



## CONDUCTING DATA EXCHANGE PROGRAMS

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The development of more effective communications, particularly in formal and informal interinstitutional data exchange, is a challenge facing institutional research (Firnberg, 1977). Institutional research must move from reporting data to providing information on which to make the "here-and-now" decisions confronting academic administration (Sliger, 1979). To do this, we must have data in context—often in the context of comparable information from peer institutions. The reports required by external constituents or the pre-packaged information-exchange procedures may be usable, but such reports often reflect the concerns of the external agencies to the extent that they cannot be used for institutional management.

The literature of interinstitutional data exchange generally dwells on the *data* to be exchanged (Curry, 1978; Durham, 1976; Hefferlin & Phillips, 1971, chap. 4; Weathersby, 1976). Researchers have turned generally to the literature of survey research for references in developing an exchange program (Herriott, 1969; Orlich, Clark, Fagan & Rust, 1975). However, there are significant differences between surveys, which are generally of individuals, and data exchanges, where survey methods can be inappropriate. This paper addresses ongoing voluntary interinstitutional data exchanges, specifically presenting a structured set of principles and procedures that speed and smooth the communication of data exchange and make the data more meaningful to each participating institution.

### Principles of a Successful Data Exchange

Certain basic principles should be followed in all phases of a voluntary interinstitutional data exchange program in order to achieve success.

1. *Cooperate and coordinate; don't legislate.* The essence of a voluntary interinstitutional data exchange program is that it is voluntary. Prospective participants will apply some sort of "what's in it for me" analysis before deciding to join. Mims and Lelong (1976) addressed this matter by pointing out that since the exchange was designed to achieve University of Michigan purposes, rather than goals developed jointly by the university and the other institutions, many of those approached viewed the . . . information as not particularly helpful for their purposes and, consequently, were less interested in participating. (p. 72)

In this case, the University of Michigan president had to call his peers at the target institutions to request participation as a favor, and they, in turn, offered data in whatever form was handy. Coordinating office resources were required to translate "their data into our format" (p. 75) in order to begin the exchange, and as a consequence, some sixteen man-months of effort were expended on a fifteen-institution program. After listing several of the drawbacks encountered in the program, Mims and Lelong complained, "Few ready and realistic tools for surmounting these obstacles can be found, especially in an IR office that . . . lacks authority to mandate the collection and exchange of data"

(p. 75). The important principle, therefore, is to develop a cooperative effort which can help all participants. As a corollary, it is important to develop communication among those preparing and potentially using the data.

2. *Keep it simple.* Wherever possible, keep the project simple and make it easy for all concerned, the participants and the coordinator. Simplicity can be difficult to attain because it is tempting to succumb to the "while you're there, why not also . . ." syndrome. This was a problem in the Michigan project, as Mims and Lelong (1976) pointed out:

Although efforts were made in the design stage to keep the data requirements to a minimum, we found that we had requested data at a level of detail far beyond what could be analyzed in a meaningful manner. (p. 75)

Everyone benefits from simplicity.

3. *Lower the cost; increase the benefit.* A data exchange program should require a minimum of resource expenditure by the participants and by the coordinator. The cost/benefit ratio can be improved by lowering cost as well as by increasing benefit. The better the ratio, the more likely it is that a broad span of institutions will decide to participate in providing the comparative data.

An example of an expensive exchange is the Virginia IEP (Information Exchange Procedures), which uses external NCHEMS (National Center for Higher Education Management Systems) software in reporting to the Commonwealth. Each year, institutions spend an average of \$2 per student in routine system operation in this required program and receive less than ideal information return on their investment (McLaughlin, 1978). It is safe to conjecture that, were it not mandatory, the individual institutions would make other use of their resources.

4. *Apply management information principles.* A data exchange program should have the characteristics of any good management information. Drucker (1974, pp. 498–504) identifies these characteristics as follows:

1. Economy. Strive for the minimum information necessary for a decision.
2. Meaning. Make the data as self-explanatory as possible.
3. Appropriateness. Always consider the context of decisions to be made.
4. Congruency. Display the data to appropriate precision.
5. Timeliness. Prepare reports in time to influence the decision.
6. Simplicity. Display the data in a simple, straightforward manner.
7. Action. Make data reports action oriented, not simply "interesting."

While it is difficult to ensure that the data exchange product will have all of these characteristics, the extra effort to achieve them may be worth it in the long run.

5. *Be flexible.* The compromises necessary in making interinstitutional data comparable preclude those data from being "all things to all people." However, the data exchange

program should be flexible enough to meet the needs of all participants: it should have here-and-now flexibility as well as the flexibility to adapt over time.

An example of flexibility can be seen in a teaching-load data exchange, coordinated by Virginia Tech (Virginia Polytechnic Institute and State University), in which other southern universities participate. Those participants using computer programs developed at Virginia Tech do not have to live with the HEGIS discipline codes either as they were submitted by other participants or as reassigned by the coordinator (for "better" comparability, aggregating similar disciplines under a single code). Each participant can try any desired reaggregation without changing the program system at all, using external conversion tables to make temporary code conversions prior to his or her own data analysis.

### Options to Consider before Starting

One of the first questions to ask when planning an interinstitutional data exchange should be, Is this trip necessary? Curry (1978) names six points to consider in a data acquisition project, and one of them has particular relevance here: "Is a suitable proxy for the information available in reports which are already being provided. . ." (p. 2). One might look to the various national data bases described by Weathersby (1976) and find that all the source data are already present and available for analysis—the annual HEGIS survey is an example. The national data bases of the federal government and of the various educational associations serve the needs of institutional management by accident, if at all, as Norris and Heydinger (1976) point out. National data bases, or those of various educational associations, seem to "mirror the needs and biases of their creators and demonstrate the limitations of such large scale activities" (pp. 39–40).

One major "inherent limitation" of the large public data bases is lack of timeliness. A common complaint about HEGIS data, for example, has been that by the time the National Center for Education Statistics (NCES) makes the material available, it is of historical interest only. However, the situation may be changing for the better: fall enrollment data are now available on magnetic tape by April of the following year. Further, individual institutions can be contacted for copies of their HEGIS submissions, thereby avoiding NCES entirely.

In addition to information contained on HEGIS and other national questionnaires, institutions may be willing to provide, informally, copies of other exchanged data. One needs to keep in mind that these materials are often considered confidential among exchange participants. Also, other existing internal documents may be made available and prove useful.

Data are not the only resources available to those researchers planning an interinstitutional data exchange. Data collection, processing, and analysis instruments are also on the market, most prominently the Information Exchange Procedures (IEP) developed and "hawked" by NCHEMS.

IEP data bases, whose ultimate purpose is the calculation of costs by discipline and level, contain a wealth of information. The problem is that construction of those data bases requires either a very simple or a superbly managed institution—or a lot of work. Further, IEP's report generators produce what has been characterized as gobbledygook—data not easily understood by those not steeped in their mysteries and requiring extra effort to display in a form that academic administrators will accept (Bloom, 1979). This is illustrated in Figure 1 and discussed in a later section.

Consideration of the data processing instruments need not be limited to home-grown instruments or those of IEP. It is possible that another group of institutions is already exchanging the data of interest: the system of collection, processing, and analysis instruments may be available for use by others.

Existing data and data collection/analysis instruments from other sources may or may not be available and appropriate to a data exchange planner. To avoid "reinventing the wheel," those

other sources should be investigated. Regardless of the apparent usefulness of an exchange, one must remember that a perfect fit in definitions or in collection procedures among the participants is extremely difficult to attain, and as a consequence, some lack of synchronization in data and comparisons should be expected.

### Communications

The final comparative data are usually what are associated with communications in interinstitutional information exchange programs (Firnberg, 1977). There are, however, other areas of communication that must be considered by the survey coordinator.

1. The first of these might be called advertising, for want of a better term. All prospective participants need to know of the exchange program, its benefits to them, and its cost.

2. Continued and active person-to-person communication is a second, very important element. Many problems can be avoided with more use of the telephone. Do not assume, for example, that no response to a written communication means no interest. People with the best intentions forget things and mail service is not infallible, so make follow-up calls.

3. Finally, the post-exchange survey of participants is an integral part of the coordination function. A questionnaire asking for comments and suggestions, while the data exchange is still fresh in everyone's mind, can increase the mutual value of the program.

### Data Processing and Analysis

Data processing, in the context of this paper, encompasses everything done with the interinstitutional data exchanged in the program: it does not begin or end at the computer room door. It starts, instead, with the data collection instrument and ends only after the last reports have been distributed to exchange participants.

**Data collection.** The instruments used for data collection are important. Data sent by participants should be in machine-readable form (punched computer cards, for example). This is an improvement over the questionnaire, in that the participant's computer is talking directly to that of the coordinator—no "typos" creep in to impede communication, no human data transcription effort is required, and it is not necessary to send data listings to participants for verification. This data transmittal concept is certainly not new. Norris and Heydinger (1976) noted that some state governments have departed from preprinted forms, collecting required data from their public institutions on magnetic tape, as with Virginia's IEP.

The transmission of data by punched cards is recommended. In a typical data exchange, each participating institution completes one or two cards for each of its, perhaps, 100 instructional departments. This produces an easily available, inch-thick card deck. A second reason for using cards is their inter-machine compatibility. The 80-column card is almost universal, and it is not difficult to read one produced by the punch of any manufacturer. A third reason for using data cards is that the 80-column limitation imposes a certain economy in that no amount of photo reduction will get additional columns of data onto an 80-column card. This limitation is quite useful in preventing a common problem with questionnaires: asking for more data than can be used (Cooley, 1969).

**Data editing and preparation.** Data editing and preparation associated with data processing can be as time and resource consuming as they are critical in the traditional questionnaire method of data collection. The use of direct, computer-to-computer communication makes this step no less critical, just faster, easier, and cheaper.

An exchange program that transmits data by punched data cards has no appreciable data preparation phase, so effort toward editing the submittals can be lavished on the computer program. Here again, the "economy" of the data is a positive factor. With few data items to be checked individually, and few interactions

among those data (cross tabulations, for example), the scope of the required editing can be well within human ability.

Each edit criterion should be listed in the data-exchange instructions, and each should be enforced by a machine-independent computer program made available to all participants. If the edit program is a particularly friendly one—pointing out the detected offenses in an easily understandable manner—and if it is easy to use, submitted data should be valid, in addition to being directly machine readable. Nonetheless, the coordinator, upon receipt of a set of data cards, should pass the cards through the edit program to prevent unnecessary embarrassment to the participants. The Virginia Tech experience with punched-card data submittal is that so few errors and anomalies occur that checking back with the participants is very little bother.

**Data analysis.** The various statistical methods for analyzing data gathered through educational research are well documented and will not be discussed here. Of far more importance than the mathematical or statistical elegance of the analysis of interinstitutional data is whether the data are meaningfully compared. The problem of how best to compare the data can be awkward since one person's idea of comparability may be no less valid than another's.

The exchange, when possible, should ensure that each participant is given the opportunity to make changes or restructure departments just before an analysis is processed in order that no participant will have to accept data comparison reports reflecting the coordinator's preferences for comparability. This can be facilitated by providing to participants appropriate, table-driven computer programs in a common language, like ANS COBOL.

**Data (information) display.** The format in which data are displayed is vital and can make the difference between communicating information and reaping a whirlwind of confusion. The presentation of comparative data from an interinstitutional exchange program is the essence of the program, and careful thought should be given to communicating maximum academic management information. Further, the direct computer output from the data analysis—not just some final written report—should be considered.

HECHEMS AT RECHT				PAGE 3
PROGRAM UNIT COST REPORT				01-01-75
PROGRAM	DISCIPLINE	DISC. STATE	CREDIT HOURS	INSTCT. COST
PRG.0703.00	1.1.0703.10	28.7037	9.0000	258.1333
	1.1.0703.30	66.3952	9.0000	437.8568
PRG.0703.10	**TOTAL**	26.0058	45.0000	1,197.4401
PRG.0703.50	1.1.0703.50	48.0952	27.0000	1,256.5704
	1.1.0703.50	101.0030	9.0000	909.3003
	1.1.0703.50	102.0067	9.0000	904.0003
	**TOTAL**	69.9935	45.0000	1,131.5707
PRG.0703.50	1.1.0101.20	8.9365	27.0000	241.2855
	1.1.0101.30	15.0333	18.0000	284.7994
	1.1.0101.50	21.7778	18.0000	192.0004
	1.1.0201.20	16.7158	18.0000	277.0250
	1.1.0201.30	26.9919	18.0000	538.0542
	1.1.0201.50	25.7670	27.0000	695.7099
	1.1.0301.20	21.0067	18.0000	390.0506
	1.1.0301.30	21.5781	18.0000	316.3310
	1.1.0301.50	47.5185	9.0000	391.6665
	1.1.0306.20	36.9711	9.0000	132.5559
	1.1.0306.30	41.9836	18.0000	746.4558
	1.1.0306.50	71.9559	9.0000	647.1331
	1.1.0400.20	12.2832	9.0000	659.9998
	1.1.0400.30	18.9556	9.0000	1,427.1034
	1.1.0400.50	255.6296	9.0000	2,300.6164
	1.1.0622.20	11.0203	9.0000	99.0000
	1.1.0622.30	13.8889	18.0000	178.0002
	1.1.0622.50	13.8888	9.0000	120.9996
	1.1.0811.20	20.1317	9.0000	184.3333
	1.1.0811.30	32.0278	9.0000	288.2507
	1.1.0811.50	60.8313	18.0000	667.9964
	1.1.0812.20	13.7778	9.0000	93.8007
	1.1.0812.30	23.6664	9.0000	421.9997
	1.1.0812.50	33.1481	9.0000	399.1329
	1.1.0913.20	17.7500	9.0000	168.1500
	1.1.0913.30	24.7037	27.0000	774.9999
	1.1.0913.50	66.0952	9.0000	437.8568
	1.1.1000.20	101.0030	18.0000	1,818.0000
	1.1.1000.30	101.0030	18.0000	1,818.0000
	1.1.1000.50	102.0067	9.0000	924.0001
	1.1.0001.20	5.0929	18.0000	91.6362
	1.1.0001.30	5.9960	18.0000	106.1723
	1.1.0001.50	15.0185	9.0000	171.1665
PRG.0703.00	**TOTAL**	38.7903	477.0000	18,225.1375
PRG.0001.10	1.1.1001.20	8.9365	9.0000	60.4295
	1.1.1001.30	25.7670	9.0000	231.9030
	1.1.1001.50	21.5781	9.0000	194.1669
	**TOTAL**			

Figure 1. Example Information Exchange Procedures (IEP) program unit cost report. (From *IEP Analysis and Use: Single Institution Data*, by M. Byers and C. Bower, National Center for Higher Education Management Systems, Boulder, Colorado, 1975.)

The computer printout can save much time and can improve the usefulness of the data exchange project if it does not have to be accompanied by several pages of decoding sheets and a translator. Figures 1 and 2 show two examples of computer output from data exchange programs. The first example (Figure 1) is from IEP (Byers and Bower, 1975), a page of the Program Unit Cost Report, photo-reduced from its 14" x 11" actual size. In general, the IEP reports produced by NCHEMS do not meet the standards for display of management information. There are, however, three good points in the title field in this example: (1) the report is identified by a title that is relatively understandable, (2) the producing program (DDM-07) is shown, and (3) the date the report was produced is prominent.

There are several serious deficiencies: First, there is no clue as to the applicable time period. Knowing when a report was produced is "nice," but knowing to what period of time it refers is vital. Second, the column headings are reasonably useful, but the periods ("") where blanks should be are distracting, and the text is far more cryptic than would ever be acceptable in a typed table. Finally, the principle of congruency is violated badly in the displayed numbers, with cost per credit hour to the hundredth of a penny and SCH to 1/10,000 credit—the numbers are displayed to far greater precision than their accuracy warrants.

The IEP display format and content in Figure 1 can be compared with the example of a comparison report produced for a teaching-load data exchange program (Figure 2). Though reduced somewhat for display here, the report is produced on standard 8½" by 11" paper, with space for 3-hole punching.

The title area tells what one would want to know about the document, and it has the report's effective date; the text still uses abbreviations but no less acceptably than in many published tables; the numeric data are displayed to reasonable precision; and the program notes those institutions with loads significantly different from average. As with IEP, the HEGIS codes can be preprocessed for better interinstitutional data comparison using a readily changeable, table-driven program. Unlike IEP, however, the report subtotals on the first two characters of HEGIS code.

The sample comparison report of Figure 2 has another feature which can have value for academic administration: the

SOS: TEACHING LOAD DATA EXCHANGE				FALL TERM 1978	DATE: 08/16/79
----- Note 1 -----					
HEGIS CODES AS SUBMITTED					
INTER-INSTITUTION COMPARISON					
----- Note 2 -----					
INSTITUTION	FTE INSTRU FAC	STUDENT CREDIT HRS (CRS)	LEVEL	TOTAL-SCH	
	RANKED OTHER	LD	GR	TOT	PER PER
					RND RND
HEGIS DISCIPLINE 0506 BUSINESS MANAGEMENT AND ADMINISTRATION					
U OF ARIZONA	8.88	2.11	3,240	749	141 4,125
U OF ARIZONA	17.48	0.00	2,913	4,830	232 7,975
U OF ARIZONA	16.50	7.25	6,669	3,627	953 11,240
** TOTALS	42.86	9.36	12,822	9,201	1,326 23,349
** STANDARD DEV					128 53
HEGIS DISCIPLINE 0500 BUSINESS AND MANAGEMENT (0501 THROUGH 0599)					
U OF ARIZONA	43.54	23.04	5,893	11,746	2,014 19,653
U OF ARIZONA	47.11	8.27	7,486	13,557	779 21,822
U OF ARIZONA	51.54	2.26	8,571	13,248	795 22,614
U OF ARIZONA	84.75	17.50	9,972	19,225	2,707 31,904
** TOTALS	226.94	51.07	31,922	57,776	6,295 95,993
** STANDARD DEV					39 61
HEGIS DISCIPLINE 0000 ALL DISCIPLINES (0101 THROUGH 5599)					
U OF ARIZONA	543.23	277.82	115,884	50,398	24,162 196,454
U OF ARIZONA	479.78	78.26	70,675	59,500	5,861 135,036
U OF ARIZONA	416.06	31.42	64,923	44,276	15,926 125,125
U OF ARIZONA	329.50	104.80	132,481	68,105	18,573 219,359
U OF ARIZONA	379.95	75.94	114,419	80,211	30,705 225,336
** TOTALS	3348.52	568.24	498,382	302,680	89,610 626,229
** STANDARD DEV					50 28

\* INDICATES A PRODUCTIVITY RATIO SIGNIFICANTLY DIFFERENT FROM AVERAGE.

Note 1. This field is spaces if program SOS has converted HEGIS Codes from those initially submitted to codes preferred for inter-institutional data comparison. If dummy codes are used to display the data so the data match the college/departments structure of a key institution, the field reads (KEYED TO Inst-name).

Note 2. Depending on the 'SYSIN' option, this field reads either A. INSTR - Only instructional faculty F.T.E. are shown. or B. STATE - All permanent state faculty F.T.E. are shown.

Figure 2. Sample interinstitution comparison report from a teaching load data exchange.

option of comparing data by HEGIS code or by the college/department structure of one's own institution. No institution, after all, is organized by HEGIS discipline. This idea was taken from the Michigan study (Mims and Lelong, 1976) of reaggregation of "selected departments to produce a common set of similar units in the . . . schools being compared" (p. 77). Thus, a dean can see data from peer institutions as if the units were organized in the same way as in his or her college. The teaching load data exchange which Virginia Tech coordinates uses that idea. Its data processing system automatically converts other-institution data to align with the college/department structure of any other given institution. The resulting display is identical with the comparison report shown in Figure 2, save that "dummy" HEGIS codes are used in the illustration. For example, the College of Agriculture might be assigned as college "AA"; the first department in Agriculture, Life Sciences, would carry a dummy code "AA01"; each institution's entry under code "AA01" would be made up of as many submissions by HEGIS code as are appropriate—both biology (0401) and zoology (0407), for example, might be converted to Life Sciences (AA01).

**Data Dissemination.** The last processing step in an information exchange program is to disseminate the comparison information to the exchange participants. One useful procedure is to send the information twice. The coordinator can produce a draft copy of the report and send it to everyone when data have arrived from 80 percent of the participants. This has several benefits: schools can note previously overlooked anomalies in their data entries that stand out only in context, institutions are alerted of any postal service problems, and the non-respondents are reminded gently that their submissions are due.

A principle advantage of submitting data in machine-readable form is apparent when the last data packet is received. Turnaround time is quite rapid because it is not necessary to transcribe questionnaire data. The possibility exists that the material can be ready for mailing within a day, greatly increasing the timeliness of the information to the participants. A second advantage accrues to those participants desiring the raw data for their own analyses: they are already familiar with the content and format of the cards. Consequently, they can have their own analysis procedures in place and can provide meaningful information to the appropriate academic administrators in their institutions in a much more timely manner.

## Conclusion

This paper has addressed the problem—generally overlooked in the literature—of conducting an interinstitutional data exchange program in a manner that speeds and smooths the interinstitutional transmission of data, that balances the resource expenditures of the participants and of the coordinating office, and that provides more meaningful information to all exchange participants. The principles and procedures presented here, and the examples used to illustrate them, should be beneficial to a prospective data exchange developer and could be of value in improving existing exchange programs.

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