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ABSTRACT

Detailed methodology used to evaluate a causal model of school environment is presented in this report. The model depicts societal features that influence school district values and organizational characteristics, which in turn influence school operations and personnel attitudes and values. These school variables affect school community members' perceptions of school climate, which then influence student outcomes. Questionnaires were completed by 352 principals, 14,721 teachers, and 24,874 students from 362 junior and senior high schools in 36 states and Canada. Findings suggest that student and/or teacher climate variables played a significant role in all the analyses. Of the sociodemographic variables, the percentages of students receiving free lunches and the percent of minority students in the school had the largest and most consistently direct and indirect effects on the outcome variables. Most school input variables' effects on outcomes were mediated by school climate variables. The findings indicate reasonable support for Keefe's mediated (1985) model of school outcomes and constitute the basis for a comprehensive assessment of school environments and possible interventions. Seven figures and one table of final variables are included. (8 references) (LMI)

Measurement and Model Linkages in Assessing School Environments

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Measurement and Model Linkages in Assessing School Environments

As Jim described, our approach to school environments was very broad including over 100 variables. Given a variety of decisions designed to reduce the number of variables we were left with six major outcome variables and a total of 28 hypothesized independent and mediating variables. My objective in this paper is to describe briefly the method of analysis we used to evaluate the NASSP model of school environments and to present the results of our analyses for the major outcome variables listed in Table 1.

Our model consisted of the linkages depicted in Figure 1.

Briefly, the model indicates that societal features influence values and organizational characteristics of the district, which in turn, influence the operation of the school and the attitudes and values of school personnel. The latter school variables influence teachers', students', and parents' perceptions of the school climate, which in turn, relate to student satisfaction and productivity, cognitive, affective, and behavioral outcomes.

The following section outlines the method and procedures used to evaluate the model, followed by a presentation of the findings from the analyses and recommendations for future evaluation of model components.

Sample and Procedures

Sample

The sample consisted of 364 schools from 36 states and Canada. Schools were selected based on a randomized cluster sampling. Ten metropolitan areas were selected as cluster points. Concentric circles defined by postal zip codes were drawn around the metropolitan midpoints. A specific number of schools were randomly selected within each concentrically defined area. When

a school refused to participate, another with similar size and location characteristics was selected. This sampling procedure produced 261 of the schools. The remainder were schools participating in an effective schools study conducted by NASSP. The procedures assured a wide range in school and community size. Seventy-five schools (20.6%) were junior high level, while 252 (69.2%) were senior high level schools. Thirty-six schools included both junior and senior high level students.

Principal Respondents. The school principals were asked to respond to a two-part questionnaire. The first section included questions regarding societal, district, and school input and output variables. In this section, various options were provided to the principals for each question. The second section included open-ended questions about school input and output variables as well as student achievement. The sample of principals included 356 who answered the first section and 355 who provided information from the second section. Three hundred fifty-two principals returned usable information from both sections.

Teacher Respondents. The teachers were asked to respond to questions about school goals, school climate, school commitment, participation in decision making, degree of autonomy, and job satisfaction. Information was obtained from 14,721 teachers from 362 schools. The number of teachers per school ranged from 8 to 86 with the mean number of teachers being 40.67.

Student Respondents. The students were asked to provide information on school climate, self-efficacy, satisfaction with teachers, and overall satisfaction. Survey data were obtained from 24,874 students from 362 schools. The number of students per school ranged from 14 to 120 with the mean number of students being 68.71. Students were randomly divided into two

samples. Responses of students in the first sample supplied data regarding school climate while (a mediating variable) the responses of those in the second sample were used as school indices of satisfaction with teachers, overall satisfaction with the school, and academic self-efficacy. The responses of teachers and students within each school were aggregated to the school level.

Procedure

Permission from the schools to administer the surveys was solicited by Dr. James Keefe of NASSP. The surveys were mailed by NASSP to school principals who then distributed the appropriate materials to their teachers and students. Principals were asked to obtain a maximum of 75 student participants and 75 teacher participants. All principals were asked to participate. A letter explaining the project accompanied each packet of measures. All responses were anonymous and confidential. Once teachers and students completed the measures, they were collected by the school principal who mailed them to the researchers at Michigan State University. MSU researchers reviewed each set of data for problems (torn answer sheets, missing data, etc.), coded open-ended answers, scored the data, and did the computer analyses described in this report.

Measures

The total set of variables that were part of our attempt to model school outcomes are contained in Table 1 which is the same set referred to by Keefe. The School District and Community Environment variables and many of the School Input variables were supplied by principals from available archival data (e.g., school size, population of the area, average teacher salary) as were some of the outcome variables listed in Table 1 (e.g., student achievement,

percentage of students receiving disciplinary referrals, percentage passing all courses, and percentage completing the school year.)

Other attitudinal or affective variables were measured using existing multi-item scales. Teacher (12 items) and student climate (12 items) were assessed by items that best represented each of the scales in the NASSP School Climate Survey (Schmitt & Ostroff, 1987). Alphas for the teacher and student measures were .89 and .91 respectively. Perceived degree of autonomy (α = .80) and participation in decision making (α = .80) were measured using the Hage and Aiken (1967) scales. Student satisfaction (α = .89; nine items) was measured using a scale developed for this purpose by Schmitt and Loher (1984) and self-efficacy (α = .92) was measured using the eight item scale developed by Brookover et al. (1969). Principal and teacher attitudes toward change were measured with a fifteen-item scale developed by Schmitt and Ostroff (1987). Alphas for these scales were .68 and .86 for principals and teachers respectively.

We should also note that many other variables were measured as well though these variables did not correlate as expected with other variables in the model. So, the models we are presenting in this paper are the end result of many exploratory and data reduction analyses.

Prior to the modelling efforts described below, we also did analyses to insure that the scales in our sample could be considered organizational (or school) level variables. When aggregating data to a higher level of analysis (in this case, individual to organizational) it is important to establish individual agreement at the higher level (e.g., James, 1982). One-way analyses of variance (ANOVA) were computed on the individual level data for each scale using the school code number as the independent variable. From the

ANOVA results, an eta squared statistic was computed for each scale by dividing the variance due to responses between schools by the total variance among individuals. The result of this calculation provides information on the amount of variance that is due to differences between schools as opposed to differences within schools. Eta squares ranged from .08 for student's satisfaction with school to .28 for teacher climate; by comparison, James (1982) indicated that median eta square in previous research was .12.

Data Analyses

In estimating and testing the linkages specified in the model depicted in Figure 1, we proceeded as follows:

1. In the first step, we examined zero order correlations of variables and eliminated those variables that did not correlate with other variables as specified in the model. This produced the set of variables listed in Table 1.

2. Each of the input variables was regressed on the Society/District variables. The standardized regression weights from this analysis were estimates of the paths relating the Society/District variables to the Input variables.

3. The mediating variables were regressed on Society and Input Variables. In this analysis, the Society variables were entered on the first step, then the Input variables reflecting the fact that the NASSP model suggests that the influence of Society variables on "Mediating" variables is thought to occur through the Input variables in the model. The standardized regression weights for the Input variables in these analyses were estimates of the path coefficients relating Input variables to Mediating variables.

4. The final set of regressions consisted of regressions of the various outcome measures on both Input and Mediating variables. These analyses provided estimates of path coefficients for (a) the linkage between Mediating and Outcome variables; and (b) estimates of the direct effect of Input variables on Outcomes.

In addition, we report and discuss a LISREL analysis for the Student Achievement outcome variable in more detail. The LISREL analysis provides an overall test of the fit of the hypothesized structural model though as we indicated above, we used a variety of exploratory analyses to arrive at the model discussed below hence the results should be replicated and/or cross-validated (Cudeck & Browne, 1983).

Results

The results of our path analyses for five of the outcome variables are presented in Figures 2 through 6. All path coefficients in these diagrams are statistically significant. While there is not time to discuss each of these analyses in detail, there are several general statements I can make about these analyses then I will discuss in more detail the analysis of student achievement. First of all, all of the adjusted R^2 values are substantial (.23 to .42). Student and/or teacher climate variables play a significant role in all of the analyses. Of the sociodemographic variables included in these analyses, the percentage of students receiving free lunches and the percent of minority students in the school have the largest and most consistent direct and indirect effects on the outcome variables. While there is evidence for some direct effects of school input variables on outcomes, most such relationships are mediated by school climate measures which is consistent with the hypothesized model depicted in Figure 1.

In Figure 7, we present the results of additional LISREL analyses of the correlation matrix involving the student achievement dependent variable. Preliminary analyses of the type used for the other outcome measures suggested that revisions to the general model would result in superior fit to the observed data; so again, the final Figure 7 is the result of several model modifications.

The goodness of fit test for the model depicted in Figure 7 was statistically significant (X^2 = 146.17, df = 31) indicating a significant difference between the observed correlation matrix and the matrix reproduced by the parameter estimates. The goodness of fit index (GFI) was .91, the adjusted goodness of fit (AGFI) was .846 and the root mean square residual (RMSR) was .12 (see Jöreskog & Sörbom for a description of these fit indices). While these indices indicate a moderate fit to the data, examination of the modification indices and residuals indicated that MINORITY and LUNCH had direct effects on student achievement in addition to the indirect effects estimated by the model and that LUNCH had a direct effect on TCLIM. Addition of these three paths produced a significantly better fitting model (X^2 = 70.60, df = 28; GFI = .96; AGFI = .91; and RMSR = .08). Moreover, all three of the added parameters were statistically significant. The original model also contained four nonsignificant parameters indicating the TCSAL and ELECT had relatively minor relationships with the remainder of the variables.

CONCLUSIONS

The results of these modelling efforts indicate reasonable support for the mediated model of school outcomes proposed by Keefe et al. (1985). The parameter estimates depicted in the figures constitute the basis for the comprehensive assessment of school environments and recommendations regarding

possible interventions which are the topics addressed by the next two speakers.

Obviously, the models depicted in Figures 2 through 7 can be further refined. The NASSP plan calls for continued data collection by users of the NASSP climate and satisfaction instruments and by the CASE Information Management System. Further analyses of the existing data base as well as analyses of data that will be collected in the future have the potential to add significantly to our understanding of what produces certain school outcomes. Finally, while we have used causal language throughout our talk, it is important that we keep in mind that we have cross-sectional correlational data and that many causal mechanisms other than those we suggested may, in fact, account for variance in school outcomes.

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Table 1 Final Set of Variables Used to Assess Hypothesized Model Linkages

School District and Community Environment

1. Population of the area in which the school is located. (POP)[a]
2. Percentage of school age children in the area served by the school. (SCHATT)

School Input Variables

3. Governance: public or private. church-related or not. (GOV)
4. Percentage of minorities enrolled in the school. (MINORITY)
5. Number of students receiving free or reduced-price lunches. (LUNCH)
6. Percentage of students in remedial programs. (REMED)
7. Number of activities for which budgeted resources are available. (BUDGRES)
8. Number of elective courses in the curriculum. (ELECT)
9. Average per pupil expenditure (exclusive of capital outlay). (PUPILEXP)
10. Principal's attitude toward change. (CHGSCL)
11. Performance of the school's administrative team. (ADMNPERF)
12. Average teacher salary. (TEACHSAL)
13. Student-teacher ratio. (STRATIO)
14. Percentage of school employees who are professionals. (PROFRAT)
15. Number of transfers in and out of the school. (TRANSFER)
16. Average daily attendance. (ATTEND)
17. Number of students whose primary language is English. (SENG)
18. Principal perceptions of autonomy of action in the district. (PHIERSCL)
19. Principal perceptions of participation in school decisions. (PPARTSCL)
20. Number of students enrolled in the school. (NOSTUDS)
21. Nature of student dress rules in the school. (SDRESRUL)
22. Nature of student employment rules in the school. (SEMPRUL)
23. Importance of 14 selected school goals. (GOAL)
24. Teacher satisfaction (NASSP Teacher Satisfaction Survey). (TSATSCL)
25. Teacher perceptions of autonomy of action in the district or school. (THIERSCL)
26. Teacher perceptions of participation in school decision. (TPARTSCL)

School Climate

27. Teacher Climate (NASSP School Climate Survey) (TCLIMSCL)
28. Student Climate (NASSP School Climate Survey) (SCLIMSCL)

Student Outcomes

29. Total achievement (combined standardized reading and mathematics scores for all grades in school). (TOTACH)
30. Percentage of students receiving disciplinary referrals. (DISPSCL)
31. Percentage of students passing all courses. (PASS)
32. Student satisfaction (NASSP Student Satisfaction Survey). (SSATASCL)
33. Student self-efficacy (Brookover Self-Concept of Ability scale). (SEFF)
34. Percentage of students completing the school year (not dropping out). (STUDCOMP)

[a]Abbreviations used in presenting the results of the path analyses.

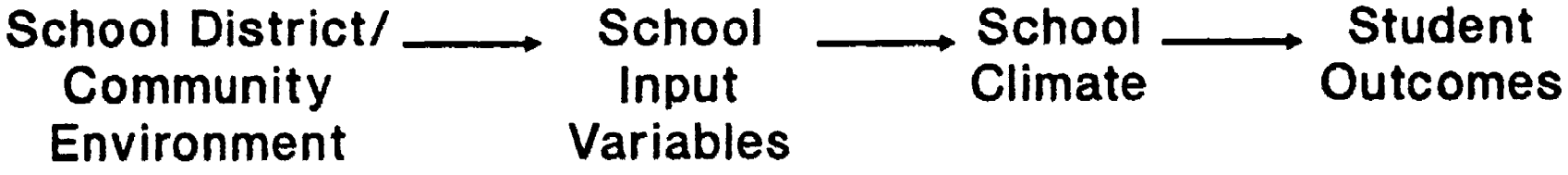


Figure 1. Model of Determinants of Student Outcome Variables

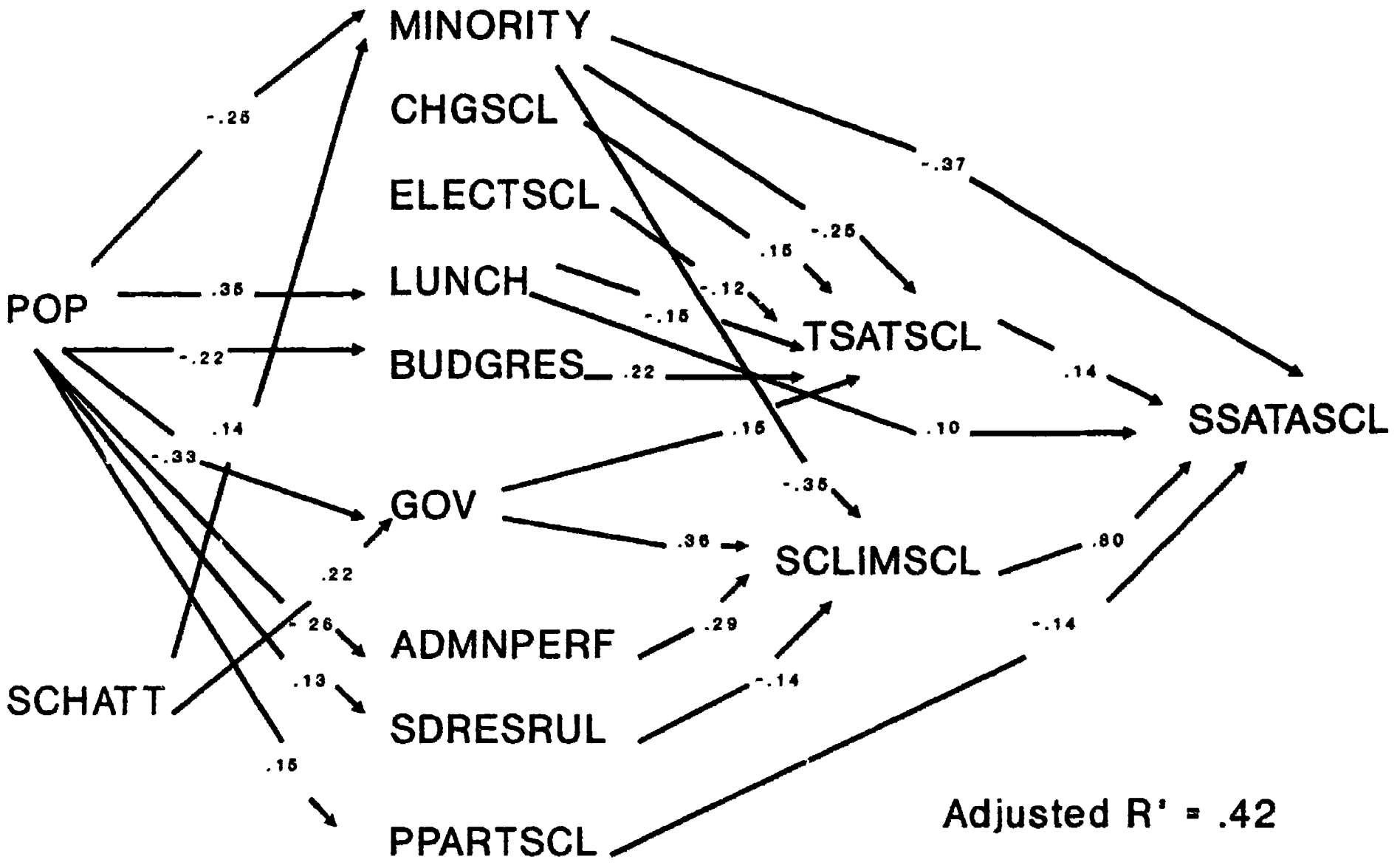


Figure 2. Path diagram of hypothesized determinants of student satisfaction

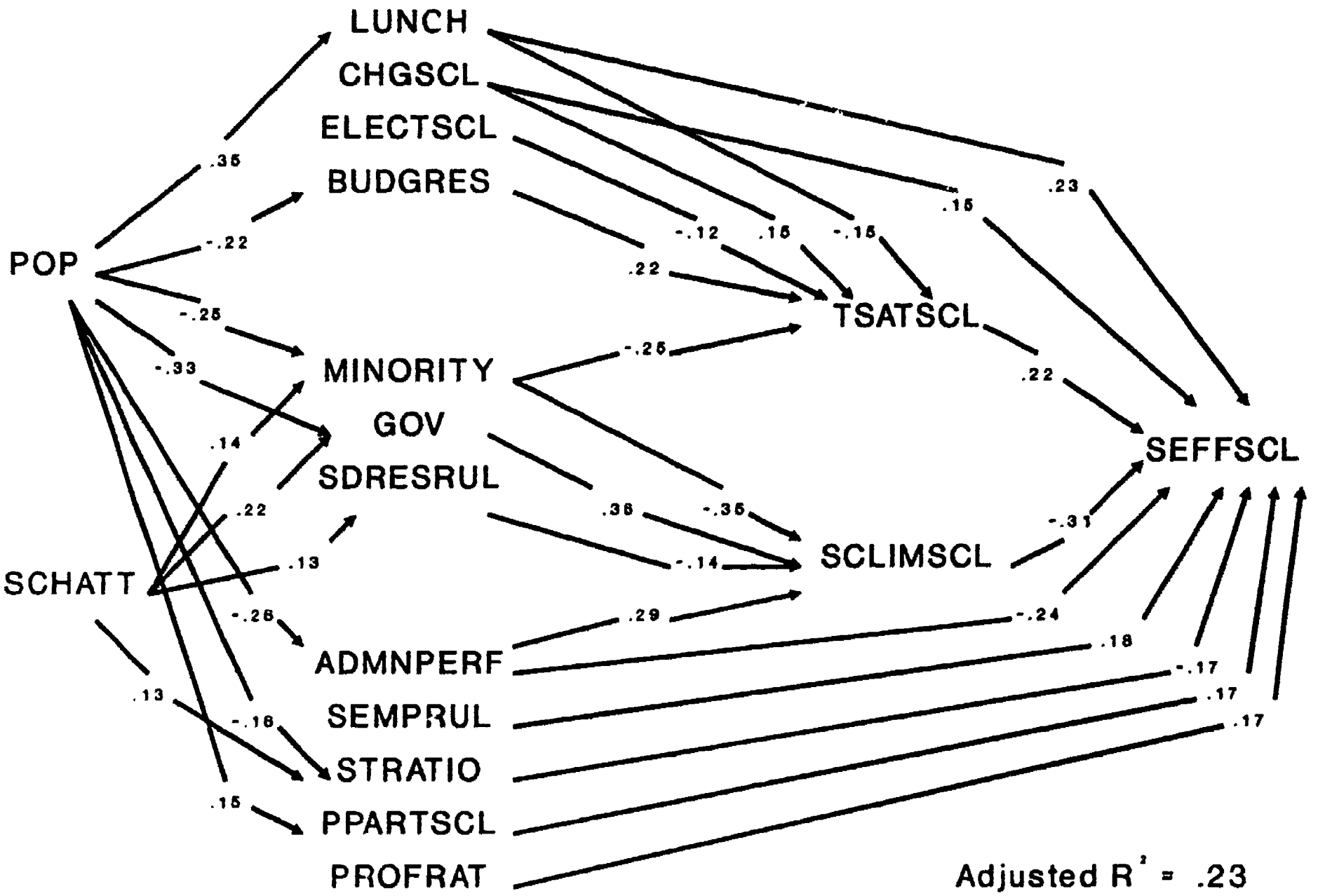


Figure 3. Path Diagram of Determinants of Student Self-efficacy

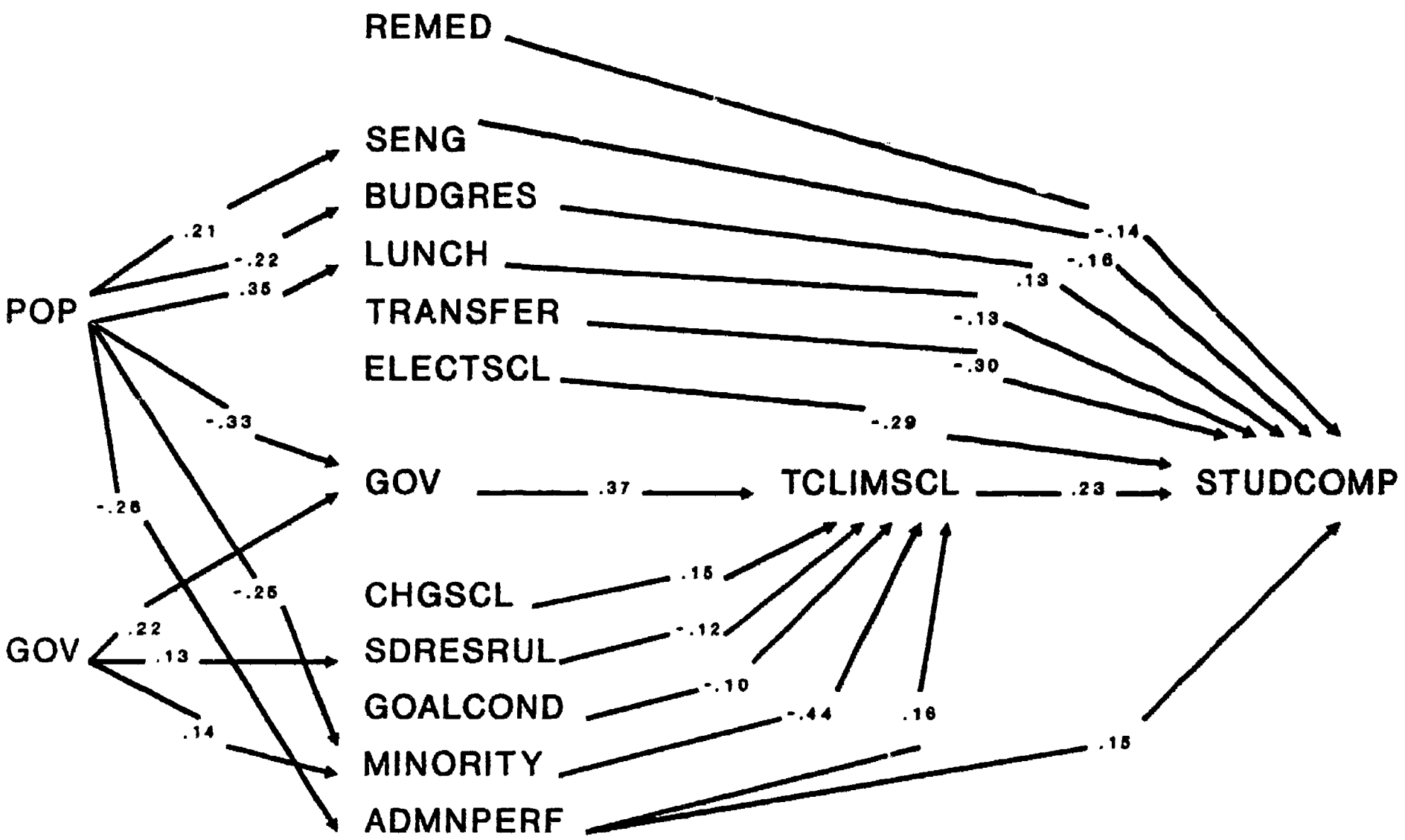


Figure 4. Path diagram of hypothesized determinants of students passing all courses.

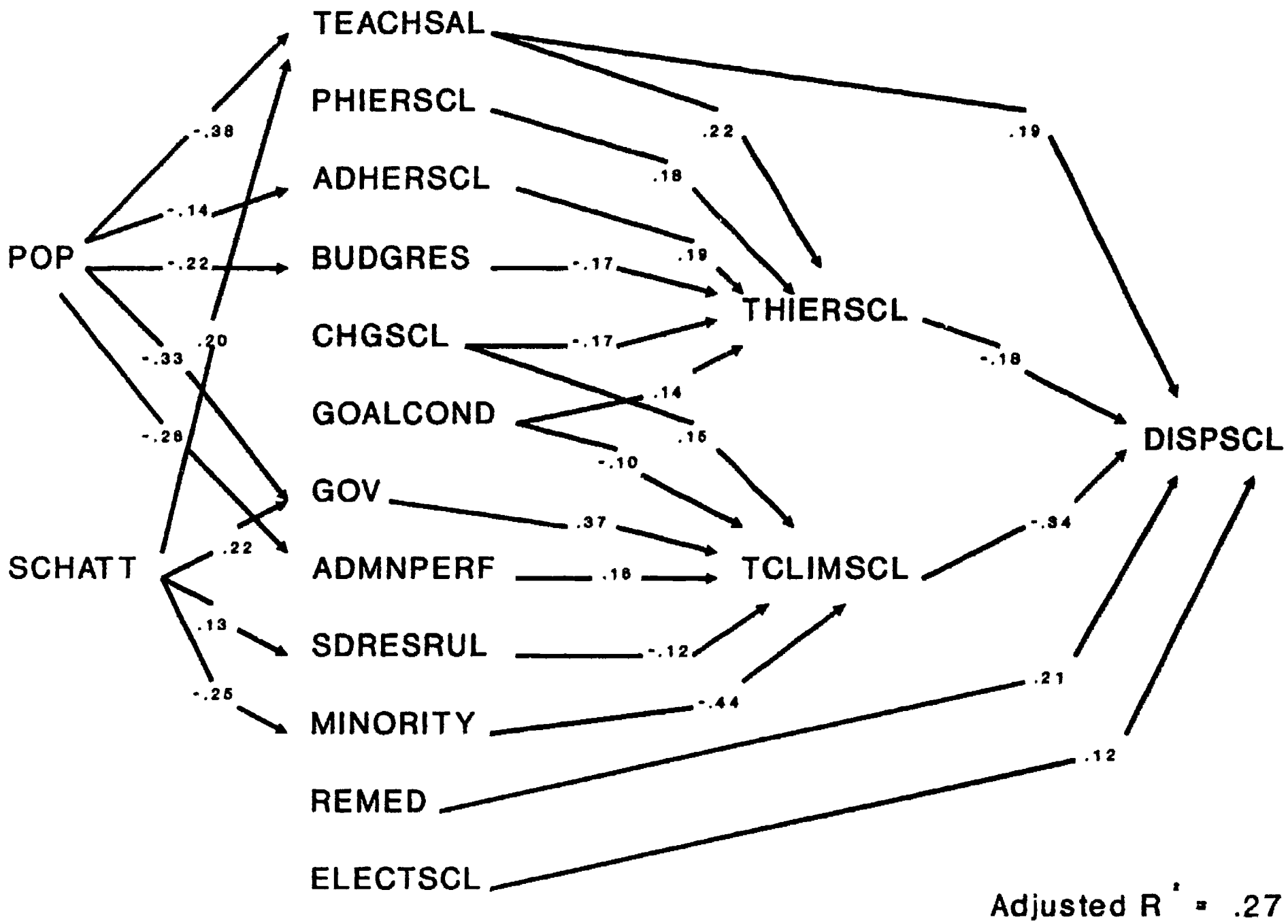
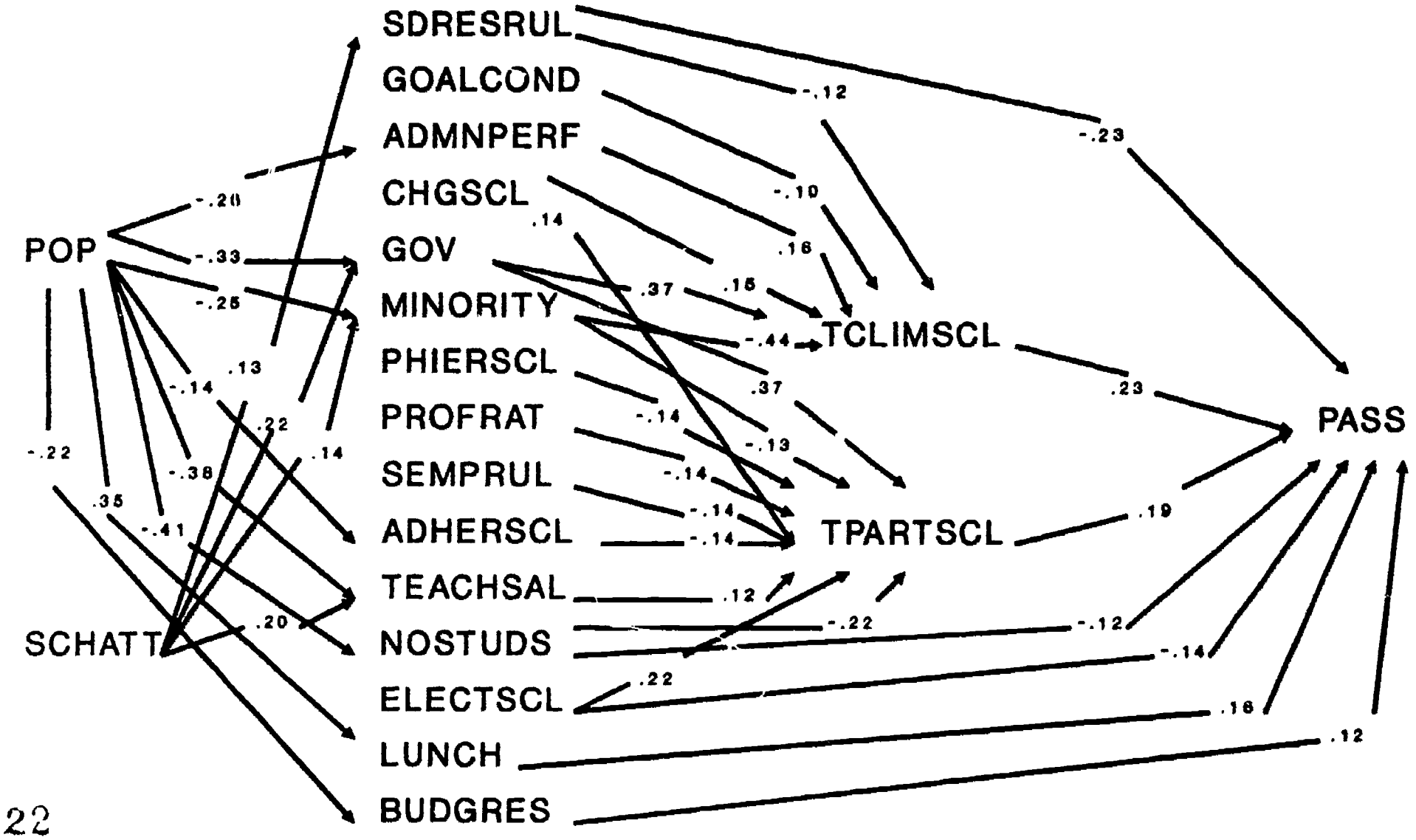
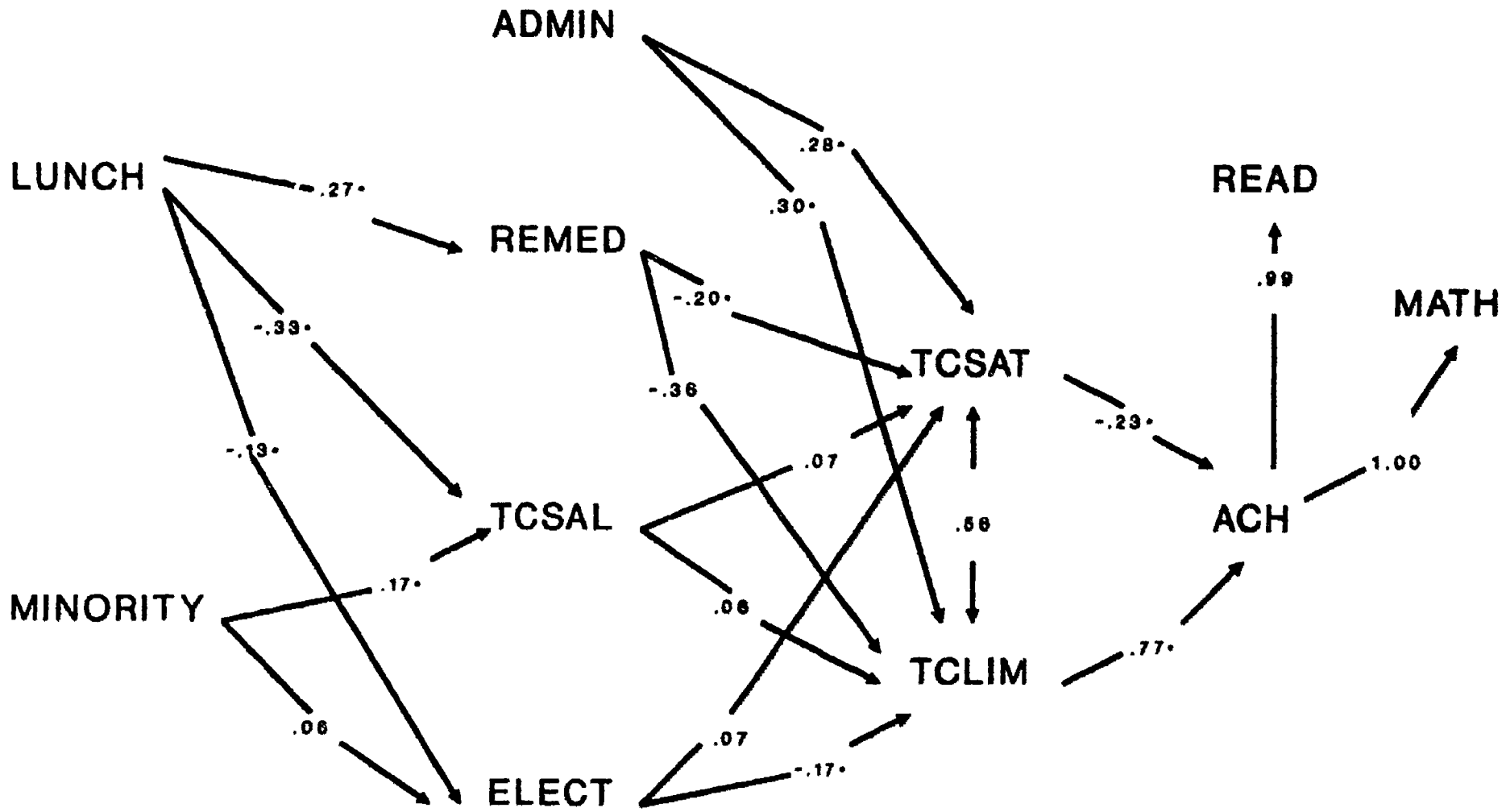


Figure 5. Path diagram of hypothesized determinants of disciplinary problems



Adjusted R^2 = .39

Figure 6. Path Diagram of Hypothesized Determinants of percent passing



R^2_{ACH} = .38
R^2_{TCLIM} = .26
R^2_{TCSAT} = .14
R^2_{ELECT} = .02

R^2_{TCSAL} = .14
R^2_{REMED} = .19

Figure 7. Results of LISREL analyses of Student Achievement.
An asterisk indicates that the parameter was statistically significant.