DEVELOPMENT OF A DATA SYSTEM FOR LONGITUDINAL RESEARCH

Robert W. Marker, University of Iowa

Professor E. F. Lindquist, originally scheduled for participation on this panel is unable to be with us. He has asked that I express to you his sincere regret in missing this opportunity. I shall attempt to treat the subject with what abilities I can muster but I cannot help but share with you a sense of loss brought about by this program change. I would count it a privilege if I could join your ranks and listen to his views on longitudinal research.

Fortunately, my task is relatively simple. I intend to outline our approach to the development of a data collection and retrieval system in Iowa. We are currently engaged in the design of a statewide data system which, if successful, should prove valuable for purposes of longitudinal research. I shall attempt today to describe;

1) something of the growing need for information,
2) an agency created to design and implement a statewide data system,
3) the potential of such a system for longitudinal research,
4) our base of service activities and how these relate to research information, and
5) the nature and extent of the support necessitated by this approach to data collection.

THE GROWING NEED FOR INFORMATION

We are witnessing dynamic changes in education. Changes in quality and quantity. Permit me to crystalize this point by citing some obvious examples. We continue to see gross increases in the number of persons educated as well as the duration of their formal schooling. Changes are occurring in the internal and external structure of educational organizations. Experimental programs in elementary and secondary curricula are being initiated in the social sciences as well as in the physical and biological sciences, mathematics and foreign languages. A mounting concern is evidenced for educational excellence at all levels, kindergarten to graduate school. The American urge to extend our systems of general, liberal, and vocational education is finding expression in legislation and practice. This mounting concern is complemented by another, no less intense, for intelligent and prudent investment of the nations resources allocated to educational functions. The changes are creating an unprecedented need for educational information. We need to identify trends, examine new programs, evaluate outcomes, communicate desirable adaptations, and develop appropriate operational educational policies at federal, state and local levels.

Change is not the only agent precipitating the need for more and better information. Education has a poor record in the matter of acquiring timely and accurate information for operational purposes. Broad scale research efforts in education can best be implemented when the required data are "creamed" from day-to-day operational information processes. Both researchers and administrative personnel are now demanding that the "information lag" be closed and that systems be designed to provide for operational needs as well as research purposes.

School teachers, supervisors, administrators, board members, parents, professional organizations, and the general public are asking for more information about our schools; universities, state education departments, accreditation bodies, and the United States Office of Education also require more and more data for policy and operational purposes. Add to this the increasingly important role of the researcher within all these groups and a case has been stated concerning the growing need for processed data.

Schools and various agencies collect data of many types and in many ways, but there is serious inefficiency and lack of coordination, considerable overlap and duplication, and frequent repetition of tasks required of persons supplying this information. Teachers and administrators, filling out numerous questionnaires and report forms for different agencies and for different purposes, find that they are supplying exactly the same detailed items of information over and over again, from agency to agency, and from year to year. Local school systems also find many inadequacies and imperfections in their systems of collecting data for their own use as well as in the systems of maintaining and utilizing their own records.

Although it is impossible for the schools and agencies to be too well informed about the many facets of their operations, it is possible to collect and have available more detailed information than can be digested and assimilated, or interpreted and used effectively. The needs

of school administrators for better methods of data collection and for more information are surpassed only by their needs for help in organizing, integrating, interpreting, and using the information that is being and may be collected.

A CENTER IS CREATED

We have created an organization to search for and implement answers to this informational problem. This agency is called the Iowa Educational Information Center. It is closely associated with the policies, personnel, and equipment of the State Department of Public Instruction, the University, and the Measurement Research Center notable for its record in test development and test scoring services. This new Center is organized to establish and maintain a comprehensive system for the continuous, systematic, and routine collection, storage, and retrieval of information about all phases of the educational enterprise - about the professional staff, students, curriculum, school facilities, and financial activities. Data thus collected, are being transcribed to a magnetic tape file, merged, integrated, organized, and stored in a form for most convenient access to large scale computers. This file will be kept continually up to date. From this file, schools and educational agencies can draw the information needed to perform their many functions most intelligently. From it can be drawn, also, the information needed for a great variety of research purposes.

LONGITUDINAL RESEARCH THROUGH CardPac

Longitudinal research is dependent upon the availability of this kind of systematic data collection. Information collected and stored in the central file will be made readily available to research workers everywhere. Much work is needed in educational and psychological research to determine the antecedents, the earliest observable symptoms, and the basic causes of various types of human behavior not easily recognized and identified until relatively late in the life of the individual. The school "dropout," the juvenile delinquent, the underachiever, the educationally and vocationally dis-oriented or non-oriented student, the leader, the specially talented individual, the creative individual, all evidence types of behavior that have their roots in the earlier experiences, environment, and inheritances of the individual. These should be recognized, precluded, or strengthened as early as possible. Heretofore, longitudinal research studies into these problems have necessarily been of the backward-looking type, in which the needed historical data about the individual have been collected only after he has clearly manifested the critical behavior.

The approach now being taken by the Iowa Educational Information Center makes possible a new kind of "Follow-back" study wherein various kinds of data, such as achievement test scores, academic marks, and vocational-educational aspirations may be integrated for a given student and also traced longitudinally year by year. Given a data file on a complete population several other possibilities present themselves to researchers. It will be relatively simple to select specific samples such as all identical twins within the state. Random samples can be generated automatically with increased potential for meaningful stratification. One could even use this data file as painless instrument for testing sampling theory.

In the Spring of 1965, the Information Center is initiating a statewide system known as CardPac for the collection of information from every secondary school in Iowa. Empasis this year is to identify data from every teacher and every student. The system employs the principle of batching information about each of the courses taken by a given student with questionnaire information supplied by the student himself into a pack of tabulator cards. The teacher places identifying information about herself on top of this pack of cards and this completes the CardPac. Each teacher, course, and student is identified by a continuing number. Thus, the several sources of information can be connected and integrated for a given year and in the future longitudinal information can be supplied for as many years as the system has been functioning. The population supplying information includes about 30, 000 professional educators and 250, 000 students.

STUDENT ACTIVITIES ARE BASIC

Service to local schools make possible the kind of approach we are taking in Iowa. A data collection project of the magnitude just described can only hope to succeed if it is tied to some useful purpose as perceived by the persons supplying the information. For this reason a great deal of our effort centers on supplying local school personnel with timely and useful information selected from the CardPac system and other sources. This "feedback" service provides some insurance of intimate support by those providing the data. Indeed the early activities of the Iowa Educational Information Center have been characterized by the service activities such as secondary student scheduling, grade reporting and attendance accounting. These services and other being developed are provided through

our "UPDATE" program of local district computer services. We now schedule about 50, 000 students in some 50 schools annually. We will continue to provide these and similar services while awaiting full scale action by state and local authorities in organizing to take advantage of automation in the schools.

RESEARCH SUPPORT REQUIRES MACHINES, MONEY AND MEN

One reason which makes it possible for us to handle this approach to the collection of research data is the availability of large-scale and specialized computer hardware. The dramatic growth of the computer industry and the methodologies of processing data are making possible an answer to the total information problem. Output speeds have consistently increased for tape processors as well as printers. We can now print at a rate of 1100 complete lines per minute. Processing speeds have increased even more markedly to the point where some individual processes are measured in nano-seconds or billionths of a second. In addition, parallel and multi-processing techniques have improved the data handling characteristics of computers. The near future will see similarly startling modifications and extensions of the necessary hardware. Improvements over the key-punch method of in-put preparation are much needed. Optical scanners which read characters or positions have proved highly beneficial in the data collection process. The Measurement Research Center is currently designing and manufacturing an optical scanner which will read both punched information and scannable marks at the rate of 35, 000 cards per hour. This scanner will be used to "read" the millions of cards associated with CardPac.

The Iowa Educational Information Center's initial pilot program began under a grant from the Measurement Research Center. MRC is continuing to develop and improve its automatic electronic scanners which can now transcribe information from an original data collection document or report form directly to magnetic tape. MRC provides to the Information Center, on a strictly at or below cost basis, all required data processing services on document scanners and IBM 1460 computer equipment, as well as the services of its staff.

The College of Education conducts the Iowa Testing Programs in which the 5 to 7 hour comprehensive Iowa Tests of Basic Skills and the Iowa Tests of Educational Development are administered annually under closely controlled conditions to almost the entire school population of the state in grades three to twelve. Over 400, 000 Iowa pupils took these tests in 1963-64. The tests are centrally scored by MRC, the scores permanently recorded on magnetic tape, and the information made immediately available to the Information Center without imposing any additional reporting burden on the schools. The College of Education provides personnel and office space for the Information Center staff, and members of the faculty contribute professional assistance in specifying the information to be collected. Facilities of the University Computer Center are also available to the Information Center, including a large scale, IBM 7044 processing system.

The State Department of Public Instruction provides personnel and access to its facilities as well as financial support for the Information Center. The Department has traditionally enjoyed unusually good relationships with the public schools of the state, and its support of the data collection activities insures that the plan as a whole will be an integral part of the legally constituted educational structure of the state. As the Center grows the Department will depend increasingly upon it for collection of data.

Funds in support of the agency and its development of data systems have been granted by the U.S. Office of Education and the Ford Foundation. It is expected, if successful, that the Iowa Educational Information Center will serve as a model for the development of information systems in other states. Iowa possesses a community of dynamic and dedicated educators. It has a rich heritage in data processing and educational innovation. A good beginning has been made in securing the necessary machines, money, and men. Given a period of years for implementation, evaluation, and revisions of the data system being developed we should be able to fully explore the potentially fruitful realm of longitudinal research.