48**	.90							
3. First generation	−.23**	−.09**	—						
4. Log family income	.20**	.04*	−.34**	—					
5. Gender (M = 1, F = 0)	.00	−.18**	−.04*	.07**	—				
6. Interest–major correlation	.04*	.07**	.02	.01	−.12**	—			
7. Academic discipline	.09**	.38**	.03	−.04*	−.29**	.09**	.83		
8. First-year GPA	.49**	.51**	−.15**	.14**	−.15**	.06**	.31**	.85	
9. Degree attainment (Yes = 1, No = 0)	.26**	.27**	−.11**	.08**	−.12**	.10**	.18**	.37**	—
Mean or proportion	21.22	3.31	0.45	61.41	0.40	0.22	47.60	2.73	0.33
SD	4.01	0.50	0.49	38.53	0.49	0.46	7.76	0.90	0.47

Note. $N = 3,072$. Estimated reliabilities are given on the diagonal of correlation matrix. GPA = grade-point average; M = male; F = female.
* $p < .05$. ** $p < .01$.

Table 2
Correlation Matrix: 2-Year Sample

Variable	1	2	3	4	5	6	7	8	9
1. ACT composite score	.96								
2. High school GPA	.41**	.90							
3. First generation	−.15**	.01	—						
4. Family income	.12**	−.05	−.31**	—					
5. Gender (M = 1, F = 0)	.12**	−.16**	−.14**	.15**	—				
6. Interest–major correlation	−.12**	−.02	.10**	−.09*	−.18**	—			
7. Academic discipline	−.06	.30**	.11**	−.15**	−.29**	.12**	.83		
8. First-year GPA	.21**	.33**	−.07	.06	−.08*	−.04	.15**	.85	
9. Degree attainment (Yes = 1, No = 0)	.01	.07	−.04	.07	.00	.06	.02	.17**	—
Mean or proportion	18.77	2.86	0.58	54.72	0.44	0.14	46.71	2.47	0.12
SD	3.79	0.55	0.49	34.77	0.50	0.50	7.81	1.01	0.33

Note. $N = 788$. Estimated reliabilities are given on the diagonal of correlation matrix. GPA = grade-point average; M = male; F = female.
* $p < .05$. ** $p < .01$.

In the 2-year sample, the interest–major correlation was negatively correlated with ACT composite score, family income, and male gender, but positively correlated with first-generation status and the measure of motivation (Academic Discipline). Unlike the 4-year sample, the only variable significantly correlated with timely degree attainment in the 2-year sample was first-year GPA ($r = .17$).

Paths to First-Year Academic Performance

Four-year sample. In Table 3, we present the modeling results for the 4-year sample. These results are also depicted in Figure 2. The overall model explained nearly 50% of the variation in first-year academic performance. High school GPA and ACT composite score typically explain about 28% of the variability of freshman GPA (ACT, 1997); the increase we see here is due to the incremental effects of motivation, sociodemographic variables, and the fact that we corrected for measurement error. The path

coefficient (beta weight) for interest–major congruence ($\beta = 0.004$) was not significant; thus, our first hypothesis (higher interest–major congruence will have a positive effect on first-year academic performance) was not supported by the results for the 4-year sample. The path coefficients for precollege educational achievement ($\beta = 0.357$), precollege academic performance ($\beta = 0.363$), first generation ($\beta = −0.096$), male gender ($\beta = −0.115$), race ($\beta = −0.270$ for African American), and motivation ($\beta = 0.213$) were all significant. These findings are not new, as these paths had been established with previous analyses of this sample (Allen et al., 2008; Robbins et al., 2006). These results suggest that first-year academic performance is affected by educational achievement and academic performance before college, and associated with sociodemographic factors such as parent's education, family income, gender, and racial/ethnic group.

Two-year sample. In Table 4 and Figure 2, we present the modeling results for the 2-year sample. Similar to the findings for

Table 3
Modeling Results for First-Year Academic Performance and Timely Degree Attainment: 4-Year Sample

	First-year academic performance			Timely degree attainment								
				Indirect effect			Direct effect			Total effect		
Predictor	β	SE	p	β	SE	p	β	SE	p	β	SE	p
Intercept	0.110	0.072					−0.554	0.208				
Institution variance	0.053	0.027					0.526	0.255	<.05			
Precollege educational achievement	0.357	0.021	<.01									
Precollege academic performance	0.363	0.023	<.01									
First generation	−0.096	0.036	<.01	−0.098	0.038	<.01	−0.230	0.100	<.05	−0.328	0.103	<.01
Log family income	0.068	0.019	<.01	0.070	0.020	<.01	0.034	0.051		0.103	0.053	
Gender (male)	−0.115	0.036	<.01	−0.118	0.038	<.01	−0.263	0.100	<.01	−0.382	0.103	<.01
African American	−0.270	0.067	<.01	−0.277	0.071	<.01	−0.052	0.205		−0.329	0.210	
Hispanic	−0.174	0.096		−0.179	0.099		−0.383	0.287		−0.562	0.295	
Asian	0.183	0.119		0.188	0.123		−0.203	0.322		−0.014	0.333	
Other race	−0.050	0.122		−0.051	0.126		−0.087	0.355		−0.138	0.366	
Interest–major congruence	0.004	0.019		0.004	0.020		0.162	0.055	<.01	0.165	0.056	<.01
Motivation	0.213	0.020	<.01	0.218	0.026	<.01	0.056	0.059		0.274	0.057	<.01
First-year academic performance							1.027	0.072	<.01			
Overall model fit	$R^2 = 0.496$						OOR = 4.114					

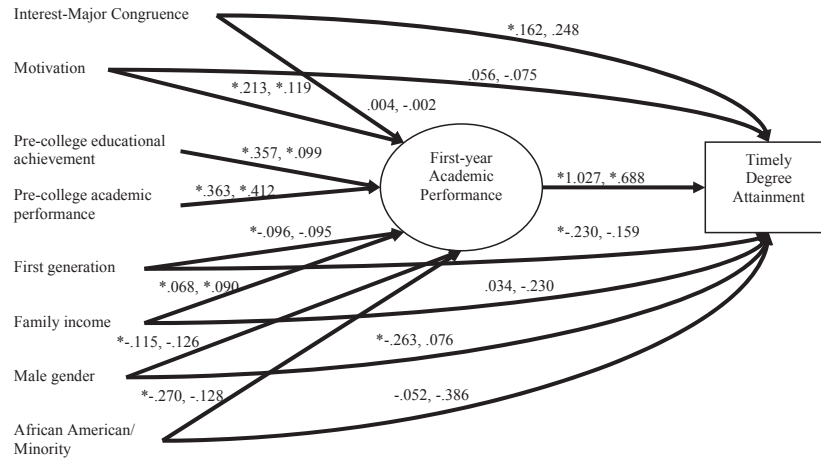*Note.* $N = 3,072$. OOR = overall odds ratio.

Figure 2. Estimated paths. Weights are given for the 4-year sample, followed by the weights for the 2-year sample. Significant paths are marked with an asterisk. Beta weights are given for paths to first-year academic performance; standardized logistic regression coefficients are given for paths to timely degree attainment.

the 4-year sample, precollege educational achievement, precollege academic performance, family income, and motivation were significantly predictive of first-year academic performance. Again, interest–major congruence was not predictive of first-year academic performance. The size and direction of the coefficients for first-generation status, male gender, and racial/ethnic minority were all similar to the results for the 4-year sample. However, these paths were not statistically significant, as the sample size for the 2-year sample ($n = 788$) was substantially less than that of the 4-year sample ($n = 3,072$). The overall model for first-year academic performance explained 26% of the variation in first-year academic performance, substantially less than the 50% observed for the 4-year sample.

Paths to Timely Degree Attainment

Four-year sample. The path coefficient for interest–major congruence ($\beta = 0.162$; see Table 3 and Figure 2) was significant.

Thus, our second hypothesis (interest–major congruence will have a positive affect on timely degree attainment, beyond the effects of first-year academic performance) was supported by the results for the 4-year sample. The path coefficient for motivation ($\beta = 0.056$) was not significant. Thus, our third hypothesis (motivation will have a direct effect on timely degree attainment) was not supported. As expected, the results suggest that first-year academic performance has a large effect ($\beta = 1.027$) on timely degree attainment. Because timely degree attainment was modeled with logistic regression, the interpretation of the coefficient is the log-odds of attaining a timely degree increase by 1.027 units for each standard deviation increase in first-year academic performance. Effect size can also be interpreted in terms of increases in the probability of attaining a timely degree, relative to some baseline probability. For example, the estimated probability of attaining a timely degree increases by .236 (from .500 to .736) for a student with baseline probability at .500 for each standard deviation in-

Table 4
Modeling Results for First-Year Academic Performance and Timely Degree Attainment: 2-Year Sample

| | First-year academic performance | | | Timely degree attainment | | | | | | | | |
| | | | | Indirect effect | | | Direct effect | | | Total effect | | |
Predictor	β	SE	p	β	SE	p	β	SE	p	β	SE	p
Intercept	0.139	0.132					−2.063	0.340				
Institution variance	0.116	0.078					0.581	0.425				
Precollege educational achievement	0.099	0.048	<.05									
Precollege academic performance	0.412	0.049	<.01									
First generation	−0.095	0.082		−0.065	0.059		−0.159	0.252		−0.224	0.255	
Log family income	0.090	0.043	<.05	0.062	0.033		0.230	0.134		0.292	0.137	
Gender (male)	−0.126	0.083		−0.086	0.061		0.076	0.254		−0.010	0.259	
Minority	−0.128	0.123		−0.088	0.089		0.386	0.361		0.298	0.366	
Interest–major congruence	−0.002	0.047		−0.016	0.033		0.248	0.148		0.233	0.150	
Motivation	0.119	0.047	<.05	0.082	0.038	<.05	−0.075	0.145		0.007	0.144	
First-year academic performance							0.688	0.153	<.01			
Overall model fit	$R^2 = 0.262$						OOR = 2.869					

Note. $N = 788$. OOR = overall odds ratio.

crease in first-year academic performance. The direct paths to timely degree attainment were also significant for first-generation status ($\beta = -0.230$) and male gender ($\beta = -0.263$), but not for family income or race/ethnicity. Thus, our fourth hypothesis (male gender, first-generation status, lower family income, and racial/ethnic minority indicators will have direct paths to timely degree attainment) was partially supported. The overall odds ratio (OOR; Allen & Le, 2008) is a measure of overall model predictive strength for logistic regression models; its use is analogous to using R or R^2 for linear regression models. The OOR for the 4-year sample was 4.11, indicating that the odds of obtaining a degree in a timely fashion increase over fourfold for each standard deviation increase in the model's linear predictor.

Two-year sample. The path coefficient for interest–major congruence ($\beta = 0.248$; see Table 4 and Figure 2) was in the hypothesized positive direction but was not statistically significant—perhaps due to the smaller sample size for the 2-year sample. The path coefficient for the direct effect of motivation ($\beta = -0.075$) was not significant. Thus, as with the 4-year sample, our third hypothesis (motivation will have a direct effect on timely degree attainment) was not supported. The results again suggest that first-year academic performance has a large effect ($\beta = 0.688$) on timely degree attainment. The direct paths to timely degree attainment were in the hypothesized directions, but not significant for first-generation status ($\beta = -0.159$) and family income ($\beta = 0.230$). However, the paths were not in the hypothesized directions for male gender ($\beta = 0.076$) and racial/ethnic minority ($\beta = 0.386$). Thus, our hypothesis that sociodemographic factors would have direct paths to timely degree attainment was not supported by the results for the 2-year sample. The OOR for the 2-year sample was 2.87, substantially less than the 4.11 observed for the 4-year sample. Thus, the overall predictive strength for both first-year academic performance and timely degree attainment was greater for the 4-year sample.

Interpreting Direct, Indirect, and Total Effects on Timely Degree Attainment

Because we treated first-year academic performance as a partial mediator, we estimated the direct, indirect, and total effects of interest–major congruence, motivation, and sociodemographic characteristics on timely degree attainment (see Tables 3 and 4). Because the paths from interest–major congruence to first-year academic performance were not significant, the total effect of interest–major congruence ($\beta = 0.165$ for the 4-year sample, $\beta = 0.233$ for the 2-year sample) on timely degree attainment was determined mostly by the direct effects of interest–major congruence. An interpretation of the total effect size of interest–major congruence for the 4-year sample is as follows: The estimated probability of attaining a timely degree increases by .041 (from .500 to .541) for a student with baseline probability at .500, for each standard deviation increase in interest–major congruence. Because the direct path from motivation to timely degree attainment was not significant in the 4-year sample, the total effect of motivation ($\beta = 0.274$) on timely degree attainment was determined mostly by the indirect effect via first-year academic performance. An interpretation of the total effect size of motivation for the 4-year sample is as follows: The estimated probability of

attaining a timely degree increases by .068 (from .500 to .568) for a student with baseline probability at .500 for each standard deviation increase in motivation.

Discussion

This study's results support the hypothesis that higher levels of interest–major congruence lead to greater likelihood of attaining a degree in a timely fashion. This finding points to the importance of effective career and educational planning for students and underscores an important factor institutions should consider as they actively promote timely degree completion. This finding is consistent with the broader workplace literature, which has consistently shown positive relations of individuals' fit and work outcomes (cf. Kristof-Brown, Zimmerman, & Johnson, 2005). Importantly, we defined each student's academic environment according to the Holland-type profile among an independent multi-institution sample of students embedded within the same major. A limitation of this approach is that it assumes that academic major environments are the same across postsecondary institutions.

To better promote timely degree attainment, it is important to understand why interest–major congruence affects timely degree attainment. We hypothesized that interest–major congruence affects timely degree attainment through two mechanisms: college major persistence and enthusiasm for coursework. We believe that college major persistence may partially mediate the relationship of interest–major congruence and timely degree attainment: Students are less likely to change their academic major when they have higher interest–major congruence (cf. Allen & Robbins, 2008; Laing, Swaney, & Prediger, 1984), and students who switch majors are more likely to require extra coursework and so prolong their graduation. In this study, we did not include major persistence as a mediating variable because (a) major persistence is only defined for students who persist, whereas we did not want to exclude dropouts from the samples; and (b) we could not define a major persistence variable for students who transferred from their initial institution (data from the NSC was used to determine which students transferred and graduated from another institution, but the data did not include academic major). We also hypothesized that students with greater interest–major congruence are more enthused about their coursework and thus accumulate credit hours more quickly, leading to faster degree attainment. This hypothesis could be tested by using a measure of enthusiasm for academic major and coursework. We expect that interest–major congruence will predict both major persistence and enthusiasm for coursework and that both of these factors will predict timely degree attainment.

Because the interest–major correlation can be estimated with reasonable reliability (we estimated the test–retest reliability at .76) with respect to any major for any student with UNIACT scores, it has the potential to be a useful counseling tool. Because it is a correlation, users can intuitively grasp that smaller values suggest worse fit of the student's interests and his or her academic major. Many students enter postsecondary education undecided about their academic major. For these students in particular, the interest–major correlation could be used to introduce majors whose Holland-type profiles are correlated with the student's own interest profile. In the 4-year sample, the interest–major correlation was not correlated with first-generation status or family income, suggesting that students of all backgrounds are equally prone to

choose majors that do not fit their interests. In the 2-year sample, first-generation and low-income students had slightly higher interest–major correlations. The interest–major correlation could also be used as a counseling tool in middle and/or high school as students begin to explore majors and careers. By assessing congruence of students' interests and planned postsecondary majors early on, counselors can help students make informed choices at critical junctures.

In both institutional settings, motivation appears to affect timely degree attainment by virtue of its affect on first-year academic performance. Because motivation is measured with a self-report instrument (the SRI), it has limited usefulness for admissions decisions (Allen, Robbins, & Sawyer, in press). However, because postsecondary institutions are continually trying to improve the effectiveness of their student affairs programs, measuring motivation (e.g., with the Academic Discipline scale) can lead to improved accuracy in the selection of students who are likely to struggle academically.

We believe that Academic Discipline measures both motivational traits and motivational skills. Psychological research indicates that the self-regulatory competencies that define motivational skills can be "markedly improved through training and practice" (Kanfer & Heggestad, 1997). Furthermore, motivational skills mediate the effects of postsecondary academic and self-management programs to promote academic success (Robbins, Oh, Le, & Button, 2009). Thus, it seems that students' Academic Discipline could be improved with proper training and practice. Future research should address the critical components of training that improves students' motivational skills pertaining to academic work. Such components might be targeted at overcoming boredom, frustration, and managing multiple homework deadlines.

First-year academic performance had a large effect on timely degree attainment in both institutional settings. Thus, all predictors of first-year academic performance (e.g., high school grades, standardized test scores, sociodemographic characteristics) are also linked, at least indirectly, to timely degree attainment. In the 4-year sample, the path coefficients of precollege academic performance ($\beta = 0.363$) and precollege educational achievement ($\beta = 0.357$) to first-year academic performance highlight the importance of high school academic preparation. As many authors have pointed out (cf. Allen et al., 2008; Pascarella & Terenzini, 2005), first-year academic success is a strong predictor of long-term persistence; the present study suggests that strong performance in the first year also leads to faster degree attainment. Thus, postsecondary retention efforts must incorporate strategies that promote academic success through combining academic and motivational strategies (see Robbins et al., 2009, for a discussion).

The findings did not support our hypothesis that interest–major congruence affects first-year performance, which was surprising given past research with both educational (Schmitt et al., 2008; Tracey & Robbins, 2006) and work task (Campbell & Knapp, 2001) outcomes. For example, direct measures of academic fit predicted higher college GPA (Schmitt et al., 2008). Our measure of interest–major congruence can be considered an indirect measure of academic fit because it represents the similarity of student and major profiles, which is different than a measure representing students' actual perceptions of fit with their academic environment. Still, because we expected that our indirect measure was predictive of direct measures of academic fit, we also expected the indirect measure to predict academic performance. Future research studies that distinguish major-specific courses from others (i.e., general education and courses outside of the major) may be more relevant for addressing the question of how interest–major congruence affects academic performance. Using a profile distance index rather than the profile correlation, other researchers have observed relationships with academic performance (Tracey & Robbins, 2006). Unlike the profile correlation, the profile distance index directly accounts for level differences between the person and the environment. Future studies should seek to determine whether level differences affect academic performance differently than similarity differences.

The findings for the 4-year sample support our hypothesis that the effects associated with certain sociodemographic characteristics persist beyond first-year academic performance. First-generation and male students not only performed worse academically in the first year, but they were also less likely to obtain a timely degree, net of the effects of first-year academic performance. This finding implies that postsecondary programs geared toward first-generation students should continue after the freshman year. In the 2-year sample, the estimated effects of being a first-generation student were similar, but were not statistically significant, perhaps due to the smaller sample size. Although African American students had lower first-year academic performance in the 4-year sample, the total effects of race/ethnicity on timely degree attainment were not significant in either sample.

Study Limitations

Limited sample size for 2-year institutions. We conducted separate analyses for students entering 15 four-year institutions and students entering 13 two-year institutions. We hypothesized that the factors affecting timely degree attainment would be the same for the two institutional settings. However, we observed some differences. Most notably, motivation had a significant total effect for the 4-year sample ($\beta = 0.274$) but not for the 2-year sample ($\beta = 0.007$). Because motivation was predictive of first-year academic performance in the 2-year sample ($\beta = 0.119$), this result is puzzling. We also observed greater model fit for the 4-year sample for both first-year academic performance and timely degree attainment, meaning that the outcomes were more predictable for the 4-year sample. This could be due to the fact that students who enter 2-year institutions are more likely to have life situations that may affect postsecondary success but that are not captured by our data set. Such situations may include parenthood and other family obligations, lateral classism (Liu et al., 2004), and diminished social capital. Our 2-year sample was much smaller ($n = 788$) than the 4-year sample ($n = 3,072$), which perhaps led to fewer significant results. Also, as all students in the 2-year sample took the ACT, which is not generally required for admission to 2-year institutions, the results may not generalize to all 2-year entrants nationwide.

Moderator effects not addressed. We did not test for possible moderator effects of gender, race/ethnicity, or first-generation status. However, it is possible that the effects of interest–major congruence, motivation, or academic performance vary across

student subgroups. Future research should address the degree that the results are invariant across student subgroups.

Reciprocal development of interests and motivation not addressed. Our study did not address the development processes of vocational interests, interest–major congruence, and motivation. Other work might suggest reciprocal development of vocational interests and motivation (e.g., interests affect motivation to attempt a task, and unsuccessful attempts may decrease interest in the task; Ackerman & Heggestad, 1997). Thus, counseling aimed at greater exploration of a student's academic major choices could also result in improvement in the student's motivation.

Our study design and the timelines of when data were collected did not permit us to examine the reciprocal development of motivation and interests. To examine this, it would be important to differentiate *individual* (i.e., enduring) and *situational* (i.e., emerging in response to the environment) interests (cf. Harackiewicz et al., 2008). Because our measures of vocational interests were obtained in Grade 11 or Grade 12, have shown to be relatively stable over time (Tracey & Robbins, 2005), and were not measured with respect to a particular environment, we view our measure of vocational interests (UNIACT scores) as measures of *individual* interest rather than of *situational* interest. We hypothesize that one's level of individual interest in a particular major affects their level of situational interest. This hypothesis can be addressed with future studies that incorporate the interest–major correlation as well as a direct measure of situational interest in major. It is also important to recognize that motivational skill is thought to be influenced by both motivational traits and task/environment conditions (Kanfer & Heggestad, 1997). Our measure of motivation was obtained at the onset of college; a later measure would better capture the level of motivational skill that emerges in response to the student's environment.

Summary

We found that students who are underprepared academically, poorly motivated, and whose vocational interests suggest a poor fit with their planned college major are all at greater risk to delay graduation. Future research needs to examine the effectiveness of different strategies of identifying and intervening with students who progress through the K–16 system underprepared academically, poorly motivated, or lacking college major or work plans that are congruent with their interests. These are issues that must be addressed earlier in the education pipeline, rather than waiting until postsecondary entry. While shedding some light on factors that affect timely degree attainment, we hope this study will encourage future research on what works in promoting postsecondary success across the education pipeline.

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Correction to Allen and Robbins (2010)

In the article "Effects of Interest–Major Congruence, Motivation, and Academic Performance on Timely Degree Attainment," by Jeff Allen and Steve Robbins (*Journal of Counseling Psychology*, 2010, Vol. 57, No. 1, pp. 23–35), the link to the supplemental material was incorrect. The correct link is http://dx.doi.org/10.1037/a0017267.supp

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