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ABSTRACT

Building on previous research, this study examined the reciprocal relationship between academic achievement and satisfaction of 1001 seniors at the University of Missouri-Columbia. Students completed a survey which measured overall satisfaction, ratings of academic and social experiences, whether the student would recommend the university to a friend, perceived academic effort, satisfaction with their achievement, and perceived social integration. Survey results were compared with the students' academic ability and achievement data. Data were analyzed using two sets of structural equation models. Results indicated that the relationship between satisfaction and achievement was an artifact of other aspects of students' college experiences, namely academic and social integration. (Contains 42 references.) (DB)

THE RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND SATISFACTION: EVIDENCE OF MODERATING EFFECTS FOR ACADEMIC AND SOCIAL INTEGRATION

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Jean Endo
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Abstract

The relationship between achievement and satisfaction has been the focus of substantial research in higher education, and the results of these studies have important implications for higher education assessment and efforts to improve retention and graduation. Building on previous research, this study examined the reciprocal relationship between achievement and satisfaction. Results indicated that the relationship between satisfaction and achievement was an artifact of other aspects of students' college experiences—namely academic and social integration.

THE RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND SATISFACTION: EVIDENCE OF MODERATING EFFECTS FOR ACADEMIC AND SOCIAL INTEGRATION

The relationship between achievement and satisfaction has been the focus of substantial research in higher education (Bean and Bradley, 1986; Feldman, 1989; Pike, 1991). The results of this research have important implications for higher education assessment and evaluation (Astin, 1977, 1993), student evaluations of instruction (Feldman, 1989), and efforts to improve student retention and graduation (Eimers and Pike, 1997; Nora and Cabrera, 1996). Building on previous research by Bean and Bradley (1986) and Pike (1989, 1991), this study examined the reciprocal relationship between students' academic achievement and their satisfaction with college. In addition, the present research sought to determine whether the observed relationship between achievement and satisfaction was influenced by other aspects of students' college experiences—namely their integration into the academic and social life of the university.

Background

Theory and research in higher education assume that students' academic achievement (most frequently measured by college grades) and their satisfaction with college are important educational outcomes. Although some higher education scholars condemn what they believe to be an over reliance on grades (see Milton, Pollio, and Eison, 1986), the fact remains that grades determine whether a student will graduate, influence entry into high-paying occupations, and affect subsequent educational attainment (Baird, 1985; Pascarella and Terenzini, 1991). Anderson (1986), for example, examined the relationships between college grades and educational attainment using data from the National Longitudinal Study of the High School Class of 1972. She found that college grades had significant effects on educational attainment

even after controlling for student background characteristics, college characteristics, and college experiences.

Growing out of the campus unrest of the 1960s and 1970s, student satisfaction with college also has come to be viewed as a key indicator of the quality of education programs (Betz, Starr, and Menne, 1972; Hearn, 1985; Morstain, 1977). In his study of 41 colleges and universities, Cameron (1981) reported that virtually all of the administrators he surveyed identified student satisfaction as a key element in the assessment of institutional effectiveness. Likewise, the 1991 Campus Trends survey found that over 60 percent of the colleges and universities involved in assessment used surveys to measure student satisfaction with programs and services (El-Khawas, 1991). More recently, almost three-quarters of the institutions responding to a survey conducted by the Clearinghouse for Higher Education Assessment Instruments reported using satisfaction surveys in outcomes assessment (Bradley, Draper, and Pike, 1993).

Achievement and satisfaction are also important because of their relationship to student retention and graduation (see Pascarella and Terenzini, 1991). Tinto (1975), for example, argued that academic achievement is the single most important factor in the decision to drop out of college. Likewise, recent models of retention developed by Bean (1980) and Nora and Cabrera (1996) identify student satisfaction as an important element in the decision to persist.

Early research using Tinto's model tended to support his claim that achievement is a key element in the decision to remain at an institution (Aitken, 1982; Munro, 1981; Pascarella and Chapman, 1983; Pascarella, Smart, and Ethington, 1986). These studies also showed that student satisfaction exerts a powerful influence on persistence and graduation (Aitken, 1982; Bean, 1980; Pascarella and Chapman, 1983; Pascarella, Smart, and Ethington, 1986; Terenzini and Pascarella, 1977). Three recent studies of student

persistence also have provided clear support for the findings of earlier research (Eimers and Pike, 1997; Nora and Cabrera, 1996; Pike, Schroeder, and Berry, in press). All three studies found that academic achievement and satisfaction with college were the two most important factors in the decision to persist at an institution.

The Achievement-Satisfaction Relationship

Research has consistently shown that academic achievement and satisfaction with college are moderately correlated. However, judgments about the direction of the relationship depend on the model used by researchers (Pike, 1991). For example, most variants of Tinto's model assume that academic achievement (i.e., grade point average) influences satisfaction. Consequently, research in this area has been predicated on the assumption that the correlation between achievement and satisfaction represents the effect of achievement on satisfaction. Liu and Jung (1980), for example, found a moderate correlation between grade point average and satisfaction with college. Based on their model, they concluded that achievement influenced satisfaction without testing the alternative hypothesis that satisfaction influenced achievement.

In sharp contrast to retention research, studies of the relationship between satisfaction with instruction and academic achievement have tended to assume that satisfaction enhances academic performance. For example, Feldman (1989) found consistent evidence of a moderate positive correlation between grades and student ratings of satisfaction with instruction. He concluded that positive evaluations of instruction resulted in higher levels of achievement, again without exploring the viability of the alternative hypothesis that achievement influenced satisfaction.

Three studies have attempted to assess empirically the viability of using a reciprocal relationship to represent the association between academic

achievement and satisfaction with college. In the first study, Bean and Bradley (1986) employed a nonrecursive structural equation model to identify the strength of the reciprocal relationship between achievement and satisfaction. Although slight gender differences were observed, results strongly suggested that satisfaction had a greater effect on achievement than achievement had on satisfaction.

Pike (1989) analyzed the relationship between academic achievement and satisfaction with college using measures of both variables at two points in time. He concluded that a substantial proportion of the association between achievement and satisfaction was an artifact of other variables. Of the part of the relationship that was unique to them, satisfaction had a greater effect on achievement than achievement had on satisfaction.

In a second study, Pike (1991) analyzed a nonrecursive structural equation model of the achievement-satisfaction relationship. Consistent with earlier studies, he found that satisfaction exerted a greater effect on achievement than achievement exerted on satisfaction. Pike also reported that the effect of satisfaction on achievement was relatively weak after controlling for selected measures of students' background characteristics and college experiences.

Factors Influencing Achievement and Satisfaction

Research has identified a variety of factors that influence academic achievement and satisfaction with college. For example, studies have found that academic and social integration can play an important role in the achievement-satisfaction relationship. Studies by Eimers and Pike (1997), Nora and Cabrera (1996), and Pike, Schroeder, and Berry (in press) found that academic integration had a significant positive effect on both academic achievement and satisfaction. In these studies, social integration also had a positive effect on satisfaction, but a negative effect on achievement

(Eimers and Pike, 1997; Pike, Schroeder, and Berry, in press). Significantly, these studies found that residuals for achievement and satisfaction were uncorrelated when academic and social integration were included in the models.

In addition, several studies have found significant positive relationships between academic achievement and entering ability as measured by admission test scores and high school class percentile rank (Aitken, 1982; Eimers and Pike, 1997; Endo and Harpel, 1982; Nora and Cabrera, 1996; Pike, 1991; Pike, Schroeder, and Berry, in press; Saupe, 1992). These studies also found that measures of entering ability generally did not have significant direct effects on satisfaction with college. However, research has shown that entering ability influences academic and social integration (Eimers and Pike, 1997; Nora and Cabrera, 1996; Pike, Schroeder, and Berry, in press). Acting through academic and social integration, entering ability can have modest but significant indirect effects on both achievement and satisfaction.

In contrast, measures of students' college experiences have significant direct effects on satisfaction, but not on academic achievement. College experience variables that have been found to influence satisfaction include encouragement from family and friends (Eimers and Pike, 1997; Nora and Cabrera, 1996; Pike, Schroeder, and Berry, in press), perceived affinity (i.e., similarity) of values (Eimers and Pike, 1997; Pike, Schroeder, and Berry, in press), and perceptions of prejudice and discrimination (Eimers and Pike, 1997; Nora and Cabrera, 1996). In addition, students' interactions with faculty and/or peers have been found to influence satisfaction with college (Bean and Bradley, 1986; Eimers and Pike, 1997; Endo and Harpel, 1982; Pascarella, 1980; Pascarella, Smart, and Ethington, 1986; Pike, 1991). Although research generally has failed to detect significant direct effects on academic achievement for college experiences, college experiences have been found to affect academic and social integration. Acting through

academic and social integration, college experiences can have significant indirect effect on both academic achievement and satisfaction.

The relationship between perceptions of prejudice and academic achievement is illustrative of the moderating effects of academic and social integration. Both Eimers and Pike (1997) and Nora and Cabrera (1996) found that perceptions of prejudice did not directly influence academic achievement. However, perceptions of prejudice did have a significant negative indirect effect on achievement, acting through academic integration.

Theoretical Models

The two models used in this study are presented in Figure 1. Both models posit a nonrecursive (i.e., reciprocal) relationship between academic achievement and satisfaction with college. Both models also assume that two broad categories of factors influence achievement and satisfaction. The first set of factors, representing students' entering ability levels, includes ACT composite scores and high school class percentile rank (HSCPR). The second set of factors, students' college experiences, includes measures of external encouragement, affinity of values, perceived discrimination, peer interaction and influence, and faculty interaction and influence. In Model 1, entering ability directly influences achievement and indirectly influences satisfaction through its effect on achievement. Conversely, students' college experiences directly influence satisfaction with college and indirectly influence achievement through satisfaction.

Insert Figure 1 about here

The second model differs from the first in that it assumes a set of moderating variables between entering ability/college experiences and achievement/satisfaction. These moderating variables are academic and social

integration, and they directly influence both achievement and satisfaction. Academic and social integration, in turn, are influenced by both entering ability and students' college experiences. As a consequence, entering ability and college experiences indirectly influence both achievement and satisfaction by acting through academic and social integration. Entering ability may also indirectly influence satisfaction, acting through achievement, while college experiences may indirectly influence academic achievement, acting through satisfaction.

Research Methods

Subjects

The setting for this research was the University of Missouri-Columbia (MU), the state's public research university. MU has an enrollment of approximately 17,000 undergraduate and 6,000 graduate and first-professional students. At the time this study was conducted (i.e., the Winter 1996 semester), 3,006 undergraduates were classified as seniors based on their having successfully completed 90 or more credit hours.

During the Winter 1996 semester, the MU Senior Survey was mailed to all 3,006 seniors. After multiple follow-up mailings completed surveys were returned by 1,001 seniors—a 33 percent response rate. Analysis revealed that females were over represented in the sample of respondents (56 percent) when compared to the population (49 percent). Likewise, white students were over represented (87 percent versus 84 percent), and respondents had higher ACT composite scores (25.6 versus 25.3) and high school class percentile ranks (81.6 versus 79.6) than the population of seniors at MU. Although there were statistically significant differences between respondents and nonrespondents, these differences accounted for only one to three percent of the variance in students' background characteristics, suggesting that statistical significance was a function of sample size, not substantive differences.

Respondents and nonrespondents did not differ in terms of their academic majors.

Measures

The measures used in this study were drawn from existing campus data and the MU Senior Survey. Campus data included entering ACT composite scores, high school class percentile ranks, and cumulative grade point averages. All other measures were drawn from questions on the senior survey.

Satisfaction was represented by a scale score formed from a weighted combination of seniors' responses to eight items (Armor, 1974). These items measured overall satisfaction, ratings of academic and social experiences, and whether the student would recommend MU to a friend considering college. Theta reliability (Armor, 1974) for the satisfaction factor score was 0.85.

Academic integration was measured by five items drawn from research by Eimers and Pike (1997). These items included questions about students' academic effort and satisfaction with their achievement. Theta reliability for the academic integration scale was 0.78. Social integration also was measured by five items used by Eimers and Pike. These items focused on the quantity and quality of students' involvement and produced a Theta reliability coefficient of 0.73.

Scale scores for external encouragement, affinity of values, and perceived discrimination were calculated using items from Eimers and Pike (1997) and Nora and Cabrera (1996). Theta reliability coefficients for these three scales were 0.89, 0.80, and 0.87, respectively. Scale scores for peer interaction/influence and faculty interaction/influence were calculated using items similar to those used by Pike (1991). Theta reliability for peer interaction/influence was 0.80, while theta reliability for faculty interaction/influence was 0.88.

Data Analysis

Campus data and scale scores from the senior survey were analyzed using two sets of structural equation models representing the relationships posited in Figure 1. Because research suggests that manifest variables representing the same construct (e.g., academic and social integration) may have significantly different effects on other components in the model, all variables were directly measured (see Eimers and Pike, 1997). Although preliminary analyses indicated the presence of significant multivariate skewness, maximum likelihood estimation procedures were used in the present research. Jöreskog and Sörbom (1993), as well as Pike, Schroeder, and Berry (in press) have found that maximum likelihood estimation of nonrecursive models tends to be robust to departures from multivariate normality, particularly when the variables in the model are directly measured.

The first set of models included measures of entering ability, college experiences, achievement, and satisfaction. Separate analyses were conducted for models with a nonrecursive relationship between achievement and satisfaction and no relationship between achievement and satisfaction. Chi-square measures of model fit and chi-square change statistics were calculated to evaluate the appropriateness of the models. The chi-square statistic for model fit provided an indication of whether a model adequately represented the observed data, with a nonsignificant chi-square coefficient representing an adequate fit between model and data. The chi-square change statistic provided an indication of whether constraining certain parameters in the model adversely affected goodness of fit. In this study, a nonsignificant chi-square change statistic would indicate that it was possible to eliminate the reciprocal relationship between grades and satisfaction without adversely affecting goodness of model fit.

The second set of models analyzed in this study included measures of academic and social integration in addition to measures of entering ability,

college experiences, achievement and satisfaction. Again, separate analyses were conducted for models with a nonrecursive relationship between achievement and satisfaction and no relationship between achievement and satisfaction. Both chi-square measures of model fit and chi-square change statistics were used to evaluate the appropriateness of the two models. In addition, measures of explained variance (i.e., squared multiple correlations) and parameter estimates were examined to determine if inclusion of academic and social integration enhanced explanation of the relationship between achievement and satisfaction. The evaluation of squared multiple correlations was analogous to an assessment of R^2 change in hierarchical regression.

Results

Academic and Social Integration Omitted

Goodness-of-fit results for the first set of models strongly suggested that a nonrecursive model was needed to explain the relationship between achievement and satisfaction when academic and social integration were not included in the model. The chi-square goodness-of-fit test for the nonrecursive model produced a nonsignificant result ($\chi^2 = 7.91$; $df = 6$; $p > 0.05$) indicating that the model provided an acceptable explanation of the data. Omitting all relationships between achievement and satisfaction produced a statistically significant chi-square fit result ($\chi^2 = 31.89$; $df = 8$; $p < 0.001$) indicating that the model provided a relatively poor explanation of the data. Not surprisingly, the chi-square change statistic also was large and statistically significant ($\Delta\chi^2 = 23.98$; $\Delta df = 2$; $p < 0.001$).

Table 1 presents the standardized direct and indirect effects for the nonrecursive model. In the table, direct effects are presented first, with

the indirect effects presented directly below the direct effects. As can be seen from the results in Table 1, the reciprocal relationship between achievement and satisfaction was quite modest. However, the effect of achievement on satisfaction was statistically significant. Moreover, the effect of achievement on satisfaction (0.09) was essentially the same as the effect of satisfaction on achievement (0.07). The indirect effects of achievement and satisfaction on themselves (0.01 and 0.01, respectively) were not statistically significant. Squared multiple correlations indicated that the nonrecursive model was able to explain approximately 34 percent of the variance in both academic achievement and satisfaction with college.

Insert Table 1 about here

Both ACT composite score and high school class percentile rank had significant direct effects on achievement (0.31 and 0.34, respectively). In addition, ACT score and high school rank had significant indirect effects on satisfaction, acting through achievement (0.03 and 0.03, respectively). All of the college experience variables had statistically significant effects on satisfaction. Effects for external encouragement (0.22), affinity of values (0.17), peer interaction/influence (0.26), and faculty interaction/influence (0.16) were positive, while the effect of perceived prejudice and discrimination on satisfaction was negative (-0.10). None of the college experience variables had a statistically significant indirect effect on achievement.

Academic and Social Integration Included

An examination of the goodness-of-fit results for the models including academic and social integration revealed that the nonrecursive model again provided an acceptable representation of the observed data (χ^2 = 7.99; $\underline{df}$ = 6; $\underline{p} > 0.05$). However, an examination of the standardized effect parameters revealed that neither the effect of achievement on satisfaction (-0.08) nor the effect of satisfaction on achievement (-0.02) were statistically significant. These findings suggested that the presence of a reciprocal relationship between achievement and satisfaction was not needed to explain the observed data. Chi-square tests for the model in which all relationships between achievement and satisfaction were omitted supported this conclusion. The chi-square goodness-of-fit test was not statistically significant (χ^2 = 8.96; $\underline{df}$ = 8; $\underline{p} > 0.05$) and neither was the chi-square change test ($\Delta\chi^2$ = 0.97; $\Delta\underline{df}$ = 2; $\underline{p} > 0.05$).

An examination of the squared multiple correlations for the final model revealed that including academic and social integration in the model provided a superior explanation of students' achievement and satisfaction. Squared multiple correlations for both achievement and satisfaction were 0.50, a substantial increase in explained variance. These coefficients, along with standardized direct and indirect effect parameters, are presented in Table 2. Again, direct effects are presented first, with indirect effects below the direct effects.

Insert Table 2 about here

The standardized direct effects of academic integration on achievement and satisfaction (0.41 and 0.35, respectively) were the largest effects in the model. In addition, the effect of social integration on satisfaction was significant and substantial (0.29). The effect of social integration on grades was significant, but negative (-0.14).

Further examination of the standardized effect coefficients revealed that both external encouragement and affinity of values had significant positive effects on academic integration (0.11 for both effects) and social integration (0.11 for both effects). High school class percentile rank and faculty interaction/influence also had significant positive effects on academic integration (0.11 and 0.18, respectively), but were not significantly related to social integration. Conversely, peer interaction/influence was positively related to social integration (0.41), but not significantly related to academic integration.

Consistent with the results for the models in which academic and social integration were omitted, both ACT composite score and high school class percentile rank had significant positive direct effects on achievement (0.28 and 0.30, respectively). In addition, high school rank had significant positive indirect effects on both achievement and satisfaction (0.04 and 0.05, respectively). ACT composite score did not have significant indirect effects on either achievement or satisfaction.

All of the college experience measures had significant direct effects on satisfaction. External encouragement (0.16), affinity of values (0.11), peer interaction/influence (0.11), and faculty interaction/influence (0.10) all had positive effects on satisfaction, while the effect of perceived prejudice and discrimination was negative (-0.10). Acting through academic and social integration, external encouragement (0.07), affinity of values (0.07), and peer interaction/influence (0.10) had significant positive indirect effects on satisfaction, but not on academic achievement. In contrast, faculty

interaction/influence had significant positive indirect effects on both achievement (0.07) and satisfaction (0.08). Perceived prejudice and discrimination did not have significant indirect effects on either achievement or satisfaction.

Discussion

The results of the present research can be summarized as follows:

- This study found evidence of a modest positive reciprocal relationship between students' academic achievement (i.e., grades) and their satisfaction with college when entering ability and day-to-day college experiences were included as explanatory factors. In this model, the effect of academic achievement on satisfaction was slightly greater than the effect of satisfaction on achievement.
- Including academic and social integration in a model of the achievement-satisfaction relationship significantly enhanced the explanatory power of the model. Not only were all paths from academic and social integration to achievement and satisfaction statistically significant, but estimates of explained variance increased from 34 percent to 50 percent for both achievement and satisfaction.
- Including academic and social integration in the model also substantively altered the nature of the relationship between achievement and satisfaction. Specifically, the modest positive association between achievement and satisfaction disappeared when academic and social integration were included in the model.

Care should be taken not to over generalize these results. This study, like the others that preceded it, is institution specific. It cannot be said with certainty that these results would apply equally well to other colleges

and universities. However, these results do have important implications for research at MU, and they may be relevant to other institutions, particularly public research universities.

A second limitation of this study is its reliance on self-report measures. Although research has generally supported the validity of using survey data in educational outcomes studies (Ewell, Lovell, Dressler, and Jones, 1994; Pike, 1995), it must be recognized that self reports of college experiences may not be completely accurate. Additional studies using objective measures of students' college experiences should be conducted to insure that self reports provide accurate and appropriate information about the factors influencing the achievement-satisfaction relationship.

The fact that data on students' day-to-day college experiences, academic and social integration, and satisfaction with college were all collected at the same point in time represents a third limitation of this research. Absence of clearly time-ordered data is always a problem in causal modeling, and it is a particular problem when the causal models are nonrecursive (Davis, 1985).

Despite these limitations, the present research has important theoretical, practical, and methodological implications for researchers and practitioners interested in students' achievement and satisfaction. From a theoretical standpoint, this study underscores the importance of including academic and social integration in models of college experiences and educational outcomes. Tinto (1975) stressed the importance of students' academic and social integration to their persistence at an institution, and research has consistently supported his claim (Nora and Cabrera, 1996; Pike, Schroeder, and Berry, in press). Research has also shown that academic and social integration may be even more important to the success of minority students than majority students (Eimers and Pike, 1997).

The findings of the present research indicate that the influence of academic and social integration extends beyond retention to include achievement and satisfaction with college. Indeed, academic and social integration may have a greater effect on educational outcomes than any other aspects of the college experience. In the current study, as well as research by Eimers and Pike (1997), academic integration was more important than entering ability to students' academic achievement. Both academic and social integration also were among the most important factors influencing satisfaction with college.

Including academic and social integration in a model of educational outcomes also heightened the indirect effects of background and college experiences on achievement and satisfaction. Increases in indirect effects were greatest for the relationship between faculty-student interaction and academic achievement. When academic and social integration were not included in the analyses, the effect of faculty-student interaction on academic achievement was virtually nonexistent. However, including academic integration in the model substantially increased the indirect effect of faculty-student interaction on achievement, bringing the results more in line with findings from previous studies (Pascarella, 1980; Pascarella, Smart, and Ethington, 1986; Pascarella and Terenzini, 1977, 1980).

Somewhat surprising was the significant negative effect of social integration on students' academic achievement. This finding, coupled with an extremely low correlation between the residuals for academic and social integration, would seem to suggest that the relationship between academic and social integration is more complex than previously thought. In fact, the relationship between academic and social integration may not be linear across all levels of the two variables. For example, academic and social integration may be positively and linearly related when integration is low to moderate. High levels of academic integration, on the other hand, may come

at the expense of social integration and vice versa. Thus, too great an emphasis on the social domain may adversely affect academic integration and hinder academic achievement. Clearly, additional research is needed to better understand the relationship between academic and social integration.

Also surprising was the absence of a significant negative indirect effect for perceptions of prejudice and discrimination on academic achievement. Previous research by Eimers and Pike (1997) and Nora and Cabrera (1996) found that perceptions of prejudice had a substantial negative indirect effect on achievement, acting through academic integration. In the present study, perceptions of prejudice were not significantly related to academic integration. Neither were they directly or indirectly related to academic achievement. One possible explanation for the current findings is that the students in this study were seniors, while previous studies focused on first-year students (Eimers and Pike, 1997; Nora and Cabrera, 1996). It may be that students who are negatively affected by prejudice and discrimination leave the institution early, while seniors have developed coping mechanisms to ensure that the existence of prejudice and discrimination does not adversely affect their academic success (Hendricks, Smith, Caplow, and Donaldson, 1996; Nora and Cabrera, 1996; Tracy and Sedlack, 1984, 1985, 1987).

From a practical standpoint, the results of the present research have important implications for efforts to improve student achievement and student satisfaction. Most basically, efforts to improve achievement are not likely to enhance satisfaction and vice versa. Indeed, efforts to improve in one area may even inhibit efforts to improve in the other area. Practitioners interested in improving student achievement should focus on increasing students' academic integration. While enhanced academic integration may also improve satisfaction, it will not have as great an effect as it has on achievement. Furthermore, the results of this research suggest that efforts

to improve satisfaction by enhancing social integration are likely to succeed at the expense of achievement.

The present research also found that there may be distinct mechanisms for improving academic and social integration. That is, students' informal interaction with faculty represents a potentially powerful method of enhancing academic integration, but it has relatively little effect on social integration. In contrast, peer interaction exerts a powerful influence on social integration, but it has little effect on academic integration. Consequently, practitioners interested in improving student achievement would be well advised to examine methods of increasing students' informal interaction with faculty outside of class. Conversely, practitioners interested in enhancing student satisfaction would be well advised to consider methods of enhancing peer interaction and involvement. They should recognize, however, that gains in satisfaction are likely to come at the expense of academic achievement.

From a methodological standpoint, the results of this research demonstrated the utility of causal modeling as an analytical tool in correlational research. Too often, researchers interpret correlational data within a set of theoretical assumptions without testing the viability of those assumptions. The relationship between achievement and satisfaction is a case in point. Some researchers have assumed that the correlation between achievement and satisfaction represents the effect of achievement on satisfaction, while others have interpreted the correlation to mean that satisfaction influences achievement. Few researchers have attempted to assess empirically the direction of the achievement-satisfaction relationship.

The strength of causal modeling is its ability to decompose correlations into direct, indirect and spurious effects and then to test the significance of those effects (Finney, 1972; Wolfle, 1985). In most cases

this decomposition of correlations can be used to untangle the relationship between correlated measures (Bean and Bradley, 1986). However, causal modeling is effective only if variables are correctly specified in the model. In the current research, the modest correlation between achievement and satisfaction is clearly spurious, but the spurious nature of the correlation could not be identified until academic and social integration were included in the model.

Good measurement and powerful analytical procedures are not sufficient to ensure that causal models provide an accurate and appropriate representation of complex educational processes. As Norman Cliff (1983, p. 125) observed: "Correlational data are still correlational, and no computer program can take account of variables that are not in the analysis. Causal relations can only be established through patient, painstaking attention to all the relevant variables." The challenge for institutional research is in identifying the relevant variables that can potentially influence educational outcomes.

The results of this research reinforce the view that educational outcomes are the product of a variety of college experiences, and the ways in which college experiences influence outcomes are frequently complex. Institutional researchers can assist colleges and universities in identifying strategies for improvement. However, the quality of that assistance is directly linked to the quality of the theories underlying the research and the willingness of institutional researchers to challenge conventional wisdom by questioning taken-for-granted assumptions.

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Table 1:

Standardized Direct and Indirect Effects for the Nonrecursive Model with Integration Measures Excluded

	Outcome Measures	
Model Component	Achievement	Satisfaction
ACT Composite	0.31‡	---
	---	0.03*
High School Class Percentile Rank	0.34‡	---
	---	0.03*
External Encouragement	---	0.22‡
	0.02	---
Affinity of Values	---	0.17‡
	0.01	---
Perceived Discrimination	---	-0.10†
	-0.01	---
Peer Interaction/Influence	---	0.26‡
	0.02	---
Faculty Interaction/Influence	---	0.16‡
	0.01	---
Academic Achievement	---	0.09*
	0.01	---
Satisfaction with College	0.07	---
	---	0.01
Squared Multiple Correlations	0.34	0.34

* $p < 0.05$; † $p < 0.01$; ‡ $p < 0.001$

Table 2:

Standardized Direct and Indirect Effects for the Final Model with Integration Measures Included

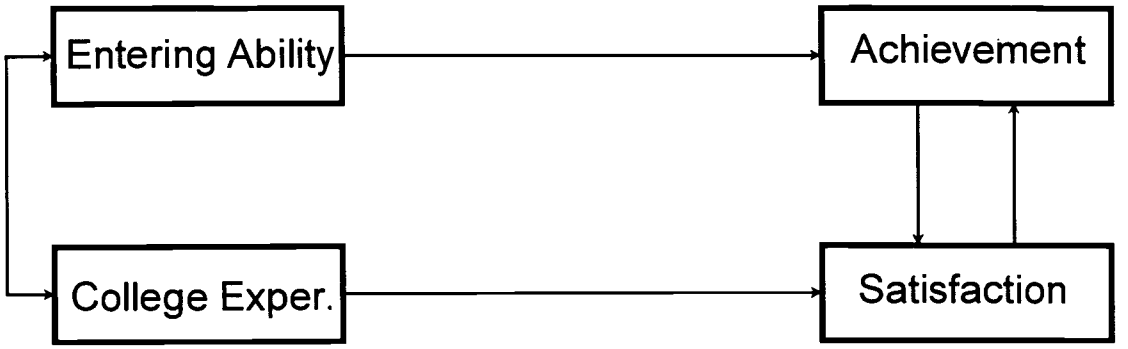
	Integration Measures		Outcome Measures	
Model Component	Academic	Social	Achievement	Satisfaction
ACT Composite	0.06	-0.05	0.28‡	---
	---	---	0.03	0.01
High School Rank	0.11†	0.04	0.30‡	---
	---	---	0.04*	0.05†
External Encouragement	0.11†	0.11†	---	0.16‡
	---	---	0.03	0.07†
Affinity of Values	0.11†	0.11†	---	0.11†
	---	---	0.03	0.07†
Perceived Discrimination	-0.05	0.03	---	-0.10†
	---	---	-0.03	-0.01
Peer Interaction	0.08	0.41‡	---	0.11†
	---	---	-0.03	0.15‡
Faculty Interaction	0.18‡	0.06	---	0.10†
	---	---	0.07†	0.08†
Academic Integration	---	---	0.41‡	0.35‡
	---	---	---	---
Social Integration	---	---	-0.14‡	0.29‡
	---	---	---	---
Squared Multiple Corr.	0.14	0.27	0.50	0.50

* $p < 0.05$; † $p < 0.01$; ‡ $p < 0.001$

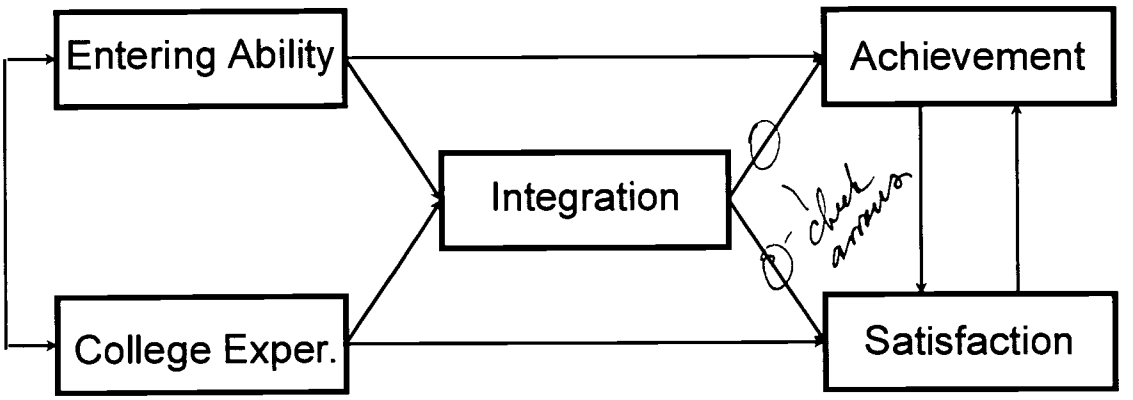
Figure 1:

Conceptual Models of the Achievement-Satisfaction Relationship

Model 1



Model 2



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