ABSTRACT
                This paper outlines procedures used to derive variables from
data in the National Survey of Postsecondary Faculty; these variables were
then used to create measures not expressly included as items in that survey.
The derived variables were used to examine faculty satisfaction in two
contexts: first, the complexity of satisfaction, and second, the importance
of the interaction between faculty professional values and institutional
norms. The sample consisted of 480 nonproprietary postsecondary institutions
in the United States, granting 2-year or higher degrees. Faculty were
selected through stratified random sampling and were then further stratified
by program area. Four independent variables were identified: tenure status,
academic discipline, scholarly activity, and role concept; the dependent
variable was measured by a Likert-like scale of faculty responses concerning
adequacy of institutional/departmental funding, professional
authority/autonomy, institutional mission/philosophy, administrative
leadership, relationships with colleagues, and support services. Factor
analysis reduced the original 19 measures to three factors: collegiality,
workload, and autonomy. The paper concludes that use of large samples such as
those collected by the National Center for Education Statistics will prove to
be an important tool for researchers studying issues facing education in
general and postsecondary education in particular. (Contain 30
references.) (CH)

Derivation of Variables from the
National Survey of Postsecondary Faculty
for Use in Secondary Data Analysis

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Editor
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ABSTRACT

Derivation of Variables from the
National Survey of Postsecondary Faculty
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Researchers (including institutional researchers, university faculty, doctoral students, and professionals employed by research institutes studying postsecondary education) are increasingly discovering the wealth of data made available by government agencies, particularly the US Department of Education. Since comprehensive data collection on a national scale cannot possibly be undertaken or replicated by an individual or a team of scholars, the raw data from surveys has been made available to researchers by the Federal government to ensure that the most comprehensive data available may be accessed.

The purpose of this paper is to outline the procedures implemented to derive variables from the National Study of Postsecondary Faculty in order to create measures not expressly included as items in that study. As part of a study on satisfaction of higher education faculty, items were combined to create new variables that were not immediately evident. Techniques discussed include a contrast matrix (to examine disciplinary differences), weighted index (to determine rate of scholarly activity), calculating percentage of time for teaching versus research (to measure role conceptualization), and principal components analysis to identify factors determining faculty satisfaction.

Introduction

The last decade of the Twentieth Century has witnessed unprecedented challenges to the structure and culture of higher education. The shrinking availability of grant support coupled with public demand for accountability has resulted in criticism from within and outside the academy, escalating competition among faculty to attract external funding and internal resources, and increasing the tension between research and teaching.

The responsibility for projecting higher education's position to the public (either the media, elected officials, parents or students) falls upon chancellors, presidents and chief academic officers. What is often overlooked, however, is the critical role of the Office of Institutional Research in providing the data needed for administrators to educate the public and to engage in strategic planning and policy-making activities as well. On individual campuses, across the institution and throughout systems, the responsibility for amassing the concrete indicators as to where the institution measures up against the postsecondary education universe (or, on a smaller scale, designated benchmarking institutions) is falling to administrators in institutional research and/or chief academic offices.

Increasingly, researchers (including university faculty, doctoral students, and professionals employed by research institutes studying postsecondary education) have discovered the wealth of data made available by government agencies, particularly the US Department of Education. Since comprehensive data collection on a national scale cannot possibly be undertaken or replicated by an individual or a team of scholars, the raw data from surveys (e.g., National Student of Postsecondary Faculty [NSOPF], Integrated Postsecondary Education Data System [IPEDS], National Postsecondary Student Aid Study [NPSAS], etc.) has been made available to researchers by the Federal government to ensure that the most

comprehensive data available may be accessed. Interest in utilizing such databases is shared by institutional research and academic administrators (for the reasons outlined above) and faculty (usually in schools of education) conducting research on issues for which this data is available. The purpose of this paper is to outline the procedures implemented to derive variables from the National Study of Postsecondary Faculty in order to create measures not expressly included as items in that study.

<div align="center">

Methodology

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The purpose of the research project under discussion (Pollicino, 1995) was to consider faculty satisfaction in the context of two premises: first, the complexity of satisfaction, and second, the importance of the interaction between faculty professional values (expectations) and the institutional values (norms, culture) manifest in the mission. The 1988 National Survey of Postsecondary Faculty (NSOPF-88), conducted by the National Center for Education Statistics (NCES) from December 1987 through October 1988, provides a comprehensive and reliable data set for a study of faculty satisfaction with institutional support. The NSOPF-88 was conducted under the auspices of the Office of Educational Research and Improvement (OERI) of the United States Department of Education under contract with SRI International, Menlo Park, California (Russell, Fairweather & Hendrickson, 1991).

Concerns surrounding the secondary analysis of sample surveys have been addressed by social science research methodologists including Hyman (1987), who cautioned users to be aware of the original data collection and tabulation procedures to appraise errors in design, and Babbie (1979), who advocates the application of logical reasoning supported by a carefully conceptualized theoretical framework. The study discussed here was conducted with awareness of NCES procedures, which were well-documented both in published materials and through

consultation with staff in Washington, DC. In addition, the terms used to label all variables were based upon the research literature, which was cited only in cases where operational definitions reflected those chosen for this study.

The sample for NSOPF-88 was selected from the 1987 Integrated Postsecondary Education Data System (IPEDS) file of 3,159 institutions that met the study criteria. The design called for a sample of 480 nonproprietary United States postsecondary institutions granting a two-year (associate) or higher degree with accreditation at the higher education level recognized by the United States Department of Education.

The sample was categorized into 12 primary strata, including: public research universities, private research universities, other public doctoral-granting universities, other private doctoral-granting universities, public comprehensive colleges and universities, private comprehensive colleges and universities, liberal arts colleges, two-year public colleges, two-year private colleges, independent medical schools, religious colleges, and other. Various substrata were formed from these original divisions based upon institutional size, a function of the number of faculty.

Selection of the faculty for the study was conducted through stratified random sampling and further stratified by program area, including agriculture/home economics, arts, business, education, engineering, English and literature, foreign languages, history, health, humanities (other than the fields listed separately), philosophy, natural sciences (including mathematics, statistics, computer science), social sciences, and all others (Russell, et al., 1991).

For the purpose of this project only the responses from four strata used by NSOPF-88, corresponding to the 1987 Carnegie Classification of Higher Education Institutions (research, doctoral, comprehensive, liberal arts), were selected. Public and private institutions were

combined because preliminary analysis indicated that responses were not significantly different

from each other and the number of institutions in each strata was uneven. Furthermore, the

liberal arts institutions only included the private sector.

This arrangement limited the sample to those institutions offering the minimum of the

bachelors degree (as in Bailey, 1993; Fairweather, 1993), eliminating the two-year colleges,

independent medical schools, religious colleges and the miscellaneous category. The rationale

for this restriction was that these institutions were not stratified by disciplinary area, a factor

considered to be of importance (Bentley & Blackburn, 1990; Biglan, 1973a, 1973b;

Blackburn, Bieber, Lawrence & Trautvetter, 1991; Bowen & Schuster, 1986; Kuh & Whitt,

1988; Linsky & Straus, 1975; Tarter, 1993; Taylor, Locke, Lee & Gist, 1984). Furthermore,

the two-year institutions have been found to possess a climate and culture demonstrating

markedly different interaction with satisfaction than baccalaureate institutions (Spencer, White,

Peterson, & Cameron, 1989).

Derivation of Independent Variables

The importance of the data screening phase of any research project cannot be

overstated, particularly in studies using secondary analysis of sample surveys. In addition to

the context in which a term (e.g., satisfaction) is included in a question, the responses

(categorical and open-ended alike) must be analyzed with an eye toward revision through

recalculation of values or even elimination of cases. In this case, preliminary screening

illuminated characteristics of the data that resulted in the revision of several variables.

Tenure Status

Examination of the open-ended responses to the item requesting faculty rank revealed

some unusual titles (i.e., preceptor, administrator, etc.), with low frequencies; a review of

these cases revealed a tendency for respondents to fall outside of "regular" tenure-track and tenured appointments. Therefore, status was recoded into a dichotomous variable (tenure-track, tenured) in order to restrict the focus to faculty holding regular appointments at their institutions, similar to Fairweather (1993)--who used this same NSOPF-88 data set--and Blackburn, Behymer and Hall (1978) who studied those holding a "regular fulltime faculty teaching appointment in a university or four-year college" (p. 133).

Academic Discipline

Constructing a variable suitable to reflect the faculty member's academic discipline proved to be complex. The principal field or teaching discipline encompassed 141 categories (Russell, et al., 1991). It was decided to combine the disciplines into three categories: arts and humanities (and related applied fields), sciences (and related applied fields), and social sciences (and related applied fields). The SAS program was written to recode each disciplinary area into one of these three categories.

This arrangement left academic discipline as the sole categorical variable. In order to proceed with the analysis, a contrast matrix was developed. A priori, or planned (orthogonal) comparison is a more powerful test of mean differences than post hoc analysis (Glass & Hopkins, 1984; Pedhazur, 1982; Tabachnick & Fidell, 1989). In order for the contrast to be orthogonal, the sum of the cross products of the weights of the comparisons must be equal to zero. In this case, the pure and applied sciences were contrasted with the remaining disciplines (SciVsNon). Independent of this comparison was the contrast of the social sciences with the arts and humanities (SocVsHum), with the pure and applied sciences assigned zero weight. This process permitted all three disciplinary areas to be considered with two degrees of freedom (see Table 1).

Table 1

Values Assigned to Academic Discipline Measures for

Orthogonal Comparison

	Social Sciences	Pure/Applied Sciences	Arts and Humanities	Total
SciVsNon	-1	2	-1	0
SocVsHum	-1	0	1	0

Note. SciVsNon = Pure/Applied Sciences contrast with Non-sciences; SocVsHum = Social

Sciences contrast with Humanities

Scholarly Activity

Preliminary descriptive statistics revealed that the differences between types of faculty

scholarly output and professional activity across disciplines were so great as to cause problems

with interpretation. A single measure of scholarly activity was needed since the numerous

items describing faculty activities in the NCES survey (i.e., 48) would be cumbersome and

dilute the final analysis. A weighted index was developed through a four-step process.

First, crosstabulations and frequencies were generated in order to determine the

patterns of activity by discipline.[1] It was evident that faculty in the various disciplines

participated in different types of scholarly activities. All variables determined to be applicable

to and representative of engagement in scholarly work (Bailey, 1993; Boyer, 1990) were included in order to legitimize cross-disciplinary analysis and give each area credit for being active in the appropriate manner conducive to its research paradigm.

Next, a formula was implemented to weight the various types of scholarly activity: WTPROD = refereed journal articles + books (multiplied by three) + presentations (multiplied by .5) + book reviews and articles + chapters in edited volumes + research and technical reports + exhibitions and performances + published nonrefereed journals (multiplied by .5) + monographs (multiplied by two) + textbooks (multiplied by two). The weightings do not replicate any single study but were derived from a combination of the "existing literature and conventional wisdom" (Kelly, 1986, p. 66).

The items carrying a value of one were considered standard indicators of productivity (Linsky & Straus, 1975; Pranulis, 1985; Straus & Radel, 1969). Monographs and textbooks were doubled in weight because although requiring considerable effort they are generally deemed to be less scholarly than books, which were then assigned a value of three. Although the actual values for these items vary across studies, it is not uncommon to differentiate between types of book-length works (Braxton & Bayer, 1986; Linsky & Straus, 1975; Straus & Radel, 1969). Conversely, presentations and articles in nonrefereed journals were halved (i.e., multiplied by .5) on the basis that they are generally not subject to the same scrutiny as refereed and edited works.

Faculty respondents ranged widely in their number of years in the profession, meaning that a scholarly activity index--although weighted--would be possibly misleading because it would reflect a simplistic total figure. Therefore, professional age was calculated by subtracting the year of the conferral of the highest earned degree from 1989, the year

subsequent to the survey. Similar arrangements have been used by researchers to control for the accumulation of publications as a result of career age (Allison & Stewart, 1974; Bayer & Dutton, 1977; Braxton, 1983; Kelly, 1986; Neumann, 1977). Finally, the rate of scholarly activity (SCHOLPRD) was determined by dividing the productivity score by professional age in order to represent the rate at which a faculty member is active in his/her respective disciplinary or professional community (Braxton, 1983; Kelly, 1986).

Role conceptualization

The variables measuring role conceptualization were created in order to reflect the percentage of time devoted by faculty to their responsibilities of teaching, scholarship and research. Respondents were asked to indicate the percentage of time allocated during a typical week to various activities, which were categorized as follows to create two variables: 1) TeachPct (percentage of time devoted to teaching and related activities) was derived from teaching and grading papers; 2) ScholPct (percentage of time devoted to scholarly activities) consisted of research/scholarship, giving performances, seeking outside funding, and other professional development. The percentage of time devoted to service to the institution and community was eliminated since the combination of these three measures would correlate perfectly to total 100 percent.

With screening of the independent variables complete, the number of final respondents (N = 4552) from baccalaureate-granting institutions still guaranteed that there would be no compromise to the recommended ratio of five cases per independent variable (Tabachnick & Fidell, 1989). Frequencies and descriptive statistics were generated by SAS UNIVARIATE in order to construct a profile of the respondents who were retained for the final analysis. The social sciences and humanities were each represented by slightly over one-third of the

respondents (37.8 and 35.1 percent, respectively); the balance (27.1 percent) was comprised of faculty in the sciences.

This final categorization is roughly representative of the demographic breakdown nationwide. Faculty had been sampled by program areas subsequent to the stratified institutional sample drawn from the IPEDS file, which yielded the following proportions: social science faculty accounted for 34 percent, the humanities were represented by 41 percent and the sciences consisted of 25 percent of eligible respondents.

Derivation of the Dependent Variable

The dependent variable of satisfaction with institutional support was initially represented by faculty responses to a Likert-type scale of statements concerning adequacy of institutional and departmental funding for activities as well as satisfaction with conditions for teaching and research, including professional authority and autonomy, institutional mission and philosophy, administrative and faculty leadership, quality of chief campus administrators, relationship with colleagues, teaching and research assistance, and support services.

Factor analysis was performed in order to reduce the 19 items to a more manageable measure of satisfaction. Principal components analysis (PCA) was selected since this method of factor extraction is "the solution of choice for the researcher who is primarily interested in reducing a large number of variables down to a smaller number of components" (Tabachnick & Fidell, 1989, p. 626). Factors were subsequently confirmed and interpreted in light of standard procedures (i.e., Scree test, parallel analysis) and the research literature.

Factor Analysis Results

The results of the initial principal components analysis of the items addressing faculty satisfaction resulted in the retention of four factors with eigenvalues greater than one. The

total of four factors was considered appropriate, given its parsimony with the criteria

recommended by Tabachnick and Fidell (1989) that the number of components with

eigenvalues greater than one in this case should fall between four and six (i.e., the number of

variables divided by five and three, respectively). The scree test revealed the eigenvalue of

the fourth factor to be slightly off-line; it was decided to examine it further upon rotation.

Promax was chosen as the rotation method because it has the advantage of generating

an orthogonal (varimax) pre-rotation followed by an oblique rotation. Furthermore, there was

no reason to expect that the factors which describe "satisfaction" would be uncorrelated.

Overall job satisfaction and authority over non-instructional matters did not load on any factor

and were deleted; overall satisfaction was highly correlated with most of the other measures.

Two other items (teaching and research assistance) were deleted due to unacceptable

percentages of missing/not applicable responses combined with strong correlations with the

availability of support services and equipment. Principal components analysis was again

invoked; the promax rotation of the 15 remaining variables yielded three well-defined factors.

In order to further confirm the decision to retain three factors, a parallel analysis (PA)

was performed. The rationale for this procedure is derived from the possibility of sampling

error interfering with the interpretation of eigenvalues from correlation matrices. Parallel

analysis creates a second correlation matrix from a randomly-generated data set with the

identical number of subjects and variables as the actual data (see Table 2). The criteria for

determining the number of factors is the number of eigenvalues from the actual data that

exceed the values of their counterpart eigenvalues from the random structure (Horn, 1965;

Humphreys & Ilgen, 1969).

Table 2

Results of Parallel Analysis of NSOPF and Random Data Sets

	Eigenvalues					
Factor	1	2	3	4	5	6
NSOPF	5.71	1.62	1.16	0.99	0.90	0.79
Random	1.10	1.08	1.06	1.05	1.04	1.03

The three retained factors accounted for a combined total of 53 percent of the variance, and were labeled Collegiality, Workload and Autonomy, respectively. Loadings equal to or greater than .45 (20 % overlapping variance) were interpreted because there was a considerable gap between this mark and the remaining values (Tabachnick & Fidell, 1989). Two-thirds of the loadings (10 of 15) fell into the ranges considered by Comrey (1973) as excellent (i.e., in excess of .71, with 50% overlapping variance), very good (i.e., in excess of .63, with 40% overlapping variance), or good (i.e., in excess of .55, with 30% overlapping variance). Correlation coefficients among the independent and dependent variables were minimal and the promax rotation produced low inter-factor correlations, appropriate for interpretation. The rotated factor pattern was selected because it measures the unique variable-factor relationship by eliminating common variance (Tabachnick & Fidell, 1989). This matrix of pattern coefficients serves to give the standardized weights of the variables regressed on the oblique factors which are preferable for factor interpretation (Cattell, 1962).

The loadings of the rotated factor pattern matrix for the three extracted components are depicted in Table 3. Collegiality indicated a perception of an atmosphere of positive administrative and faculty relationships, leadership, and cooperation (institution-wide as well as inter- and intra-departmental), and endorsement of the institutional mission/philosophy.

Workload items consisted of satisfaction with the conditions for carrying out the different professorial responsibilities and confidence in the quality and availability of support services, facilities, and equipment. Time management, especially between different areas of responsibility, is a challenge for faculty facing departmental, college and institutional expectations for teaching, research, and service.

Autonomy was measured by confidence in personal authority to make decisions about instructional matters, as well as job security and the quality of departmental/program leadership. It appears important that a faculty member feel that he/she has the opportunity to exercise personal professional autonomy and that this perception is linked to job security.

Conclusion

Comprehensive studies of college and university faculty that can be generalized to the higher education community are becoming a necessity in this age of accountability. Simultaneously, the need for results stratified by such variables as institutional type, academic discipline, gender, etc. (in multiple combinations) calls for large sample sizes. Accessing data collected by governmental agencies such as the National Center for Education Statistics is a logical choice for institutional researchers and faculty in schools of education. The ability to manipulate this carefully collected raw data into new variables will become more important in the future as researchers attempt to study on a large scale the issues facing education in general and postsecondary education in particular.

Table 3

Promax Rotated Factor Pattern Loadings for Faculty Satisfaction

	Factor			
C	W	A	h^2	Source of Satisfaction
.75	.14	-.10	.62	Faculty-administration relations
.73	.13	-.11	.59	Quality of chief administrators
.73	-.09	.14	.56	Faculty spirit of cooperation
.72	-.04	-.00	.50	Faculty leaders: Senate/Council
.69	.07	.01	.53	Institutional mission/philosophy
.66	-.01	.12	.49	Interdepartmental cooperation
.48	-.18	.40	.43	Quality: department colleagues
-.13	.81	.09	.63	My workload
-.00	.73	.20	.66	Req'd mix: teaching, research, administration & service
-.03	.72	.03	.51	Time for advisement, mentoring
.36	.51	-.15	.49	Research facilities and support
.35	.48	-.12	.44	Support services and equipment
-.07	.02	.80	.62	Auth'ty: course content/method
-.07	.28	.53	.41	My job security
.43	-.07	.46	.49	Quality: department leadership
3.06	2.02	1.41		Eigenvalues

Notes. C = Collegiality, W = Workload, A = Autonomy, h^2 = communalities.
Sum of eigenvalues and communalities are not equal due to oblique rotation.

Notes

[1] Copies of these tables are available from the author.

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