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ABSTRACT

Influences on students' reported academic development over a 4-year period were assessed, focusing on college influences on student growth and changes each year. Tinto's model of college student attrition was found to account for about 23% of the variance in students' reports of their academic skill development over 4 years of college. For each year's follow-up instrument, students indicated two things: the estimated number of times during the year they had met with a faculty member outside the classroom for at least 15 minutes; and the average number of hours per week they had spent in organized extracurricular activities. Students also completed questionnaires that measured social and academic integration, as well as classroom and social involvement. LISREL analysis indicated that students' academic integration in each of the 4 years had a direct and indirect effect on reported academic skill development in that year and in succeeding years. Social integration was more influential in students' reported academic growth in the junior and senior years. The nature and strength of these two influences varied over time, however, with the relative importance of academic and social integration reversing over the period. (SW)

STUDENTS' ACADEMIC GROWTH DURING FOUR YEARS OF COLLEGE

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Ann K. Dickey, Chair
Forum Publications Editorial
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Abstract

This study sought to model the sources of influence on students' reported academic development over a four-year period, focusing on institutional influences on student growth and assessing how those influences vary from one year to another. A LISREL analysis indicated that students' academic integration in each of the four years had a direct and indirect effect on reported academic skill development in that year and in succeeding years. Social integration was influential in students' reported academic growth only (but prominently) in the junior and senior years. The nature and strength of the influences varied over time, however, with the relative importance of academic and social integration reversing over the period.

STUDENTS' ACADEMIC GROWTH DURING FOUR YEARS OF COLLEGE

As the costs of higher education continue to rise, legislators, taxpayers, parents and students are increasingly asking to see the evidence supporting claims regarding the direct and indirect benefits of college attendance. Tennessee and South Dakota have already mandated "value-added" student outcomes assessment programs, and similar projects are being planned in Colorado, New Jersey, Texas and Virginia.

Despite the enormous volume of research on student outcomes (Lenning et al., 1974a, 1974b; Feldman & Newcomb, 1969; Bowen, 1977), a number of shortcomings in our knowledge are evident. First, most studies use a cross-sectional design and focus on relatively easy-to-measure outcomes (e.g., percentage going on to graduate school or into full-time employment). A review of this literature leads to the surprising discovery that little of what longitudinal research exists is concerned with the central purpose of higher education: students' cognitive development. Most major longitudinal investigations (e.g., Sanford et al., 1956; Chickering, 1967; Katz et al., 1968; Trent and Medsker, 1968; and Astin, 1977), tend to concentrate on students' personal development during college. Bowen (1977) recognized this weakness in the literature and commented: "One of the anomalies of studies conducted on outcomes is that less attention has been devoted to cognitive learning than to affective development" (p. 64).

At the same time, virtually without exception (Lehmann, 1968, is one), studies of students' development of academic and intellectual skills make no attempt to monitor the rate of acquisition of such skills or their constancy from year to year to determine when such growth occurs. Moreover, few studies seek to identify those collegiate experiences that might facilitate or impede the acquisition of those skills and over which institutions have some policy or programmatic control. Most studies compare senior scores on some variable with those obtained at the time of entry to college.

Terenzini, Theophilides and Lorang (1984), during each year of a three-year period, studied students' development of such academic skills as gaining factual knowledge, critical thinking ability, applying abstract principles, and learning fundamental principles, generalizations and theories. The present study builds upon that work in two ways. First, the use of ordinary least-squares (OLS) regression in that longitudinal study confounds the effects of correlated error terms and autocorrelation among the same measures taken at different points in time. The result is generally unreliable (usually over-estimated) regression coefficients, tending to suggest stronger relations among variables than may, in fact, exist. The present study deals with these problems by adopting a more powerful analytical technique (LISREL), described in greater detail below.

Second, while Terenzini, Theophilides and Lorang (1984) based their study on a theory of college student attrition given by Tinto (1975) but adapted for studying students' academic skill acquisition, there was no explicit, specific attempt to validate Tinto's model or to assess its utility for studying other forms of collegiate impact besides attrition. Rather, the model served as a general set of guiding principles for variable selection and regression model specification. The present study adopts the same theoretical base, but offers a more explicit and rigorous test of the validity of that theory for predicting students' academic development in each year of four consecutive years.

METHODOLOGY

Theoretical Framework

In his model of undergraduate student attrition, Tinto (1975) theorizes that students' pre-college traits lead to varying initial levels of goal and institutional commitment. These commitments, in turn, influence the manner in which the student interacts with the academic and social environment of the institution, resulting in varying subsequent levels of integration in the institution's academic and social systems. "Other things being equal,

the higher the degree of integration of the individual into the college systems, the greater will be (the) commitment to the specific institution and to the goal of college completion" (Tinto, 1975, p. 96).

Tinto's model can also be a useful framework, however, for conceptualizing the variables and processes potentially involved in other areas of collegiate impact on students. If the college experience influences positively the personal and academic growth of a student, then the student who is more integrated into (or "involved" in) the academic and social life of an institution might be expected to grow more than a less integrated or involved student in a number of ways.

Design and Sample

The study was longitudinal and ex post factor. During the summer of 1980, freshmen attending a randomly-selected five of nine summer orientation sessions at a large, selective, public research university in the northeast were asked to complete a locally-developed questionnaire soliciting a variety of academic and personal background information. Usable responses were received from 1,105 freshmen who subsequently matriculated at the university (approximately 50% of the 1980 freshmen class).

In April of each of the four succeeding academic years, a detailed questionnaire asking students about their experiences during the year just ending was sent to each of the students who had participated in the preceding year's data collection. After a follow-up mailing each year, usable response rates were: freshmen year, n = 723 (65%); sophomore year, n = 460 (64%); junior year, n = 301 (65%), and senior year, n = 206 (68%). This study, then, is based on the responses of the 206 students who participated in each of the four years of the study. This group constitutes 19 percent of the original sample, and nearly 10 percent of the entering freshman class four years earlier. Tests indicate that respondents are representative of the population of freshmen with respect to academic aptitude (combined SAT courses), high school achievement (high school percentile rank), gender and combined parental education.

Variables

Students' pre-college characteristics, treated as exogenous variables (i.e., outside the causal model), were high school achievement (percentile rank in graduating class) and highest degree planned (bachelor's, master's or doctorate). Preliminary analyses indicated that other background variables for which data were available were not reliably related to the dependent measures nor to other post-matriculation variables and were, consequently, excluded from the model. Excluded variables were: sex, race or ethnicity, combined SAT scores, and parents' level of formal education.

Each year's follow-up instrument asked students to: 1) estimate the number of times during the year they had met with a faculty member outside the classroom for each of six reasons (only conversations lasting 10 to 15 minutes or more were to be counted); 2) indicate the number of hours per week, on the average, they had spent in organized, extra-curricular activities in both the fall and spring semesters (subsequently summed to form a single index); 3) to respond to a series of 34 Likert scale items designed to measure various dimensions of social and academic integration in the Tinto model, and 4) to respond to ten items describing various indicators of level of classroom and social involvement.

The 34 Likert items, comprising five dimensions, were taken from Pascarella and Terenzini (1980). A series of principal components analyses indicated substantial stability of the five-factor solution across academic years. Scales based on three of these factorial dimensions, labeled "Peer Relations," "Faculty Relations," and "Faculty Concern for Student Development and Teaching," were used in this study. The internal consistency (alpha) reliability coefficients for these three scales range from .71 to .82 in this study.

Frequency of contact with faculty was measured by students' estimates of the total (summed) number of times during the year they had met with a faculty member outside of class for "academic" purposes (to get academic program advice, to discuss careers, or to

discuss intellectual or course-related topics), and for "non-academic" purposes (to discuss personal problems, to discuss campus issues, or to socialize informally). Sums were transformed to a natural logarithm prior to analysis in order to correct for skewness.

The indicators of students' classroom and social involvement were taken from Terenzini, Pascarella and Lorang (1982) and have alpha internal consistency reliability coefficients of .61 and .75. Sample items from the classroom experience scale are: "enjoyed my classes" and "learned something new in my classes." The social involvement scale includes such items as "felt at home here" and "met students who were interesting." Principal components analyses indicated that the two-factor solution is stable across years for the students in this study.

Thus, the predictor variables in this study were the two covariates listed earlier and eight independent variables, or "college experience" variables, grouped in two sets--one reflecting academic integration, the other indexing social integration--for each of the four years under study. The variables comprising each set are given in Table 1.

On each of the follow-up instruments, students were also asked to indicate the amount of progress they had made during the year just ending in each of twenty-nine skill or growth areas (Terenzini, Pascarella and Lorang, 1982). The items were scored on a one-to-four scale, where 1 = "no progress at all" and 4 = "a great deal of progress." One of four components derived factorially from these items, the "Academic Skill Development" scale, was adopted as the dependent measure in this study. This scale includes the following four items: 1) gaining factual knowledge (terminology, methods, trends); 2) developing the ability to evaluate critically ideas, materials and methods; 3) developing the ability to apply abstractions or principles in solving problems, and 4) learning fundamental principles, generalizations, or theories. The internal consistency reliabilities for this scale over the four study years were .70, .71, .68 and .78 for the freshman through senior years, respectively.

The overall dependent measure of students' academic growth over the four-year period (the final endogenous variable) was an eight-item, factorially-derived scale. On this scale, students reported their academic growth on the same 29 items used to constitute the academic development scales for each of the four years of the study. In making their overall ratings, however, students were asked to report their academic progress "since coming to Albany" (using a 9-point Likert scale, where 1 = "no growth or development at all," and 9 = "an extraordinary amount of growth"). The eight items constituting this scale were students' overall progress in: 1) gaining factual knowledge; 2) evaluating ideas, materials and methods; 3) applying abstractions or principles in problem-solving; 4) learning principles, generalizations and theories; 5) recognizing general principles in specific events/conditions; 6) understanding a particular discipline's research methods; 7) understanding a particular discipline's various schools of thought, and 8) developing a sense of the inter-relatedness of different disciplines. This scale has an internal consistency reliability of .93.

Analytical Method

LISREL (Joreskog & Sorbom, 1981) was employed to fit Tinto's theoretical framework to the variables and processes potentially involved in the impact of college on students' academic growth. The LISREL technique offers several advantages over the more common ordinary least-squares (OLS) path analytic techniques. First, LISREL affords a more comprehensive and rigorous test of a model's empirical adequacy as an explanatory system (its internal validity) than can be obtained using statistics routinely computed from OLS estimates of the standardized regression coefficients (Hennessey, 1985).

Second, LISREL models are nonrecursive: they can estimate reciprocal (simultaneous) effects of two variables, each influencing the other. OLS path models, by comparison, are recursive (i.e., the causal influence is assumed to be unidirectional) and cannot model reciprocal effects.

Third, LISREL permits the researcher to control measurement error and any correlation between error terms, thus producing relatively unbiased path estimates. This is particularly useful in longitudinal studies where the autocorrelation between measures of the same variable at $Time_1$ and $Time_2$ is a significant confounding factor when measuring structural effects and assessing changes that occur between measurements (Joreskog, 1981).

Fourth, LISREL allows the researcher to estimate the effects of latent (unobservable) constructs on the ultimate endogenous (dependent) variable while simultaneously controlling for correlations between their empirical indicators. The LISREL model produces more reliable (unbiased) estimators than can be obtained using OLS procedures.

The structural model specified that goal commitment was a latent construct influenced by the exogenous (outside the model) variable "highest degree expected." Academic aptitude was also specified as a latent construct, influenced by the exogenous variable "high school achievement. These two constructs were theorized, in turn, to influence students' levels of academic and social integration. "Academic integration" was presumed to be reflected in students' scores on the variables listed under that heading in Table 1, while "social integration" was operationalized by scores on variables listed under that heading in the same table. Both academic and social integration levels were hypothesized to have a direct effect on students' reported academic skill development during the same year and on the level of social and academic integration in the following year, which, in turn, would influence reported academic skill development in that same year, and so on through the senior year. Reported academic development in each of the four years was hypothesized to have both a direct and indirect effect (i.e., through its influence on other variables) on students' reports of their overall academic growth during their four years of college.

RESULTS

Table 1 reports the means and standard deviations for all variables used in the analysis. It also provides a key to variable abbreviations used in subsequent schematic representations of the model.

Figure 1 displays for heuristic purposes the full LISREL model for the freshman year only, reflecting the relationship between the "measurement model" and the "structural model." The structural model is discussed in detail below. The square boxes represent the observed variables used in the analyses, with the ovals connected to them representing the latent constructs presumably reflected (the structural model). The values next to the lines connecting the boxes to the ovals are interpretable as factor loadings and reflect the relative contribution of each variable to the operationalization of the latent construct: the higher the coefficient, the larger the contribution to defining the latent trait. For purposes of model identification, one parameter (the best indicator of the underlying construct) is set with a starting value of 1.0.

In the interest of parsimony and clarity, the measurement model coefficients, indicating the relative contributions of each observed variable to the latent construct it is presumed to reflect, are given in Table 2 rather than being shown on a later figure. The coefficients are given for each construct for each of the four years. As can be seen there, academic integration over the four-year period is defined primarily by the students' perceptions of the nature and quality of their relationships with faculty members (coefficients of 1.0 throughout) and by the frequency of their contact with faculty for social purposes, although the importance of the latter variable diminishes in the senior year. For social integration, the social activities scale is dominant throughout, with the quality of students' peer relations being important in the freshman and sophomore years, but dropping-off sharply in the junior and senior years.

The relationships expressed by the lines connecting the ovals represent the theoretical model being tested, and the numbers associated with the connecting lines are the path coefficients, interpretable as standardized regression weights. They reflect the relative strength of the influence of one latent construct on another.

Figure 2 displays the full, structural model, which, overall, produced an R^2 of .23, indicating that the model explained about one-quarter of the variance in the final dependent variable (overall academic growth). The overall goodness-of-fit index (which can vary from 0 to 1, where 0 reflects no fit and 1 indicates a perfect fit) was .80, indicating a moderately high degree of fit between the observed covariance matrix and that predicted by the structural model (X^2 = 1,085, d.f. = 713).

Giving primary attention to the coefficients of the paths linking the ovals in the model, one can see that the background traits employed in this study are positively (if modestly) related to freshman year academic integration, the influence of goal commitment (.15) being twice that of rank. Goal commitment is also negatively related (-.14) to reported academic skill development in the sophomore year. Moreover, there is an indication, albeit statistically unreliable, that a student's high school achievement and level of goal commitment are negatively related (-.18) to reported overall academic growth. (Path coefficients in parentheses are statistically unreliable; certain of these are retained because of their substantive interest.)

The theoretical expectations derived from Tinto's model were of four general kinds. First, students' levels of academic integration in one year were expected to have a positive relation to their level of academic integration in the following year. Students' social integration levels were predicted to follow a similar relational path over the years. This set of theoretical expectations was ~~only partially~~ fulfilled in ~~the freshman and sophomore~~ each of the four years; ~~the expected effect of academic integration was supported, but the paths from social integration to academic growth in both years were not statistically~~

~~reliable. In the junior and senior years, however, the predicted paths for both academic and social integration were observed.~~

Second, the theory leads one to expect a direct relationship between students' reports of their academic growth in one year and their reported development in the following year. As can be seen in Figure 2, this expectation was confirmed in each of the four years.

Third, the model predicts reliable paths from reported academic growth in one year to level of academic and social integration in the following year. In no instance did the analysis support this expectation. The failure of such paths to emerge for either social or academic integration, and in all years constitutes one of the major surprises of this study.

Finally, the model would lead one to expect that students' levels of academic and social integration would influence their reports of academic skill development in the same year. Indeed, this is the study's central set of hypotheses. The expected path between academic integration level and reported academic development emerged in each of the four years. Such was not the case with social integration, however: in the freshman year, the expected path was in the right direction and approached--but failed--to reach statistical significance. In the sophomore year, the relation did not emerge at all. Theoretical expectations were, however, supported in the junior and senior years.

Of particular interest in Figure 2 is the relative importance of academic and social integration over the four-year period. In the freshman through junior years, academic integration clearly has a more powerful influence than social integration on reported academic growth in each of those years. In the junior year, however, the potency of academic integration begins to wane (to .23), down from .29 in the freshman year and from its peak (.40) in the sophomore year. At the same time, however, the influence of social integration begins to grow in the junior year (to .08), making a modest, but statistically reliable contribution, whereas it played no role at all in students' academic

growth in the freshman and sophomore years. By the senior year social integration appears to be at least as influential (if not slightly more influential) than academic integration (.13 vs. .11, respectively).

This study was concerned not only with the sources of influence on students' academic growth over the four years of college, but also with whether the years' relative contributions varied over time. Figure 2 indicates that students' reported development is not constant over the four-year period. The senior year appears to have the largest direct effect (.20) on overall academic development, followed in order by the sophomore year (.17), the junior year (.16) and the freshman year (where the coefficient was non-significant).

One other finding is noteworthy: the reciprocal (i.e., two-way) relationship between academic and social integration reported by Pascarella and Terenzini (1979, 1983) was not found in this study. A direct, but one-way, influence was identified, academic integration influencing the level of social integration, but only in the freshman year. In no other year was a direct relation (whether reciprocal or recursive) identified between academic and social integration.

Limitations

This study is limited in several respects. First, the results are based on the responses of students at a single institution. To the extent that these students and their experiences during four years of college differ from those at other institutions, the results reported here may not be generalizable beyond the university at which the study was conducted. Second, students' self-reported perceptions of their academic skill development was the criterion measure in this study, and it is not yet known how precisely students' self-reports of growth may correspond to more objective developmental measures. Third, due to limitations on the amount of background information available on respondents in this study, the role of background traits may be underestimated. Future

studies of this sort should include additional measures of students' pre-college personal and academic histories. Finally, as noted earlier, the present model probably constitutes a less than fully-specified representation of Tinto's constructs of academic and social integration. Future research should include additional measures of those constructs, such as degree of value consensus with faculty and other students.

SUMMARY AND CONCLUSIONS

The results of this study offer generally strong support for the construct validity of Tinto's (1975) model of college student attrition and for its utility in the study of other student outcomes. With certain exceptions, the results obtained in this study were consistent with theoretical expectations. Overall, the structural model developed in this study accounted for about 23 percent of the variance in students' reports of their overall academic skill development over four years of college. Moreover, the overall goodness-of-fit index in this study was a respectable .80, indicating a moderately high degree of validity for the theoretical structure.

The major failings of the the model were in two areas. First, social integration was not reliably related to students' reported academic development in the freshman and sophomore years. Such a path was suggested in the freshman year, but it was statistically unreliable. In the junior and senior years, however, the expected relations between social integration and subsequent academic growth emerged. Indeed, as will be discussed below, by the senior year social integration came to play a prominent role.

Second, the theoretically predicted relation between academic growth in any given year and level of academic and/or social integration in the following year was not supported in any year. The absence of such a path is particularly surprising for students' subsequent academic integration levels. It is possible, of course, that the theoretical model does not accurately reflect reality, although such an hypothesis is intuitively

unsatisfying. A more plausible explanation is that the absence of the hypothesized path is a function of sample size (the standard error of the regression weight, a major value in the calculation of statistical significance, is strongly influenced by sample size). In an earlier set of analyses of this same data set, focusing on the first two years of college but using a sample twice the size of that in the present investigation, the theoretically predicted path from academic growth to subsequent academic integration was observed. Thus, it is possible that the present analyses were not powerful enough to detect a real, if modest, relation between growth and subsequent level of academic integration. It would appear that only additional research will illuminate the matter.

More often than not, however, the model's constructs and the relations among them were supported. Academic integration in one year was consistently, positively and reliably related to academic integration in succeeding years, and social integration levels in one year were similarly and consistently related to subsequent levels of social integration. Academic integration in one year was consistently and reliably related to reported academic growth, and reported academic development in three of the four years was and reliably related to students' reports of their overall academic skill development over the entire four-year period. While academic growth during the freshman year was not reliably related to overall development, the direction of the relation between the two variables was consistent with theoretical expectations.

Whereas Pascarella and Terenzini (1979, 1983) had previously identified a reciprocal relationship between academic and social integration (high levels of one compensating for low levels of the other) in promoting student retention, no evidence was found in this study to support such a relationship in students' acquisition of academic skills. Indeed, academic integration was found to have a unidirectional effect on social integration, but only during the freshman year. This finding suggests that the relation between these two latent constructs, if it in fact exists, may be situational, dependent on the particular

student outcome in question, or both. Additional research will be required to clarify this issue as well.

Perhaps the most significant finding of this study is that the relative importance of students' levels of academic and social integration appear to reverse over the four-year period. In the freshman and sophomore years, academic integration is clearly the most important influence on reported academic skill development during those years. By the junior year, however, the influence of academic integration appears to begin a decline, while social integration begins to grow in influence. By the senior year, however, the reversal is completed: students' level of social integration appears to be slightly more influential in senior year academic growth than is academic integration level.

This phenomenon may reflect the socialization of students into their major academic fields. The academic major represents an important source of identity for students and is the only institutionally-provided peer grouping that is academically-based. Students entering a major share experiences that socialize them into the discipline, and new, academically-related friendships are formed. The last two years of college are also a time when students are gaining mastery in their discipline, and it may well be that more learning during this closing period of college occurs within and among student groups than in formal instructional settings. Classes are smaller, there are more opportunities for intellectual interactions with one's peers, and those peers are, in their senior year, far more capable and able to serve as academic "teachers" (whether formally or informally) than at any other time in their baccalaureate careers.

From a practical standpoint, the results suggest the importance of each year in students' reported academic development. In each of the four years, academic integration plays a role in students' academic skill development, and by the junior and senior years, social integration is involved as well. The potential academic benefits of helping new students become academically integrated may not be fully appreciated.

Programs that introduce students to the institution's intellectual world (e.g., orientation, academic advising by faculty members, freshman seminars or other intellectual experiences tailored for freshmen) may play a critical role in students' subsequent levels of academic integration and, consequently, in their academic development.

Second, the results indicate that each year's level of academic and social integration is related to that in succeeding years, suggesting that the beneficial effects of involvement in the academic and social systems of an institution may be cumulative, a good start in the first year leading to greater and continued development in subsequent years.

Third, the discovery of the growing importance of social integration in students' reported academic growth suggests a clear need for more careful attention to role of other students in the learning process, particularly during the junior and senior years. These results point toward a possible need for more seminars and for more group projects in the latter years of college. The evidence clearly suggests that students may play a larger role in one another's education than we have previously thought.

Finally, the results of this study suggest the enormous complexity of the college-related growth process. We are just beginning to understand some of the dimensions of that process, and future research, using models similar to that employed in this study with different samples of students and in different institutional settings will add much to that understanding and to the ability of colleges and universities to better serve their students.

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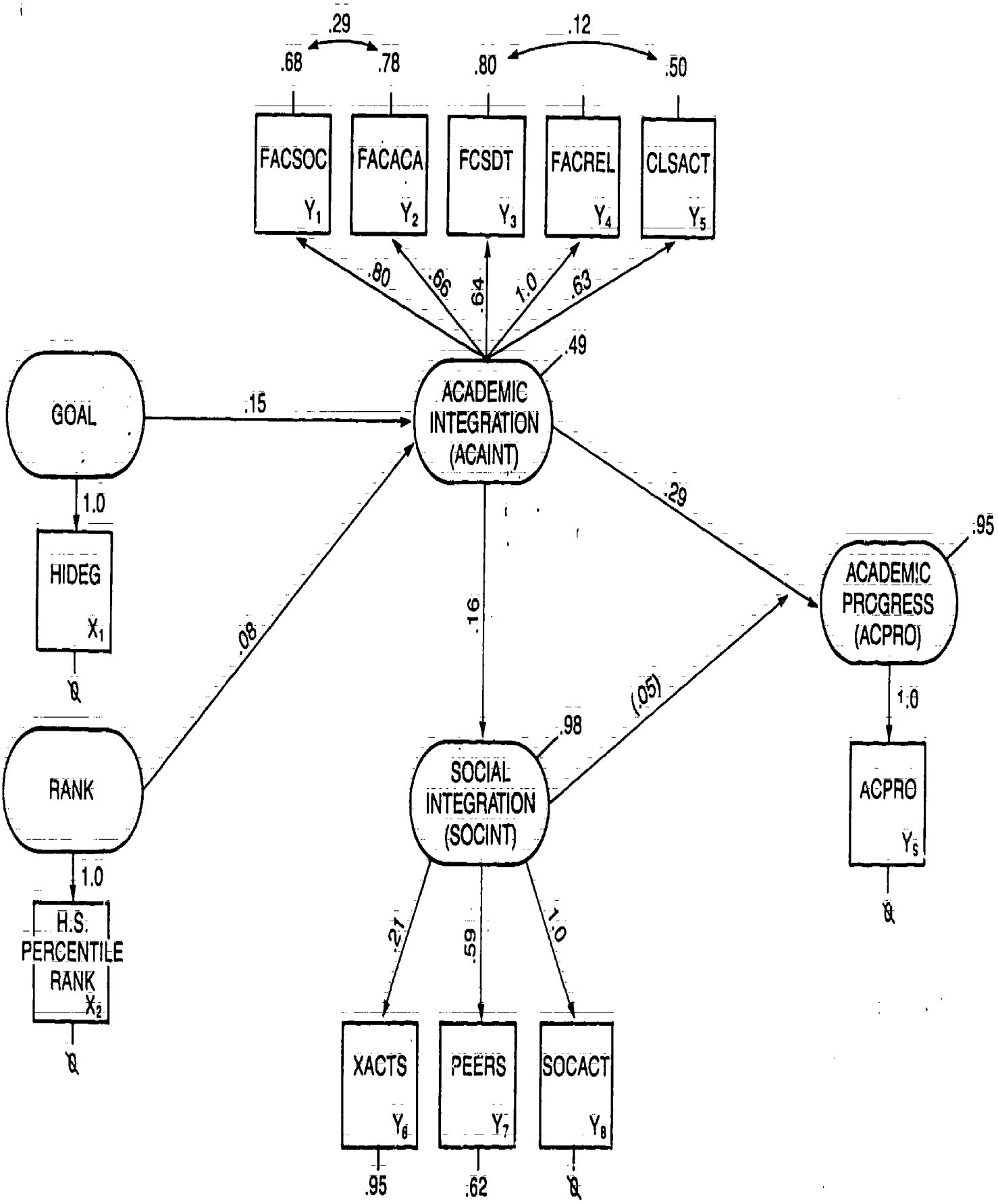

Figure 1. MEASUREMENT MODEL COMBINED WITH STRUCTURAL MODEL

Table 2

LISREL MEASUREMENT MODEL COEFFICIENTS

SCALE/VARIABLE	Fr.	So.	Jr.	Sr.
ACADEMIC INTEGRATION				
Frequency of Contact with Faculty for Social Purposes (FACSOC)	.80	.82	.85	.56
Frequency of Contact with Faculty for Academic Purposes (FACACA)	.66	.64	.80	.55
Faculty Concern for Student Development and Teaching Scale (FCSDT)	.64	.69	.07*	.16
Faculty Relations Scale (FACREL)	1.00	1.00	1.00	1.00
Classroom Activities Scale (CLSACT)	.63	.71	.51	.10*
SOCIAL INTEGRATION				
Extracurricular Activities (XACTS)	.21	.14	.19	.18
Peer Relations Scale (PEERS)	.59	.53	.08*	.09*
Social Activities Scale (SOCACT)	1.00	1.00	1.00	1.00

NOTE: *Not significant ($p<.05$, two-tailed)

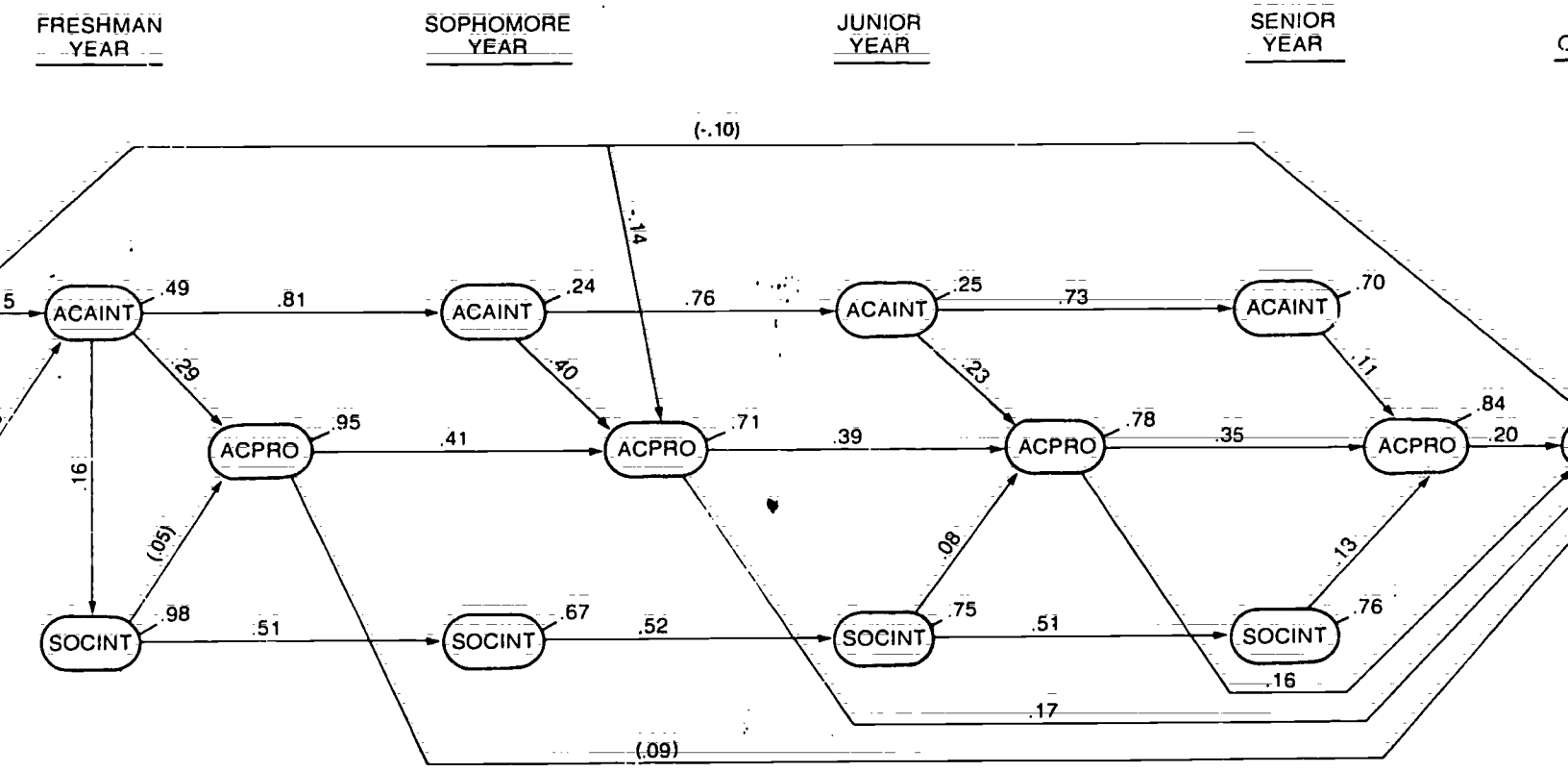

Figure 2. STRUCTURAL MODEL OF ACADEMIC SKILL DEVELOPMENT OVER FOUR YEARS OF COLLEGE