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In a recently conducted study it was found that an effective college teacher could be characterized chiefly in terms of "research", "teaching", and "service to the university". The present experiment corroborated these findings using a relatively unknown approach to data collection, analysis, and interpretation. A free-response method of data collection, in conjunction with nonmetric multidimensional scaling, produced results highly similar to those of the previous study. In addition, the solution permitted a straightforward means of assessing the performance of individual faculty members. (Author)

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The present study had two basic purposes: (1) to construct a prototype of the ideal university professor, as determined by inputs from university faculty; and (2) to assess the utility of novel procedures for data collection and interpretation, with regard both to constructing this prototype and comparing individual faculty members to it.

Despite the important part colleagues' judgments play in decisions regarding tenure, promotion and salary, few studies have made a serious attempt to determine the criteria employed by university faculty in evaluating one another (cf. Guthrie, 1954; Maslow & Zimmerman, 1956).

In a recently conducted study, Wilson, Dienst and Watson (1973) used sixty-seven items concerned with teacher behavior outside the classroom (e.g., attendance at campus events and production of scholarly papers). Faculty at the University of California, Davis checked "yes" or "no" according to whether these items described the most effective teacher whom they knew on that campus. Items were intercorrelated and analyzed by principal components. Five outside-of-class components of effective teachers were identified by varimax rotation: (1) research activity, (2) participation in the academic community (i.e., active in campus life and a congenial colleague), (3) intellectual breadth, (4) relations with students, and

(5) concern for teaching. High-loading items were selected to define five scales corresponding to these factors and intercorrelations between scales were computed. Scales 1 and 3 correlated .41, Scales 2 and 4 correlated .39, while other correlations were generally quite low. These results suggest a simpler description of the effective teacher in terms of: (1) research/intellectual activity (Scales 1 and 3), (2) university support/congeniality (Scales 2 and 4), (3) concern for teaching (Scale 5).

The present study is similar in intent to that of Wilson et al. (1973) with the following differences in methodology: (1) dimensions of an "ideal professor" were determined which presumably should lead to a more general solution than outside-of-class factors related to an "effective teacher"; (2) data were collected so that respondents generated their own descriptions of the ideal professor rather than being limited to statements provided by the researcher; and (3) the basic characteristics of the ideal professor were extracted from the data by nonmetric multidimensional scaling, a technique which often produces more parsimonious solutions than principal components or factor analysis (Shepard, 1962a, pp. 129-132).

METHOD

Anonymous questionnaires were mailed to all 17 faculty members of the Department of Educational Psychology at the University of Wisconsin, Madison, in the Spring of 1973. Each faculty member was asked to do three things: (1) list the characteristics associated with his or her conception of the ideal university professor; (2) divide

100 points among the characteristics to indicate each one's relative importance; and (3) for each characteristic listed, sort 17 colleagues plus the "ideal professor" (18 total professors) into 2-5 self-determined categories and label each category. For example, the 18 professors might be sorted into "high", "medium" and "low" categories with respect to the characteristic "research productivity." This method of data collection allows respondents to generate the characteristics of the ideal professor, to weight each characteristic differentially and to determine the rating categories used to evaluate faculty members. Thus, there is little chance of biasing the final results due to experimenter inclusions or exclusions. A similar approach has been used by Wish, Deutsch and Biener (1970) to collect data on the way people perceive different nations.

Of the 17 questionnaires distributed, 14 were returned, giving a response rate of 82%. For each questionnaire q, a measure of similarity between each pair (i and j) of the 18 faculty members was computed as follows:

$$(S_{ij})_q = \sum_{c=1}^{n_q} w_c (s_{ij})_c$$

where

$(S_{ij})_q$ = similarity between professors i and j on questionnaire q

n_q = number of characteristics of the ideal professor listed on questionnaire q

w_c = weight (.00 to 1.00) assigned to characteristic c on questionnaire q

$$(s_{ij})c = \begin{cases} 1 \text{ if professors i and j were sorted into the same category on questionnaire q with respect to characteristic c} \\ 0 \text{ if professors i and j were sorted into different categories on questionnaire q with respect to characteristic c} \end{cases}$$

The quantity, $(S_{ij})_q$, takes on values .00 (low similarity) to 1.00 (high similarity) depending upon the frequency that i and j are sorted into the same category and the weights assigned to characteristics on questionnaire q. An overall measure of similarity, S_{ij}, between professors i and j was defined as the mean of the $(S_{ij})_q$ values across all questionnaires; S_{ij} also takes on values .00 (low similarity) to 1.00 (high similarity).[1] Since 18 faculty members were rated, an 18 x 18 matrix of similarity values S_{ij} (i,j = 1,2,...,18) resulted. The basic characteristics of the ideal professor were receovered from this similarity matrix using a nonmetric multidimensional scaling computer program (Young, 1968). This is analogous to the recovery of factors from a correlation matrix by principal components, as in the Wilson et al. (1973) study.

RESULTS

The nonmetric multidimensional scaling solution revealed that the input data were accounted for reasonably well by three basic dimensions. In Figure 1, each of the 18 professors is represented

Insert Figure 1 about here

by a "balloon" anchored to a plane, or more precisely, by numerical coordinates in three-dimensional space. Balloons 1-17 represent the actual professors used in the study, and Balloon 18 is the ideal professor. The anchor point of a balloon indicates a professor's position with respect to Dimensions I and II, while the length of the string indicates his or her position with respect to Dimension III.

Figure 1 was obtained by arranging the 18 balloons in three-dimensional space so that the distance, d_{ij}, between a pair of balloons i and j corresponds to the similarity, S_{ij}, between professors i and j (Kruskal, 1964a, 1964b; Shepard, 1962a, 1962b). For example, professors 2 and 18 had a high similarity value $S_{2,18}$; consequently they were placed close together in Figure 1. Conversely, professors 1 and 18 had a low similarity value $S_{1,18}$, and they were placed far apart. The 18(18-1)/2 = 153 distances d_{ij} in Figure 1 represent the 153 original input similarities S_{ij} quite well. This is indicated by an acceptable "stress" value of .10, which is a measure of how well the d_{ij} corresponds to the S_{ij} (Kruskal, 1964a). Stress takes on values between .00 and 1.00, with low values indicating good correspondence. Actually a configuration of balloons was obtained in 1 to 6 dimensional space, with associated stress values of .33, .16, .10, .06, .04, and .03 respectively. Figure 1 was chosen on the basis of stress value and interpretability, much the same way that Wilson et al. (1973) selected their principal components solution on the basis of eigenvalues and interpretability.

Interestingly, the three dimensions discovered here appear to compare quite favorably with the three primary factors previously identified in the Wilson et al. (1973) study: namely, research/ intellectual activity, concern for teaching, and university support/ congeniality. The axes of Figure 1 were so identified by using characteristics of the ideal professor which respondents listed on the questionnaires. The characteristics fell into four general domains as shown in Table 1. Also shown is the average weight across

all questionnaires assigned to each domain.

Insert Table 1 about here

The axes of Figure 1 were positioned as follows: Numerical values HR_i and LR_i, were computed for each professor (i=1,2,...,18), corresponding to the frequency that i was sorted by respondents into the highest and lowest rating category with respect to research. Differences, $DR_i = HR_i - LR_i$, were computed and used as ordinal measures of research for the 18 professors. Differences, $DT_i = HT_i - LT_i$ and $DS_i = HS_i - LS_i$, were similarly computed as ordinal measures of teaching and university service. The axes of Figure 1 were then positioned to optimize rank order correlations between DR_i, DT_i, DS_i values and projections of balloons on the hypothesized "research", "teaching" and "service" dimensions respectively.[2] Resulting correlations were: (1) $\rho = .92$ between DR_i and projections on the research axis, (2) $\rho = .90$ between DT_i and projections on the teaching axis and (3) $\rho = .65$ between DS_i and projections on the service axis. The moderate correlation, $\rho = .65$, for the service dimension indicates that it represents something other than pure university service. Projections along the service axis appear to be partially determined by professor characteristics such as integrity, energy, and independence mentioned by individual respondents but not by the sample as a whole. If more axes were added to represent these individual characteristics, variation along the service dimension would be determined almost entirely by university service. However, Figure 1 is the best possible configuration in that it is simple, interpretable, and representative of the sample as a whole.

Finally it should be noted that with this technique and with the inclusion of the "ideal professor", not only are the perceived dimensions recovered but also each professor is positioned in the space defined by these dimensions. Thus, conclusions about how an individual is perceived or "how well one is doing" (in terms of colleague evaluations) can be assessed more objectively in terms of "how close one is" to the ideal professor (as measured by Euclidean distances).

DISCUSSION

The present study utilized an open-ended method of data collection and a relatively unknown method of data reduction to produce a simple, interpretable characterization of the ideal professor in terms of three dimensions: research, teaching and service. While this approach may prove useful in determining similar dimensions at different institutions, it is not claimed that the solution obtained here would be duplicated elsewhere. (For instance, the "research" dimension might be given less weight or relate less to the prototype of an "ideal professor" at institutions where research is de-emphasized and teaching rewarded.) However, the correspondence between the present characterization of the "ideal professor" and that of an "effective teacher" reported previously (Wilson et al., 1973) is interesting.

There is also a high degree of similarity between students' perceptions of an "effective teacher" and their characterization of the "ideal professor". Students in the Wilson et al. (1973) study described effective teachers in terms of five factors: (1) analytic/

synthetic approach, (2) organization/clarity, (3) dynamism/enthusiasm, (4) instructor-group interaction, (5) instructor-individual student interaction. Factors 1-3 appear to be components of "teaching" while Factors 4 and 5 are components of "interpersonal relations". Students at the University of Wisconsin, Madison, described the ideal professor mainly in terms of these same two dimensions, as shown in Table 2.

Insert Table 2 about here

Multidimensional scaling of the student-derived similarity matrix did not yield a "clean" solution (in terms of stress and interpretability). An examination of the student questionnaire suggests that a given faculty member is perceived quite differently by different students; that is, student perceptions of individual faculty members were much more variable than were the corresponding colleague perceptions.

In summary, the present study was conducted primarily to illustrate a method which seems appropriate for gathering and interpreting data related to perceived characteristics of an ideal university professor. In this illustration, essentially the same characteristics were obtained as in an earlier factor-analytic study. However, the flexibility of the data collection process and the method of data analysis and interpretation have much to recommend themselves, and should be exploited in educational research as they have been in other disciplines.

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Table 1

Faculty Characterization of the Ideal Professor and Corresponding Weights

Domain	Typical Characteristics	Weight
Research	Quality of research Creativity Number of publications Number of convention papers	.42
Teaching	Intellectual breadth Stimulating instructor Provides positive reinforcement Skilled communicator Well-organized courses	.38
Service	University and departmental support Congeniality and openness	.15
Other	Integrity Energetic Independent	.05

Table 2

Student Characterization of the Ideal Professor and Corresponding Weights

Domain	Typical Characteristics	Weight
Teaching	Knowledge Clear communication/stimulating Organization/structure/preparedness	.50
Inter-personal Relations	Supportive Friendly/interactive Approachable/available Honest/open Humanistic	.35
Research	Creative Guides student projects Resource person	.10
Other	Consistency Curiosity	.05

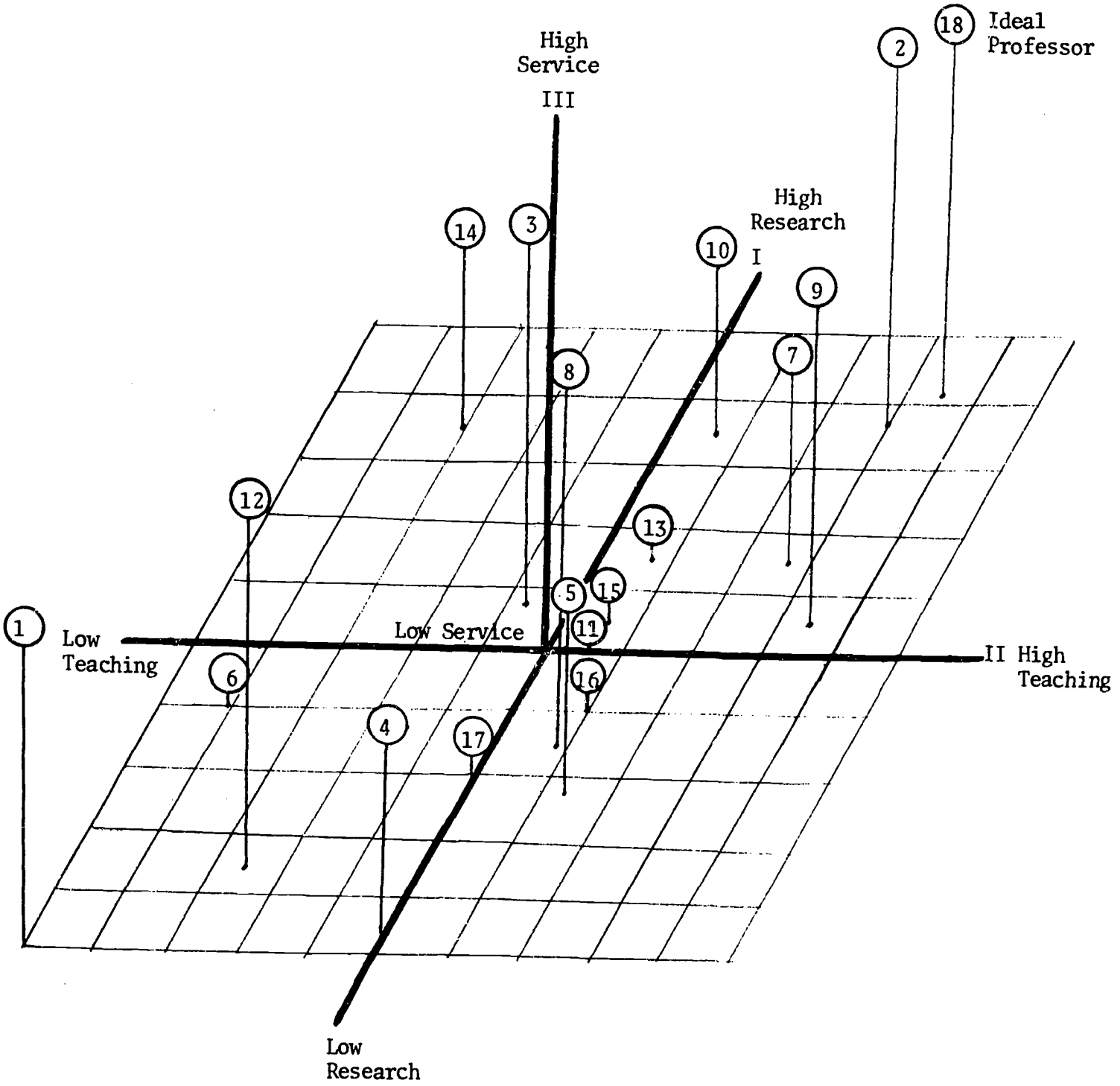

Figure 1

Multidimensional Representation of the Basic Characteristics of a University Professor

(Note: Dimension I = "Research"; Dimension II = "Teaching"; Dimension III = "Service to the University")

Footnotes

[1]A simpler measure of similarity S_{ij} could be defined as the proportion of times i and j are sorted into the same category across all questionnaires, if there is no interest in weighting characteristics differentially.

[2]Carroll (1972) discusses a similar method for positioning axes such that object projections on each axis correlate optimally with measured values of the corresponding objects.