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ABSTRACT

This report describes and analyzes statistical indicators of educational knowledge production and dissemination capability, presenting data at both the state and regional levels of aggregation. Three factors underlie 12 statistical indicators: a document production and access factor, a human-based linkage and exemplary practices factor, and a state planning and capacity building factor. A score of selected demographic, economic, and educational measures are used as potential predictors of the knowledge production and dissemination indicators. Factor analysis of these measures produces seven "predictor" factors: (1) staff size and number of educational agencies; (2) educational expenditures; (3) relative expenditure effort; (4) population and institutional density; (5) population change; (6) Intermediate Service Agency (ISA) service level, and (7) Teacher Center (TC) service level. Multiple and canonical correlation analyses demonstrate that the size factor alone is a powerful predictor of all indicators that are based on counts. Hierarchical grouping analyses of the 50 states and the District of Columbia are made separately, and the state-level data are aggregated by the ten United States Office of Education (USOE) Regions, based first on production and dissemination indicators, and then on contextual predictors. (Author/CWM)

INDICATORS OF EDUCATIONAL KNOWLEDGE PRODUCTION, DISSEMINATION, AND UTILIZATION: EXPLORATORY DATA ANALYSES

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Educational Dissemination Systems Support Program

FAR WEST LABORATORY FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

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ABSTRACT

Statistical indicators of educational knowledge production and dissemination capability are described and analyzed, with data presented at both state and regional levels of aggregation. Three factors are shown to underlie 12 statistical indicators: a document production and access factor, a human-based linkage and exemplary practices factor, and a state planning and capacity building factor. A score of demographic, economic, and educational measures are selected as potential predictors of the knowledge production and dissemination indicators. Factor analysis of these measures produces seven "predictor" factors: 1) staff size and number of educational agencies, 2) educational expenditures, 3) relative expenditure effort, 4) population and institutional density, 5) population change, 6) Intermediate Service Agency (ISA) service level, and 7) Teacher Center (TC) service level. Multiple and canonical correlation analyses demonstrate that the size factor alone is a powerful predictor of all indicators that are based on counts (e.g., number of documents, number of computer search services, number of validated practices. The remaining predictor factors add small predictive increments, especially for the non-ERIC-related indicators.

Hierarchial grouping analyses of the 50 states and the District of Columbia are made separately, first based on production and dissemination indicators, and then based on contextual predictors. The two types of analyses are shown to produce similar typologies of states.

Finally, the state-level data are aggregated by the ten USOE Regions. Substantial differences among the regions are found on both the knowledge production and dissemination indicators and on the contextual predictors. The results indicate that there are regional as well as state-level effects operating, either directly on educational knowledge production and dissemination or indirectly through contextual factors such as size, wealth, and number and types of intermediate structures.

Overview

One of the general objectives of the Educational Dissemination Systems Support Program (EDSSP) is to establish efficient means for analyzing, monitoring and communicating the status, needs, and accomplishments of educational dissemination performers. Previous EDSSP reports have summarized a number of research studies, surveys, evaluations and other descriptive information pertaining to federal, state, and local dissemination programs and performing agencies. Since the content of the majority of these studies focused on specific programs (e.g., the National Diffusion Network), or special agencies (e.g., schools, colleges, and departments of education) we began to look for statistical data which might possibly provide more comprehensive coverage, programmatically, agency-wise, and geographically.

The initial impetus for our first exploratory study began somewhat accidentally. A visiting scholar was planning some case studies, within individual states, of inter-organizational arrangements that were designed to support educational dissemination and practice improvement activities (Paul, 1978). We asked the following simple questions: Which states should be selected for case study? Could states be typed? Was there any objective basis for typing states that would be relevant to educational dissemination? If so, would this typology be helpful in selecting states for case study or in generalizing case study findings?

EDSSP staff had already begun collection of a wide variety of dissemination and utilization data on all 50 states (EDSSP Technical Proposal, April 1978). We sifted through these state files to identify data elements that might serve as <u>dissemination capacity indicators</u>. Eight indicators were identified in this initial search. We also undertook a search for knowledge base indicators that could be associated with each state. Eventually five knowledge base indicators were identifed. Our search for satisfactory utilization indicators proved fruitless. Although we failed to find acceptable indicators of knowledge utilization, it was possible to locate or create a large number of "contextual" indicators (pertaining to population, economic or educational structural data) that might act as predictors of the state-level knowledge production or dissemination capacity indicators.

Following preliminary visual examinations of univariate and bivariate data distributions, several variables were transformed to produce more normal distributions, and two new variables that were ratios of original variables were created. Eventually, our exploratory data consisted of 13 production and dissemination variables and 22 predictor variables. Factor analysis of the predictor variables produced seven factor scores that were used in place of the original 22 predictor variables for many subsequent analyses. A variety of multi-variate data analysis techniques were then employed to examine the relationships within and between the predictor and the production and dissemination indicator data sets, and to examine similarities and differences between states in terms of these data. After examining state-level data, the states were grouped by USOE regions and additional analyses were made in terms of the ten USOE regions. The development of the indicators and the results of state-level and the regional-level analyses are described in subsequent sections of this report.

The Conceptual Framework and Approach

The notion of "social indicators" (Bauer, 1966; Sheldon and Moore, 1968; Gross, 1969; Van Dusen, 1974) plays an important role in the approach we have taken. A social indicator may be defined as "a statistic of direct normative interest which facilitates concise, comprehensive, and balanced judgments about the conditions of major aspects of society" (DHEW, 1969). In the field of education, there are many examples of the use of indicators; however, virtually none of these educational indicators have a direct bearing on educational knowledge production, dissemination, or utilization (KPDU), although some of them (e.g., size and type of staff, number and type of institution, level of funding) might serve as "contextual" variables that might be related to educational knowledge production, dissemination, or utilization (KPDU).

Hood (1979) describes a model for a system of KPDU indicators consisting of four components: 1) indicators of educational knowledge production outputs, 2) indicators of educational knowledge dissemination structures, 3) indicators of educational knowledge utilization, and 4) indicators of contextual factors that may be used to predict or explain the patterning of the other types of indicators.

Production output indicators are concerned with estimates of the type, quantity, quality, or other characteristics of quantifiable units of educational knowledge (e.g., documents) as related to their origin (e.g., author or institution location). Ideally, these indicators should reflect the extent and ways in which the educational knowledge production community organizes and transforms knowledge in all its forms. Currently available data pertain primarily to formal documentary or formal oral forms or their derivatives (e.g., abstracts, citations, proceedings).

Dissemination structure indicators are concerned with the characteristics or capacity of structural or functional components of the educational dissemination system (e.g., number and type of information search services, number and type of linking agents). In general, these indicators should display how educational dissemination resources--funds, people, products, services, and technology--are allocated across educational sectors and geographic areas.

Utilization indicators should provide information regarding request and usage rates, adoptions, impact, benefits, etc., by geographic or educational sectors, for types of institutional and individual consumers of educational knowledge, products, and services. Currently there are very few satisfactory utilization indicators available on a national basis that can be used to inform us regarding the various facets of knowledge utilization or its impacts.

Contextual indicators provide information concerning distribution across geographic areas of changing composition and trends of aggregative data that reflect the demographic, organizational, social, political, economic, and educational environments for educational knowledge production, dissemination, and utilization. Contextual indicators can reflect conditions or forces that may serve to supply, support, constrain, or otherwise influence the production, dissemination, or consumption of educational knowledge.

Relationship Among Types of Indicators. Because of the sometimes highly local connections of production, dissemination, and utilization (e.g., within an immediate primary group or within one organization), it would not be surprising to find strong correlations between some types of production, dissemination, and utilization indicators, especially those that may be based on counts of units or entities. However, there is also strong reason to suspect that contextual factors (e.g., population density, per capita wealth) might constitute common underlying factors that may account for much of the observed correlation between production and dissemination indicators or between dissemination and utilization indicators when aggregated by region or state. For example, one might expect that more populous states or regions would display higher counts of publications, higher numbers of information search services, and higher numbers of organizational and individual requests for information searches than would less populous states or regions. It is also easily conceivable that relatively wealthy states and regions could afford to fund more knowledge production (e.g., research studies, innovative practices), support more extensive and expensive dissemination services, and create educational consumer environments with the organizational "slack" and incentives fostering less parochial forms of knowledge consumption. Hence, contextual indicators need to be considered when examining aggregate data.

Hood (1979) presents a dimensional taxonomy for analyzing the educational knowledge base, the formal dissemination structures and arrangements that have been created to facilitate communication or to provide access to knowledge in education, and the various conceptions and associated data bearing on knowledge utilization. He also discusses the implications of these taxonomic dimensions for the development of educational KPDU indicators (op cit., pp. 19-22; 27-28; 40-55). Summarized briefly, most of the detailed information about the educational knowledge base refers to the more formal types of documents and materials that are indexed by national information systems. This type of information constitutes only a very small part of the total knowledge base in education. We know very little about the contents of knowledge that is communicated orally or informally. Although we have extensive statistics on libraries and we know a great deal about the wide variety of other types of educational dissemination services and structures, there is very little information about the nationwide distribution of most non-library services. In utilization, a similar situation is encountered in which several different lines of research have produced a rich mass of descriptive information; but, aside from relatively superficial and sometimes spotty market survey, project adoption, or user request data, there are virtually no accurate, nationwide indicators of educational knowledge utilization.

BUILDING A DATA FILE

Indicators of Knowledge Production

For our exploratory work we created five indicators of knowledge production:

- Number of Resources in Education (RIE) documents in ERIC (cumulative to 1978), produced in each state.
- Number of documents in ERIC, produced by State Education Agencies (cumulative to 1978).
- Estimated relative number of documents in ERIC (1972-75), produced by the schools, colleges, and departments of education in each state.
- Number of JDRP-approved/DD-funded exemplary practices.
- Number of State-validated (IVD) practices.

Statewide RIE Production. The first indicator was created by special computer searches of the entire RIE file on the Lockheed DIALOG system to obtain counts by state of the "institutional source" field for each RIE entry. Because the RIE citation conventions employ a compact, non-redundant style, several types of searches had to be employed, difference reconciled, and, in one case, a regression estimate made.* Note that this indicator is a

* For example, if the state name appears in the institutional name, e.g., Washington State Department of Education, the state is omitted. Hence, both state and institutional fields must be searched. However, institutional names that include words that are the same as state names, e.g., George Washington School District, in Washington state or in another state, create special problems. Some were solved by using Boolean sets. In one case, the State of Washington, a multiple regression equation based on data for all remaining states was used to estimate the count.

cumulative count based on over 12 years of systematic RIE accessions. (It also includes USOE-sponsored research reports dating back to 1956.) State counts range from over 100 to over 8,000 RIE entries. Although there may be some yearly fluctuation in the proportional rate of RIE accession from state to state (a matter which may be investigated later as part of planned time series analyses), it seems reasonable to assume that, given this 12-year cumulative base, the relative positions of the 50 states (and DC) will remain moderately stable over time spans of several years. For data analysis purposes, raw state counts were converted to logarithms.*

What does the State RIE indicator represent? RIE is one of two documentation services provided by ERIC. (The other, Current Index to Journals in Education, CIJE, indexes journal literature.) RIE includes published reports and fugitive documents not published elsewhere, e.g., project reports, speeches, committee reports, handbooks, instructional modules. Because the RIE accession of federally-sponsored education research reports reaches back to 1956, this base provides one of the most accessible and useful indicators of "raw" production over much of the less formal end of the continuum of educational documentation.

<u>State Education Agency (SEA) RIE Production</u>. This indicator is similar to the previous indicator, but is confined to the cumulative count of all SEA-produced documents in RIE through 1978 (transformed to log 10).

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* Logarithmic transformations (base 10) were used consistently to transform all count data for various indicators where the maximum state count exceeded 25. Generally, raw count data for states exhibit highly skew frequency distributions. A logarithmic transformation tends to make the distribution more normal and also tends to stabilize the standard deviation. For statistical analysis involving variances and covariances, the log transformations tend to prevent excessive weight from being given to extreme values.

<u>Schools, Colleges, and Departments of Education (SCDEs) ERIC Production.</u> This indicator was derived from SCDE productivity data reported by Clark and Guba (November 1976). Among seven Clark and Guba substudies of SCDE knowledge production, two substudies were most comparable to the statewide RIE and the RIE-SEA counts. These were the Educational Journals Study and the RIE Study. In the Educational Journals Study, all articles, essays, and reviews in each of 26 national journals were recorded for a three-year period of time (circa 1972-74).* The authors of these journal entries were tracked to the institutions or agencies in which they were employed at the time the publication was issued and, where possible, to their departments within institutions. Contributions were recorded with a maximum of 1.0 credit per article, with fractional credits for multiple authorship.

In the RIE Study, all RIE abstracts for a two-year period (April 1, 1973 through March 31, 1975) were accessed and classified by type of source institution. All RIE entries which were certainly or likely housed in the SCDE of higher education institutions were classified by the RITE system which classifies the national population of SCDEs (N = 1,367) into 12 categories.

By employing SCDE institutional productivity data for journals and RIE reported by Clark and Guba for each type of SCDE, an overall institutional

* Criteria for selecting these 26 journals out of the more than 700 journals covered in CIJE or other educational journal indexes were that they had been identified in previous studies as being significant in the growth of the knowledge base in the field of education, they included practitioner-oriented journals in balance with researcher-oriented journals, they represented a spectrum of substantive areas in education, or they were among the highest circulation journals in education. The reader should note that CIJE citations do not identify the institutional source of the CIJE entry; therefore, computer search of CIJE to obtain state counts is not possible. Statewide or SEA counts for journal production would have to employ some kind of journal sampling and author-to-source matching similar to that employed by Guba and Clark.

productivity weight was developed for each of the 12 SCDE categories.* These weights were further refined to adjust for within-category institutional productivity variability by creating "above average," "average," and "below average" weights for each of the 12 categories. A productivity weight was then assigned to each of the 1,367 SCDEs. The weights for all SCDEs in each state were summed to produce a state SCDE productivity estimate. These estimates, which are proportional to the state's total annual SDCE productivity in 26 "core educational journals" and in RIE, were then transformed to logarithms (base 10). It should be noted carefully that the journal estimate is confined to only 26 core journals and thus represents only a small fraction of the total educational journal production; however, there is a strong presumption that, if many more journals had been included in the journal sample, it probably would not change significantly the SCDE productivity rank ordering at the state level of aggregation.** Because the derived index is a composite of RIE and of counts of only 26 core journals, we are not claiming that this index is an indicator of absolute numbers. However, we do believe that it is a good estimate of the relative numbers of documents that the total of all SCDEs in each state may have contributed to ERIC (both RIE and CIJE). Because the SCDE knowledge production indicator is based in part on journal production,

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* The average SCDE produced 1.08 journal credits per year and 0.66 RIE entries; however, "Public R&D Center" SCDEs averaged 19.5 journal credits per year and 12.4 RIE entries per year.

** Increasing the number of journals sampled would have served to increase the ratio of journal credits to RIE entries in the composite estimate. While developing the SCDE production weights for each RITE category, trial computations were made for separate indexes based on RIE and on journals. The correlations across the states were so high that it was decided to combine the two estimates into a single composite.

this indicator covers an even wider range of educational documents than the statewide RIE or the SEA-RIE indicators.*

<u>JDRP-approved and DD-funded Exemplary Practices</u>. While the three previous indicators all deal with documents, this indicator measures the production of exemplary practices in each state that are of sufficient quality to pass the review of the HEW Joint Dissemination Review Panel (JDRP) and to qualify for funding as an NDN Developer/Demonstrator (DD) project. <u>Educational Programs That Work</u> (Far West Laboratory, Winter 1977) was the source for this data.

<u>State Validated (IVD) Programs</u>. In the Fall 1977, the Florida Department of Education, ESEA Title IV-C Office, conducted a survey of state program certification methods. The survey asked for the number of certified programs developed through old ESEA Title III or new ESEA Title IV-C as of September 1977. This indicator is the total of programs certified by either USOE/NASACC or other certification methods than JDRP.**

<u>Relationship Among the Knowledge Production Indicators.</u>

Table 1 displays the means, standard deviations, and correlations for these three knowledge production indicators.

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* The Clark and Guba productivity study (pp. V-49 and 50) indicates that SCDE production accounts for over half of all journal credits in practitioner-oriented journals and nearly two-thirds of all journal credits for research-oriented journals in the sample of 26 journals.

** USOE/NASACC--The U.S. Office of Education and the National Association of State Advisory Council Chairmen for ESEA Title III published <u>Sharing Educational Success: Handbook for Validation of Educational Practices</u> (1974). JDRP-validated programs were not counted since another indicator is based on the JDRP count.

TABLE 1

MEANS, STANDARD DEVIATIONS (S.D.), AND CORRELATIONS FOR FIVE EDUCATIONAL KNOWLEDGE PRODUCTION INDICATORS (N = 50 States and D.C.)

INDICATOR		MEAN	S.D.	CORRELATIONS 1 State	2 SEA	3 SCDE	4 JDRP	5 IVD
1. State RIE count	(log)	2.92	0.48	-	.72	.84	.57	.44
2. SEA RIE count	(log)	2.07	0.45	.72	-	.59	.57	.53
3. SCDE estimate	(log)	1.07	0.50	.84	.59	-	.47	.40
4. JDRP count	(raw)	3.45	3.38	.57	.57	.47	-	.64
5. State IVD count	(log)	.79	0.53	.44	.53	.40	.64	-

We note first that the means for statewide RIE and SEA-RIE production are directly comparable and that the SEA-RIE count is a subset of the total statewide RIE count.* Although the SCDE productivity estimate is also expressed in logs, no direct comparison can be made with statewide or SEA data because the SCDE data are estimates of relative numbers rather than absolute numbers.

The correlations display strong, but far from perfect intercorrelation. The stronger correlations are between statewide RIE and SCDE productivity (.84) and between statewide RIE and SEA-RIE productivity (.72). The correlation between the SEA and SCDE productivity indicators is markedly less, but still substantial (.59). Number of JDRP-approved projects is moderately correlated with all three document production indicators (.57, .57, .47). Number

* Arithmetic means of log-transformed data are the geometric means of the raw count data. The antilog of 2.92 = 832., which is the geometric mean for the statewide RIE count. The antilog of 2.07 is 118., which is the geometric mean of the SEA-RIE count. The ratio of these two geometric means is approximately 7:1.

of state-validated (IVD) projects is also moderately correlated with all three document production indicators (.44, .53, .40), and is even more strongly correlated with the JDRP count (.64).

It is possible to construct a number of additional indicators of knowledge production that are based on document systems (e.g., books in print, journal counts for various types of journals, RIE counts for various subject matter sectors, counts based on professional meeting program listings or session abstracts; and all of these counts may be cross-classified by type of educational institution or by educational sector). However, the cost of creating the data is considerable. So, for exploratory purposes, we stopped with these five indicators. Their intercorrelations are sufficiently high, but not so extremely high to suggest that they are indexing different facets of the general level of knowledge production in the 50 states (and DC).

Indicators of State Dissemination Capability

Eight indicators of state dissemination capability were identified. The first three are related to the ERIC system:

ERIC Standing Orders. This indicator is based on the count of the number of agencies in each state that maintain standing orders for ERIC microfiche. Standing order customers usually maintain complete ERIC collections (e.g., RIE, CIJE, microfiche and readers) and are usually open to the public. If complete through 1977, an ERIC microfiche collection would contain over 140,000 titles. The standing order counts were obtained from ERIC Central in Spring 1978.* Counts ranged from 1 to 56 collections per state. The raw scores were transformed to logarithms (base 10).

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* Now available in Directory of ERIC Microfiche Collections, ERIC Processing and Reference Facility.

Computerized Search Services. This indicator is the count of the organizations in each state that were currently providing computerized searches of the ERIC database as of Spring 1978.* At that time, the number of computerized search services ranged from zero to 23 per state.

ERIC Clearinghouses. This indicator is the count (0, 1, or 2) of ERIC clearinghouses in each state.**

In addition to these three ERIC-related indicators, there are three indicators that are related to State Educational Agency dissemination leadership:

State Capacity Building (SCB) Grant Status. In FY 1975, the National Institute of Education initiated the State Capacity Building Grant Program. SCB provides support for three to five years for each state educational agency (SEA) that chooses to participate in this program to build comprehensive and continuing dissemination capability. The 28 states that were recipients of SCB grants in Spring 1978 received an indicator score of "2." States that were recipients of Special Purpose Grants (that usually are planning precursors to full SCB status) received a score of "1." States that were not participating in the SCB program received a score of "0."

State Dissemination Plan. State education agencies have been encouraged to adopt state plans for educational dissemination. These plans may include

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* Survey of ERIC Data Bases. This reference has been replaced by the Directory of ERIC Search Services, prepared by ERIC Processing and Reference Facility.

** ERIC Clearinghouses are organized by subject content areas and may be considered national resources. However, because most clearinghouses will allow visitors to use their collections, presence of one or more ERIC Clearinghouses in a state is a dissemination asset. During the past two years, several USOE-funded clearinghouses have been established. These will be added when this indicator is updated.

dissemination objectives, descriptions of strategies for accomplishing these objectives, designation of roles and responsibilities within the SEA, identification of resources, and description of evaluation methods. In Spring 1978, 23 states were known to have developed or to be developing a state plan. These states were scored "2." Eleven states were known to have no plan. These states were scored "0." The status of 16 states and DC was unknown. They were scored "1."*

R&D Exchange Service. During 1976-1977, five Regional Exchanges of RDx (AEL, CEMREL, NWREL, RBS, and SEDL) provided services to 33 states.** This indicator is a dummy variable (1, if a state was served by RDx; 0, otherwise). The logic of this indicator is that the RDx regional exchanges were known to be working with many SEAs to help them develop or implement state dissemination plans and to help them train state dissemination personnel.

The following three indicators move from a focus on documentary information services or SEA dissemination activities to an attempt to identify human (e.g., linking agent) dissemination capabilities.

R&D Utilization Program Intermediaries. The purpose of the NIE-sponsored R&D Utilization Program (RDUP) is to provide services that help schools use R&D-based innovations that improve educational practice. RDUP includes seven field projects that link resources of SEAs, local education agencies, regional laboratories and R&D centers, intermediate educational agencies, and institutions of education with selected RDUP school sites in

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* The logic of this scale is not strong. We began by scoring states with plans "+1," states without plans "-1," and states where status was unknown "0." Adding a constant of 1 to each score produces the 2, 1, 0 scale. State plan information was obtained from the R&D Exchange: An Overview of State Dissemination Activities.

** In February 1979, 42 states were served by seven RDx regional exchanges.

19 states. The number of RDUP projects, and the number of RDUP linking agent personnel varied among the 19 states. A four-point indicator was created; states without RDUP projects were scored 0, states with RDUP projects were scored 1, 2, or 3, depending on relative number of RDUP linking agents operating in the state.

NDN State Facilitator Ratings. By the end of 1977, National Diffusion Network (NDN) State Facilitators had been established in all but four states. Since a "0-1" dummy variable would provide virtually no information, we asked persons who were familiar with NDN State Facilitator (SF) activities to rate SFs on a four-point (1-4) scale in terms of their dissemination capability or effectiveness.* States without SFs were scored "0."

JDRP-approved and DD-funded Exemplary Practices. This indicator was included in the Knowledge Production set. Because these projects were approved as NDN Developer/Demonstrators (DDs), they may also be considered as part of a state's dissemination capacity.**

Relationship Among Knowledge Production and Dissemination Indicators

Table 2 displays the means, standard deviations, and correlations among 13 knowledge production and dissemination indicators. The knowledge production indicators appearing in Table 1 have been reentered in Table 2 as Indicators 1, 2, 3, 7, and 8. The first six indicators located in Table 2, which are all

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* These ratings appear to be based on number of years in NDN, subjective appraisal of SF project staff skill, and general visibility and reputation of the SF in the NDN.

** Although the National Diffusion Network (NDN) is designed to encourage dissemination of DD projects beyond state lines, each state's DD projects can be important state dissemination resources.

concerned with ERIC-related document production or dissemination, display relatively high intercorrelations.

The number of ERIC standing order locations (#4) is highly related to the total RIE productivity of the state (.81), the number of ERIC computer search services offered (.72), estimated SCDE productivity (.68), and SEA-RIE count (.67). There are moderate correlations with the number of JDRP,DD-funded exemplary projects (.59), the number of ERIC clearinghouses (.45), and the number of state-validated (IVD) projects (.43). The ERIC standing orders are also weakly associated with RDUP linkages (.36), RDx service (.27), and NDN State Facilitator ratings (.25).

The number of ERIC computer search services (#5) is correlated with the State RIE count (.77), number of computer search services (.72), schools, colleges, and departments of education (SCDE) productivity estimate (.69), SEA-RIE count (.64), number of ERIC clearinghouses (.57), number of JDRP-approved/DD-funded exemplary projects (.52), and number of state IVD-validated projects (.42). There is small association with NDN State Facilitator ratings (.26), SCB status (.22), and RDU linkages (.18).

In general, the ERIC Clearinghouse count (#6) displays smaller correlations with the 12 indicators than any of the first 5 indicators listed in Table 2. The higher correlations are with State-RIE count (.60), ERIC computer researches (.57), ERIC standing orders (.45), SEA-RIE count (.41), SCDE productivity estimate (.36), and JDRP, DD-funded projects (.29).

The number of JDRP, DD-funded exemplary projects (#7) is most strongly correlated with number of state IVD projects (.64). It displays correlations between .47 and .59 with the first five indicators. This DD count is also correlated with RDUP linkages (.51), State Capacity Building (SCB) status (.38), NDN State Facilitator ratings (.33), and ERIC clearinghouses (.29).

TABLE 2

MEANS, STANDARD DEVIATIONS (S.D.), AND CORRELATIONS FOR THIRTEEN STATE-LEVEL EDUCATIONAL KNOWLEDGE PRODUCTION AND DISSEMINATION INDICATORS
(N = 50 States and DC)

INDICATOR	Mean	S.D.	CORRELATIONS (Decimals omitted)												
			RIE 1	SEA 2	SCDE 3	SO 4	CS 5	CH 6	DD 7	IVD 8	SCB 9	PLAN 10	RDx 11	RDU 12	SF 13
1. State RIE Count (log)	2.92	0.48	-	72	84	81	77	60	57	44	09	-03	18	38	27
2. SEA/RIE Count (log)	2.07	0.45	72	-	59	67	64	41	57	53	10	-04	05	26	21
3. SCDE Estimate (log)	1.07	0.50	84	59	-	68	69	36	47	40	15	09	25	45	33
4. ERIC Standing Orders (log)	0.88	0.43	81	67	68	-	72	45	59	43	11	-07	27	36	25
5. ERIC Computer Searches (#)	3.92	4.22	77	64	69	72	-	57	52	42	22	-01	-06	18	26
6. ERIC Clearing-houses (#)	0.31	0.64	60	41	36	45	57	-	29	17	01	-07	-02	-13	-05
7. JDRP/DD Projects (#)	3.45	3.38	57	57	47	59	52	29	-	64	38	17	00	51	33
8. IVD Projects (log)	0.79	0.53	44	53	40	43	42	17	64	-	27	11	25	32	28
9. SCB Grant (0-2)	1.21	0.91	09	10	15	11	22	01	38	27	-	54	-08	28	19
10. State Plan (0-2)	1.23	0.78	-03	-04	09	-07	-01	-07	17	11	54	-	27	17	11
11. RDx (0-1)	0.65	0.48	18	05	25	27	-06	-02	00	25	-08	27	-	10	03
12. RDUP (0-3)	0.63	0.97	38	26	45	36	18	-13	51	32	28	17	10	-	29
13. NDN/SF (0-4)	1.88	1.18	27	21	33	25	26	-05	33	28	19	11	03	29	-

Number of state IVD projects (#8), which excludes JDRP/DD projects, is correlated .64 with number of JDRP/DD projects and .53 with the SEA-RIE counts. This latter correlation with state education agency RIE productivity is somewhat higher than the correlation with State RIE count (.44) or SCDE productivity estimate (.40). Other moderate size correlations are with number of ERIC standing orders (.43) and number of ERIC computer searches (.42). Similar correlations include RDU linkages (.32), NDN State Facilitator rating (.28), SCB (.27), and RDx (.25).

State capacity building (SCB) grant status (#9) is the first of the listed indicators that shows no appreciable correlation with any of the six ERIC production and dissemination indicators (#1 to #6). There are four moderate correlations with: state plan status (.54), number of JDRP/DD-funded exemplary projects (.38), RDUP linkages (.28), and IVD count (.27).

State plan status (#10), as noted, is moderately correlated with SCB status (.54). Since one of the objectives of SCB projects is to organize state dissemination activities, the presence of state plans might be considered to be an effect of SCB.* Aside from a very modest correlation with RDx (.27), this indicator is generally unrelated to the remaining ten indicators.

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* The reader may recall (see page 14) that it was not possible to determine from available data whether 16 states and DC had state plans. If these 17 states (including DC) are excluded, the relation between SCB and a state plan is even stronger:

	Plan Yes	Plan No
SCB grant (multi-year or Special)	19	2
No SCB grant	4	9

RDx-served States (#11). In addition to a modest correlation with IVD (.25), states that were served by RDx regional exchanges in 1977 tended to have a state dissemination plan (.27), higher college of education (SCDE) productivity (.25), and more ERIC standing order locations (.27).

RDUP Linkages (#12). This indicator displays moderate correlations with several other indicators, including: JDRP/DD-funded exemplary projects (.51), SCDE productivity (.45), statewide RIE count (.38), ERIC standing orders (.36), IVD project count (.32) NDN State Facilitator rating (.29), SCB grant status (.28), and SEA-RIE count (.26). The R&D Utilization Program sought proposals that reflected significant existing dissemination capacity on which the R&D Utilization Program could build. Although none of these correlations are very strong, it appears that the existence and relative strength of RDUP linkages is positively correlated with a wide variety of production and dissemination indicators.

NDN State Facilitator ratings (#13) display small positive correlation with 9 of the 12 other indicators. The correlations in order of magnitude are: JDRP/DD-funded projects (.33), SCDE productivity (.33), RDUP linkages (.29), statewide RIE count (.27), state IVD count (.28), ERIC computer search services (.26), ERIC standing orders (.25), SEA-RIE count (.21), and SCB grant status (.19).

Factor Analysis of Educational Knowledge Production and Dissemination Indicators

Factor analysis results. An iterated principal components factor analysis, followed by Varimax rotation, was performed. Four factors with Eigenvalues greater than 1.0 extracted 74 percent of the trace. The results are displayed in Table 3.

TABLE 3

FACTOR ANALYSIS OF THIRTEEN STATE-LEVEL INDICATORS
OF EDUCATIONAL KOWLEDGE PRODUCTION AND DISSEMINATION
(N = 51 States and DC)

INDICATORS			FACTORS				h^2
			I	II	III	IV	
* P	1	State RIE Count	.91	-.04	.14	.22	.73
P	2	SEA-RIE Count	.78	-.02	-.02	.25	.67
P	3	SCDE Estimate	.74	.02	.25	.35	.89
D	4	ERIC Standing Orders	.82	-.06	.19	.28	.79
D	5	ERIC Computer Searches	.87	.09	-.15	.11	.80
D	6	ERIC Clearinghouses	.78	.05	-.10	-.42	.79
PD	7	JDRP/DD Practices	.58	.30	-.12	.53	.72
PD	8	State IVD Practices	.47	.22	.15	.45	.49
D	9	SCB Grant Status	.10	.85	-.20	.23	.83
D	10	State Plan Status	-.08	.86	.31	.03	.84
D	11	RDx Service Status	.08	.06	.96	.03	.94
D	12	RDUP Linkages	.16	.13	.10	.77	.65
D	13	NDN State Facilitator Rating	.13	.05	-.05	.67	.47
		Percent Common Variance	35.5	12.5	10.0	16.0	74.0

* P = Production, D = Dissemination

h^2 = Communality

Factor I has very high loadings on all six of the ERIC (document-based) production and dissemination indicators, as well as moderate loadings on both of the validated practices variables. The remaining five indicators display negligible loadings on this factor. Factor II is primarily a couplet, involving high loadings on SCB Grant Status and State Plan Status, with very small loadings for the two validated practices indicators. Factor III is associated almost exclusively with the RDx Status indicator, but with very small loadings for State Plan Status and SCDE Estimate.* Factor IV is best identified by the high loadings for RDUP linkages and for NDN State Facilitator Ratings. There are moderate loadings for both of the validated practices indicators, and smaller loadings for five of the ERIC-related indicators. The ERIC Clearinghouse indicator is negatively loaded (-.42). This suggested that, if the effects of the first three factors are held constant, there is a small tendency for states with ERIC Clearinghouses to have somewhat fewer human linkages and innovative practices structures.

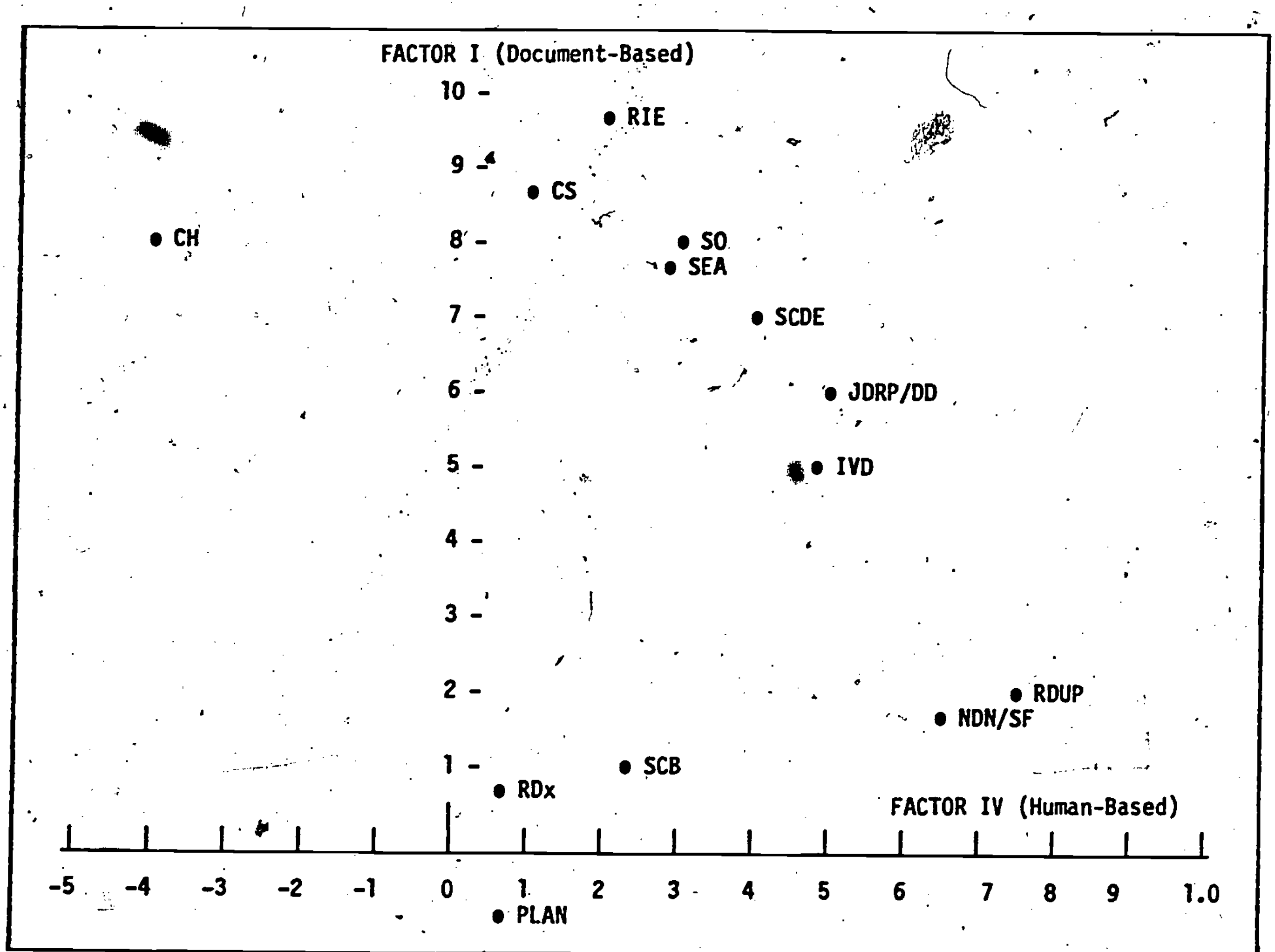
Factor Analysis Summary. If we exclude the singular RDx indicator and its associated factor, we have 12 remaining indicators, with 3 factors explaining most of the covariance among them. Factor I is a general knowledge production and access factor that is strongly associated with document-based indicators; Factor II is a state agency planning and capacity building factor; and Factor IV is primarily a human linkage and innovative practices factor. Eight of the 12 indicators have substantial loadings of Factor I; only two indicators load highly on Factor II; Factor IV is defined by perhaps half the indicators, but mainly by the two "human linkage" indicators.

The two validated practices indicators, which combine aspects of production and dissemination of school-based innovative practices, are particularly interesting because they display approximately equal loadings on the document-based knowledge production and access factor (1) and the human

* This small relation of RDx and State Plan may be due to the fact that an RDx report was the basis for assigning State Plan indicator values.

FIGURE 1

PLOT OF FACTOR I WITH FACTOR IV



LEGEND

CH	ERIC Clearinghouses
CS	ERIC Computer Searches
IVD	State Validated (IVD) Practices
JDRP/DD	JDRP Validated/Developer Demonstrator Funded Practices
NDN/SF	National Diffusion Network/State Facilitator Ratings
PLAN	State Dissemination Plan Status
RDUP	R&D Utilization Program Linkage
RDx	RDx Regional Exchange
RIE	State RIE Productivity
SCB	State Capacity Building Grant Status
SCDE	Estimate of School, College & Dept. of Education Productivity
SEA	State Education Agency RIE Productivity
SO	ERIC Standing Orders

linkage factor (IV).* Figure 1 displays the plot of Factor I with Factor IV. We are suggesting that these two factors, one document-based and one human-based, are perhaps the primary factors that underly ten of the 13 knowledge production and dissemination indicators.**

Predictors of State-level Production and Dissemination Capability

Selection of Contextual Indicators. During preliminary examination of data distributions, we noted that higher knowledge production and dissemination indicator counts tended to be associated with larger state populations. Although less apparent in the data, it seemed that wealth might also be a contributing factor. For our exploratory work, we eventually selected 22 "contextual" indicators which could possibly be related to the production/dissemination indicators and for which information was readily attainable. The 22 variables are listed below by groups:

School Enrollment and Staff Size

- Elementary and secondary public school enrollment (ES Enroll.) in 1975 (log 10)
- Elementary and secondary public school instructional staff (ES Staff) in 1974 (log 10)
- Elementary and secondary public school consultants and supervisors of instruction (ES Sups.) in 1974 (log 10)
- School librarians (Librarians) in 1974 (log 10)
- Enrollment in institutions of higher education (IHE Enroll.) in 1974 (log 10)

* The ERIC Clearinghouse indicator displays a somewhat similar pattern, but with negative sign on Factor IV.

** Three indicators, RDx, State Capacity Building, and State Plan, all 0-1 or 0-2 status variables, have essentially zero loadings on both Factor I and Factor IV.

School Organizational Structures

- Number of local educational agencies (LEAs) in 1973 (log 10)
- Percent of LEAs with enrollment of 25,000 or more (Urban LEA %) (percent)
- Percent of LEAs with enrollment of less than 300 (Small LEA %), (percent)
- Number of Intermediate Service Agencies (ISAs) in 1977 (log 10)
- ES enrollment divided by number of ISAs (ISA Ratio) (log 10)
- Number of Teacher Centers (TCs) in 1977 (log 10)
- ES staff divided by number of Teacher Centers (TC Ratio) (log 10)
- Number of Institutions of Higher Education (IHEs) in 1974 (log 10)

Demographic and Financial

- Population per square mile (Density) in 1970 (log 10)
- Population Change from 1960 to 1970 (Pop. chg.), (percent)

- ES school expenditure per pupil (PP$) in 1974-75, (in $100s)
- State per capita school expenditure in 1975 (PC$75), (in $10s)
- State per capita school expenditure in 1976 (PC$76), (in $10s)
- State per capita income (PC Income) in 1975, (in $100s)
- Ratio of 1975 school expenditure per pupil to 1975 per capita income (PP$/PC Income)
- Average ES public school instructional staff salary (Staff Sal.) in 1974-75, (in $100s)
- Ratio of staff salary to per capita income (Staff Sal./PC Income)

Enrollment and Staff Size. Total elementary and secondary school enrollment and total IHE enrollment were selected as general measures of the student population in each state. Among the several statistics on school staff, we selected the total number of elementary and secondary school (a) instructional staff, (b) consultants and supervisors, and (c) librarians. The last two were selected because of small, but possibly interesting variations from state to state in the proportion of these positions to instructional staff.

School Organizational Structures. The states vary immensely in the number of school districts (from 1 in Hawaii and DC to over 1,200 in Nebraska). Since most external dissemination efforts must work through LEA sactions, the number of LEAs was selected as a contextual indicator. Two other derivative indicators are the proportion of large urban LEAs and the proportion of very small LEAs. Large urban LEA, with enrollment over 25,000, constitute special dissemination and school improvement challenges. The proportion of large urban LEAs range from less than one percent to one hundred percent. Very small LEAs with enrollment under 300 tend to be isolated rural schools. The proportions range from none to 85 percent of the LEAs in each state.

The Intermediate Service Agencies (ISAs), constitute a potentially important dissemination and school improvement link between the state and local education agencies. In 1977, twenty-nine states had a recognized ISA system, with one to 77 ISAs. In addition to the ISA count, we computed the ratio of school enrollment to ISAs in order to adjust the LEA count for differences in state school enrollments.* Teachers Centers represent another "grass roots" linkage for local instruction staff. As in the case of ISAs, both the number of teachers centers and ratio of instructional staff to number of teachers centers were employed.* Finally, the number of institutions of higher education (IHEs) was noted.

Demographic and Financial Indicators. Since we knew that state school enrollment was almost perfectly correlated with state population, the latter statistic was eliminated. However, two other population related indicators were employed. Population density, which varied from less than three to over 12,000 persons per square mile, was considered as a potential useful indicator of ease of interpersonal communication and ease of physical access to knowledge resources.

Seven financial indicators were employed. School expenditure per pupil and the two per capita school expenditure indicators all relate to general

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* Because ISAs and TCs do not serve all schools in some states, these ratios do not accurately reflect the average number of pupils served per ISA or the average number of instructional staff served per TC.

level of elementary and secondary public school expenditure, either on a per pupil or per capita basis. Because state school expenditure could be related to per capita income, we added per capita income and the ratio of school expenditure per pupil to per capita income. This ratio indicator can be considered a crude measure of educational expenditure adjusted for per capita income differences. The last two indicators look more directly at instructional staff salaries in terms of average instructional staff salary and in terms of the ratio of staff salary to per capita income.*

Factor Analysis of 20 Contextual Indicators. A principal components factor analysis of twenty of these indicators, with Varimax rotation, produced seven factors with Eigenvalues greater or equal 0.8, accounting for 92 percent of the trace. The results are displayed in Table 4.**

Factor I, accounting for 31 percent of the common variance, is readily interpretable as a size factor with very high loadings on all school enrollment and staff size indicators, and moderately high loadings on all counts of numbers of educational agencies (LEAs, ISAs, TCs, and IHEs). The somewhat lower loadings for counts of types of institutions reflect the fact that the numbers of these institutions are not distributed in as direct proportion to school enrollments as are school personnel.

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* Because per capita income is based on the entire population in the state rather than wage earners, staff salary ratios are greater than one, and range from 1.56 to 2.75.

** Since ES enrollment and ES staff correlated .99, the ES Enrollment Indicator was dropped from the factor analysis. Large Urban LEA %, which correlated .77 with number of LEAs, was also dropped. Using the standard Egenvalue cutoff of 1.0 produced five factors accounting for 84 percent of the trace. Inspection of five-; six-, and seven-factor solutions led to the choice of the seven-factor solution in order to produce factor scores that were most directly interpretable.

TABLE 4

FACTOR ANALYSIS OF 20 CONTEXTUAL INDICATORS
(N=51 States and DC)

CONTEXTUAL INDICATORS	FACTORS (Decimals Ommitted)							h^2
	I	II	III	IV	V	VI	VII	
ES Staff	98	-02	07	11	02	-07	-03	98
ES Sups.	91	15	06	01	-02	-11	01	87
Librarians	92	-05	15	22	02	-07	-03	93
IHE Enroll.	97	05	11	02	03	-07	-04	97
LEAs	59	-19	-69	13	-17	08	-12	92
Small Lea %	-29	05	-84	-24	-05	16	-14	89
ISAs	65	06	-11	-05	-01	01	-75	100
ISA Ratio	01	-14	20	17	07	-09	94	99
TCs	68	10	02	-67	08	06	-16	97
TC Ratio	30	-13	07	91	-08	-15	14	98
IHEs	93	-15	02	-04	-12	-03	-06	90
Density	51	13	65	-27	-[illegible]5	04	20	87
Pop. Change	-02	27	-01	-08	87	-09	04	84
PP$ (expenditures)	08	97	09	-11	-11	-01	00	97
PC $75	-06	96	-11	04	06	-06	-07	95
PC $76	-18	88	-10	04	15	-04	-12	86
PC Income	04	85	11	-17	20	39	-04	96
PP $/PC Income	05	61	-02	02	-43	-52	03	83
Staff Sal.	20	83	19	-08	27	-18	00	88
Staff Sal./PC Income	21	03	14	13	14	-89	08	90
Percent of Common Variance	31	23	09	08	06	07	08	92

Factor II, which accounts for 23 percent of the common variance, is also easily interpretable as an expenditure variable that displays high loadings on all measures of school expenditure and per capita income as well as the staff salary measure.

These first two factors, size and expenditure, account for 54 percent of the common variance, and are thus by far the strongest two factors. None of the remaining five factors account for more than nine percent of the common variance in these 20 contextual indicators.

Factor III displays a high positive loading on population density and high negative loadings on number of LEAs and percent of small LEAs. Since the pure effect of size was removed in Factor I (note that the density indicator also displays a high loading on this factor), Factor III may be interpreted as a measure of high relative density that is associated with few LEAs and absence of very small LEAs.

Factor IV is almost purely a teacher center factor, however, the signs of the loadings indicate that it should be interpreted as low teacher center distribution since the loading is negative on number of teacher centers and highly positive of the ratio of intructional staff to number of teacher centers.

Factor V is associated primarily with positive population change. Other smaller loadings suggest that positive percent of population change may be more in less dense states, and that positive population change may be associated with higher per capital income and higher school staff salaries, but with lower per pupil expenditure in relation to per capita income.

Factor VI is perhaps best interpreted as a low educational expenditure effort factor that is marked by a very high negative loading on the ratio of instructional staff salary to per capita income and also by a moderately high negative loading for the ratio of per pupil expenditures (which include staff salaries) to per capita income. The difference between these two negative loadings suggest that it is low salaries of teachers relative to per capita income that is the more prominent element. Please recall that factor II already accounts for most of the direct expenditure effect. Factor VI is a relative effort measure of school expenditure adjusted for P.C. income. Low effort states may tend to pay lower instructional salaries (this loading is very small, -.18), but they may not be low per capita income states (this loading is +.39).

Factor VII is the ISA service factor. Like Factor IV, which is interpreted as low TC service, Factor VII is interpreted as low ISA service with a high negative loading on number of ISAs and a very high positive loading on the ratio of ES Enrollment to number of ISAs (i.e., high factor scores are associated with high ratios--larger numbers of pupils per ISA).

Summary. Factor analysis of 20 context measures produced seven factors:

I	Size
II	Expenditure
III	High Density (Urbanization)
IV	Low Teacher Center Service
V	Positive Population Change
VI	Low Relative Educational Effort
VII	Low ISA Service

The first two factors are the most prominent. Ten context indicators are strongly associated with Factor I, and six are strongly associated with Factor II. The remaining factors are each defined in terms of only two or three context indicators.

Relationships Between Context Indicators and Knowledge Production and Dissemination Indicators

Multiple Correlation Analysis. Table 5 displays the correlations between the seven context indicator factor scores and the 13 indicators of knowledge production and dissemination. Due to the zero correlation among the orthoganal factor scores, the correlations in Table 5 are also interpretable as regression beta weights, indicating the relative predictive power of each context indicator factor score to contribute to the multiple correlation with each of the 13 production and dissemination indicators.*

Inspection of the SIZE factor score correlations in Table 5 quickly leads to a possible explanation for the high correlations among the first eight production and dissemination indicators. All eight of these indicators are based on counts or estimates of counts (i.e. RIE documents, journal articles, ERIC standing orders, computer search services, clearinghouses, validated projects). With the exception of ERIC Clearinghouses, where the correlation with the SIZE factor is only .39, the remaining correlation with SIZE range from .63 to .87. The size of the state (in terms of numbers of educational staff and numbers of educational agencies**) is thus a powerful predictor of the quantities of educational knowledge production outputs and dissemination services. For ERIC standing orders, where the correlation is highest, the SIZE factor alone is capable of accounting for three-fourths of all the state-to-state variation in number of standing orders. The SIZE factor also

* The reader should note that orthoganal factor analysis also implies that the effects of each factor are removed from the other factors, e.g., considering the Teacher Center (TC) factor, the effects, size, educational expenditure, density, etc. are removed (controlled).

** The size factor is also almost perfectly correlated with school enrollment and total population.

TABLE 5

CORRELATIONS BETWEEN CONTEXT INDICATOR FACTOR SCORES AND DISSEMINATION INDICATOR VARIABLES
(N = 51 States and DC)

PRODUCTION AND DISSEMINATION INDICATOR VARIABLES	SIZE I	EXPEND. II	DENSITY III	TC IV	POP. INCR. V	EFFORT VI	ISA VII	R*
1. State RIE documents	.81	.30	.19					.88
2. SEA-produced RIE documents	.76		.16		-.15	-.13	-.14	.81
3. SCDE-produced documents	.73	.25					-.15	.79
4. ERIC Standing Orders	.87		.18					.89
5. ERIC Computer Search Services	.74	.26		-.13		-.12	-.10	.81
6. ERIC Clearinghouses	.39	.34	.14		-.11			.55
7. JDRP/DD Projects	.72	.18	-.10		.11		-.19	.78
8. IVD Projects	.63		-.29	-.14			-.18	.73
9. SCB Grant Status	.17	.33	-.12				-.29	.49
10. State Dissemination Plan Status		.14	-.18	-.11		-.10	-.29	.40
11. RDx Serving State	.23	-.14		-.38			-.21	.51
12. RDU Linkages	.40	.15			.12		-.36	.57
13. NDN SF Ratings	.37		-.19	-.19	-.18			.49

* Multiple correlations are computed on the basis of all predictors with beta weights of .10 or larger.

Key to abbreviations:
RIE = Resources in Education
SEA = State Education Agencies
SCDE = Schools, Colleges and Departments of Education
ERIC = Educational Resources Information Center
SCB = State Capacity Building
JDRP = Joint Dissemination Review Panel
IVD = State Identification, Validation, Dissemination Project
RDx = Research and Development Exchange
RDU = Research and Development Utilization Project
NDN = National Diffusion Network
SF = State Facilitator
TC = Teacher Center
ISA = Intermediate Service Agencies

contributes modest predictive weights for all remaining indicators except State Dissemination Plan Status.

The educational EXPENDITURE factor is the second most powerful predictor, contributing modest beta weights to (correlations with) nine of the 13 indicators. States with higher educational expenditures tend to: produce more RIE documents and more SCDE documents (RIE and journal), have more computer search services, may have one (or two) ERIC clearinghouses, slightly more JDRP/DD projects (but not necessarily more IVD projects), have a SCB Grant and perhaps a state dissemination plan or RDU linkages. There is a very small tendency for states that expend more on education to <u>not</u> be part of the RDx Regional Service territory.* Note that the highest correlation, .33, with SCB Grant Status, only accounts for 11 percent of the covariance, hence none of these relationships with the EXPENDITURE factor are very large.

In terms of predictive contribution, Factor VII, low ISA service is the next most powerful predictor. Low service is negatively correlated with nine of the 13 indicators, implying that states where ISAs operate and where the total number of ES enrollment divided by number of ISAs is relatively low will be states that are favored positively on many of the indicators. These include: SEA productivity, SDCE productivity, computer search services, both JDRP/DD and IVD-validated projects, SCB grant status, state dissemination plan status, RDx service, and RDU linkages. Again, none of these correlations with TC service are very high; the largest, -.36 with RDU linkages, accounts for 13 percent of the covariance.

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* Since the Appalachia Educational Laboratory's Regional Service area encompasses most of the South-eastern states, this very small negative correlation (-.14) is easily explained.

Fourth in predictive power is the DENSITY factor. Although again the correlations are quite modest, there is an interesting pattern for this factor. DENSITY is positively associated with four of the ERIC-related measures (State-RIE, SEA/RIE, ERIC standing orders, and ERIC Clearinghouses); however, it is is negative for five other indicators (JDRP/DP projects, IVD projects, SCB grant status, state dissemination plan status, and NDN SF ratings). Denser states (typically with fewer LEAs and low percentages of very small LEAs) tend, slightly, to fare better with respect to established document-based resources and not as well with the newer, validated practices and capacity building activities.

Fifth in predictive power is the Teacher Center (TC) Service Factor. Low TC service is negatively associated RDx service (-.38), with NDN SF Ratings (-.19), IVD Projects (-.14) and ERIC computer searches (-.13); however there is a small positive correlation with state dissemination planning (.11).*

The POPULATION INCREASE factor score contributes in a very minor way (1% to 2%) to the prediction of five indicators. States with increasing population tend to have slightly more JDRP/DD projects (.11) and more RDU linkages (.12) and slightly lower SEA productivity (-.15). There is also slightly less chance that they will have an ERIC Clearinghouse (-.11) or higher SF rating (-.18).**

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* Again we note that these are orthoganal factor scores where the effects of other factors are removed. For instance, the zero-order correlation between Staff/Teacher Center and RDx is +.36, with NDN SF it is -.11, for ERIC computer searches it is +.09 and with state dissemination planning it is +.02.

** Zero order correlations between the population increase context indicator (not the factor score) and these same production and dissemination indicators are: JDRP/DD (.11), RDU (.10), SEA-RIE (-.05), ERIC Clearinghouse (-.04) and SF rating (-.15).

The relative EFFORT factor score (a measure of greater educational expenditure relative to per capita income) is not related appreciably to any of the indicators. There are three very small negative correlations that contribute only one to two percent to the prediction of three indicators. Since this is a measure of <u>low</u> EFFORT, high EFFORT is very slightly associated with higher SEA productivity, more ERIC computer services, and greater probability of having developed a state dissemination plan.

In the last column of Table 5 are displayed the multiple correlations (R) computed on the basis of the displayed correlations. The multiple Rs for all ERIC related indicators except the Clearinghouses are substantial, ranging from .79 to .89. The Rs for the two validated projects counts are also quite high (.73 and .78).

State Dissemination Plan Status is least well predicted (.40)*. The remaining multiple correlations range from .49 to .57.

The reader may want to note which predictor factor scores contribute what portion of the covariance. For this purpose the values displayed in Table 5 must be squared. For example, total number of documents in RIE is predicted by three factor scores: SIZE (.81) contributes 65.6%, educational EXPENDITURE (.30) contributes 9.0%, and DENSITY (.19) contributes 3.6%, for a total 78.2% of covariance; the square root of .782 is .88, which is the computed multiple correlation.

<u>A Note on Significance and Reliability of These Results.</u> Since all 50 of the United States and the District of Columbia constitute the defined population, this is a 100 percent sample and hence there is <u>no</u> sampling error.

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* Recall that this is a three point (0-2) measure, with the status of 17 states (including DC) unknown and assigned an intermediate value of 1.

Consequently, all of the results may be considered statistically significant. Of course there can be measurement error and there certainly may be changes in the indicator values over time. Hence significance in terms of reliability of measurement and generalization over time must be considered. Most of the document-based knowledge production indicators involve large data bases. Hence, the relative rankings among states can be expected to remain highly stable over several years. The numbers of ERIC standing orders and computer services are not as large as the document counts, but are still sufficiently large that relative positions of states should be reasonably stable over several years. The remaining validated practices and other dissemination indicators are expected to have less stability. For example, some states could easily double or triple a very small number of validated practices. Additional states have already been included in the RDx Regional Service territory. Several states will prepare state dissemination plans in the next year or two. A new cohort of NDN State Facilitators (SFs) will eventually acquire skills and expertise that may change the Ratings...and so on. For these reasons there may not be very high stability for the newer, more "down-stream" and typically "human-linkage" types of dissemination indicators.

Expected stability among the context indicators is generally higher but yet variable. The relative positions among the states for most of the population and economic indicators should remain fairly stable over periods of several years. Because school enrollments are highly correlated with population, and educational staffing numbers are, in turn, highly correlated with school enrollment, these types of context indicators should be markedly stable. By contrast, our data on Teacher Centers and ISAs are probably less accurate; moreover, the numbers of TCs and ISAs can be expected to change sufficiently over several years to have some effect on the relative values among the states.

We can also note that, while the SIZE and educational EXPENDITURE factor scores are based on several measures and can thus average out measurement errors, the remaining factor scores are based on one or only a few measures and are thus more vulnerable to measurement errors.*

These considerations of expected stability in indicators over time lead to two different types of conclusions. First, we can expect that the generally strong relationships between the SIZE factor score and <u>counts</u> of most document-based sources will be stable. Second, we are much less sure of the predictive stability for the other indicators. The prediction equations for JDRP/DD projects may change slowly, however the prediction equations for indicators such as RDx Service, State Dissemination Plan Status, or SF Ratings are probably far more subject to change over time.

<u>Canonical Correlation Analysis</u>. In the above section we examined the use of seven orthoganal factor scores, based on contextual indicators, to compute multiple correlations with each of 13 educational knowledge production and dissemination indicators. As we know the 13 indicators are intercorrelated. We performed a second analysis in which the canonical correlations between 20 of the original context indicators and the 13 production and dissemination indicators were computed. The goal of canonical analysis is to define the primary independent dimensions which relate one set of variables to another, in this case the context (predictor) indicators and the production and dissemination (criterion) indicators. This technique, like factor analysis, is primarily descriptive.

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* The two ratio indicators (TC Service and ISA Service) are especially vulnerable to unreliability due to measurement errors in the counts of TCs and ISAs that are the denominators in these ratios. The numerators in these ratios are far more accurate.

The analysis offers answers to three questions concerning:

(1) The number of ways the two sets of indicators are related.

(2) The strength of each relationship.

(3) The nature of the relationship.

Although the maximum number of independent multivariate relationships will be equal to the smaller of the two sets of indicators, 13 in this instance, we shall summarize the results for only the first four most significant canonical correlations.

The first canonical correlation is .96+. It involves all of the "size" indicators on the predictor side and all of the "counted" indicators on the criterion side. Large states tend to produce more documents and validated practices and to have more of all of the countable dissemination facilities.

The second canonical correlation is .89. It involves a combination of all of the educational expenditure measures plus higher number of LEAs, ISAs, TCs and (high) percent of small LEAs in the predictor side, with SCB Grant Status, validated projects; NDN State Facilitator Ratings, and RDU Linkages prominent on the criterion side together with more modest associations with ERIC computer searches and all three (state-wide, SEA, SCDE) of the document production indicators.

We note that the criterion sides of these first two canonicals are quite similar to the two factors plotted in Figure I, page 22; i.e., they seem to involve the prediction of primarily document-based indicators in the first canonical and primarily, but not exclusively, the more human-linkage indications in the second canonical.

The third canonical correlation is .91. It involves the majority of the context indicators, but it best interpreted in terms of high ISA numbers, high TC numbers, high staff salaries, together with somewhat higher size measures and educational expenditure on the predictor side, that are associated with higher numbers of validated projects and ERIC search services and, to a lesser extent, greater productivity on all three document measures, more RDU linkages and greater probability of being a SCB Grant recipient. This third canonical suggests a pattern in which the existence of intermediary structures, e.g., ISAs and TCs, accompanied by above average size and expenditure, are associated with a wide range of production and dissemination advantages, including especially more validated projects and information search services.

The fourth canonical correlation is .84. This canonical is interpretable in terms of high per pupil and per capita educational expenditures, high per capita income, and high instructional staff salaries, with low density, a larger percentage of very small LEAs, and perhaps fewer pupils per ISA. These predictors are associated with a combination of criteria that are marked especially by higher probability of RDx services and the existence of a state plan, together with the presence of RDU linkages, and higher SCDE document productivity, but with lower SEA-RIE counts and fewer ERIC computer search services. This canonical pattern may typify some of the more affluent, but less dense states where document productivity is associated primarily with the SCDEs, and some ISA services are available. Although these states may or may not be part of the State Capacity Building (SCB) Program, they tend to have produced a state dissemination plan, have RDU linkages, and are probably in the RDx Regional Service territory. Or the contrast for the opposite side of this canonical pattern may be less affluent, but denser states with lower SCDE productivity, but higher SEA-RIE productivity, with little or no ISA service, that tend not to have state plans or RDU linkages or be in the RDx service area.

Discussion of Relationships of Predictors to Production and Dissemination Indicators. In the above sections we have presented the results of multiple correlation and canonical correlation analysis of the relationships between contextual measures and 13 indicators of educational knowledge production and dissemination. We have seen that measures of size (e.g. school enrollment, staff size, number of LEAs) are highly intercorrelated with all production and dissemination measures that are counted (e.g., number of documents in RIE, number of computer search services, number of validated projects), and that size of the state accounts for much of the intercorrelations among these counted indicators. States with large school populations simply tend to produce more educational documentation and more exemplary projects, and to have more dissemination structures. In many cases Size alone accounts for as much as 50 to 66 percent of the covariance. Next to Size, the level of Educational Expenditure also acts as a positive predictor for many indicators. Presence of intermediate structures such as Intermediate Service Agencies (ISAs) and Teacher Centers (TCs) also adds small increments to the multiple correlations for many indicators. Density (urbanization) is only weakly related to most of the production and dissemination indicators, but with positive correlation with the ERIC-related indicators and negative correlation with the non-ERIC indicators.*

The Population Increase and Effort/Income-predictive measures contribute only one or two percent covariation to a few of the indicators. For many of the ERIC indicators, Size by itself is almost as good a predictor as the entire set of seven predictor factors; whereas, for the remaining indicators,

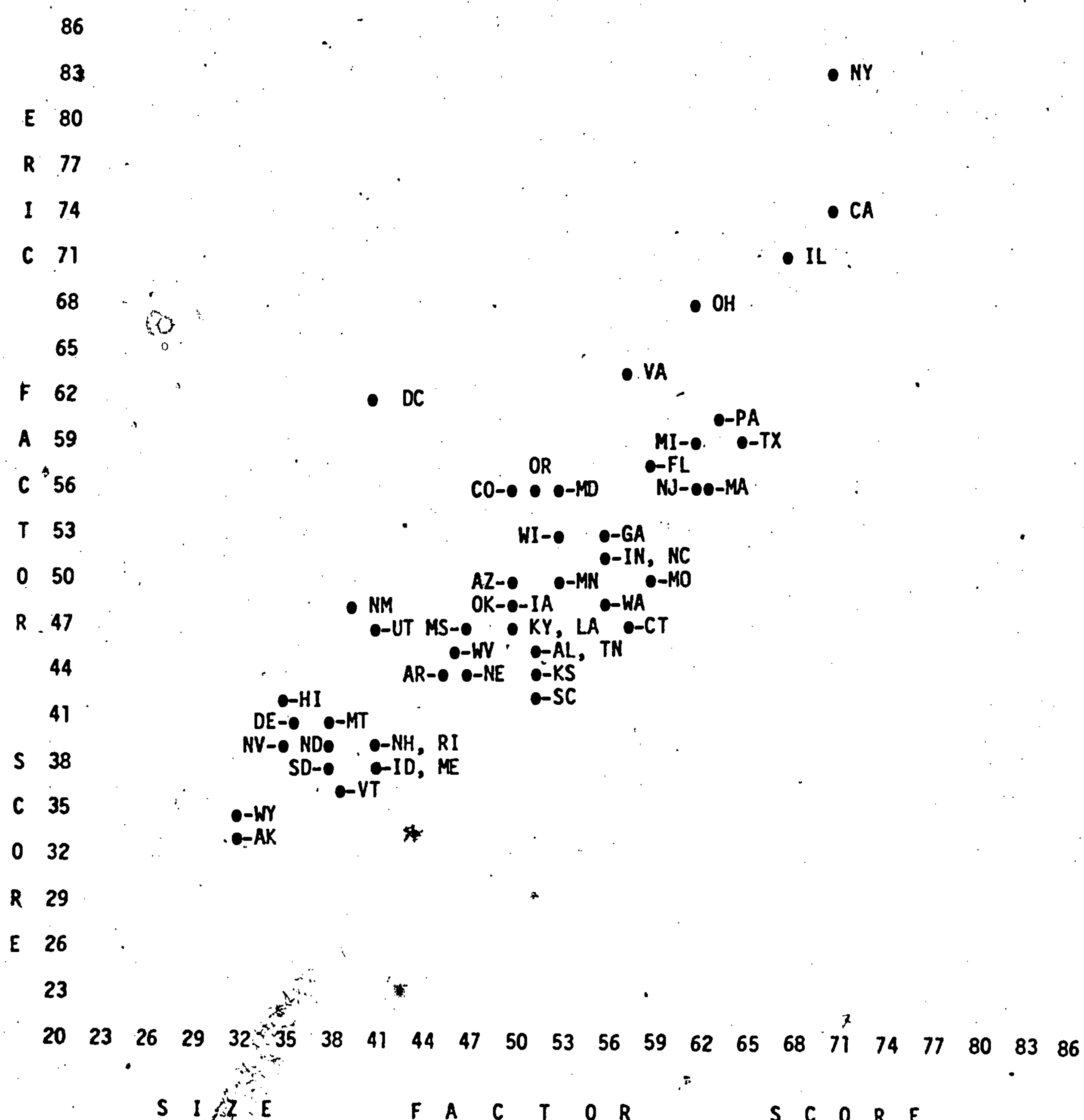
* We note that this latter pattern is consistent with the conclusion of Emrick Peterson and Argawala-Rogers (1977) that NDN has an intensionally strong rural bias.

the other six predictor factors add considerable predictive strength to Size alone. It seems, then, that although a state's document-based productivity, dissemination (and we also suspect its utilization) can be predicted effectively by some simple quantitative measures of size, it is necessary to know considerably more about a state to do at all well in predicting less document-oriented aspects of its dissemination capability. In the canonical correlation analysis we found even stronger correlations between the set of context measures and the set of production and dissemination indicators.

Scatterplots. The first and largest canonical correlation was interpreted as representing the joint relation between size predictors and all counted indicators (i.e., the ERIC-related indicators and the validated projects). To avoid dealing with canonical weights and scores, we went back to our factor analyses and selected the SIZE factor score from the contextual indicator factor analysis (p. 27) and the ERIC factor score from the production and dissemination factor analysis (p. 20). The scatterplot of this relationship is displayed in Figure 2. When the SIZE factor score is used to predict the ERIC factor score, the correlation is .85, which means that SIZE accounts for nearly three-fourths of the variance among states on the ERIC factor score.

FIGURE 2

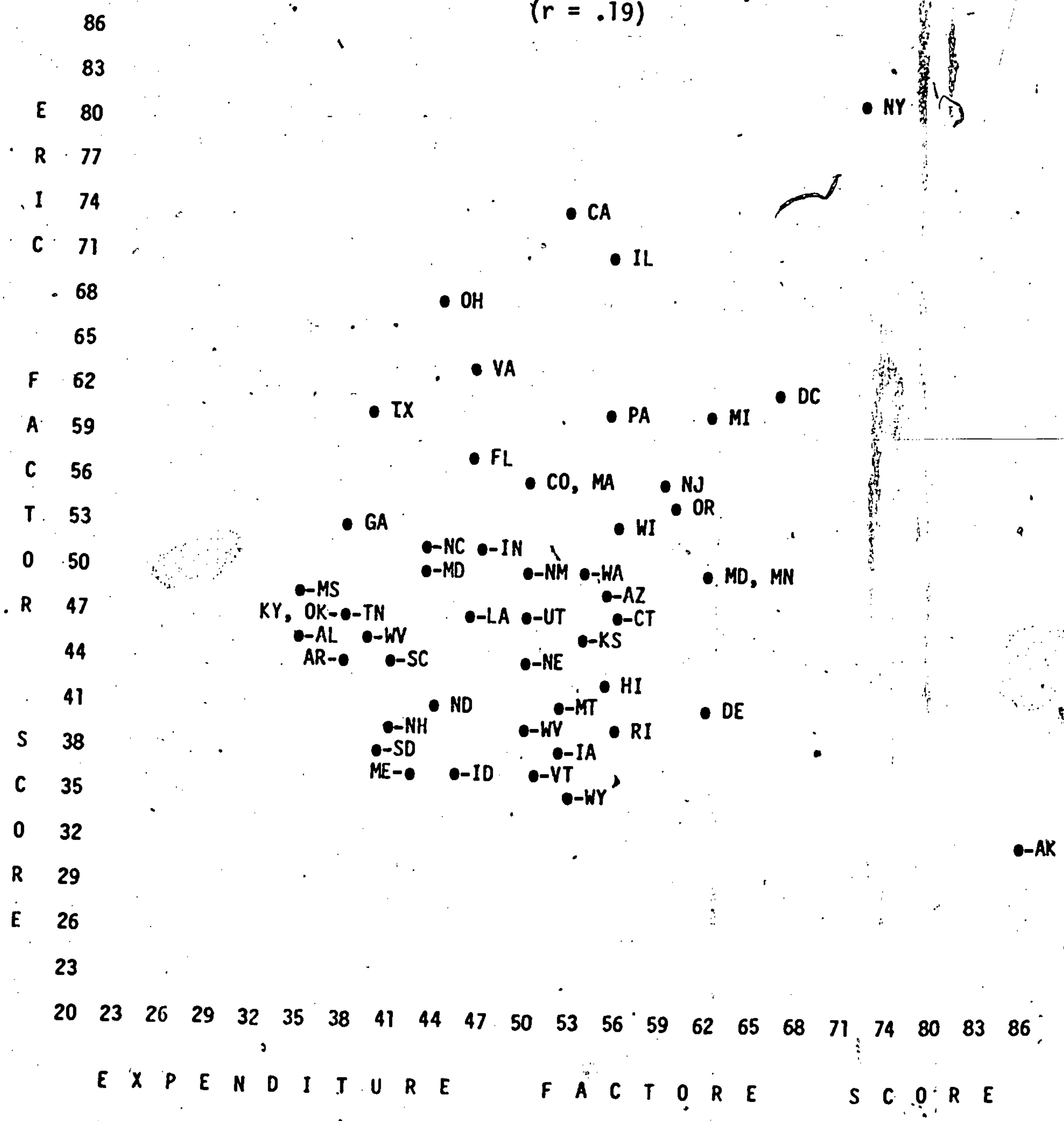
SCATTERPLOT OF SIZE FACTOR SCORE BY ERIC FACTOR SCORE
FOR 50 STATES AND WASHINGTON, DC
(r = .85)



In Figure 3 we display the scatterplot of the educational EXPENDITURE factor score with the ERIC factor score. Although EXPENDITURE is the second most powerful predictor, the correlation is only .19.

FIGURE 3

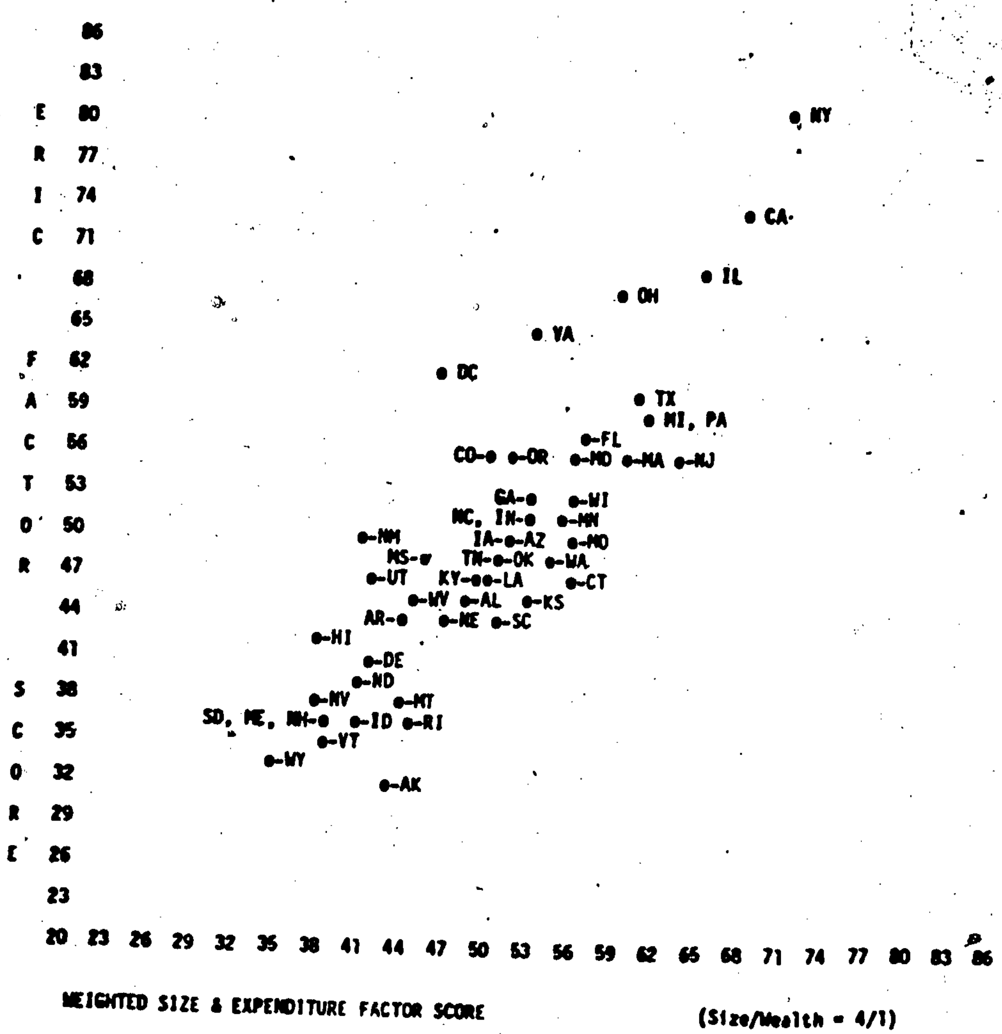
SCATTERPLOT OF EXPENDITURE FACTOR SCORE BY ERIC FACTOR SCORE
FOR 50 STATES AND WASHINGTON, DC
(r = .19)



Finally, in Figure 4, the scatterplot of a weighted combination of the SIZE and EXPENDITURE factor scores with the ERIC factor score is displayed. It may be of interest to note that the states that are somewhat off the regression line in Figure 4, i.e., DC, Virginia, Ohio, Illinois, and New York, are all somewhat higher on ERIC productivity and dissemination than would be predicted by their SIZE and EXPENDITURE combined.

FIGURE 4

SCATTERPLOT OF WEIGHTED SIZE AND EXPENDITURE FACTOR SCORE BY ERIC FACTOR SCORE FOR 50 STATES AND WASHINGTON, DC
(r = .87)



DEVELOPMENT OF A TYPOLOGY OF STATES

The initial stimulus for examination of quantitative indicators was interest in developing an objective basis for classifying or typing states in terms of their knowledge production, dissemination, or utilization characteristics. The analyses reported above are preliminary steps designed to gain better understanding of the exploratory set of indicators that had been selected. The predictive power of the contextual indicators was anticipated, yet the very strong relationships, especially with SIZE, were a bit of a surprise. In the following sections, we report results of two types of hierarchial grouping analyses.* The first is based on the educational knowledge production and dissemination indicators; the second on context indicators.

Development of a Typology of States Based on Educational Knowledge Production and Dissemination Indicators.

A hierarchial grouping analysis of states was run based on all 13 of the production and dissemination variables. The results of the last six stages of grouping are displayed in Figure 5. At the six-group level, a discriminant analysis showed that at least two groups differed significantly on all of the 13 indicators. The states comprising the six groups and the descriptions of the distinguishing characteristics of these groups are presented on the left side of the table. The way the groups combine is depicted on the right side. The groups are in sequence from highest production/dissemination capability on the top of the page to lowest capability on the bottom. Because of their

* Ward's (1963) agglomerative hierarchial grouping method was employed through the HGROUP program (Veldman, 1967). All measures were standarized prior to grouping.

FIGURE 5

HIERARCHIAL GROUPING OF STATES BY PRODUCTION AND DISSEMINATION INDICATORS

in Group

(2) 1. CA, NY

- Highest on all ERIC indicators
- Highest on JDRP projects

(12) 2. CO, FL, GA, IL, MA, MI, MN, OR, PA, TX, WA, WI

- High on all ERIC indicators
- High on JDRP projects

(7) 3. AZ, CT, IA, KS, NE, NJ, UT

- Moderate on ERIC indicators
- High on SCB, state plans, JDRP projects, NDN State Facilitator ratings

(14) 4. AR, DC, IN, LA, MD, MS, MO, NM, NC, OH, OK, TN, VA, WV

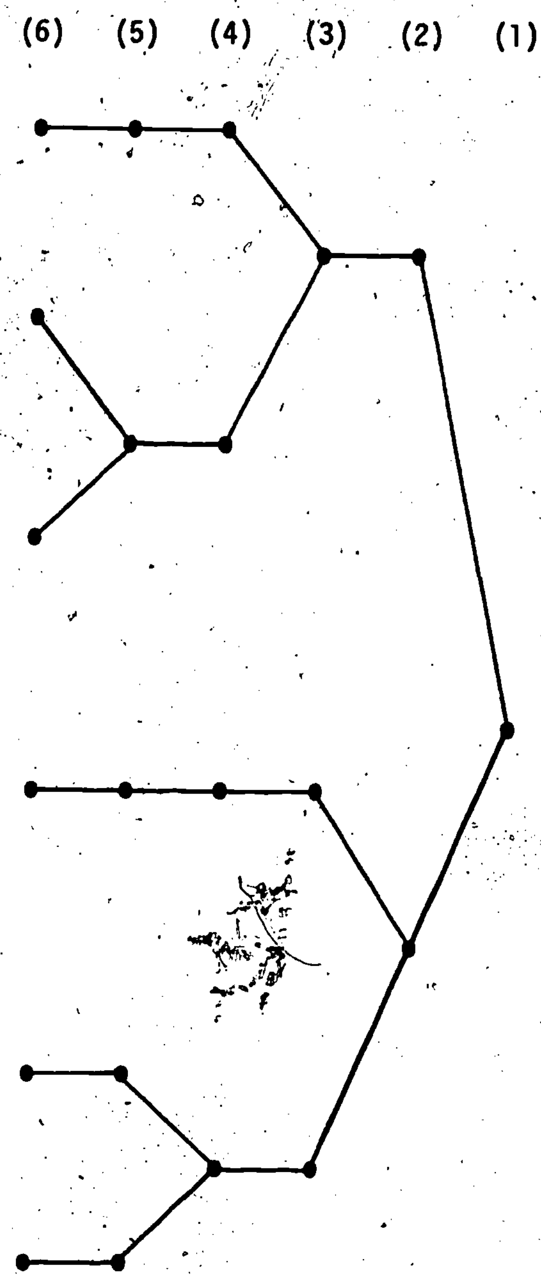
- Moderate on ERIC indicators
- Low on SCB, state plans, JDRP projects, NDN State Facilitator ratings

(9) 5. AL, AK, DE, HI, ID, KY, MT, NV, SC

- Low on all ERIC indicators

(7) 6. ME, NH, ND, RI, SD, VT, WY

- Lowest on all ERIC indicators



massive size, California (CA) and New York (NY) tend to remain as a separate pair until only four groups remain. Although groups 2 and 3 differ somewhat on relative level of the ERIC-related indicators, their similarities on other non-ERIC indicators (generally high on SCB, state plans, JDRP-validated projects, and NDN State Facilitator ratings) cause them to merge first, and then to join CA and NY to compose a group of 21 states consisting of the top 3 groups. The major difference between groups 3 and 4 is that group 4, while moderate on the ERIC indicators, is lower than group 3 on the non-ERIC indicators. Group 4, however, is sufficiently higher than groups 5 and 6, that group 4 maintains its own grouping until only 3 groups remain. Groups 5 and 6 combine at the four-group stage to create a group of 16 states that tend to be low on nearly all the ERIC indicators.

Development of a Typology of States Based on Contextual Indicators

In order to see what groupings of states would emerge on the basis of the contextual variables, three analyses were run. Figure 6 displays results at the six-group level for the first two analyses. On the left are the results obtained by using nine context variables loading primarily on the SIZE and EXPENDITURE factors. A discriminant analysis indicated that there were significant differences on all nine size and expenditure variables. The states comprising the six groups and the descriptions of the distinguishing characteristics of the groups are presented, with the groups in sequence from highest size and expenditure on the top to lowest size and expenditure on the bottom.

Despite the fact that size and expenditure variables were shown to be powerful predictors of production and dissemination capacity (especially for the ERIC-related indicators), the other five factors (DENSITY, POP. INCREASE, TC SERVICE, ISA SERVICE, and EFFORT) do contribute something to prediction,

FIGURE 6

HIERARCHICAL GROUPING OF STATES BY PREDICTOR VARIABLES AND BY PREDICTOR FACTORS

	BY PREDICTOR VARIABLES (Size and Expenditure only)		BY SEVEN PREDICTOR FACTORS
1-5	CA, FL, IL, OH, TX • Highest on school staff size • Highest on number of ISAs • Highest on number of teacher centers • Highest on number of LEAs	1-8	CA, CT, IL, KS, MA, MO, NJ, TX
6-15	CT, IA, MD, MA, MI, MN, NJ, NY, PA, WI • High on school staff size • High population density • Highest on per pupil expenditure/ per capita income • High on number of ISAs • High on number of teachers centers • High on number of LEAs	9-16	AZ, ME, MI, MN, NM, NY, PA, WI
16-34	AZ, CO, ID, KS, LA, ME, MO, MT, NE, NH, NM, ND, OK, OR, SD, UT, VT, WA, WY • Moderate on nearly all size and wealth variables • Highest on percentage of LEAs which are small	17-36	AL, CO, FL, GA, ID, IA, MT, NE, NH, NC, ND, OH, OK, OR, SD, UT, VT, WA, WV, WY
35-45	AL, AR, GA, IN, KY, MS, NC, SC, TN, VA, WV • High on school staff size • Lowest on population increase • Lowest on per pupil expenditure • Low on percentage of LEAs which are small	37-44	AR, IN, KY, LA, MS, SD, TN, VA
46-49	DE, DC, HI, RI • Low school staff size • Highest per pupil expenditure • High per pupil expenditure/per capita income • Low on number of ISAs • Low on number of LEAs • Lowest on percentage of LEAs which are small	45-49	DE, DC, HI, MD, RI
50-51	AK, NV • Lowest school staff size • Lowest population density • High per pupil expenditure • Lowest on number of ISAs • Low on number of teacher centers • Low on number of LEAS • High on percentage of LEAs which are small	50-51	AK, NV

especially for the non-ERIC indicators. Results of grouping on the basis of the seven contextual measure factor scores are displayed on the right hand side of Figure 6. The results are similar as can be seen by comparing the two groupings. Most of the states (33 of 51; underlined) occur in the same group in the two analyses; only five states occur in groups that are more than one rank apart. (Florida, Maryland, and Ohio occur in a lower-ranked group when all seven factors instead of just size and expenditure variables are used; Kansas and Missouri occur in higher-ranked groups when all seven factors are used.)

Figure 7 presents a comparison of the six group analyses for the nine size and expenditure predictor variables and the 13 indicators. In this case there are only 19 states that are in the same group levels in these two analyses.* One explanation for the poor matching is the fact that the numbers of states in comparable levels of groupings are quite different, e.g., there are five states in the top group on the left hand side in Figure 7, but only two states on the right hand side.

However, there is another possible problem. In terms of predicting the full set of 13 production and dissemination indicators, both of these groupings have faults. The grouping by size and expenditure measures alone omits the minor contributions made by the other five factors. However, the grouping by seven predictor factors gives all seven factors equal weight, which is far from the results obtained in the multiple correlation analysis (see Table 5).

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* Comparison of the grouping by 13 indicators with the grouping by seven factor scores, shows that there are 16 states in the same levels of groups.

FIGURE 7

HIERARCHIAL GROUPING OF STATES BY NINE SIZE AND EXPE[illegible]TURE PREDICTORS AND BY THIRTEEN INDICATORS

GROUPING BY 9 PREDICTOR VARIABLES (9 Size and Expenditure only)

1-5 CA, FL, IL, OH, TX

- Highest on school staff size
- Highest on number of ISAs
- Highest on number of teacher centers
- Highest on number of LEAs

6-15 CT, IA, MD, MA, MI, MN, NJ, NY, PA, WI

- High on school staff size
- High population density
- Highest on per pupil expenditure/per capita income
- High on number of ISAs
- High on number of teacher centers
- High on number of LEAs

16-34 AZ, CO, ID, KS, LA, ME, MO, MT, NE, NH, NM, ND, OK, OR, SD, UT, VT, WA, WY

- Moderate on nearly all size and wealth variables
- Highest on percentage of LEAs which are small

35-45 AL, AR, GA, IN, KY, MS, NC, SC, TN, VA, WV

- High on school staff size
- Lowest on population increase
- Lowest on per pupil expenditure
- Low on percentage of LEAs which are small

46-49 DE, DC, HI, RI

- Low school staff size
- Highest per pupil expenditure
- High per pupil expenditure/per capita income
- Low on number of ISAs
- Low on number of LEAs
- Lowest on percentage of LEAs which are small

50-51 AK, NV

- Lowest school staff size
- Lowest population density
- High per pupil expenditure
- Lowest on number of ISAs
- Low on number of teacher centers
- Low on number of LEAs
- High on percentage of LEAs which are small

GROUPING BY 13 INDICATORS (13 ERIC and non-ERIC variables)

1-2 CA, NY

- Highest on all ERIC indicators
- Highest on JDRP projects

3-14 CO, FL, GA, IL, MA, MI, MN, OR, PA, TX, WA, WI

- High on all ERIC indicators
- High on JDRP projects

15-21 AZ, CT, IA, KS, NE, NJ, UT

- Moderate on all ERIC indicators
- High on State Capacity Building grants
- High on state dissemination plans
- High on JDRP projects
- High on NDN State Facilitator ratings

22-35 AR, DC, IN, LA, MD, MS, MO, NM, NC, OH, OK, TN, VA, WV

- Moderate on all ERIC indicators
- Low on State Capacity Building grants
- Low on state dissemination plans
- Low on JDRP projects
- Low on NDN State Facilitator ratings

36-44 AL, AK, DE, HI, ID, KY, MT, NV, SC

- Low on all ERIC indicators

45-51 ME, NH, ND, RI, SD, VT, WY

- Lowest on all ERIC indicators

To approximate the relative weights of the various factors, we selected ten context measures:

1. Instructional staff size
2. Number of consultants and supervisors
3. Number of IHEs
4. Number of LEAs
5. Number of very small LEAs
6. Population change
7. Per capita ed. expenditure, 1975
8. Per pupil expenditure/PC Income
9. Intermediate Service Agency (ISA) Ratio
10. Teacher Center (TC) Ratio

The results of this analysis in terms of ten predictors (chosen to roughly approximate the multiple correlation analysis weights) are displayed on the left hand side of Figure 8. Comparison to the right hand size shows that there are now 26 states in the same groups on each side (double underlined).

Again there is the problem that the two sets of groupings result in groups that are not the same size on the left and right. If we combine adjacent pairs of groups on each side as suggested by the horizontal lines, we arrive at three groups of states on each side. Although a coarser level of discrimination is required in this instance, we find that 38 states are matched at the same level of grouping on both sides (double underlined states that are matched at the six-group level plus single underlined states that are matched at the three-group level). In terms of this three-level grouping, only one state, Oregon, is located more than one group away. Oregon, which is in the bottom group on the predictor side, is in the top group on the indicators side. (It moves from fifth to second in terms of the six-level analysis.) States that

FIGURE 8

HIERARCHIAL GROUPING BY TEN PREDICTORS AND BY THIRTEEN INDICATORS

GROUPING BY 10 PREDICTORS		GROUPING BY 13 INDICATORS	
1-6	IA, MI, MN, NY, PA, WI	1-2	CA, NY
7-15	CA, CO, CT, FL, IL, MA, OH, TX, WA	3-14	CO, FL, GA, IL, MA, MI, MN, OR, PA, TX, WA, WI
16-19	AZ, AR, KS, MD	15-21	AZ, CT, IA, KS, NE, NJ, UT
20-32	AL, IN, GA, KY, LA, MS, MO, NJ, NM, NC, SC, TN, VA	22-35	AR, DC, IN, LA, MD, MS, MO, NM, NC, OH, OK, TN, VA, WV
33-41	DC, DE, HI, MT, NE, OK, OR, RI, UT	36-44	AL, AK, DE, HI, ID, KY, MT, NV, SC
42-51	AK, ID, ME, NH, ND, NV, SD, VT, WV, WY	45-51	ME, NH, ND, RI, SD, VT, WY

look better in terms of their indicator level that their predictor level include: Georgia, Oregon, District of Columbia, Nebraska, Oklahoma, and Utah. Those states that are located in a lower group on the indicator side than would be expected given their location on the predictor side include: Iowa, Connecticut, Ohio, Alabama, Kentucky, and South Carolina.*

Given the fact that the ten predictor measures are completely independent of the 13 indicators, the results displayed in Figure 8 provide some assurance that states can be typed at least roughly, and that comparable groupings can be obtained from completely different sets of data. Twelve of the 14 states (86% accuracy) that are placed in the highest of three groups in terms of their production and dissemination indicators are also in the highest of three groups based on their contextual indicators (size, expenditure, etc.). At the other extreme, 13 of the 16 states (81% accuracy) that are placed in the lowest of three groups in terms of their production and dissemination indicators are also in the lowest of three groups based on their contextual indicators. The accuracy of placement is least for the middle group.** Of the 17 states in the middle group on the predictor side, 13 are also found in the middle group on the production and dissemination indicator side (76% accuracy).

* Because of the differences in numbers of states at comparable levels, one of three states (IA, CT, or OH) would have to be located in the second level on the indicator side, because there are 15 states in the top group on the predictor side, but only 14 states in the top group on the indicator side. Similarly, three of the 19 states in the bottom group must be placed in the middle group on the indicator side since there are only 16 states in the bottom group on the indicator side. Consequently, at least four states must be misclassified, simply due to unequal groups on the two sides.

** Because there are 21 states in the middle group on the indicator side but only 17 states in the middle group on the predictor side, this middle group on the indicator side must include four states that were classified in top or bottom groups on the predictor side.

COMPARISON OF USOE REGIONS

Since the U.S. Office of Education has organized its services to states by ten regions, it might be interesting to see if there are differences among the USOE Regions either in terms of educational knowledge production and dissemination capability or in terms of the contextual factors that are predictive of this capability. We shall examine the contextual factors first.

Comparisons of Regions on Contextual Factors

Since the seven contextual factor scores contain most of the information available in 20 contextual measures, we employed these factor scores to look for regional differences.

One-way Analysis of Variance. The one way analysis of variance shows that the USOE Regions differ significantly on at least four of the seven factor scores: SIZE, EXPENDITURE, DENSITY, AND POPULATION CHANGE. The regions did not differ reliably on the TEACHER CENTER SERVICE, ISA SERVICE, OR EFFORT factors.* The mean factor scores (and rankings) for each of the 10 USOE Regions are shown in Table 6.

With a little study of this table, the reader can compare regions on one or more factors. For example: on the EXPENDITURE factor (based on variables such as school expenditure per pupil, per capita school expenditure, and instructional staff average salary), Region II (New York and New Jersey) and Region X (Alaska, Idaho, Oregon, and Washington) are highest, while Region IV (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina,

* As noted previously, there is no sampling error, but there may be measurement error, especially in the last three factor scores (TC, ISA, EFFORT) in Table 6.

TABLE 6

MEAN FACTOR SCORES (AND RANKINGS) OF THE 10 USOE REGIONS ON DISSEMINATION CONTEXT FACTORS
(M = 50; S.D. = 10)

PREDICTOR FACTOR	USOE REGIONS I	II	III	IV	V	VI	VII	VIII	IX	X	F-RATIO (SIGNIF. LEVEL)
EXPENDITURE	(6) 49.7	(1) 66.0	(3) 54.8	(10) 39.0	(4) 54.7	(9) 42.4	(7) 49.3	(8) 48.2	(5) 53.8	(2) 59.5	4.27 (.001)
DENSITY	(5) 48.8	(6) 48.5	(1) 62.8	(2) 56.9	(3) 50.7	(7) 45.4	(10) 42.0	(8) 42.8	(4) 50.5	(9) 42.3	3.69 (.002)
POPULATION INCREASE	(6) 48.0	(10) 42.0	(7) 46.7	(3) 52.5	(5) 48.3	(4) 48.4	(9) 42.3	(8) 46.5	(1) 69.8	(2) 55.3	3.64 (.002)
SIZE	(8) 46.5	(1) 66.0	(6) 49.2	(3) 52.9	(2) 59.2	(5) 50.4	(4) 51.8	(10) 39.5	(7) 47.5	(9) 44.8	2.81 (.012)
ISA RATIO (low service)	(2) 56.3	(1) 56.5	(6) 52.3	(7) 47.9	(8) 44.7	(4) 54.4	(3) 54.8	(10) 42.0	(5) 53.8	(9) 44.2	1.64 (.137)
LOW RELATIVE EFFORT	(10) 45.7	(7) 47.0	(2) 55.0	(6) 47.2	(5) 47.3	(8) 46.6	(1) 62.2	(3) 53.5	(9) 46.0	(4) 51.2	1.37 (.234)
TC RATIO (low service)	(10) 38.0	(9) 48.5	(8) 49.2	(1) 55.2	(2) 53.5	(7) 50.2	(4) 51.0	(5.5) 50.5	(5.5) 50.5	(3) 51.2	1.33 (.251)
STATES IN THE REGION	CT MA ME NH RI VT	NJ NY	DC DE MD PA VA WV	AL FL GA KY MS NC SC TN	IN IL MI MN OH WI	AR LA NM OK TX	IA KS MO NE	CO MT ND SD WY UT	AZ CA HI NV	AK ID OR WA	

South Carolina, and Tennessee) and Region VI (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas) are lowest. Similarly, one can compare the scores of factors for regions of interest. For example: Region II (New York and New Jersey) is higher than any other region on SIZE and EXPENDITURE, moderate on DENSITY*, and lower than any other region in POPULATION INCREASE.

Comparison of Regions on Production and Dissemination Indicators

One-way Analysis of Variance. Analysis of the 13 production and dissemination indicators suggest that the USOE Regions may differ significantly on as many as eight indicators. The greatest differences in order of the size are: RDX Service, number of ERIC Standing Orders, number of SEA-produced documents in RIE, number of ERIC Clearinghouses, number of RIE documents, NDN State Facilitator Ratings, number of JDRP/DD projects and number of ERIC Computer Search Services. Two other indicators, SCDE Productivity and State Plan Status, display substantially less reliable differences. Differences on the remaining three indicators, SCB Status, RDU Linkages and IVD Projects, are so small, relative to within region variation, that they may be considered unreliable.** The values in Table 7 are directly interpretable. In each case the sum of the indicators for states is divided by the number of states

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* Please recall that the DENSITY (Urbanization) factor is measured not only in terms of population density, but also in terms of low numbers of LEAs and low percentages of small LEAs.

** It has been noted that statistical tests based on random sampling assumptions are not appropriate for 100 percent samples. However measurement errors and changes in indicators over time make it less likely that small differences among regions, relative to within-region differences among states, will persist reliably. Data in Table 7 are ordered by size of the one-way analysis of variance F-ratio. If this ratio is small, the difference may be unreliable.

TABLE 7

MEAN SCORES (AND RANKINGS) OF THE 10 USOE REGIONS
ON KNOWLEDGE PRODUCTION AND DISSEMINATION INDICATORS

PRODUCTION DISSEMINATION INDICATORS	U S O E R E G I O N S										F-RATIO (SIGNIF. LEVEL)
	I	II	III	IV	V	VI	VII	VIII	IX	X	
RDx Service (0-1)	(9) .00	(9) .00	(6) .83	(15) .88	(2.5) 1.00	(2.5) 1.00	(2.5) 1.00	(7) .33	(9) .00	(2.5) 1.00	12.89 (.0000)
ERIC Standing Orders (log)	(9) 0.56	(1) 1.47	(5) 1.02	(3.5) 1.06	(2) 1.15	(3.5) 1.06	(6) 0.86	(10) 0.47	(7) 0.73	(8) 0.61	3.06 (.007)
SEA-RIE (log)	(9) 1.81	(1) 2.81	(3) 2.20	(5) 2.10	(2) 2.42	(6) 2.07	(7) 2.06	(8) 1.82	(4) 2.18	(10) 1.58	2.57 (.019)
ERIC Clearing-houses (#)	(9) 0.0	(1) 1.5	(3) 0.7	(19) 0.0	(2) 0.8	(6.5) 0.2	(9) 0.0	(6.5) 0.2	(4.5) 0.3	(4.5) 0.3	2.37 (.029)
State RIE (log)	(9) 2.57	(1) 3.38	(3) 3.23	(6) 2.89	(2) 3.34	(7) 2.85	(5) 2.94	(10) 2.54	(4) 3.00	(18) 2.72	2.25 (.038)
NDN SF Ratings (0-4)	(2) 2.8	(4) 2.0	(9) 1.3	(6) 1.6	(3) 2.3	(8) 1.4	(1) 3.3	(5) 1.8	(10) 0.8	(7) 1.5	2.22 (.040)
JDRP/DD Projects (#)	(8) 2.2	(1) 10.0	(10) 1.8	(5) 3.1	(2) 6.3	(7) 2.4	(4) 4.0	(9) 2.0	(3) 4.3	(6) 3.0	2.11 (.050)
ERIC Computer Search (#)	(7) 2.7	(1) 13.5	(4) 4.5	(5) 4.0	(2) 5.5	(6) 3.4	(8.5) 2.0	(8.5) 2.0	(3) 5.2	(10) 1.8	1.97 (.069)
State Plan Status (0-2)	(8) 1.0	(8) 1.0	(10) 0.5	(2) 1.6	(4) 1.3	(5) 1.2	(3) 1.5	(6) 1.1	(8) 1.0	(1) 2.0	1.53 (.171)
SDCE Production (log)	(9) 0.79	(5) 1.10	(3.5) 1.13	(3.5) 1.13	(1) 1.60	(7) 1.02	(2) 1.19	(10) 0.67	(16) 1.09	(8) 0.96	1.60 (.147)
IVD Projects (log)	(8) 0.67	(1) 1.30	(5) 0.77	(6) 0.69	(2) 1.22	(4) 0.86	(3) 0.92	(10) 0.52	(9) 0.58	(7) 0.68	1.03 (.434)
SCB Grant Status (0-2)	(3) 1.50	(1) 2.00	(10) 0.50	(4) 1.38	(5) 1.33	(8.5) 1.00	(8.5) 1.00	(7) 1.17	(6) 1.25	(2) 1.75	0.88 (.555)
RDU Linkages (0-3)	(6) 0.50	(10) 0.00	(6) 0.50	(3) 0.88	(2) 1.00	(8) 0.40	(4) 0.75	(9) 0.17	(6) 0.50	(1) 1.25	0.59 (.796)
STATES IN THE REGION	CT MA ME NH RI VT	NJ NY	DC DE MD PA VA WV	AL FL GA KY MS NC SC TN	IN IL MI MN OH WI	AR LA NM OK TX	IA KS MO NE	CO MT ND SD WY UT	AZ CA HI NV	AK ID OR WA	

in the region. The ERIC Standing Orders, SEA-RIE, State RIE, and SCDE Productivity measures are mean logs (base 10) for each region. The values of ERIC Clearinghouses, JDRP/DD Projects, and ERIC Computer Search Services are means of the actual number of ERIC Clearinghouses, JDRP/DD Projects, and ERIC Computer Search Services. For RDx Service, since a state either receives a score of "0" (absent) or "1" (present), the table value can be intrepreted as the percent of states in the USOE Region that had RDx Services (in 1977). The NDN SF Rating and State Plan Status are means based on 0-4 and 0-2 scales, respectively.

For example, Region II (NJ, NY) is the highest ranking region on six indicators: RIE Standing Orders, SEA-RIE, ERIC Clearinghouses, State RIE, JDRP/DD Projects, and ERIC Computer Searches. (All six of these indicators are based on counts. As we have noted in Table 6, Region II is also by far the highest ranking region on both SIZE and EXPENDITURE, the two most powerful predictors of count data.) In Region II, the average, per state, is 35 ERIC Standing Orders (log = 1.47), several hundred SEA documents, several thousand state-wide RIE documents, 1.5 clearinghouses, ten JDRP/DD Projects, and 13.5 ERIC Computer Search Services. The average SF Rating is 2.0 and State Plan Status is 1.0 (unknown for NJ and NY). Neither state was served by a RDx Regional Exchange (.00).

Region I (CT, MA, ME, NH, RI, VT) presents a stark contrast, ranking seventh to ninth on all indicators except the NDN SF Rating, which is second highest among the regions.

Region VII (IA, KS, MO, NE) displays a broad range of rankings. It is first in the NDN SF Ratings, second in average SCDE productivity, third in State Plan Status, fourth in average number of JDRP/DD Projects, fifth in average number of RIE documents, it is tied with Region VIII for eighth/ninth place in average number of computer search services and is tied with Regions I and IV in last place for complete absence of ERIC Clearinghouses.

Discriminant Analysis.* In an initial analysis all 13 indicators were employed. The results indicated that the RDx status indicator might be masking interpretation of the effects of the other indicators so RDx was omitted and a second analysis was run.**

The centroids for the first three discriminant dimensions in this second analysis are displayed in Table 8. In this analysis the first discriminant root accounts for 37 percent of the variance, the second for 24 percent and the third for 14 percent. Hence, these first three roots account for three-fourths of the total variance. Unfortunately the three dimensions are complex, therefore, it may be helpful to look at some figures that plot the relationships graphically. In Figure 9 are plotted the USOE Region centroids for the second and third discriminant dimensions.

Both the second and the third discriminant dimensions are identified by positive correlations (.3 to .7) on all six of the ERIC-related indicators. The major differences between the two dimensions are that the second dimension places greater emphasis on ERIC Standing Orders and Computer Searches, i.e., on document-based dissemination systems, while the third

* Discriminant analysis may be considered as an extension of single classification analysis of variance that included simultaneously a group of dependent variables. A discriminant analysis of the contextual factors was not run since these factor scores are statistically independent.

** Table 7 shows that there are massive differences among the USOE Regions in RDx service proportions with an F-ratio much larger than the other indicators. The RDx indicator is the major element in the first discriminant root which extracted 54 percent of the variance. Correlations of other indicators with the first discriminant dimension were not large, but were in the .2 to .3 range for four indicators. By omitting the RDx variable, the effects of the remaining 12 indicators are easier to interpret. See page 21 where RDx was dropped in our interpretation of factor analysis results.

TABLE 8

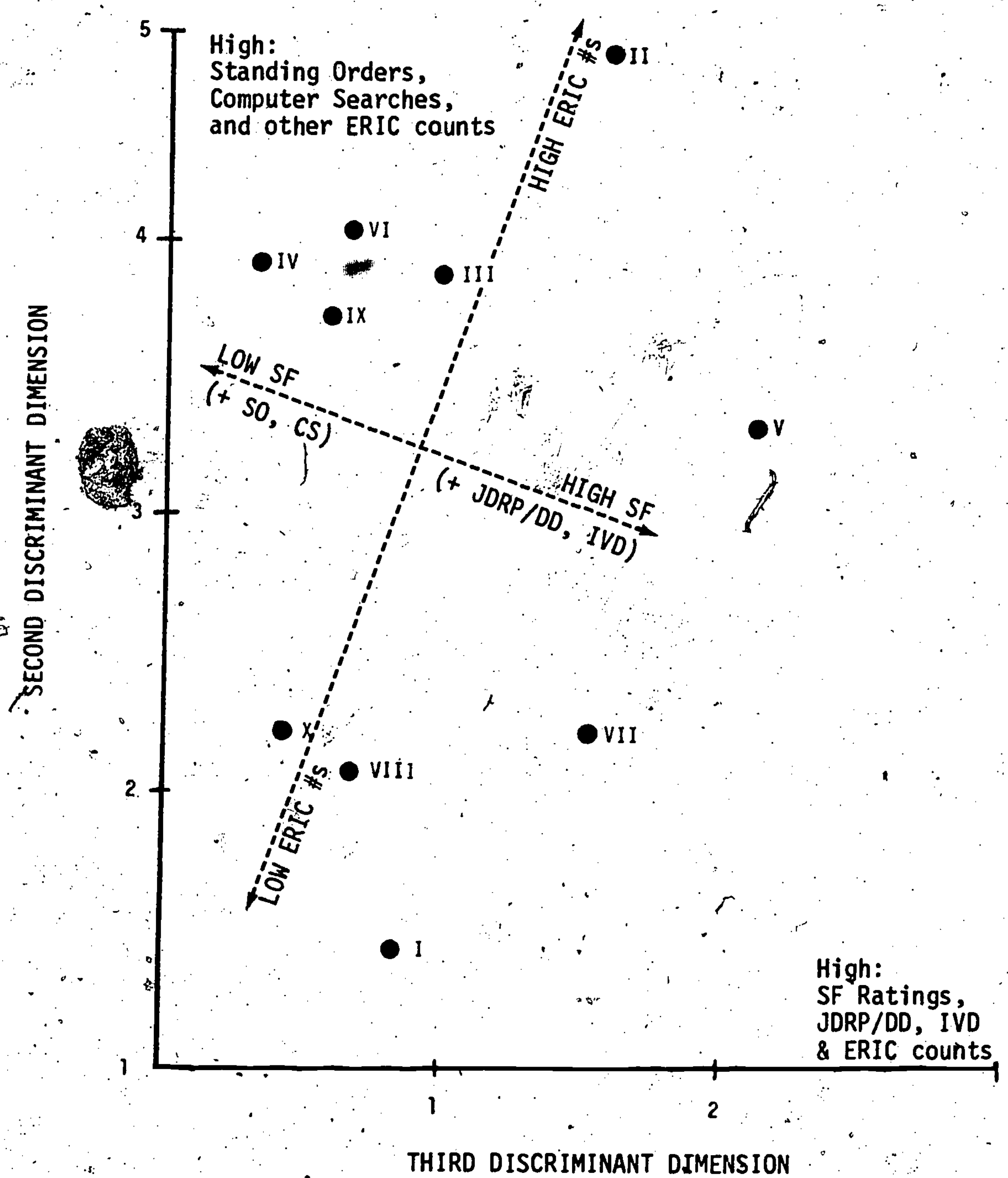
USOE REGION CENTROIDS
ON KNOWLEDGE PRODUCTION AND DISSEMINATION INDICATORS

DISCRIMINANT DIMENSION	USOE REGIONS I	II	III	IV	V	VI	VII	VIII	IX	X	CHI-SQUARE (SIGNIF. LEVEL)
#1 Plan, RDU, SCDE vs. CS, CH, SCB, JDRP	(7) 0.69	(10) -2.75	(6) 1.67	(3) 2.28	(5) 2.02	(2) 2.43	(1) 2.68	(8) 0.42	(9) -0.39	(4) 2.09	47.2 (.001)
#2 SO, CS, & other ERIC	(10) 1.43	(1) 4.82	(4) 3.88	(3) 3.90	(6) 3.36	(2) 4.04	(7) 2.21	(9) 2.08	(5) 3.73	(8) 2.20	36.6 (.007)
#3 SF, JDRP, IVD, & ERIC	(5) 0.84	(2) 1.57	(4) 0.98	(10) 0.32	(1) 2.10	(7) 0.65	(3) 1.51	(6) 0.69	(8) 0.49	(8) 0.44	24.9 (.074)
STATES IN THE REGION	CT MA ME NH RI VT	NJ NY	DC DE MD PA VA WV	AL FL GA KY MS NC SC TN	IN IL MI MN OH WI	AR LA NM OK TX	IA KS MO NE	CO MT ND SD WY UT	AZ CA HI NV	AK ID OR WA	

dimension is marked by greater emphasis on NDN State Facilitator Ratings, JDRP/DD Projects, and IVD Project, i.e., by <u>exemplary practices dissemination systems</u>. The dotted diagonal lines in Figure 9 roughly define the major conceptual axes. Region II (NJ, NY) ranks first on every ERIC-related indicator, while Regions I, VIII, and X are among the lowest ranking on these indicators. Generally, the higher a region is along this diagonal axis, the higher will be the means for all ERIC production and access indicators. The second dotted line defines an axis that most markedly separates the regions in terms of their mean SF Ratings. The five USOE Regions to the right of the dotted line are the five highest ranking, and those to the left are the five lowest ranking on the SF Ratings. Although much less consistent across regions, there is also a small difference in <u>relative</u> numbers on Standing

FIGURE 9

USOE REGION CENTROIDS FOR SECOND AND THIRD DISCRIMINANT DIMENSIONS



Orders (SO) and IVD projects, when allowances are made for differences among the regions in terms of the Size factor.*

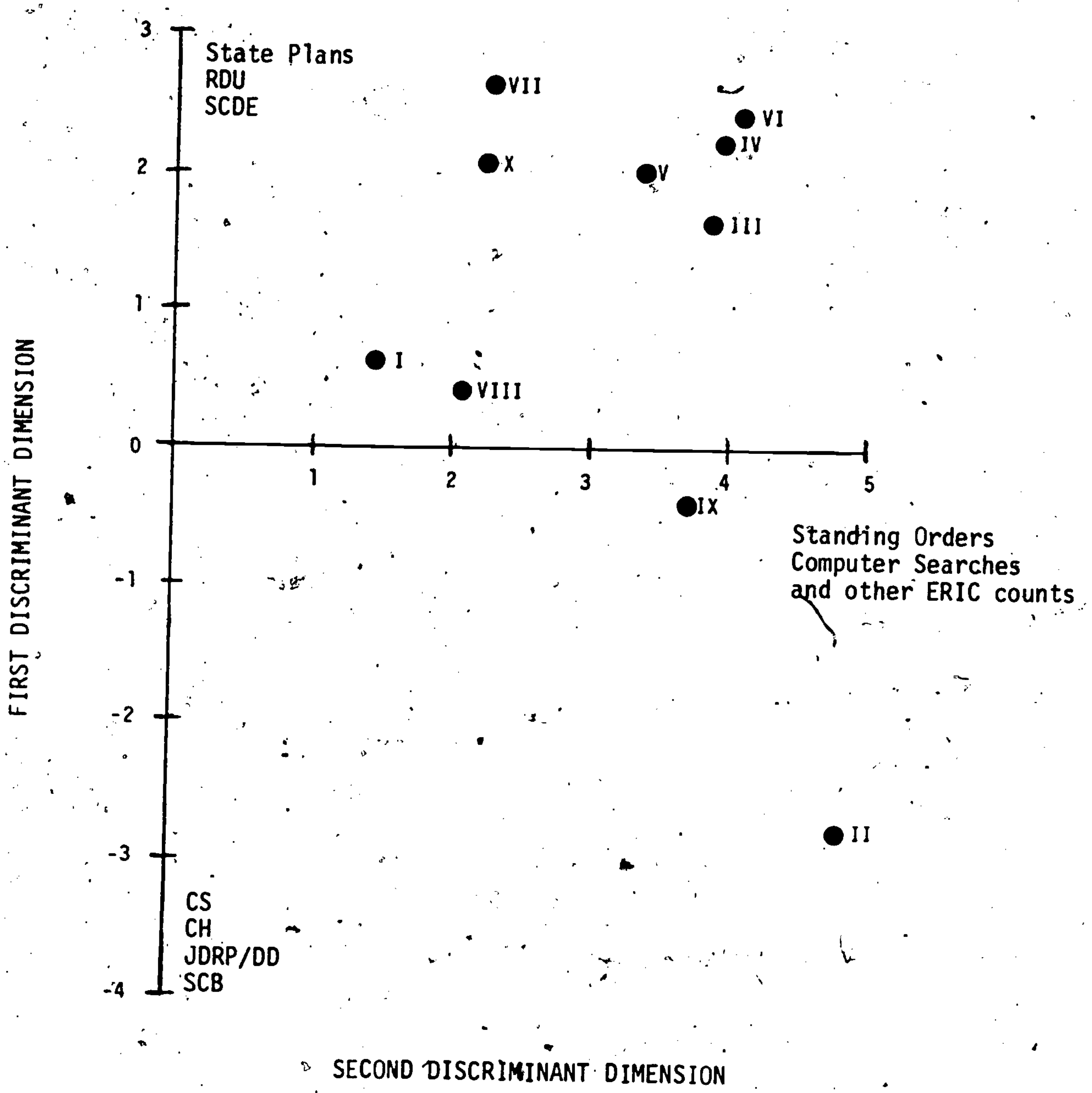
Figure 10 displays the centroids for the first and second discriminant dimensions. The first discriminant dimension is a fairly well defined bipolar dimension with State Plan Status, RDU Linkages, and SCDE Productivity defining the positive side and ERIC Computer Search Services, ERIC Clearinghouses, JDRP/DD Projects, and SCB Grant Status defining the negative side. The high side of the first dimension seems to characterize regions that contain states that have developed dissemination plans, have productive SCDE faculties, and have above average RDU Linkages, but that tend to have few ERIC Clearinghouses, ERIC Computer Search Services, and JDRP/DD Projects, and that may not have SCB Grants. As we have previously noted in examining Figure 9, the second discriminant dimension is identified on its high side with higher counts on all ERIC-related indicators and especially by high ERIC Standing Order and ERIC Computer Search Services counts.

Thus one sees in Figure 10 a horizontal separation of regions in terms of SIZE and concomitant productivity, with a vertical separation of regions that contrasts relative lack of capacity building, computer searches, clearinghouses, and JDRP/DD projects, all perhaps more organized and centralized forms of dissemination, with presence of state plans, productive colleges of education, and more RDU linkages on the high positive side. As we move vertically down Figure 10, the pattern tends to shift. RDU linkages disappear. SCDE productivity is less, at least when relative SIZE is considered, and State

* This effect is especially pronounced for Region VII which ranks fourth for JDRP//DD Projects and is tied for eigth/ninth ranks on ERIC Computer Search Services, and for Region III which ranks last in JDRP/DD Projects, but is fourth for ERIC Computer Search Services.

FIGURE 10

USOE REGION CENTROIDS FOR FIRST AND SECOND DISCRIMINANT DIMENSIONS



Plan status is mixed or unknown. As we cross into the negative side, we find only Regions IX (AZ, CA, HI, NV) and II (NJ, NY). Here large SIZE is confounded with presence of Computer Search Services, Clearinghouses, large numbers of JDRP/DD Projects, etc. But SCDE Productivity is only average and RDU Linkages are average (in IX) or non-existent (in II).

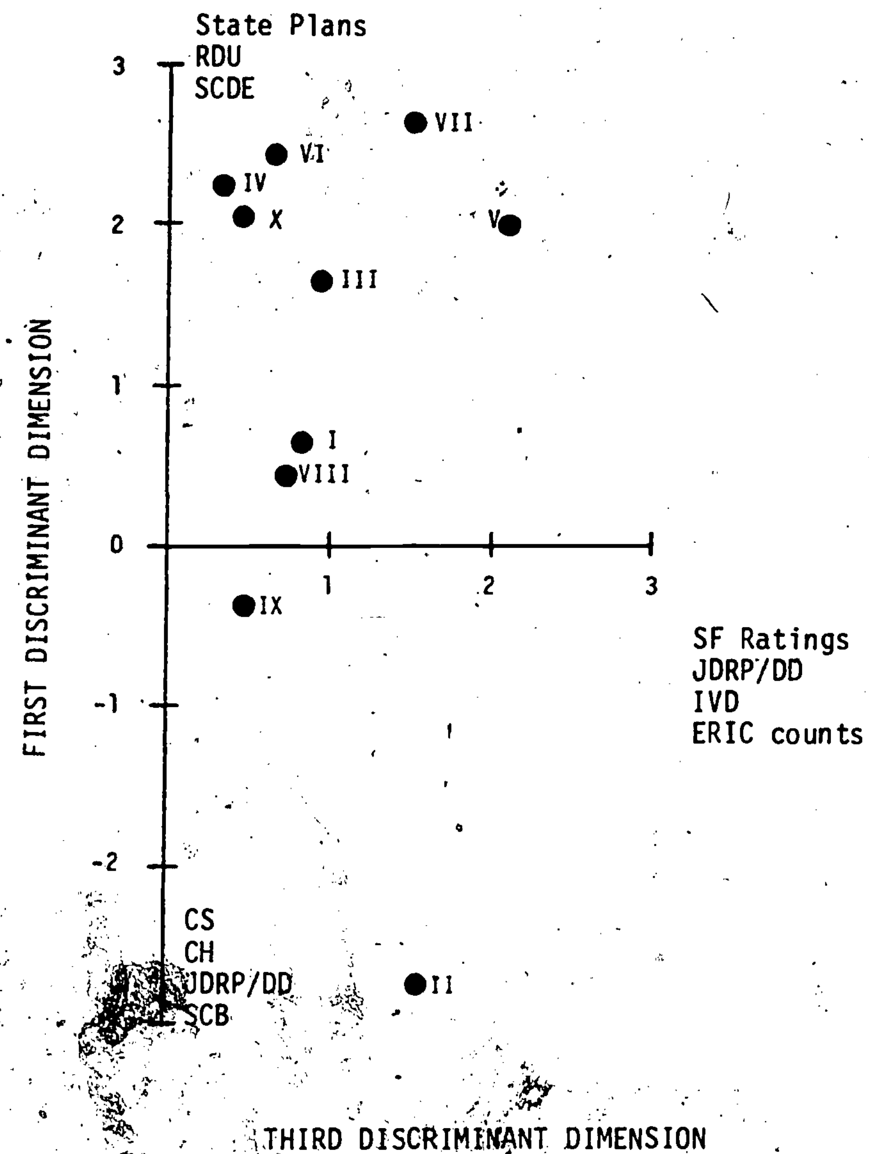
In Figure 11, the USOE Regions are plotted against the first and third discriminant dimensions. Both of these dimensions have been described. The abbreviations for the key indicators defining the ends of the dimensions have been added.

Region VII's high positive position on both dimensions is explained in terms of its first ranking on NDN SF ratings, second ranking on SCDE productivity, third rankings on State Plan Status and IVD Projects, and fourth ranking on JDRP/DD Projects. Region V is also high positive on both dimensions. Region V ranks second on eight indicators, first in SCDE Productivity, third in SF Ratings, fourth in State Plan Status, and fifth in SCB Status.

Region II's extreme positions on both the first and the third discriminant dimensions have been noted. It is highest on all counts including ERIC indicators and both validated projects indicators, but it is low on RDU Linkages and State Plan Status, and only average in SCDE Productivity. Regions I, VIII, and IX, which form a cluster near the center, share [illegible] low IVD Project counts and low ERIC Standing Order counts. Regions I and VIII are also among the lowest in State-RIE and SEA-RIE counts and in ERIC Computer Search Services. Region IX is separated vertically in the negative direction from Regions I and VIII by virtue of having substantially more ERIC Computer Search Services, JDRP/DD Projects, and a slightly higher percentage of ERIC Clearinghouses.

FIGURE 11

USOE REGION CENTROIDS FOR FIRST AND THIRD DISCRIMINANT DIMENSIONS



Mapping of States. Figure 12 maps the states in terms of their ERIC factor score (a combination of all ERIC-related indicators of production and dissemination). This mapping indicates graphically that there are both between-region and within-region differences in ERIC facilities and productivity levels.

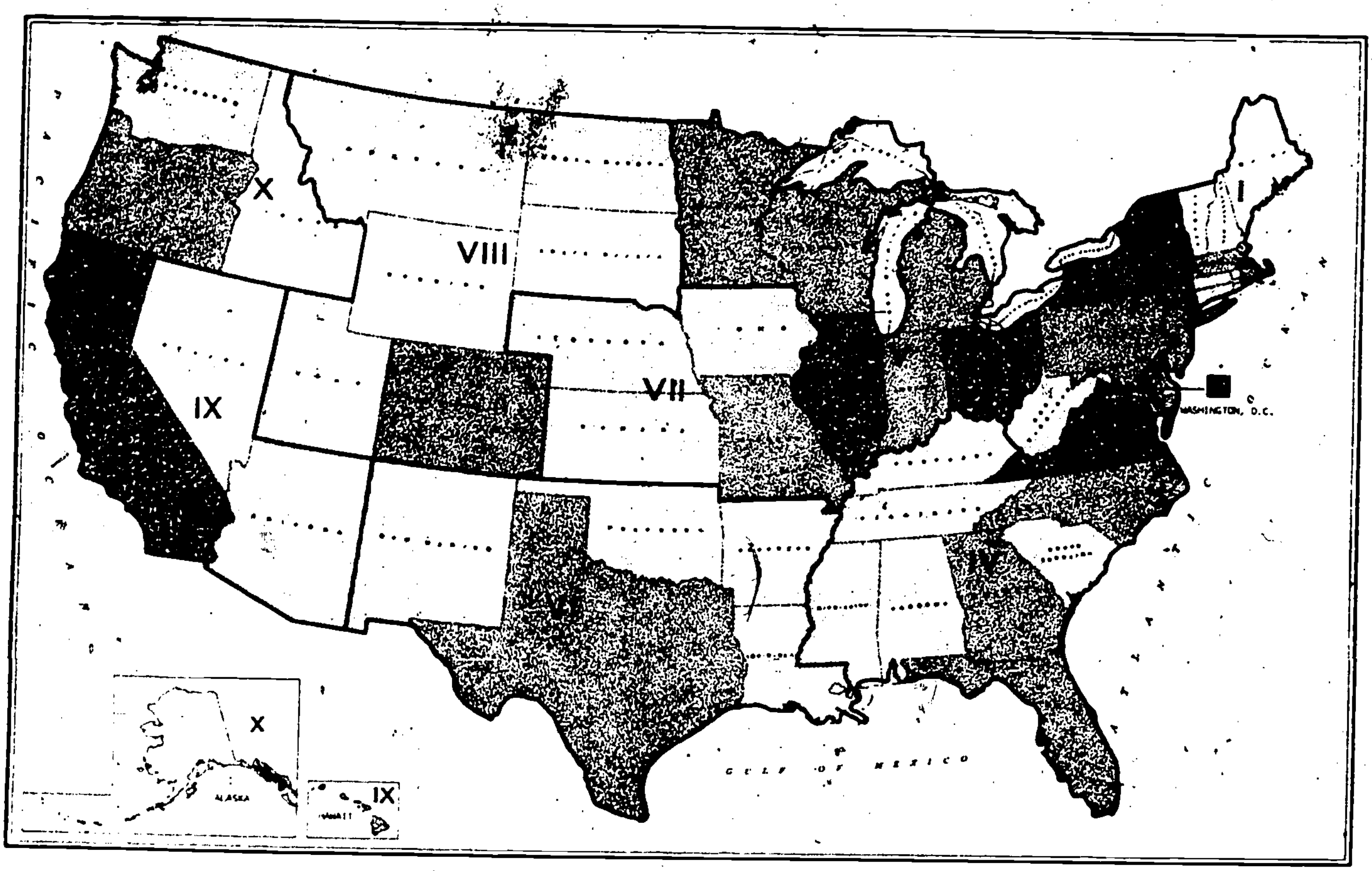
Figure 13 is a mapping of the states on public school staff size. This is one of several highly intercorrelated measures of size that have been shown to be strongly predictive of all the ERIC-related measures. The general correpondence between Figures 12 and 13 is visually obvious.

Relationships Between Contextual Predictors and Production/Dissemination Indicators Within USOE Regions

It has been shown that it is possible to classify states into groups and to characterize those groups on the basis of similarities and differences in contextual measures that predict production/dissemination capabilities and also on the basis of similarities and differences in direct measures of some aspects of production and dissemination capacity. It has also been shown that, when states are grouped by geographic regions (i.e., USOE Regions), the regions do differ on many of these dissemination predictors and indicators. This would seem to indicate that there are geographic effects operating either directly on educational knowledge production and dissemination or on contextual factors that are related to (and influence?) dissemination. It is interesting to discover that despite these differences between regions on such variables and factors as SIZE and ERIC production and dissemination, the strong predictive relationship between SIZE and ERIC is maintained within each region as well. It can be seen in Figures 12 and 13 that, for the states within each of the 10 USOE Regions, the correlation between

FIGURE 12

DISTRIBUTION OF STATES ON ERIC FACILITIES AND PRODUCTIVITY
(STANDARDIZED FACTOR SCORES)



States which are more than one standard deviation below the mean on the score.

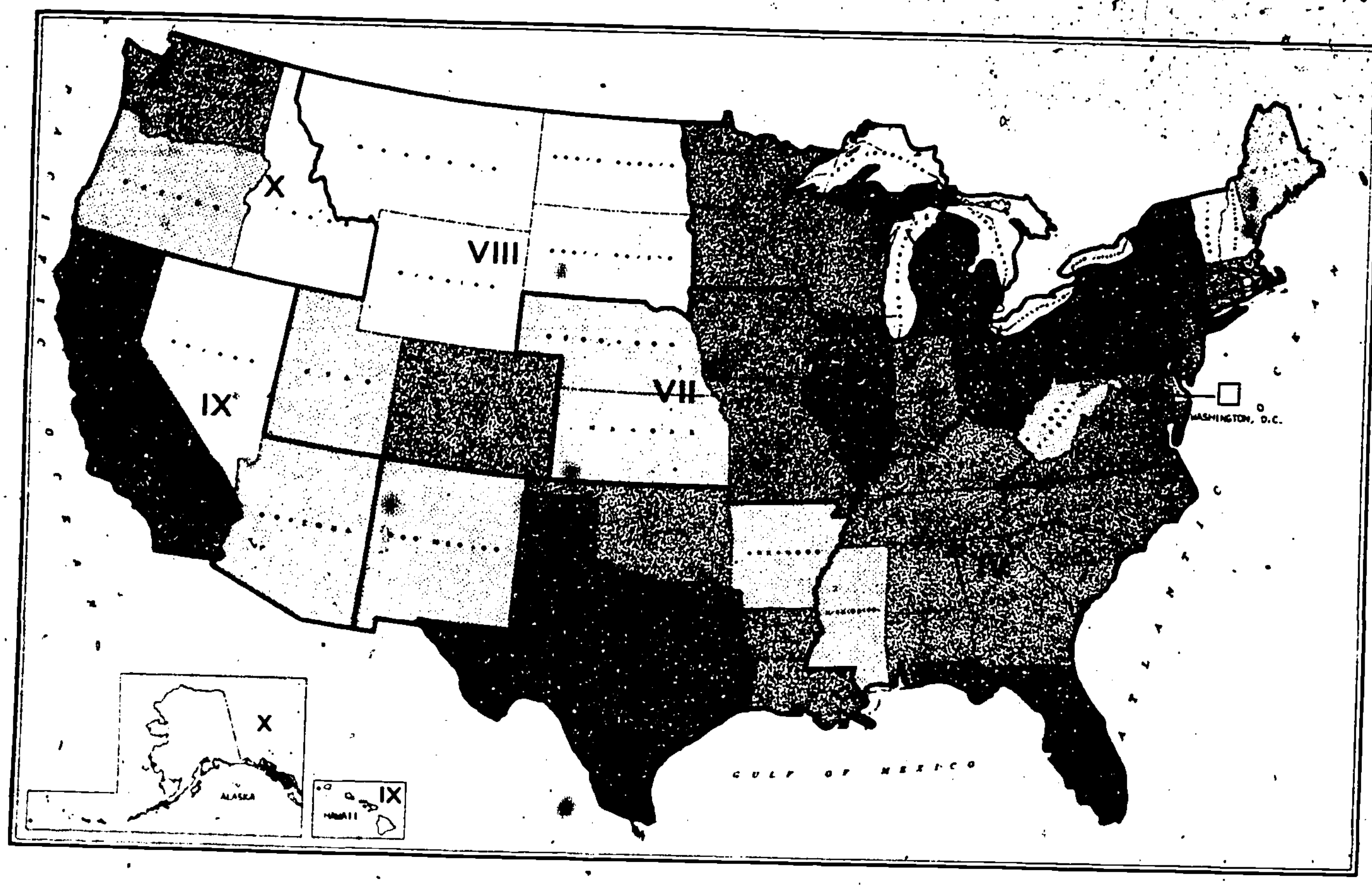
States which are between the mean and one standard deviation below the mean on the score.

States which are between the mean and one standard deviation above the mean on the score.

States which are more than one standard deviation above the mean on the score.

FIGURE 13

DISTRIBUTION OF STATES ON PUBLIC SCHOOL STAFF SIZE



- States which are more than one standard deviation below the mean on the score.
- States which are between the mean and one standard deviation below the mean on the score.
- States which are between the mean and one standard deviation above the mean on the score.
- States which are more than one standard deviation above the mean on the score.

7. SIZE and ERIC is approximately the same. (The previously identified outlier states of New York, Ohio, Illinois, Virginia, and District of Columbia lessen the correlation in three of the regions.)

CONCLUSIONS

Despite the simple variables chosen as indicators and potential predictors of production and dissemination capacity in this initial work, we have been able to make a promising beginning in predicting state dissemination capability and developing a typology of states based on dissemination capability. Our major conclusions to-date are:

- SIZE (e.g., school enrollment, instructional staff size, population, density, number of consultants and supervisors of instruction, number of school librarians) is the single most powerful predictor of state educational knowledge production and dissemination capability.
- SIZE is particularly good at predicting ERIC productivity and dissemination (correlations of SIZE with ERIC variables range from .73 to .87).
- A weighted sum of SIZE and EXPENDITURE factor scores correlates .87 with ERIC factor scores (a composite of all the ERIC variables).
- SIZE is less highly correlated with non-ERIC indicators of dissemina tion, but when combined with other predictors (EXPENDITURE, DENSITY, TEACHER CENTERS, POPULATION INCREASE, ISA), the multiple correlations range from .40 to .78.
- States can also be grouped on the basis of their "scores" on production/ dissemination capacity variables. Using a typology of six groups results in groups of states which can be clearly characterized, distinguished, and described according to their dissemination characteristics.

- States can also be grouped on the basis of the contextual factors or measures that predict dissemination.
- The typology based on dissemination predictors and the typology based on dissemination indicators are quite similar; many of the states cluster into the same groups in the two typologies.
- Though the typology of states based on geographic proximity USOE Regions) is quite different from the typologies created to maximize differences between groups on dissemination indicators or predictors of dissemination, there are considerable and consistent differences between the USOE Regions on many of the dissemination predictors and on many of the dissemination indicators.
- The relationship between <u>SIZE</u> and <u>ERIC</u> productivity and dissemination remains strong even for states within each of the 10 USOE Regions.

FUTURE DIRECTIONS

We are continuing to expand and refine our attempts to develop predictors of dissemination and typologies of states based on dissemination indicators. Some of the directions we are now taking are:

- Further study of geographic distribution and relationships among indicators at three levels of aggregation--regional, state, and SMSAs.
- Further examination of data on the distribution of and services provided to special populations (e.g., minorities, handicapped, geographically isolated).
- Development of indicators of utilization and examination of their use as "dependent" variables in time series analyses of state-by-state trends and their causal determinants.
- Development, analysis of the reliability of, and use of subjective indicators (e.g., judgmental ratings of relatively intangible qualities such as "dissemination leadership" or "technical effectiveness").
- Development of more detailed predictive or causal models designed to account for regional or state variance in dissemination or utilization indicators.
- Sensitivity analysis of the stability of model parameter estimates.
- Examination of residual or outlier cases to attempt to account for the reasons for poor fit between data and the predictive models.

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