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ABSTRACT

A study of attrition after the first year of college was conducted with the 1984 entry class (N=233) of the National Technical Institute for the Deaf (NTID). A path-analytic model of nine factors affecting student persistence was tested. The nine factors were: cumulative grade point average, a composite academic performance index, ability in oral skills, social satisfaction, participation in college-sponsored extracurricular activities, scores on the Stanford Achievement Test, distance from NTID to home, percent of elementary and secondary education spent in mainstreamed programs, and participation in high school sponsored extracurricular activities. Results indicated social integration was an important factor in college persistence. Grade point average was not a critical factor in first year attrition. Results were somewhat different than those of studies with hearing students but may have been specific to NTID. (Author/DB)

Factors Affecting Persistence of Deaf College Students

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Abstract

A study of attrition after the first year of college was conducted with the 1984 entry class of the National Technical Institute for the Deaf. A path-analytic model of 9 factors affecting student persistence was tested using LISREL (N=233). The results indicated social integration was an important factor in college persistence. Grade point average was not a critical factor in first year attrition. While provocative, the reasons behind these findings may be specific to NTID. For example, many students come to NTID specifically for its social community. It is concluded, therefore, that while these results were somewhat different from those of studies with hearing students, they support the proposition that studies of college attrition cannot be generalized across institutions.

Factors Affecting Persistence of Deaf College Students

Enrollment of deaf persons in colleges has increased from approximately 250 in 1950 to more than 8000 in 1986 (Rawlings and King, 1986). This growth resulted from the baby boom after World War II, changes in societal attitudes toward providing educational opportunities to people with disabilities, and at least two significant rube a epidemics during the same time period.[1]

Such enrollment growth clearly indicates that this handicapped group is gaining access to higher education. However, according to Walter (1986), about 70 percent of all deaf students entering college exit without graduating. This figure compares to about 50 percent for entering hearing college students (Beal & Noel, 1980). If we make the assumption that this rate of attrition is too high, especially for a handicapped group of students who will find it increasingly difficult to compete in a society that is moving from a "manufacturing" to an "information" based economy without education beyond high school, then two questions must be posed: Why are the rates so high, and what can be done to reduce these rates of attrition?

This paper reports results of a study that applied structural equation modeling to an assessment of factors influencing the persistence or withdrawal of one group of deaf

students after their first year of college at the National Technical Institute for the Deaf (NTID) at the Rochester Institute of Technology (RIT).

A theoretical model presented by Spady (1970), elaborated by Tinto (1975) and tested in various environments (Pascarella & Terenzini, 1979, 1980; Pascarella & Chapman, 1983; Bean & Metzner, 1985) provides an explanatory predictive theory of the persistence/withdrawal process that can be applied, with modifications, to deaf college students.

The theory posited by Tinto (1975) is longitudinal and considers persistence to be, primarily, a function of the quality of a student's interactions with the academic and social systems of an institution. That is, students come to a particular institution with a range of background traits (e.g., achievement, communication, sex, social-economic status, personality). These background traits influence, not only how the students will perform in college, but also how they will interact with, and subsequently become integrated into, an institution's social and academic systems. Other things being equal, the greater students' level of social and academic integration, the more likely they are to continue their enrollment at the particular institution.

There is little published research about causes of withdrawal and attrition among deaf college students. Welsh &

Schroedel (1982) used regression techniques to study factors affecting the success of deaf graduates from the Rochester Institute of Technology. Sauer, et al. (1986) used path analysis to explore relationships among high school background, success in college and subsequent employment of deaf college students. Neither study, however, investigates the factors relating to college withdrawal among deaf students.

The use of a general model to explain student persistence for a specific population or particular institution must be applied with caution. Both NTID students and the institution itself differ in many ways from the populations and institutions used to develop the Tinto model. Students' skills in academic areas vary more widely than their hearing counterparts and obviously in their ability to communicate and socialize with both hearing and other deaf students.

Skill levels in the areas of math, science and reading[2] often hamper a deaf person's ability to use traditional avenues of information transfer in college. While most postsecondary programs for deaf persons provide support services of interpreting and notetaking (Rawlings, et al., 1986) these services, by themselves, may not necessarily improve the ability of deaf students to understand the content of a textbook or a lecture. The provision of lecture notes or sign language interpretation for lectures does not necessarily mean that the

"achievement barrier" created by low reading and mathematics skills has been breached. Taken, together, the factors of communication, achievement skill levels and experience in mainstreamed educational settings are generally thought to be important factors impacting college social and academic system integration.

Initial Model Conceptualization

Since these factors (achievement, communication and mainstreaming) appear to be critical variables influencing the success of deaf persons in college, they were added to the conceptual model described by Tinto (1975) for the purposes of this research.

NTID is a national program and the variable "distance from home" was also included in this study, since the relevant literature suggests a relationship between distance from home and college withdrawal. Three variables were selected as precollege factors and the impact of these precollege factors on achievement and communication skills was then posited. High school achievement and communication skills, in turn, were thought to impact on Academic and Social integration of the students and, subsequently, on their decision to withdraw from or persist in college. The purpose of this study was to then assess (or test) the adequacy of this model's explanation of college persistence among a sample a deaf students at NTID/RIT.

Method

The general method employed in this study was a longitudinal, ex post facto analysis of the NTID 1984 entry class regarding college persistence during the first year of study. Measures were obtained from the 1984-85 academic year freshman class (a) prior to attending college, (b) during a precollege program, (c) during the final academic quarter of the first year, and (d) after completion of the first year. These measures were incorporated into causal models (see Figures 1 and 2) which were evaluated using LISREL-VI (Joreskog & Sorbom, 1984).

In path analysis, models are constructed that hypothesize the causal relationships among a set of variables and the adequacy with which observed correlations fit those in the hypothesized model is evaluated. In using LISREL, or other path analytic techniques, it is necessary to distinguish between exogenous variables (in which variability is assumed to be determined by causes outside the model) and endogenous variables (in which variability is explained by other variables within the model). In this model, Stanford Achievement Test Score, percent mainstreaming, participation in high school activities, distance from home and social satisfaction were specified as exogenous variables. Academic performance, college speechreading scores,

grades, participation in organized college activities and student persistence/withdrawal were endogenous variables.

The LISREL analysis produces maximum likelihood estimates of the strength of the relationships for paths between variables. These coefficients are comparable to unstandardized regression weights.

Sample and Design

Four-hundred-twelve (412) students comprising the 1984-85 academic year freshman class were the initial participants in this study.[3] They participated in a 4-week precollege program immediately prior to the start of their September classes, during which they were given a battery of standardized communication and achievement tests and were asked to complete questionnaires on their background and attitudes towards college. In the final quarter of the year, all students still enrolled were asked to complete a questionnaire about attitudes toward participation in college life. In addition, information about cummulative grade point average and enrollment status (persist/withdrawal) at the end of the first year were extracted from student records.

Complete data on all measures were collected for 233 students, and they comprised the sample for the data analyses. For these students, the mean degree of hearing loss, as measured by pure-tone thresholds for the better ear, was 96.1 dB (SD = 11.9). The mean grade-level score on the reading comprehension

section of the California Reading Test was 8.4 (SD = 1.35), and their mean age was 18.9 years (SD = 1.05). There were 127 males and 106 females.

Variables

The ten (10) variables included in the model for this study are graphically displayed in Figure 1.

The dependent variable, end-of-freshman-year persistence/withdrawal, was dummy coded 2 = persistence and 1 = withdrawal. Data on this variable were obtained from official records in September 1985. Of the 233 students used in this study for which there was complete data, 82% returned for their second year of study.

Cumulative GPA at the end of the first year of college was calculated. This is the mean grade for all technical and liberal arts courses completed by students from their first quarter, Fall 1984, to the end of the third quarter, Spring, 1985.

Four predictor variables obtained during the first year of college were as follows:

1. An academic performance index was derived by adding the standardized scores from four ability measures:
    a. The California Reading Test, junior high level (Tiegs and Clark, 1963), is a standardized reading test which includes comprehension questions about

written text, reading skills items and items regarding following written directions.

b. The NTID Mathematics Diagnostic Test includes subtests about fractions, decimals, percentages and algebra and is a measure of basic mathematics skills (Taylor, 1979).

c. The Abstract Reasoning subtest of the Differential Aptitude Test (Bennett, Seashore, Wesman, 1972) requires perception of an operating principle in a series of changing diagrams and is a non-verbal measure of a student's reasoning ability.

d. The Michigan Test of English Language Proficiency measures the ability of a student to understand printed English and is intended as a measure of the ability to succeed in an academic educational environment (Upshur, Palmer, Harris, and May, 1961).

2. Ability in Oral Skills was measured by the NTID Speechreading without Sound test (Johnson, 1976). Students viewed a silent videotape with sentences from the CID Everyday Sentence List (Davis and Silverman, 1964) and then reproduced each of the ten sentences in writing. Scores were obtained by counting the number of key words written correctly.

3. A social satisfaction scale was derived from seven Likert questionnaire items that addressed such aspects of social life as "the chance to meet people with the same interests as yours" and "the opportunity to make close friends here." This scale had an alpha coefficient of .82.

4. Participation in College-sponsored extracurricular activities was measured with a set of 17 Likert items assessing frequency of participation in activities such as sports, fraternities/sororities, etc. Total scores were obtained by summing the individual scores across the 17 items. This scale has an alpha coefficient of .72.

There were four background predictor variables included in the causal models:

1. Stanford Achievement Test is a total battery score which includes scores on the mathematics Comprehension and English Comprehension subtests as taken from the Stanford Achievement Test -- Advanced Battery (Madden, et al., 1972). The test was administered during the students' last year of high school.

2. Distance from NTID to home grouped the number of miles from NTID to home into a 5-Point scale. Values were 1 (10 or less miles from NTID to home), 2 (11-50 miles),

3 (51-100 miles), 4 (101-500 miles), and to 5 (501 or more miles).

3. Perce[illegible]nstreaming is a scale derived by calculating for each student the percent of years spent in elementary and secondary mainstreamed programs, defined as "public schools for the hearing" and included "day classes for the deaf in a hearing school."
4. Participation in high school-sponsored extracurricular activities was measured with a set of Likert items assessing frequency of participation in 16 activities (e.g. "intramural athletic teams," "theatre," etc.). Total scores were obtained by summing the individual item scores across the 16 items. This scale has an alpha coefficient of .72.

Analysis

LISREL results pertaining to degree of fit between hypothesized and observed correlation matrices were evaluated for two models. The smaller the residual difference between the hypothesized and observed correlation matrix, the better the fit. One model-fitting index of goodness-of-fit is a chi-square test; the smaller the chi-square value, the better the fit. The LISREL-VI program also produces a goodness-of-fit index which can

have values ranging from zero to one, with higher values indicating better fit (Joreskog & Sorbom, 1984).

Results

Table 1 displays the means, standard deviations and correlations among the 10 variables selected for this study.

Insert Table 1 about here

When using LISREL, a model must be specified for testing; in this case the initial model submitted to LISREL was one based solely on theoretical considerations from Tinto (1975) and Pascarella's work. The results from this initial model testing were then used diagnostically to construct a second model (Model 2), which was subsequently evaluated.

The maximum likelihood ratios and standard errors for the paths between variables for Model 1 are displayed in Figure 1. The results of the tests of overall goodness-of-fit for Model 1 were mixed. The LISREL goodness-of-fit index was relatively high (.98), but the chi-square test of the goodness-of-fit index indicated the observed correlation matrix was significantly different from that estimated by the model (χ^2= 25.27, p=.02). Thus, for this test, the fit of the model was not as good as it would have been if the chi-square value had not been statistically significant.

Insert Figure 1 about here

Another estimate of goodness-of-fit is the ratio of the chi-square value to the degrees of freedom for that model. The closer this value is to one, the better the fit of model to the data (Bentler & Bonnet, 1980; Burt, 1973). For Model 1, the ratio was 1.94, indicating a less than ideal fit.

The maximum likelihood estimates for individual paths and the corresponding tests of significance are as important as the tests of goodness-of-fit. The negative likelihood estimate obtained in Model 1 for the path between participation in sponsored college activities and persistence indicates that first-year students who participated in a relatively large number of activities were less likely to persist. Social satisfaction was also significantly related to persistence; those students who expressed greater satisfaction were more likely to persist. In contrast, grades, college speechreading performance, and distance from home were not significantly related to persistence. The lack of a statistically significant path between grades and persistence is especially surprising given the theoretical basis for the existence of that path and the large (r=.46) correlation between these variables. Since only two of the five hypothesized

direct paths going to persistence were statistically significant, these results also indicate limited support for Model 1.

Given this limited support, the following efforts were undertaken to develop a revised model which would better fit the data:

1. Following suggestions of Long (1983) and Pedhazur (1982), hypothesized paths which were not satistically significant were eliminated.

2. Additional paths were inserted in the revised model based on the values of the modification indices. The modification index is a diagnostic tool provided by the LISREL-IV program which can be used to improve the fit of the model through the insertion of additional paths. Values of the modification indices suggested the addition of paths from social satisfaction to college speedreading and to sponsored college activities. A path from distance from home to participation in sponsored college activities was also added. Modification indices also indicated that paths from social satisfaction to persistence and from distance from home to persistence should be included in the revised model, even though they had not been statistically significant in Model 1.

3. Finally, a path going from grades to persistence was included in the revised model even though it was not significant in Model 1 and the modification indices did not suggest such a

path. It was included because previous research with normally hearing students strongly supported the existence of this path (Pascarella, Terenzini, & Wolfe, in press) and because it was possible that the test of the revised model might yield statistical support for this path.

Figure 2 shows the maximum likelihood ratios and standard errors for Model 2 (the revised model). Results of the tests of LISREL goodness-of-fit indicate that Model 2 better fit the data than Model 1. The value of the chi-square test indicated that the observed and estimated correlation matrices were not significantly different from each other (χ^2=9.53, p=.57). The goodness-of-fit index was .99 and the ratio of the chi-square value to degrees of freedom was .87, further indicating a better fit for Model 2.

Insert Figure 2 about here

The maximum likelihood ratios also indicated that Model 2 fit the data better than did Model 1. Note in Figure 2 that three of the four hypothesized paths to persistence were statistically significant: those emanating from social satisfaction, participation in sponsored college activities and from distance from home.

Social satisfaction played a more important role in Model 2 than in Model 1. The path from satisfaction to persistence was again significant and the paths from satisfaction to college speechreading and to participation in sponsored college activities were also significant. These paths indicated that social satisfaction exerts a positive influence on speech reading and that high satisfaction tends to lead to reduced participation in sponsored activities.

Distance from home was also a more important variable in Model 2. Statistically significant paths indicated that when the students' home was closer to NTID, they tended to participate in more activities and to persist in college.

Efforts to develop a third model with an even better fit were not successful. While this third model yielded a lower chi-square value relative to the degrees of freedom, it merely added more nonsignificant paths to the model; hence the second model was accepted.

Discussion

The study of student persistence/withdrawal is both important and complex. As this research demonstrates, not only is persistence a multi-dimensional phenomenon composed of academic, psychosocial and demographic factors but, as noted by Pascarella (1986), it varies by institution and changes continuously even within one group of students. Thus, this study

supports the position that any institution's pattern of student persistence/withdrawal is, by definition, seriously limited in generalizability.

Discussion of the Findings

An important finding was that freshman students who expressed greater social satisfaction, in the sense of perceived opportunities to meet socially relevant goals, were more likely to persist. This result is consistent with Tinto's (1975) theory that persistence is a function of the students' interactions with the social systems of college, as well as with academic ones. Taking this interactive perspective, social satisfaction is assumed to reflect personality characteristics of students as well as their response to the social environment. In line with this thinking, the path from social satisfaction to speechreading performance can be interpreted as reflecting the tendency of students who are more comfortable with a hearing environment to demonstrate better communication skills.

The direct path from social satisfaction to persistence may reflect the importance of the goal of having a quality social life, including opportunities to meet interesting and compatible fellow students and to date members of the opposite sex. Furthermore, students' dissatisfaction with their social life can be a major reason for leaving college. One indication of the high value students attach to social life at NTID is that many

incoming students have reported the quality of social life to be one of the primary factors attracting them to the college (Lang & Stinson, 1982). Furthermore, in a national study of deaf students and of educators of the deaf, both groups agreed that the size of the deaf population was the most important factor in attracting students to postsecondary programs (Innes, 1985). It can be assumed, therefore, that a major reason for the appeal and attractiveness of large programs such as NTID or Gallaudet University is the availability of many social opportunities. The results of this study suggest the importance of further studying the impact of college socialization on student satisfaction and persistence.

Another result relating to social integration is the finding that students who engaged in more sponsored college activities were more likely to withdraw. One interpretation of this result is that students who participate in many activities in their first year can be overemphasizing their social involvement, which can result in withdrawal. This interpretation assumes that to make a satisfactory adjustment to college, students must first address the tasks of establishing relationships with roommates and hallmates, developing independent living skills, mastering self-management of time for studying, etc. If students are involved with many sponsored social activities, they are likely to devote insufficient effort to addressing the more basic needs

they must meet in order to be truly integrated into the college environment.

Students whose homes were further from college were more likely to withdraw. This finding is consistent with most previous studies of this relationship for normally-hearing students (Lenning, 1982). Distance from home may have a greater impact on some deaf students' adjustment to college than it does for most hearing students. Also, approximately half of the college's students come from mainstreamed programs. Many of these students experience much social isolation in that setting (Mertins, 1986), and, with their limited social experience, it can be especially difficult for them to adjust to the social stimuli and complexities of college life. Periodic visits home can provide a break from the stress of this adjustment; however, if the student's home is far away, as is the case for many students, there may be no such breaks, thus resulting in greater dissatisfaction with college.

The results supported three paths in the model that went from high school achievement test performance to college achievement test performance and, then, to grades. These results are not surprising and are consistent with previous research with hearing and deaf college students. Achievement test scores tend to be highly intercorrelated (e.g., Welsh & Schroedel, 1982), and

these scores, in turn, are generally good predictors of college grades (Bean, 1982).

What is surprising is that the final link in this series of paths, the one going from grade-point average to persistence, was not significant; i.e., there was no support for including this path in the model. This finding is contrary to that of previous research, which has generally found a grades-persistence relationship (Bean, 1982), and grade-point average is generally viewed as an indicator of the students' academic integration into college (Chapman & Pascarella, 1983). So why did the relationship fail to hold up in this study? The result may be due to the unique set of alternatives and supports provided by the academic environment of NTID. Many students are enrolled in preparatory programs in the first year and, therefore, they are not required to take numerous demanding courses in their majors. Furthermore, four program levels are offered: Bachelor's degree, Associate of Arts degree, Diploma, and Certificate. In many majors, students who encounter difficulty at a given level can change in the next quarter to a less difficult program. There is also variation in the difficulty of different majors, and students can make a change in this manner. Finally, there is an unusually extensive program of counseling, tutoring and remedial instruction for those experiencing academic difficulty.

It cannot be safely assumed that there is no relationship between grades and persistence throughout deaf students' college experience. Grades may very well affect persistence in subsequent years when students more frequently take demanding courses in their majors. Attempts are presently underway at NTID to continue following the 1984 entry class through the completion of their 2nd and 3rd years of study and to test Model 2 against each year's attrition data.

Limitations of the Study

It must be pointed out that the logic behind the use of structural equation modeling and LISREL is to test and compare models, not to create them. For the purpose of this preliminary investigation, however, where the goal was to better uncover and organize hypothesized direct and indirect relationships, the utility of LISREL was both valuable and appropriate.

The findings reported and discussed here, while highly provocative to and relevant for NTID, may not be the same for other postsecondary institutions serving a deaf student population. It is hoped, however, that this research design may prove useful in attempts to understand student persistence/withdrawal from the standpoint of both secondary college preparatory programs and postsecondary institutions.

Concluding Comments

The need to study student persistence for purposes of institutional planning and programming is becoming increasingly important as the eligible student applicant pools nationwide continue to shrink. From an individual standpoint, college persistence and degree attainment is crucial to obtaining a good job. For deaf students in particular, a college education can translate into personal & career opportunities that would not be possible to obtain with a high school diploma. For example, the salaries of NTID graduates are 93% of what a comparable hearing cohort earns. However, deaf high school graduates earn just 70% of comparable hearing high school graduates (Welsh, Walter, & Reilly, 1986). This fact, coupled with today's need for more technically qualified workers, indicates a premium being placed on the deaf student who completes a program of study at NTID. In the case of NTID students, therefore, the failure to persist in college directly translates into significant lost earnings and social status. Additionally, a poor occupational performance for any disabled group means added social burdens and has implications, for example, for Vocational Rehabilitation and Social Security.

Footnotes

[1]The epidemics occurred in 1957-59 and 1963-65. It is estimated that the 1963-65 epidemic resulted in more than 8,000 additional births of people with congenital hearing impairments.

[2]For example, the median reading grade equivalent for 17-year-old hearing-impaired students is 3.2 on the Stanford Achievement Tests (Allen, 1986).

[3]Students admitted to NTID must have a hearing loss that seriously limits their chance of success in college (70 dB or greater) without special support services. They must also demonstrate at least an 8th grade level of academic achievement, which is substantially higher than that of the average graduate of a high-school program for deaf students (Allen, 1986).

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Table 1

Means, Standard Deviations, and Correlations of Variables

Variable	1	2	3	4	5	6	7	8	9	M	SD
1. Stanford Achievement Test (high school)	–									9.28	1.33
2. Distance from NTID to home	-.13*	–								2.95	.52
3. Proportion of secondary education in mainstreamed setting	.13	-.05	–							.43	.41
4. Participation in high school-sponsored extra curricular activities	-.20**	-.03	-.30**	–						11.10	6.44
5. College achievement test performance	.76**	-.12	.19**	-.14*	–					12.01	2.91
6. College speech reading	.32**	-.06	.26**	-.23**	.39**	–				53.25	29.23
7. Social satisfaction	.08	-.06	.05	.09	.14*	.13*	–			19.25	3.95
8. Sponsored college activities	-.10	-.15*	-.16*	.45**	-.09	-.15*	.18**	–		4.74	4.39
9. Grade point average	.39**	-.07	.06	-.15*	.39**	.15*	-.04	-.04	–	6.41	1.46
10. Persistence/withdrawal	.17*	-.10	.08	-.19**	.18**	-.02	.11	-.07	.46**	1.82	.38

Note.
n=233
*$p \leq .05$
**$p \leq .01$

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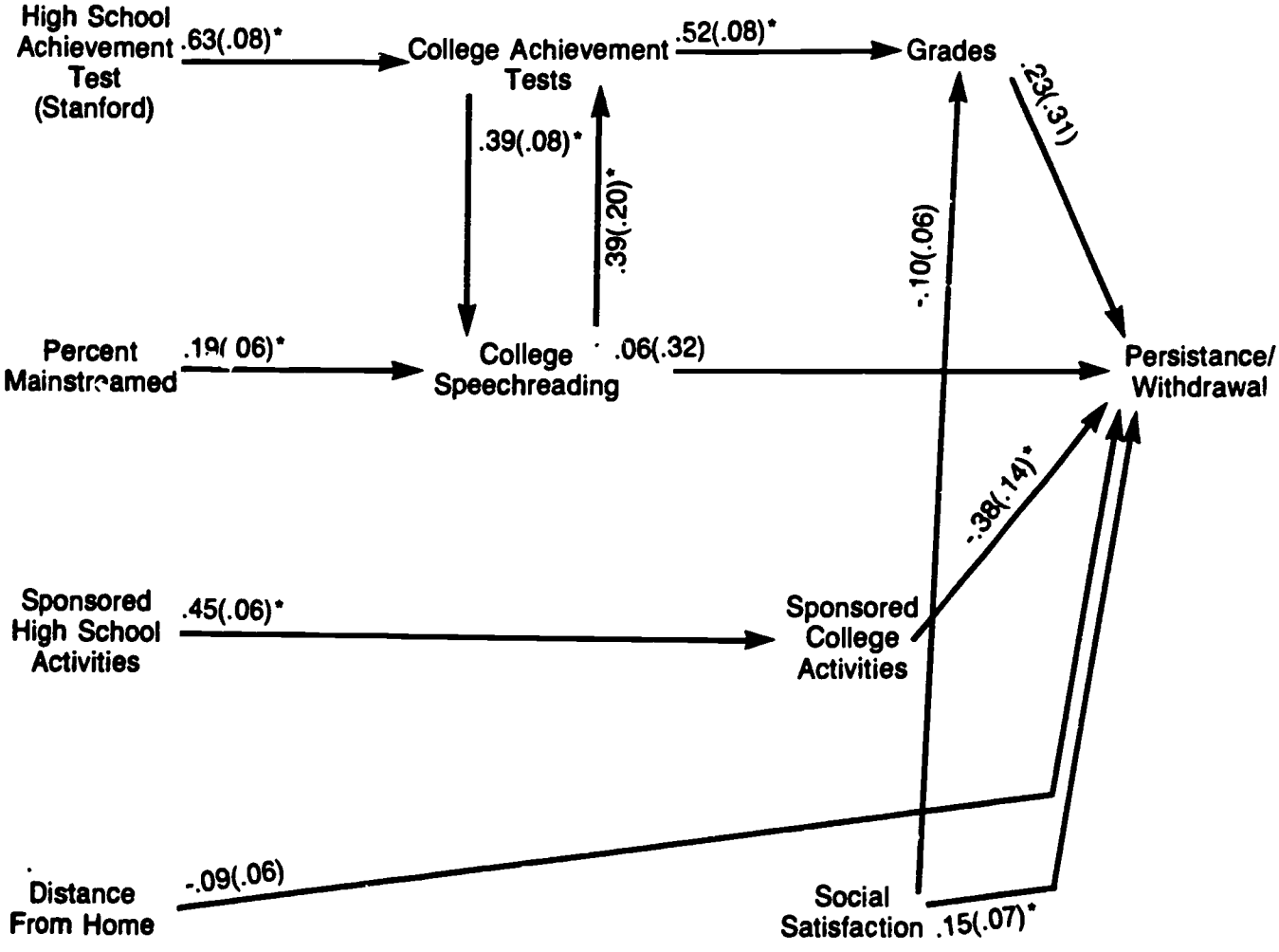
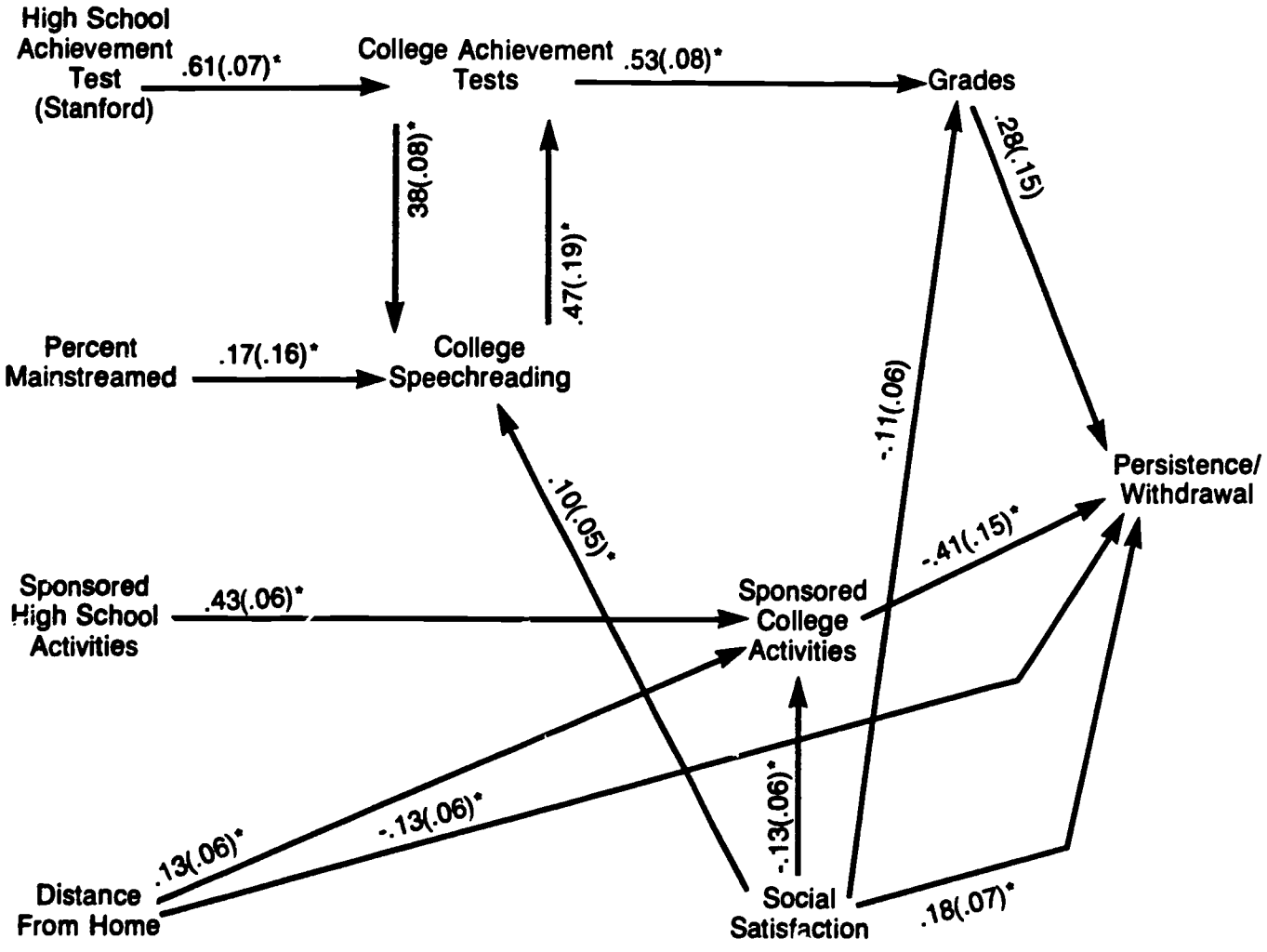


* $p < .05$

Figure 1
Model 1: Initial Model of Factors Affecting College Persistance with Maximum Likelihood Estimates (and Standard Errors)



* $p < .05$

Figure 2
Model 2: Revised Model of Factors Affecting College Persistance with Maximum Likelihood Estimates (and Standard Errors). Paths added from Social Satisfaction and Distance From Home