Individual Differences in Academic Growth: Do They Exist, and Can We Predict Them?

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College admissions tests predict college performance well, particularly first year grade point average (GPA; Kuncel, Hezlett, & Ones, 2001, 2004). However, noncognitive measures may add to the incremental validity of cognitive measures in that they will assess a broader range of college performance dimensions and reduce racial subgroup differences in performance. Beyond predicting first year GPA, no studies, to our knowledge, have addressed patterns of academic growth across time. This paper reports data that demonstrate individual differences in academic growth patterns and variables that predict them. Results indicate that noncognitive predictors add to the prediction of GPA beyond traditional college admissions tests for our sample of freshmen students. Implications for student affairs professionals are discussed.

The prediction of academic success in the college-student population has been of interest to researchers, practitioners, educators, or policymakers for over 75 years (Kent & Schreurs, 1928). For both high school and college institutions, knowledge of these factors can inform the development of curricular and extra-curricular programs, career counseling and training materials, and college-admissions criteria.

A great deal of research indicates that scores on standardized tests of ability, such as the SAT and the ACT, as well as past academic performance (generally measured by high school GPA and class rank) are the most valid predictors of success in college. When corrections for measurement unreliability and range restriction are taken into account, scores on standardized tests have demonstrated strong criterion-related validities with cumulative college GPA ($r \approx .45$) and correlations with high school GPA and rank (between $r \approx .44$ to .62; Hezlett et al., 2001). These appear to be currently the most used measures that determine college applicant selection decisions (Harackiewicz, Barron, Tauer, & Elliot, 2002).

Although scores on standardized tests and past academic performance have been found to be the most valid predictors of college achievement, there are problems associated with the use of these predictors. One review found that although these predictors are most valid, their combined average R^2 values are less than .25, which leaves much variance in college achievement unexplained (Mouw & Khanna, 1993). Furthermore, some have noted that average correlations across colleges vary from year to year (Willingham, Lewis, Morgan, & Ramist, 1990), though some of this variability may actually be a function of various types of statistical error (Hezlett et al., 2001). Moreover, for some minority subgroups, such as Black and Hispanic subgroups, performance on these traditional cognitively based predictors has tended to be substantially lower than that of Whites, leading to lower selection rates for these groups (Sackett, Schmitt, Ellingson, & Kabin, 2001).

Although there exists a large body of

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literature on the prediction of college success using both traditional (e.g., SAT, ACT, and GPA) and nontraditional predictors (e.g., personality and self-concept), very few of these studies have examined how predictors relate to patterns of outcomes over time (Farsides & Woodfield, 2003). A vast number of studies have defined academic success primarily in terms of college GPA, and of those studies, the majority focus on first year GPA (Hughes & Douzenis, 1986; Kanoy, Wester, & Latta, 1989; Mouw & Khanna, 1993; Pettijohn, 1995; Ting & Robinson, 1998; Young & Sowa, 1992).

However, a few notable studies investigate longer-term success. For instance, Boyer and Sedlacek (1988) examined how the Non-Cognitive Questionnaire (NCQ) predicted the GPA of international students over the course of two years, finding that self-confidence and availability of a strong support system predicted GPA for all eight semesters examined, but other variables such as self-appraisal were predictive of GPA for only a few semesters. Rubin, Graham, and Mignerey (1990) examined how college students' communication competence related to fourth year GPA, discovering that college student participants tended to decrease in communication competence during their sophomore year of college and increase in competence from their junior to senior year. Harackiewicz et al. (2002) investigated how achievement goals and ability functioned as predictors of early success in college and over the long term. Although their findings indicated that ability and prior performance measures predicted all outcomes both early and later, the predictive validity of the achievement goals differed depending on the outcome being predicted. These studies provide evidence for change over time in students' levels of success along different dimensions, and they also show that predictors of success vary over time in their predictive power.

Even among those studies that have viewed college success longitudinally, none have addressed whether there are individual differences in growth patterns of measured success and whether such differences could be predicted. This is of interest because it would indicate (a) whether individuals achieve academic growth differently and (b) whether certain variables predict consistent patterns of change. To our knowledge, no such work on this topic has been conducted in the educational domain, though some related work in the applied psychology domain has focused on predicting such patterns of change with the use of latent growth modeling, or LGM (e.g. Chan & Schmitt, 2000; Lance, Vandenberg, & Self, 2000). These studies demonstrate the usefulness of LGM techniques for predicting individual differences in patterns of intra-individual growth over time. The current study also uses LGM to understand differences between students regarding longitudinal changes in their levels of academic development and college success. In determining which factors might predict differences in how students develop academically, we first considered work on the dimensionality of student performance.

Oswald, Schmitt, Kim, Ramsay, & Gillespie (2004) developed and investigated various dimensions of student performance in order to determine what dimensions of performance universities felt were important and were seeking to develop in their students. Identifying specific college performance dimensions allows researchers to measure the broad domain of college student performance more completely and to develop more targeted predictors of specific aspects of performance. By examining the websites of several universities and focusing their attention on the

information related to stated educational objectives or mission statements of the university, they finalized a list of twelve dimensions of college performance. These dimensions were (a) knowledge and general skills, (b) continuous learning, (c) artistic appreciation, (d) multicultural appreciation, (e) leadership, (f) interpersonal skills, (g) social responsibility/citizenship, (h) physical/psychological health, (i) career orientation, (j) adaptability, (k) perseverance, and (l) ethics/integrity. Noncognitive measures (biographical data and situational judgment tests) were then constructed as potential predictors of each of these dimensions. From these 12 dimensions, 5 were selected that we felt were most relevant to the prediction of academic *growth* in college *over time*: knowledge and general skills, continuous learning, perseverance, adaptability, and interpersonal skills. We did not feel a priori that other dimensions, such as artistic and multicultural appreciation, leadership, social responsibility, and ethics, would have as great of an impact on change in academic performance over time, as measured by GPA, because they are not as directly related to academic performance and learning in a classroom context.

Knowledge, learning, and mastery of general principles involves gaining knowledge and understanding how ideas, theories, and facts interrelate. Of all the dimensions, this is closest to what might be considered the primary academic objective of educational institutions. Therefore, past evidence of success on this dimension should predict future college academic success.

Continuous learning deals with actively seeking new information and skills in various areas and being intellectually curious (Oswald et al., 2004). Personality constructs similar to continuous learning, such as openness to experience, have demonstrated positive relations with academic achievement (De Fruyt & Mervielde, 1996; Farsides & Woodfield, 2003; Rothstein, Paunonen, Rush, & King, 1994). However, compared with these other personality constructs, continuous learning appears to have greater face validity and may be more directly related to learning-based outcomes. For instance, according to Harackiewicz et al. (2002), when an individual has a mastery goal orientation toward learning, learning is intrinsically rewarding. Thus, a mastery student's "purpose is to develop competence by acquiring new knowledge and skills" (p. 562), which is very similar to having an orientation toward continuous learning.

Perseverance involves being committed to one's goals and priorities despite obstacles that may potentially interfere. Willingham (1985) found that one of the qualities that added to the prediction of college success, over and above entrance exams and high school GPA, was persistent effort or follow-through—essentially perseverance. Ridgell and Lounsbury (2004) found that work drive, which involves the motivation to finish projects and meet deadlines, predicted course grades and GPA for undergraduates. Perseverance also involves putting continual effort into something even though it may be difficult or challenging. Kanoy et al. (1989) found that one of the noncognitive variables that added significantly to the prediction of freshman-year GPA for college women was the amount of effort put into work.

Major aspects of *adaptability* include being flexible and capable of dealing with sudden change and novel problems. Research has shown that students' confidence in their ability to deal with the demands of college correlates positively with their success in college (Fuertes, Sedlacek, & Liu, 1994). Adaptability also involves knowing how one relates to the context of a situation in order to determine

appropriate and effective ways to deal with it. Boyer and Sedlacek (1988) found that realistic self-appraisal was predictive of academic success in college for Black and White students and international students in the U.S., whereas Ting (2000) found it predicted first year GPA for Asian-American students.

Having good *interpersonal skills* means communicating well with others and understanding the social dynamics of a situation. Rubin et al. (1990) reported that those college students who had less anxiety about communicating were viewed as more competent in their interpersonal communications by others and had higher fourth year GPAs. Guay, Boivin, and Hodges (1999), in a study of school-age children, found that positive peer relations led to an increase in academic achievement. Furthermore, the construct of interpersonal skills is similar to personality constructs such as agreeableness, which has already been shown to positively predict academic achievement in college (Farsides & Woodfield, 2003).

Based on the above arguments, we propose the following:

> *Hypothesis 1*: Knowledge and mastery of general principles will predict *initial status* of individuals (individual intercepts), after controlling for traditional measures such as the SAT and ACT.
>
> *Hypothesis 2:* The four dimensions of continuous learning, perseverance, adaptability and interpersonal skills will predict individual differences in academic growth trajectories (individual slopes).

METHOD

Participants

Data were collected from a sample of 644 freshman undergraduate students from a large Midwestern university the spring semester of their first year. Students volunteered for the study and received $40 for their participation. Students were recruited through their classes and housing units, and through advertisements in the student newspaper. Data were originally collected for a related validation project (Oswald et al., 2004). Mean age was 18.5 years (*SD* = .69). Seventy-three percent were females. Seventy-eight percent of the participants were White, 9.5% were Black, 5.3% were Asian, 1.9% were Hispanic American, and 4.5% were from other ethnic groups. This was nearly identical to the racial/ethnic composition of the university which was 77.3% White, 9.8% Black, 1.9% Hispanic American, 5.3% Asian, and 5.6% other. However, although an effort was made to recruit a representative sample, females were over-represented in the sample, as only 55% of the university's freshmen population was female. Of the original sample, 537 participants (83%) provided usable data for the current study. Most missing data were due to the fact that students dropped out of college and grades for all four semesters examined were unavailable.

Design and Procedure

A biodata measure was administered during the spring semester of participants' first year in college. At this time, participants also provided permission to obtain their GPA from the university registrar's office over the course of two years, as well as standardized test scores.

Measures

Standardized Test Scores. Standardized scores on the SAT and ACT served as an index of cognitive ability. For those students who took both tests (n = 124) these scores were first standardized and then combined because of their high correlation (r = .85).

Biodata. A 49-item biodata, or bio-

graphical data measure, developed by Oswald et al. (2004), was used as a measure of the five dimensions of college success. Biographical data measures operate under the assumption that the best predictor of future behavior is past behavior. Thus, biodata measures attempt to capture classes of behaviors individuals have demonstrated in the past or types of experiences in which individuals have participated in the past to predict future outcomes. There are several advantages to the use of biodata measures. Biodata measures tend to possess high criterion-related validities, can be developed to measure different aspects of behavior with relatively low intercorrelations, and finally, provide a targeted view of an individual's background (Owens & Schoenfeldt, 1979).

The Oswald et al. (2004) biodata measure used in this study presented participants with a list of behaviors that they could have engaged in during high school or college. Items on the biodata measure were gleaned from various pre-existing biodata measures as well as rationally derived based on the 12 dimensions of college performance identified. Response options were tailored to reflect the college context, and the response scales were also pilot tested on a group of undergraduate students who provided information on appropriate ranges for responses based on the college context. Validities of the biodata measure ranged from .22 (knowledge) to .04 (interpersonal skills) with first year GPA, with validities of .21 for adaptability and .16 for perseverance. Perseverance and knowledge were also significantly negatively related to absenteeism (–.21, –.19, respectively, $p < .05$), and several other dimensions including knowledge, interpersonal skills, and perseverance were significantly positively related to peer ratings of the dimensions (for more details on the creation of the biographical data measure as well as validation results with various outcomes readers are referred to Oswald et al.).

An example of a biodata item used to measure knowledge and general principles is, "Think about the last several times you have had to learn new facts or concepts about something. How much did you tend to learn?" and for continuous learning, "In the past month, how many times did you go out and learn something simply because it seemed interesting?" The respondent was then asked to indicate how often, how many times, or to what extent they had participated in these behaviors in the past. For example, for the knowledge item just presented, the participant was asked to indicate if he tended to learn (a) usually not enough, (b) sometimes not enough, (c) just what is needed, (d) a little more than what is needed, or (e) much more than what is needed; for the continuous learning item respondents indicated whether they researched a topic that interested them never, once, twice, three or four times, or five or more times. Participants were asked to reference behaviors they demonstrated in high school when answering biodata questions, because they were freshmen in their first semester and had not had the opportunity to engage in many behaviors during college. Generally, more frequent occurrence of a behavior resulted in higher scores on the dimension the behavior was representing.

GPA. Academic success was indexed by grade point average (GPA). Specifically, fall and spring semester GPAs for participants' freshmen and sophomore years were collected from the university registrar's office, resulting in four measurement occasions over time.

Data Analysis

LGM analysis "involves identifying an appropriate growth curve form that accurately and

parsimoniously describes intraindividual change over time (at the aggregate level of analysis) and allows the examination of interindividual differences in the parameters (intercept and slope) that control the pattern of intraindividual change over time (at the individual level of analysis)" (Chan & Schmitt, 2000, p. 195). For the purposes of our study, the intercept and slope estimate first-semester GPA and rate of change in GPA, respectively.

The intercept factor in LGM contains information about the mean and variance of individual intercepts (i.e., initial status on GPA) from each individual's growth curve. Similarly, the slope factor in LGM contains information about the mean and variance of the set of individual slopes from each individual's growth curve. LGM examines the covariance of these parameters as well as the relations of these parameters to individual difference predictor variables. This allows one to draw conclusions about whether the variable of interest across time changes similarly for all individuals, or whether there are significant differences in the rate of change or change trajectory of the variable across individuals (i.e., whether types of individuals exist) and what factors correlate with these differences (i.e., what might in part predict these types; Lance et al., 2000).

All LGM analyses were conducted using the LISREL 8.5 program. The basic latent growth model without predictors was used initially to represent change in GPA across time and to determine the presence of interindividual differences in both the slope and intercept of GPA. Next, models including the predictors were evaluated to test our two basic hypotheses. Using information from these models we tested a set of substantively reasonable alternative models.

In order to assess model fit, four common fit indices, the non-normed fit index (NNFI), the comparative fit index (CFI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA) were used. Values for the NNFI and CFI of .90 or greater indicate good model fit, whereas values for the SRMR of greater than .10 and for the RMSEA of greater than .08 are considered indicators of poor fit (Cudeck & Browne, 1983). Normal theory weighted least squares chi-square values were used as general indicators of model fit and to assess incremental change in model fit when models were nested.

RESULTS

Table 1 presents descriptive statistics, reliabilities, and intercorrelations of scores on all measures for our sample. As is evident in this table, the rank order of students' GPA over time is relatively stable with slightly decreasing correlations as the time interval between student performance measures increased. The biodata knowledge dimension showed the strongest relationship with the GPA measures. The internal consistency reliabilities of two of the individual biodata dimensions, the adaptability and interpersonal skills dimensions, were relatively low, which may restrict the strength of some of the findings presented below.

The basic growth model without predictors was tested first. We compared the fit of linear, quadratic, and unspecified two-factor models to the changes in GPA over time. A linear trajectory would indicate steady growth, decline, or a flat line with neither growth nor decline in academic performance over time. A quadratic model would indicate that students' performance does not increase or decrease in a constant, linear fashion but, instead, increases or decreases differentially across time, the exact nature of the change being determined by the parabola shape.

In order to determine the exact nature of change in student performance over time, several models were examined. A monotonically increasing linear model was examined based on the rationale that students should steadily increase in performance during the first two years of college as they adjust to the challenges of college and over time develop successful ways to adapt. In order to examine the applicability of a contrasting theory, the sophomore slump theory, which states that college students pass through a period of self-doubt and anxiety during their sophomore year in college, which often results in declining performance, we tested a linear model that contained an initial upward and then subsequent downward trajectory. An unspecified model was also tested to determine whether the data indicated an alternative pattern of results. Finally, a positively increasing quadratic model was tested based on the rationale that students mean initial increase in performance is gradual but becomes more accelerated as they are able to more effectively deal with the demands of college due to their increased familiarity with college experiences.

The linear model was specified by fixing the slope factor loadings of the four time points to 0, 1, 2, and 3 respectively. These time points represent fall and spring semesters of the participants' freshman and sophomore years. The slump model was specified by fixing factor loadings to 0, 1, –1, and 0, specifying an initial upward, then downward trajectory. For the quadratic model, loadings were fixed at 0, 1, 4, and 9, as specified by Chan (2002). The unspecified two-factor model was fitted by fixing the slope factor loadings of the first

TABLE 1.
Descriptive Statistics, Reliabilities, and Intercorrelations

	Mean	*SD*	1	2	3	4	5	6	7	8	9	10
1. Bio–Know	0.00	0.53	*0.72*									
2. Bio–Learn	0.00	0.53	0.53	*0.67*								
3. Bio–Person	0.00	0.41	0.24	0.21	*0.47*							
4. Bio–Adapt	0.03	0.52	0.32	0.26	0.39	*0.58*						
5. Bio–Persevere	0.01	0.53	0.55	0.37	0.29	0.37	*0.63*					
6. GPA F01	3.10	0.63	0.17	–0.01	0.01	0.18	0.13	1.00				
7. GPA S02	3.04	0.71	0.25	0.07	0.04	0.17	0.18	0.65	1.00			
8. GPA F02	3.15	0.61	0.12	–0.07	0.05	0.06	0.09	0.50	0.59	1.00		
9. GPA S03	3.03	0.77	0.11	–0.05	0.03	0.04	0.09	0.48	0.54	0.60	1.00	
10. SAT/ACT	0.58	0.67	0.08	0.02	–0.07	0.03	–0.11	0.30	0.28	0.26	0.24	1.00

Notes. Correlations of .08 or above are statistically significant at $p < .05$; those above .12 are statistically significant at $p < .01$. Numbers on the diagonal are coefficient alpha estimates of reliability. The reliability of GPA and SAT/ACT measures were assumed to be 1.00 as we had no means of assessing their reliability in this research study. Bio = biodata scales, Know = Knowledge, Learn = Continuous Learning, Person = Interpersonal Skills, Adapt = Adaptability, Persevere = Perseverance, GPA = grade point average. F01 = Fall 2001, S02 = Spring 2002, FS02 = Fall 2002, S03 = Spring 2003, and SAT/ACT = average of the available SAT and ACT scores.

TABLE 2.

Tests of Linear, Quadratic, and Unspecified Two-factor Models of Change in GPA

Model	*df*	χ^2	Model Comparison	$\Delta\chi^2$	Δ *df*	NNFI	CFI	SRMR	RMSEA
1. Linear	5	14.16				0.99	0.99	0.03	0.06
2. Quadratic	5	16.56				0.98	0.98	0.05	0.07
3. Unspecified Two Factor	3	3.85	3 versus 1	7.23*	2	1.00	1.00	0.01	0.02
4. Slump Model	5	40.08				0.95	0.96	0.05	0.11

Note. NNFI = non-normed fit index, CFI = comparative fit index, SRMR = standardized root mean square residual, RMSEA = root mean square error of approximation.

*$p < .05$.

two time points at 0 and 1, respectively, and freely estimating values for the other two time points. The latent slope and intercept were allowed to covary in all models. Table 2 presents fit values for each model. Given various considerations, including chi-square estimates and fit indices, the linear model provided the best fit to the data. When the unspecified two-factor model was fitted, there were inappropriate estimated values for several of the parameters. There were multiple correlation values over 1.00, and negative variance associated with some of the estimates. This may have been due to the high degree of multicollinearity between the variables and/or the lack of identification of parts of this model. Thus, this model was uninterpretable. Significance of the differences in fit between the quadratic and linear models could not be tested because they were not nested within each other, but in an absolute sense, based on various fit indices, the quadratic model fit the data less well than did the linear model ($\chi^2 = 16.56$, $df = 5$). The same was true for the slump model ($\chi^2 = 40.08$, $df = 5$), which fit even less well than the quadratic model.

Figure 1 presents the standardized parameter estimates of the linear model. The intercept variance estimate of this model indicated that variances in initial status of each individual on academic success were significantly different from zero. Thus, as expected, individuals who entered college varied on their initial academic success. The variance estimate for slope was also significant, indicating that there were statistically significant differences in the rates of change of academic success across individuals. The model specifying a positive, linear slope provided the best fit, signifying that on the whole, students may steadily increase in academic growth in college over time, although this interpretation should be tempered by the fact that the slope estimate itself was almost zero (0.00), indicating little growth in performance.

The next step was to enter the predictors into the model to test our two hypotheses (see Figure 2). These included the dimensions of knowledge, continuous learning, adaptability, perseverance, and interpersonal skills, as well as SAT/ACT scores. Knowledge and SAT/ACT scores were entered as predictors of

individual intercepts, whereas the other variables were entered as predictors of individual slopes. Out of the five dimensions of college success, knowledge is the dimension most related to past academic experiences, such as high school performance, as at its core, it has to do with the acquisition of knowledge and skills and that is why it was hypothesized to predict individuals' intercepts, or initial academic performance. The other four dimensions, on the other hand, are thought to be more likely to influence the course of development or change of an individual related to performance, especially when encountered with challenges and obstacles, and that is why they were hypothesized to predict individuals' slopes, or rates of change. The model with the aforementioned predictors fit the data quite well (χ^2 = 51.93, *df* = 21, $p < .01$; NNFI = .95; CFI = .98; RMSEA = .05; SRMR = .04).

Hypothesis 1. Hypothesis 1 stated that the dimension of knowledge of general principles would predict initial status on success above and beyond average cognitive ability, as indexed by SAT and ACT test scores. Results demonstrate that SAT/ACT scores was a significant predictor of initial status ($\lambda = .33$, $p < .05$). Thus, those students who had higher SAT/ACT scores coming into college tended to be more successful in college initially than those with lower scores. In addition, the biodata measure of knowledge of general principles also predicted initial success above and beyond average cognitive ability ($\lambda = .20$, $p < .05$). Thus, Hypothesis 1 was supported.

Hypothesis 2. The second hypothesis stated that the dimensions of continuous learning, adaptability, interpersonal skills, and perseverance would predict rate of change in academic success over time. Of these dimensions, only continuous learning ($\gamma = -.20$, $p < .05$) and adaptability ($\gamma = -.13$, $p < .05$) significantly predicted rate of change. Thus, Hypothesis 2 was not fully supported. How-

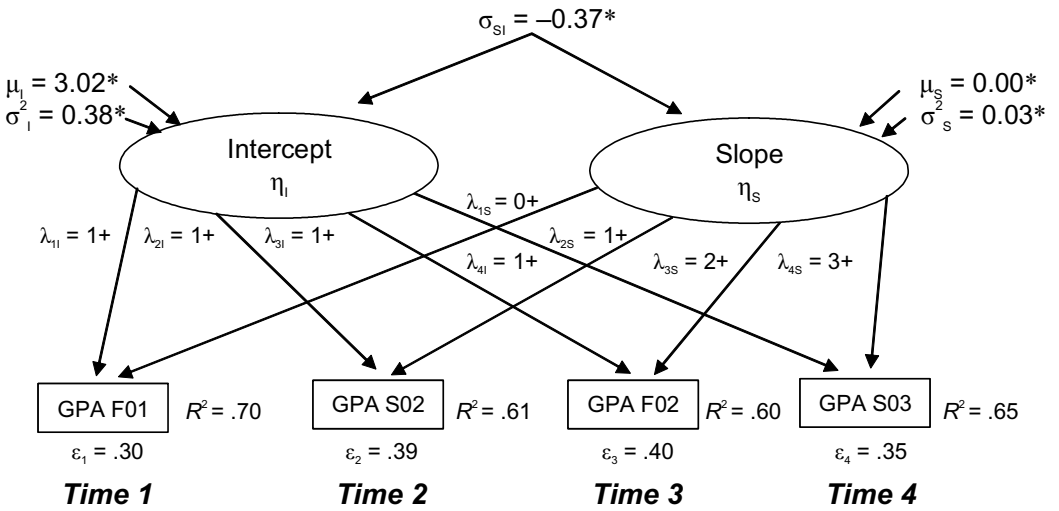

FIGURE 1. Linear Trajectory Growth Model for GPA Over Four Semesters

Notes. A parameter value with a plus sign indicates that the parameter is fixed at that value. All values are standardized with the exception of slope and intercept mean and variance estimates.

*$p < .05$.

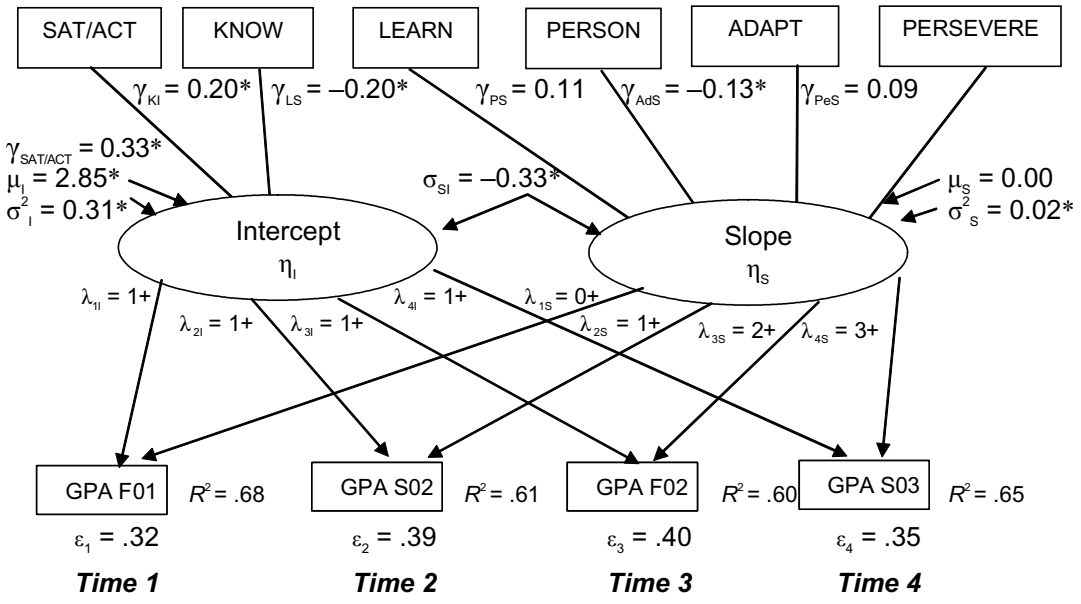

FIGURE 2. Growth Model With Predictors

Notes. A parameter value with a plus sign indicates that the parameter is fixed at that value. I = intercept, S = slope, Know = Knowledge, Learn = Continuous Learning, Person = Interpersonal Skills, Adapt = Adaptability, Persevere = Perseverance, SAT/ACT = average of the available SAT and ACT scores. All values are standardized with the exception of slope and intercept mean and variance estimates.

*$p < .05$.

ever, the relationship of the biodata measure of continuous learning and adaptability to the slope of GPA was negative, not positive. Additional analyses on the continuous learning dimension indicated that persons whose grades portrayed a downward trajectory over time actually reported engaging in greater numbers of continuous learning experiences. These findings contradict our original hypotheses, and our discussion section provides possible explanations for these findings.

The correlation between the intercept and slope factors in this model was slightly negative ($r = –.33$), indicating that students whose initial GPA was highest had the smallest additional increase in GPA across the four semesters considered. This is not unexpected given that those students with the best grades often cannot improve further.

DISCUSSION

The main purpose of the current study was to examine college students' academic growth over time and determine what factors, other than traditional standardized test scores, predicted growth. Traditionally, studies that have examined academic success, and what predicts success, have been cross-sectional in nature, often using only first-year college GPA as an indicator of academic success (Hughes & Douzenis, 1986; Kanoy et al., 1989; Mouw & Khanna, 1993; Payne, Rapley, & Wells, 1990). This paper is one of a handful of studies that has attempted to examine academic success longitudinally and the only study that these authors are aware of that uses LGM

techniques to analyze and describe academic growth over time.

Findings from the current study indicate that students differ significantly both in their rate of academic growth over time, and in how they perform when first entering college. There is, however, more variation to explain in students' initial performance ($\sigma^2_I = .38$, $p < .05$) than there is to explain in their rate of change over time ($\sigma^2_S = .03$, $p < .05$). The model employed did account for a greater amount of the variance in intercept (16%) than in slope (6%). Similar to previous research (e.g., Pettijohn, 1995) we found that students' initial performance was predicted by standardized ability test scores. However, in addition to cognitive ability, students' skill in gaining knowledge and mastery of general principles predicted their initial academic success. In fact, students' reports of biographical experiences related to acquiring knowledge predicted their initial academic performance above and beyond their measured average cognitive ability.

In addition to interindividual differences in initial status, differences in the rate of academic growth over time were also predicted by two college performance dimensions: continuous learning and adaptability. The continuous learning dimension of college performance predicted slope, so that generally, students scoring higher on this dimension performed better academically overall than those who scored lower. However, the performance of students who were intellectually curious and actively sought new knowledge and skills, both in and outside their core area of study, actually decreased over time. This unexpected finding may mean that students with a high interest in continuous learning do not focus on achieving high grades. Instead they are more interested in more general mastery learning (e.g., Harackiewicz et al., 2002) and are content to get lower grades if this interferes in the pursuit of the knowledge or skills in which they are most keenly interested. Another possible explanation is that students with high scores on the continuous learning measure are the best students and their grades cannot be improved as much as less able students; this would be similar to the "ceiling effect" evidenced by the negative correlation between the slope and intercept factor noted above. This possibility indirectly addresses one potential limitation of our study and that is the use of grades as an index of student growth. Willingham, Pollack, and Lewis (2002) have shown that grades have multiple determinants including the types of courses one takes, grading variations and unreliability, and a construct they label "scholastic engagement." Future work on academic growth may benefit from the inclusion of more sensitive or meaningful measures of growth.

The adaptability dimension was also found to negatively predict rate of academic growth over time, contrary to our expectations. Although adaptability was not negatively correlated with GPA at any of the four time points ($r = .18$, $p < .01$; $r = .17$, $p < .01$, $r = .06$, n.s.; $r = .04$, n.s., respectively), results seemed to indicate that those who most successfully dealt with sudden and novel problems and change were the ones whose performance decreased over time, whereas those who could not deal as well with change actually improved in their performance. A possible explanation is that those who score low on adaptability have the hardest time adjusting initially, the period when one could argue, there is the greatest amount of sudden change and novel experiences, and adaptability is the most crucial for good adjustment and performance. Therefore, these individuals do very poorly initially, when they most need to

avail of their adaptability skills, and improve later on, when adaptability no longer becomes as important for adjustment. Those individuals who score high on adaptability, however, have very little problem adjusting to the new surroundings initially and therefore perform very well, and thus do not have much more room for growth. This argument is discussed further in the limitations section.

The relevance of these dimensions of college performance to predicting academic success and growth in college underscores the usefulness of including noncognitive factors in determining students' future academic development and success. There has been an increased interest in recent times both in the popular media (Capuzzi-Simon, 2004) and in academic circles (Oswald et al., 2004) for a more holistic approach to the process of selecting and admitting students into universities. This study demonstrates that factors other than traditional standardized test scores can be valid in predicting not only who will tend to do well in college initially but also who will be more likely to grow academically over time.

In addition to realizing incremental validity, another advantage of the use of noncognitive predictors in college admissions is a potential reduction in mean subgroup differences by race or ethnicity. In contrast, the use of standardized tests such as the SAT or ACT often produces large subgroup mean differences (Sackett, Schmitt, Ellingson, & Kabin, 2001). Oswald et al.'s (2004) biodata measure, however, resulted in much smaller racial subgroup mean differences than were found for both standardized tests and college GPA. Black–White subgroup differences for the five dimensions included in this study ranged from $d = -0.18$ for interpersonal skills to $d = .01$ for continuous learning (positive values indicate Blacks scored higher whereas negative values indicated Whites scored higher). By comparison, the standardized Black–White subgroup difference for SAT/ACT scores was –1.22 whereas the d-value for GPA was –1.09 (Oswald et al.). Consequently, using certain noncognitive predictors in addition to standardized test scores for selection can help to reduce adverse impact to some extent.

These results are not only useful for college admission officers involved in selection, but it can also inform the practices of higher education student affairs practitioners. Once skills that are useful for academic achievement and growth can be identified, college advisors can focus much of their preparatory and developmental advising around the improvement of these skills. For example, the results of this study showed the dimension of knowledge, learning, and mastery of general principles predicted initial student success above and beyond ACT/SAT score. College advisors could serve as liaisons to high schools and communicate the importance of developing this dimension to students, not for the purposes of recruiting but for the purposes of preparing the students for college (Paul & Blank, 1983). This is especially important now that more and more high school graduates are enrolling in college due to an increased demand by employers for a college education (Carnevale & Desrochers, 2003). Alternatively, this could also be done as a part of the socialization/orientation process once a high school student has accepted admission into a college but has not yet begun classes. College advisors could encourage high school students to engage in activities such as challenging games that require individuals to exercise their ability to learn the details involved with complicated rules and also the general principles involved in developing strategy, an essential aspect of the knowledge dimension.

They could also suggest students take some time out to learn all they can about at least one topic they are interested in, in order to help them develop the skill of learning how to master a topic through conducting research and going beyond basic class information.

In addition to preparing prospective students for college, a focus on certain dimensions of college performance could be used in the development of students once they enter college. Our results showed that the dimensions of adaptability and perseverance were positively correlated with GPA for the first year of college, indicating that the development of these skills are especially crucial during the initial turbulent period of entry into college. Freshman seminars are offered at many universities and have been used effectively as tools to prepare students for college life (Howard & Jones, 2000). Perhaps in addition to information about campus resources, students could be given measures of their levels on several dimensions of college performance, including adaptability and perseverance. Information on how to develop these dimensions could be offered either universally to all students, or an effort could be made to identify those students who score especially low on these measures. The students selected could then be offered additional workshops or advising sessions to help them develop these dimensions.

Finally, the importance of providing students with a holistic education and encouraging the development of noncognitive skills has been stressed, especially in terms of its effects on students' identity formation (Baxter-Magolda, 2003; Boyd, Hunt, Kandell, & Lucas, 2003). Although this is partly accomplished through curriculum, another way for student affairs professionals to advance this development throughout students' college careers is to incorporate it as part of academic advising, counseling, or learning skills instruction programs. Studies have shown that students' levels of satisfaction with student affairs services have the potential to affect how they rate their college overall, their learning outcomes, and even retention (Consolvo, 2002; Graham & Gisi, 2000). Therefore, incorporating more noncognitive skills developmental programs into student affairs services can not only further the growth and identity of students but it can possibly have the added benefit of increasing students' overall satisfaction with the university.

An interesting finding of our study from a development and growth perspective concerned the nature of the students' academic growth trajectories. It is commonly believed that after completing their first year in college, many students enter a period of time where they no longer feel confident in themselves, where they feel isolated from others, and where they turn to introspection (Margolis, 1976). This period is commonly known as the "sophomore slump," and it is characterized by, among other things, a significant decline in academic performance. Our results, however, do not support this commonly held belief. Instead our data support a rather flat growth trajectory for students during their first two years of college, indicated by a slope that is very close to zero. However, because there is a significant amount of variation in slope, this indicates that some students may have followed this sophomore slump pattern. Nevertheless, results from an analysis of a simulated "slump model" also indicated that this model does not accurately reflect the nature of students' growth overall. Consequently, although the notion of the sophomore slump may hold for some students in our sample, the patterns of academic growth indicate that the majority of students are not victims of this phenomenon.

LIMITATIONS AND FUTURE WORK

Although continuous learning and adaptability predicted academic growth, the other two dimensions hypothesized to predict growth did not. This may be due to the time frame in which these measures were taken. It is possible that certain dimensions are more relevant to success at certain times than at other times, and therefore, do not demonstrate significant predictive capability for change across all four semesters in the first two years of college. In fact, student developmental theory recognizes that there are certain time periods in students' lives when they become ready to respond to learning experiences and to cyclical and qualitative changes with which they are confronted (Terenzini, 1994). Thus, although students may be ready to deal with certain experiences when they enter college, this readiness will not express itself in their behavior until they are presented with those experiences at a certain point in time. In addition, at a later point in time, if they no longer have to deal with those experiences, their readiness may no longer be expressed in their behavior and the outcomes resulting from their behavior.

Several studies have obtained findings that are consistent with this notion of certain characteristics affecting student learning outcomes at different points in time. For example, Cooper, Healy, and Simpson (1994) found that college students' involvement in student organizations positively affected their life management skills the first year but positively affected a much wider variety of their life activities by their third year. Similarly, Pascarella, Palmer, Moye, and Pierson (2001) found that students' participation in various diversity experiences positively affected their critical thinking skills, but that these experiences had differential effects on critical thinking skills at different points during the students' college tenure. Boyer and Sedlacek (1988) found that the predictive capability of the variables they examined differed depending on what time period was being examined. Huang and Chang (2004) also argue, based on adult developmental theory, that participation in extracurricular activities will affect college student growth and academic development towards the latter half of a college student's career but will not markedly affect growth during the initial two years.

Indeed, when examining correlations between our biodata measure of adaptability and GPA over four semesters, we found that adaptability was significantly moderately correlated with GPA over the first two semesters ($r = .18$, $p < .01$; $r = .17$, $p < .01$, respectively) but was no longer significantly related to GPA during semesters 3 and 4 ($r = .06$, n.s.; $r = .04$, n.s., respectively). Considering that adaptability is most crucial to adjustment and success in times of initial major change, such as the first year of college, this finding is not surprising. After the first year, students presumably have adjusted to their surroundings and adaptability may no longer play as large a role in academic success. The biodata measure of perseverance follows a similar pattern. Although, unlike adaptability, it does not lose its significant correlation with GPA the last two semesters, its correlation with GPA does decrease from the first two semesters to the second two semesters ($r = .13$, $p < .01$; $r = .18$, $p < .01$; $r = .09$, $p < .05$; $r = .09$, $p < .05$, respectively). Again, this may be due to the fact that perseverance is most important in times of great struggle and difficulty and thus would be more vital to academic success during periods of adjustment and uncertainty. On the whole, this may be more characteristic of the first year than the second year of college.

Another limitation of the current study

was the duration of the time frame in which the measures were taken. Although this study did examine the prediction of academic growth over a period of two years, which is longer than many other studies have done in the academic and psychological literature (Hughes & Douzenis, 1986; Kanoy et al., 1989), this accounts for only half of most students' college careers. Different patterns of relationships between the dimensions of college performance and academic growth could be revealed through studies of longer duration. As mentioned previously, researchers have found that how variables relate to academic success can change over time (Boyer & Sedlacek, 1988; Harackiewicz et al., 2002). Therefore, future research should examine how noncognitive variables, such as the dimensions of college performance, relate to rate of academic growth over a student's entire college career.

A limitation related to the method by which data were collected in this study involves the sample used. Although it would be ideal to use high school seniors as a sample in the study, because this would be the population on whom measures relating to the prediction of college achievement would be most useful and most likely to be used, our circumstances did not allow this predictive approach. Therefore, the dimension scores of the college freshmen students in our sample may not necessarily correspond to the dimension scores they would have received had they taken the measures while they were still seniors in high school. However, all the items in the measure did ask respondents to answer according to their behavior and experiences when in high school, which may have helped to eliminate some of the problems associated with using an older sample.

The sample we used was limited due to the fact that only those students who had GPA values for all four semesters were included in the study, and therefore, those people who dropped out of school within the first two years of college were not included. We conducted an analysis of those students who were excluded based on lack of GPA information in order to determine if there were any noticeable differences between this set of students and those included in our sample. In terms of demographics, there appeared to be no significant difference in gender, years in school, citizenship status, and English fluency between the excluded sample and the experimental sample. There were small differences in age and ethnic composition, however, the differences between the groups on these demographics were not so large that we feel they would alter the interpretation of our results in any significant way.

Finally, the criterion used to measure achievement, undergraduate GPA, is limited in its ability to capture the full domain of college success and is vulnerable to the effects of error due to grade inflation. As mentioned in the introduction to this paper as well as by reference to the Willingham et al. (2002) work above, research on college mission statements has revealed that the majority of institutions seek to develop skills in their students other than simply the ability to acquire knowledge and apply it (Oswald et al., 2004). Characteristics such as social responsibility, leadership, ethics, and multicultural tolerance are cited by colleges as important outcomes they wish to develop in students (The Chronicle of Higher Education, 2003). Insight can be gained from looking at research done in the high school domain, where achievement and success have been defined by various outcomes other than grades, including educational plans, self-conceptions of academic competence, intellectual orientation, coursework selection, and eventual educational attainment (Alexan-

der & McDill, 1976; Marsh & Kleitman, 2003). Even in the domain of graduate work, criteria for success are being expanded to include non-grade based outcomes including degree attainment, research productivity, and faculty ratings (Kuncel, Hezlett, & Ones, 2001). Thus, conceptualizations of appropriate criteria for success in college should be expanded to include factors other than grade-based outcomes, and future research should be aimed at testing and refining these outcomes.

Another potential limitation to the use of GPA as a criterion for college student success is the error in GPA due to grade inflation. Grade inflation can lead to a restriction of variance in GPA, which results in the performance of many students being equated, making it difficult to differentiate among students (Kfir, Fresko, & Benjamin-Paul, 2002). In addition, it reduces the construct validity of GPA, which no longer represents an index of true learning and achievement, as well as its reliability. Thus, grade inflation can lead to attenuated or inflated validity estimates for predictor variables of achievement as measured by GPA (Olivares, 2002). However, the degree of pervasiveness of grade inflation and whether it has a notable impact on the reliability of GPA is still being debated, with some claiming it has no marked effect (Kwon, Kendig, & Bae, 1997; Millman, Slovacek, Kulick, & Mitchell, 1983), others claiming that it does (Kfir et al.; Weller, 1984), and still others claiming that it does only under some conditions (Kuh & Hu, 1999). Nevertheless, the effect of grade inflation on the predictive validity of noncognitive variables for achievement should be researched further.

CONCLUSION

The primary objective of the current study was to examine how certain dimensions of college performance related to both students' initial academic success in college and their rate of academic growth over time using latent growth modeling techniques. Our findings indicate that students differ in the rate at which they grow academically over time in college as well as in their initial performance in college and that these differences can be predicted. Researchers should explore further whether other noncognitive variables relate to academic success and how these variables relate over time. These variables, if found to be valid, could be measured prior to college entrance and supplement the use of SAT or ACT scores and high school GPA criteria in the selection of college students. More studies should examine academic growth longitudinally in order to determine whether a positive linear model provides the best representation of academic growth over all four years of college and whether differences in growth can be explained by individual differences or aspects of the college environment. The criterion space should also be re-examined and expanded to include aspects of success that are not solely academic. Clearly, additional research understanding is needed in the area of college student success and achievement, and this study has demonstrated that the use of new growth modeling techniques can help to meet that need.

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