DOCUMENT RESUME

ED 253 126 HE 017 927

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TITLE Comparing Citation Rates with Other Measures of Scholarly Productivity.
PUB DATE Oct 84
NOTE 28p.; Paper presented at the Joint Meeting of the American Educational Research Association Division J and the Association for the Study of Higher Education (San Francisco, CA, October 28-30, 1984).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *College Faculty; Conferences; *Evaluation Criteria; Financial Support; Higher Education; Institutional Characteristics; *Productivity; Reputation; *Scholarship; *Schools of Education; *Writing for Publication
IDENTIFIERS *Faculty Publishing

ABSTRACT

The construct validity of scholarly productivity was investigated, with attention to definitions and measurement approaches. A nonrepresentative sample of 51 schools of education was selected to include very productive schools. Measures were made of the following variables: citations, rankings from previous studies, publications, conference participation, funding, and general institutional characteristics. Publication counts were estimated from data in the Educational Resources Information Center (ERIC) system. Each school of education's participation in the American Educational Research Association conference was assessed for 1981 and 1982. Information on grants awarded to schools of education during 1978-1982 was obtained from the Smithsonian Science Information Exchange. Finally, the Higher Education General Information Survey provided data on five variables: percentage of doctorates granted, total research expenditures, total overall expenditures, government grants and contracts per full-time equivalency, and average faculty salary. Conclusions include the following: program size did not significantly determine prestige; surveys on reputation did not appear to be reliable; and citation counts seemed to be the best measure of scholarly work. (SW)

Comparing Citation Rates with Other Measures of Scholarly Productivity

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In assessments of excellence in higher education, questions of scholarly productivity are often pivotal. Research and publication are the driving forces in the modern university, and evaluators of university programs are attuned to this fact. From individual promotion and tenure decisions to overall institutional prestige, scholarly research is a fundamental issue.

A variety of procedures have been used to measure productivity. Some researchers have surveyed faculty or administrators to obtain rankings of universities and departments. Others have used the quantity or quality of publications to rate programs, sometimes including presentations of papers at conferences. Another measure is the type and amount of funding obtained by a department, and, at the university level, characteristics such as faculty salaries and research expenditures have been linked to faculty productivity. Finally, citation rates, a measure of peer recognition, have been used to assess scholarly accomplishment. In some way, each of these measures has been associated with productivity.

This study addressed the construct validity of scholarly productivity: How this concept has been defined, and how

Paper presented at the Joint Meeting of the American Educational Research Association Division J and the Association for the Study of Higher Education, San Francisco, California, October 28-30, 1984.

various ways of measuring it compared. In particular, data pertaining to schools of education were examined. The perspective was that of an administrator or evaluator who must collect and assess information regarding productivity, discovering in the process what data are available for making valid, useful comparisons among schools of education, what problems occur in gathering this data, what relationships exist among measures, and what interpretations can be made. These issues are of considerable practical significance, reflecting processes that often have a direct impact on the future of a program, a school or a career.

Interrelationships among various measures of productivity have been explored in different ways by several researchers. Hagstrom (1971) determined that a single, unrotated factor was sufficient to account for most of the variance among 188 university science and mathematics departments on ten variables related to institutional quality. Astin and Solmon discovered two factors, "scholarly excellence of faculty" and "commitment to teaching," in their factor analysis of a questionnaire on undergraduate excellence (Astin & Solmon, 1981; Solmon & Astin, 1981). They also found evidence that overall institutional prestige is an important aspect of individual departmental ratings. Another study (Andersen, Narin, & McAllister, 1978) used regression techniques to predict prestige rankings from various publication and citation data, finding that variables related to size, as well as to quality, are predictive of prestige. Endler, Rushton and Roediger (1975) correlated both

publication counts and citation data with other measures, concluding that citation rates may be better than publication counts as a measure of quality. Eash (1983) produced composite rankings of schools of education using conference presentations and publication counts.

This study examined relationships among a series of measures of productivity for a single sample of schools using computerized data bases easily accessible to any researcher. In particular, the results of citation analysis, a method not often used in many fields, including education (Kroc, 1984), was compared with other data.

Method

Sample

A non-representative sample of 51 schools of education was chosen from rankings in other studies to include as many of the most productive schools as possible (see Table 1). For each school, faculty lists were obtained from 1981 course catalogs or by writing directly to the university. Measures were made of the following variables: citations, rankings from previous studies, publications, conference participation, funding, and general institutional characteristics. Data for the 4600 faculty included in the study were aggregated at the school level.

Citations

The number of citations for each faculty member in the 1981 Social Science Citation Index (SSCI) was counted. The SSCI lists, by author, citations of that author's work during a given

year. A set of rules was developed to standardize the counting procedure, and two judges were trained, enabling an assessment to be made of the reliability of citation counts. The obtained inter-rater correlation coefficient of r=.90 indicated that citations can be reliably counted.

The SSCI proved to be a rich source of data, fully referencing 160 education journals, as well as many other journals in related fields, on an annual basis. A more thorough discussion of SSCI citation analysis occurs elsewhere (Kroc, 1984).

Rankings from Previous Studies

Rankings of schools of education from nine studies were recorded. Five of these research efforts (Blau & Margulies, 1975; Cartter, 1977; Ladd & Lipset, 1979; Sieber, 1966; Walberg, 1972) were surveys of either education faculty, AERA members, or deans of schools of education. The other four studies prodcued ranks based on publication counts (West, 1978), AERA presentations (Dole, 1981; Schubert, 1979) or both (Eash, 1983).

Publications

Two data bases, Research in Education (RIE) and the Current Index to Journals in Education (CIJE) were searched using the ERIC system. The high cost of obtaining this information for each faculty member ensured that there were limitations on the amount of data that could be collected and on the number of faculty surveyed, resulting in a decision to sample 25% of the 4600 faculty. Based on previously obtained citation data,

faculty from each university were split into four strata, and an optimal allocation formula (Cochran, 1953, p. 93) was used to determine the proportion of observations within each strata which would minimize the standard error of the mean publication counts.

Conference Participation

Conference participation was measured by counting the number of presentations listed in the annual meeting programs at two conferences--the American Educational Research Association (AERA) conferences in 1981 and 1982. Two consecutive AERA conferences were surveyed to control for bias due to the meeting location: The 1981 conference was held in Los Angeles, while the 1982 location was Boston. All types of AERA presentations were given equal weights, except discussants, who were not counted.

Funding

Only one accessible source of funding data was found, the Smithsonian Science Information Exchange (SSIE), an agency that compiled and stored for computer access information on grants issued between 1978 and 1982. SSIE received project descriptions from over 1,300 organizations: federal, state and local government agencies; nonprofit associations and foundations; colleges and universities; and, to a limited extent, private industry and foreign research organizations. Approximately 90% of the information was provided by agencies of the federal government. Unfortunately, the SSIE was phased out late in 1981, a victim of federal budget cuts. However, the National

Technical Information Service (NTIS) has assumed a portion of SSIE's former services, but does not yet gather data from the agencies which are most likely to fund educational research. The dissolution of the SSIE was not a problem in this study, since funding data was available through 1981.

The organization of the SSIE data base made it possible to enter the program and university name at a computer terminal and receive a printout containing abstracts of the government grants obtained by that education program between 1978 and 1982. Each abstract listed the grant's investigators, title, sponsoring organization, performing organization, funding period, and dollar amount. Unfortunately, this information was not always complete; in fact, 30% of the abstracts did not list a dollar amount for the grant. Still, it was possible to count the number of grants obtained by each program, as well as to get some indication of the money involved.

Institutional Characteristics

All universities that receive federal funding must report certain information annually to the government. This data is documented in the Higher Education General Information Survey (HEGIS) and is available on magnetic tape. Variables which were accessible and of interest for this study were dollar amount of government grants and contracts per FTE (1978-79), total research expenditures (1979-80), total expenditures (1979-80), percentage of doctorates granted (1979-80), and average faculty salaries (1980-81). All of these measures were at the university level, not at the school or department level.

Analysis

Two sets of rankings of schools of education were produced for each variable, one based on total counts for each school and the other on total counts divided by the number of faculty in each school. Comparisons of the six sets of variables, using both units of analysis, were made by examining correlation coefficients. The patterns of these coefficients provided data on how the variables in this study were inter-related as well as how they compared with measures of productivity from other studies.

RESULTS

Relationship Between Citation Counts and Rankings from Other Studies

As discussed, a number of studies of education schools have been done. The rankings resulting from these studies were correlated with one another as well as with citation data, producing the coefficients in Table 2. On the diagonals are the number of schools which were ranked in the study that is listed at the top of the column. For example, the ranks for 23 programs which were available from the Dole (1981) study, correlated .26 with rankings from the Ladd and Lipset (1979) study. Five sets of rankings (Cartter, 1977; Ladd & Lipset, 1979; Sieber, 1966; Blau and Margulies, 1975; and Walberg, 1962) were based on surveys which asked respondents to list the top schools of education. The correlations among these five studies showed considerable variation, indicating how survey responses

can differ. For example, both Cartter (1977) and Ladd and Lipset (1979) surveyed education faculty members in attempts to discover the most distinguished schools of education. Yet their rankings correlated only .14. Prestige rankings then may not be very consistent, even when similar questions are asked of the same group of respondents.

Studies that obtained less subjective measures of quality fared somewhat better when compared with one another. Schubert (1979), Dole (1981) and Eash (1983) used AERA presentations as measures for ranking programs. Schubert counted total presentations, Dole used presentations per faculty, and Eash reported both. The ranks of Dole and Eash show a correlation of .70, while those of Schubert and Eash correlate .83, an indication that AERA presentation counts are somewhat consistent.

Similarly, Eash (1983) and West (1978) ranked programs according to the total number of articles appearing in leading education journals. The correlation between these studies, $r = .49$, would probably have been higher had more of the same journals been surveyed. Nonetheless, there is evidence of moderate reliability in ranking by counts of journal articles.

Results of studies using total faculty counts showed low correlations with those calculating results on a per faculty basis. For example, the AERA presentation ranks of Dole and Schubert correlate only .19. In general, ratings using the faculty member as the unit of analysis correlate more highly with prestige rankings, as shown by comparing Walberg's (1972) rankings with those of Eash. When asked to rank schools of

education, survey respondents seem to think more in terms of research productivity per faculty member than they do of total productivity.

Mean citation ranks correlated moderately to strongly with all survey rankings except Ladd and Lipset's and with all other rankings which used individual faculty as the unit of analysis. The highest correlations were with the Cartter survey (r = .83) and with Eash's rankings of AERA presentations per FTE (r = .65). Mean citation rank, then, showed a relationship with the ranking methods used in other studies.

Although mean citation rank correlated well with other types of ratings, total citation counts were not as strongly related to other measures. Percentage of faculty with zero citations, on the other hand, followed a pattern identical to that of the mean citation rate, indicating that they both may be tapping the same dimension of productivity.

Publication Counts

Publications were estimated from data in the ERIC system. Two other studies (West, 1978; Eash, 1983) used publication counts as a method for ranking programs. Table 3 shows inter-correlations among the ranks produced from these various methods of measuring publications, while Table 4 displays correlations between publication ranks, citation measures, and rankings from other studies.

The consistency between Eash's counts of articles in the 14 journals and the publication measures in this study was shown by the strong relationship between Eash's total articles and the

total ERIC publication rank ($r = .75$) as well as by the correlation between the two FTE counts ($r = .63$). West's method of ranking (based on total publication counts in 2 journals) did not correlate as well with either of the other measures ($r = .33$ with total ERIC publication rank, and $r = .49$ with Eash's total counts).

The correlations between publication rankings and other types of rankings showed a wide range of values. In general, though, the five survey results had more in common with per faculty measures of publications than with total counts: four out of the five studies had higher correlations with per faculty publication rates.

Citation ranks were not strongly related to publication counts, as shown by the coefficients in the first three columns of Table 4. Mean citation rate correlated only .34 with Eash's FTE publication ranks and .39 with per faculty ERIC publication ranks, while total citation rank showed a similar degree of relationship with the three measures of total publications. A stronger correlation, though, was found between the percentage of faculty with no citations and per faculty publication ranks. It may be that those faculty who are more often cited have quite variable publication patterns, thus lowering any correlation between citation and publication rates, while those who are not cited tend homogenously not to publish, thereby increasing the relationship between publication rates and the percentage with no citations.

It should be noted that the publication counts in this

study were based on combining entries from both the CIJE and RIE. These publication counts, then, include both journal articles and "fugitive" literature such as technical reports and evaluations.

Conference Participation

Each school of education's participation in the American Educational Research Association conference was assessed for two years, 1981 and 1982. Three other studies used AERA participation as a means for ranking programs. Schubert (1979) used data from 1975 to 1979 to obtain counts of total presentations by each school of education. Dole (1981) used Schubert's figures, dividing each total by the number of faculty to produce rankings with faculty as the unit of analysis. Eash (1983) counted AERA presentations over a seven-year period, 1975-1981, compiling both total and FTE rankings of schools. Table 5 shows the intercorrelations among these three studies and with the ranks from this study. These coefficients indicated greater consistency among AERA studies than among studies of publication rates. This seems reasonable, given the ease with which AERA participation can be judged from the program meeting notes, and the fact that each publication study used counts from a different set of journals.

Table 6 indicates correlations between the various AERA measures and three groups of rankings, representing citation rates, publication counts and prestige surveys. Citation measures correlated better with AERA presentations than with publication rates. Perhaps authors who are cited more often

have a greater inclination to submit their work to the national exposure offered by AERA conferences.

Correlations between AERA data and publication ranks showed a pattern of moderate relationships, while prestige surveys did not correlate consistently with AERA results, as might be of expected.

Funding

A computer search of the Smithsonian Science Information Exchange (SSIE) elicited lists of abstracts of grants awarded to schools of education between 1978 and 1982. From this information, the number of grants for each education program as well as the dollar amount was extracted.

Correlations between funding data and other indices are indicated in Table 7. Higher correlations are apparent for the number of grants (first two rows of the table) as opposed to dollar amounts (last two rows). As mentioned previously, there was difficulty in obtaining complete information on the amount of the awards.

Clearly, citation rates correlate better than publication counts or AERA presentations with funding data. If the case is made that more productive faculty are better able to obtain grants, then these correlations enhance the validity of citation counts as an index of scholarly work, particularly in comparison with publication data and AERA conference participation. It may be that more cited scholars write stronger grant proposals, or that their reputations influence the decisions of the granting agencies.

Institutional Characteristics

The Higher Education General Information Survey (HEGIS) was the source for data on five variables: percentage of doctorates granted, total research expenditures, total overall expenditures, government grants and contracts per FTE, and average faculty salary. All of these variables were measured for the entire university, not at the school of education level, and reflect either the 1978-1979 or the 1979-1980 academic year.

Table 8 shows correlations between institutional characteristics and four sets of variables considered in this study: citation rates, publication data, AERA presentation ranks and funding information. These coefficients show that data reflective of the university as a whole was related to department-level indicators of productivity. This was true for the schools of education in this study across all measures. Perhaps universities which command greater resources, and hence can afford larger salaries and expenditures, are able to attract more productive faculty.

As with the SSIE funding data, institutional variables, especially expenditures, grants and contracts, and salaries, tended to correlate best with citation rates. Although the halo effect may have been an issue with these data, this does not explain why citation rates are the strongest correlates. A more likely explanation may be that these institutional variables had a direct or indirect influence on departmental productivity, and the number of citations were a better reflection of this.

Conclusion

Few would doubt the importance of scholarly productivity in university life, yet obtaining measures suitable for making comparisons among universities may be difficult and controversial. This study provided comprehensive data on several relevant variables for a selected sample of schools of education. Relationships among these measures suggest several points related to construct validity.

First, the tendency for prestige survey results to correlate more highly with means rather than with totals on other measures was an indication that the program size was not a significant determinant of prestige: quality was more important than quantity.

Second, surveys had an annoying tendency to show inconsistent relationships with one another. Although the small number of schools ranked in some studies, as well as differences in when the assessments were made, may have contributed to this problem, the reliability of surveys on reputation was not evident in these data.

Third, the moderate correlations found among the various measures indicated considerable shared variance and, perhaps, justification for thinking of scholarly productivity in schools of education as a unitary concept.

Finally, citation analysis, a reliable process with a compelling and logical basis, produced data which showed a stronger relationship than did any other measures with funding

and institutional variables. The evidence in this study implied that citation counts are most central to the concept of productivity. Although all measures are somewhat flawed, particularly when used to evaluate individual careers, the citation rate may be the best single measure of scholarly work.

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Table 1

List of Universities

University of Arizona
Arizona State University
Boston University
University of California at Berkeley
University of California at Los Angeles
University of California at Santa Barbara
Catholic University
University of Chicago
City University of New York
University of Colorado
Columbia University
University of Connecticut
Cornell University
University of Florida
Georgia State University
Harvard University
University of Houston
University of Illinois: Champaign-Urbana
University of Illinois: Chicago Circle
Indiana University
University of Iowa
University of Kansas
University of Michigan
Michigan State University
University of Minnesota
University of Missouri
University of Montana
University of Nebraska
New York University
University of North Carolina: Chapel Hill
Northwestern University
Ohio State University
University of Oregon
University of Pennsylvania
Pennsylvania State University
University of Pittsburgh
Purdue University
University of Rochester
Rutgers University
University of Southern California
Stanford University
Syracuse University
Temple University
University of Texas
Peabody-Vanderbilt University
University of Virginia
Virginia Polytechnic Institute
Washington University
University of Washington
University of Wisconsin

Table 2

Correlations Among Other Studies Producing Rankings of Education Programs and Citation Data

	Mean Citation Rank	Total Citation Rank	Percent of Faculty With No Citation	Carter (1977)	Blau and Margulies (1975)	Ladd and Lipsett (1979)	Sieber (1966)	Walberg (1972)	Schubert (1979)	Dole (1981)	West (1978)	Kash (1983) AERA Total	Kash (1983) AERA Per FTE	Kash (1983) Total Articles	Kash (1983) Articles Per FTE
Mean Citations	-.75	-.58	-.77	-.79	-.40	-.22	-.37	-.45	.04	-.33	-.10	.01	-.52	.09	-.42
Mean Citation Rank	n=51	.69	.79	.83	.31	.07	.39	.47	-.06	.48	.25	.21	.65	-.11	.34
Total Citation Rank		n=51	.47	.54	.37	.41	.34	.37	.41	-.10	.28	.65	.04	.31	.12
Percent of Faculty With No Citation			n=51	.86	.39	.31	.35	.46	.11	.55	.24	.12	.59	.09	.45
Carter (1977)				n=14	.51	.14	.61	.59	.03	.53	.05	-.31	.67	.41	.71
Blau and Margulies (1975)					n=12	.47	.06	.05	-.21	.01	-.18	-.26	-.05	-.06	.10
Ladd and Lipsett (1979)						n=15	.49	.77	.28	.26	.24	.17	-.04	.51	.37
Sieber (1966)							n=10	.89	.39	.54	.21	.27	.52	.00	.31
Walberg (1972)								n=12	.37	.65	.08	.20	.72	.27	.66
Schubert (1979)									n=27	.19	.08	.11	.09	.55	-.13
Dole (1981)										n=23	.28	.46	.70	.03	.60
West (1978)											n=24	.20	.20	.49	.20
Kash (1983) AERA Total												n=24	-.09	.42	-.44
Kash (1983) AERA Per FTE													n=24	-.27	.59
Kash (1983) Total Articles														n=24	.19
Kash (1983) Articles Per FTE															n=24

Table 3

Intercorrelations of Publication Measures

	Total ERIC Publication Rank	Per Faculty ERIC Publication Rank	West (1978) Total Publication Rank	Eash (1983) Total Publication Rank	Eash (1983) FTE Publication Rank
Total ERIC Publication Rank		.50	.33	.76	-.21
Per Faculty ERIC Publication Rank			.47	.38	.63
West (1978) Total Publication Rank				.49	.30
Eash (1983) Total Publication Rank					.19
Eash (1983) FTE Publication Rank					

Table 4

Correlations Between Publication Measures and Other Rankings

	Mean Citation Rank	Percentage of Faculty With No Citations	Total Citation Rank	Cartter (1977)	Blau and Margulies (1975)	Ladd and Lipset (1979)	Sieber (1966)	Walberg (1972)	Schubert (1979)	Dole (1981)	Eash AERA Total Rank	Eash AERA Rank Per FTE
Total ERIC Publication Rank	-.11	.09	.31	.11	-.06	.51	.00	.27	.55	.03	.42	-.27
Per Faculty ERIC Publication Rank	.34	.45	-.12	.11	.10	.07	.31	.66	-.13	.60	-.14	.59
West (1978) Total Publication Rank	.25	.24	.28	.05	-.18	.24	.21	.48	.68	.31	.46	.20
Eash (1983) Total Publication Rank	.06	.08	.49	-.48	-.48	.37	.04	.31	.68	-.26	.58	-.35
Eash (1983) FTE Publication Rank	.39	.54	.21	.51	-.22	.38	.37	.83	.36	.36	.02	.51

Table 5

Intercorrelations Among AERA Presentation Measures

	AERA Rank Per Faculty	AERA Total Rank	Eash AERA Rank Per FTE	Eash AERA Total Rank	Dole AERA Rank Per Faculty	Schubert AERA Total Rank
AERA Rank Per Faculty		.64	.66	.02	.71	.26
AERA Total Rank			.11	.79	.20	.83
Eash AERA Rank Per FTE				.09	.70	.09
Eash AERA Total Rank					.11	.83
Dole AERA Rank Per Faculty						.19
Schubert AERA Total Rank						

Table 6

Correlations Between AERA Presentation Measures and Other Rankings

	Mean Citation Rank	Total Citation Rank	Percentage of Faculty With No Citations	Total ERIC Publication Rank	Per Faculty ERIC Publication Rank	Eash (1983) Total Publication Rank	Eash (1983) FTE Publication Rank	West (1978) Total Publication Rank	Cartter (1977)	Blau and Margulies (1975)	Ladd and Lipset (1979)	Sieber (1966)	Walberg (1972)
AERA Rank Per Faculty	.56	.20	.64	.10	.60	-.20	.35	.42	.55	-.06	.26	.37	.66
AERA Total Rank	.36	.57	.34	.63	.41	.39	-.19	.55	.01	-.29	.46	.41	.53
Eash AERA Rank Per FTE	.65	.04	.59	-.35	.51	-.27	.59	.20	.67	-.05	-.04	.52	.72
Eash AERA Total Rank	.21	.65	.12	.57	.01	.42	-.44	.46	-.31	-.26	.17	.27	.20
Dole AERA Rank Per Faculty	.48	-.10	.55	-.26	.36	.03	.60	.31	.53	.01	.26	.54	.65
Schubert AERA Total Rank	.06	-.43	-.11	-.68	-.36	-.55	.13	-.68	.03	.21	-.38	-.49	-.57

Table 7

Correlations Between Funding Data and Other Measures of Productivity for 51 Schools of Education

	Mean Citation Rank (1=highest)	Total Citation Rank	Percentage of Faculty With No Citations	Total ERIC Publication Rank	Per Faculty ERIC Publication Rank	Eash (1983) Total Publication Rank	Eash (1983) FTE Publication Rank	West (1978) Total Publication Rank	AERA Rank Per Faculty	AERA Total Rank	Eash AERA Rank Per FTE	Eash AERA Total Rank	Dole AERA Rank Per Faculty	Schubert AERA Total Rank
Total Number of Grants	-.55	-.71	-.49	-.44	-.35	-.43	-.09	-.38	-.34	-.54	-.08	-.39	.06	-.48
Number of Grants Per Faculty	-.65	-.47	-.77	.01	-.45	-.08	-.39	-.18	-.53	-.30	-.46	-.09	-.34	-.10
Total Number of Dollars	-.38	-.37	-.18	-.22	-.21	.09	.31	.22	-.39	-.54	-.11	-.48	-.08	-.21
Number of Dollars Per Faculty	-.55	-.25	-.45	.02	-.40	.22	-.25	.23	-.57	-.39	-.56	-.18	-.47	.00

Table 8

Correlations Between Institutional Characteristics and Measures of Productivity for 51 Schools of Education

	Mean Citation Rank	Total Citation Rank	Percentage of Faculty with no Citations	Total ERIC Publication Rank	Per Faculty ERIC Publication Rank	Cash (1983) Total Publication Rank	Cash (1983) FTE Publication Rank	Web (1978) Total Publication Rank	AERA Rank Per Faculty	AERA Total Rank	Cash AERA Rank Per FTE	Cash AERA Total Rank	Dole AERA Rank Per Faculty	Schubert AERA Total Rank	Total Number of Grants - SSIE	Number of Grants Per Faculty - SSIE
Percentage of Doctorates	-.34	-.45	-.30	-.30	-.18	-.44	-.02	-.49	-.12	-.31	.26	-.11	.23	-.14	.37	.23
Total Research Expenditures	-.55	-.30	-.64	.06	-.21	-.05	-.32	-.18	-.42	-.[illegible]	-.35	-.01	-.34	-.19	.36	.56
Total Expenditures	-.60	-.29	-.69	.11	-.20	.05	-.39	-.07	-.41	-.12	-.16	.15	-.35	-.02	.35	.61
Government Grants and Contracts Per FTE	-.58	-.29	-.65	.20	-.16	.01	-.30	-.13	-.39	-.11	-.30	.02	-.34	-.08	.31	.61
Average Faculty Salary	-.68	-.56	-.71	-.18	-.45	.00	-.57	-.24	-.51	-.40	-.49	.24	-.19	-.10	.47	.63