2. The Computing and Data Processing Center.

Many aspects of the analysis and demonstration programs of the Center can be conducted in the laboratory and seminar facilities of the Computing and Data Processing Center of Wayne State University. The large scale electronic digital computing system available in the Computing and Data Processing Center can be used to analyze and demonstrate selected aspects of educational research findings and other related resources.

Included in the equipment and space available to the Resource Center through the facilities of the Computing and Data Processing Center are:

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R E P O R T R E S U M E S

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A FEASIBILITY STUDY FOR ESTABLISHING A PILOT CENTER FOR ANALYSIS AND DEMONSTRATION OF EDUCATIONAL RESOURCES AT WAYNE STATE UNIVERSITY.

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DESCRIPTORS- *EDUCATIONAL RESEARCH, EDUCATIONAL RESOURCES, *RESOURCE CENTERS, *ORGANIZATION, *INFORMATION DISSEMINATION, *SYSTEMS DEVELOPMENT, FINANCIAL NEEDS, BUDGETING, TEACHER EDUCATION, SPEECH IMPROVEMENT, PROGRAMED INSTRUCTION, COMPUTER ASSISTED INSTRUCTION, PILOT PROJECTS, DETROIT, MICHIGAN

THE FEASIBILITY OF ESTABLISHING AN EDUCATIONAL RESOURCE CENTER WAS EVALUATED. INCLUDED IN THIS REPORT ARE DETAILED DISCUSSIONS OF (1) THE PHYSICAL AND ORGANIZATIONAL DESIGN OF THE RESOURCE CENTER, (2) A TIMETABLE FOR ESTABLISHMENT OF THE CENTER, (3) PLANS FOR THE DISSEMINATION OF INFORMATION, (4) PLANS FOR DEMONSTRATION OF SYSTEMS TO BE DEVELOPED AT THE CENTER, AND (5) BUDGETARY REQUIREMENTS. OTHER VENTURES UNDERTAKEN WITHIN THE DIMENSIONS OF THE FEASIBILITY STUDY WERE ALSO DISCUSSED, INCLUDING SPECIFIC ASPECTS OF TEACHER EDUCATION, SPEECH IMPROVEMENT, PROGRAMED INSTRUCTION, AND COMPUTER-ASSISTED INSTRUCTION. (GD)

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Joseph E. Hill

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According to the original proposal concerning the investigation of the possibility of establishing a pilot center for the analysis and demonstration of educational resources at Wayne State University:

> ...The planning operation will require some six months. Participants will be university faculty members, administrators, representatives of equipment manufacturers and media producers, research specialists, school architects, and systems development specialists. The planning will be done mainly on the University campus. The plans to be formulated will encompass (a) physical and organizational design for the resource center; (b) establishment of a time table for establishment of the resource center; (c) plans for the dissemination of information; (d) plans for the demonstration of systems of educational resources to be developed at the Center; and (e) budgetary requirements. ...

Pursuant to this phase of the contract, the format of the report is based upon these five categories.

(a) Physical and Organizational Design for the Resource Center

At the time of the First Quarter Progress Report, the physical design for the Resource Center was envisioned to involve two areas on the University campus: (1) the facilities of the Experimental Instructional Media Center located in the basement area of the College of Education Building (a complex formed by rooms 57-59); and (2) the Computing and Data Processing Center located on the first and second floors of the Administrative Services Building. Later developments in the study demonstrated clearly the advantages that could be realized by the employment of a "systems" approach to the establishment and operation of such a Center. In order to

provide a frame of reference for the "systems" concept as it is employed in this study, the topic of treating the Center as a system is accorded a brief discussion at this point.

The Center as a System

The systems approach has been utilized successfully in analyzing and solving problems associated with large, complex organizations, industrial concerns and certain governmental agencies. It is important to note that the systems approach involves more than the consideration of the operations of a multiplicity of disciplines and the configuration of a set of sub-systems. This approach demands the identification of objectives and problems, the establishment of specific performance goals (operational objectives); the planning of organized attacks upon the problem areas extant in the entity under consideration; the development of appropriate methodologies in order to implement the "planned attacks"; the collection of data pertaining to the total operation; the analysis of that data in deriving "optimal solutions" (i.e. those decisions that produce the "best" results for each unit involved under the existing circumstances) to problems under consideration; and, finally, the evaluation of the effort in terms of the attainment of the operational and general objectives of the total entity under consideration.

The system of the Center for the Analysis and Demonstration of Educational Resources involves a complex, interrelated set of activities, functions, sub-systems and operations that must be effectively coordinated to the end of successfully achieving the requirements and objectives of the

"Demonstration Center" approach. Treated as a system, the Center has a set of inputs and outputs, design criteria, specification of performance objectives, and a structure of relationships between elements of the system such that the modification of a single aspect of the configuration might well require modifications in other elements included in the structure.

The inputs and outputs of the "system" consist of the study designs, proposed projects, and experimental programs submitted to the Center for consideration, and upon completion of the accepted proposals, the "packaged" results of these endeavors.

The design criteria for the Center system are established in terms of the "sponsored" research and service projects, the dissemination of information produced by these projects, and the capability of the Center in matters related to the implementation of "findings" (curriculum innovations, program, etc.) in school operations. The design criteria involved with these aspects of the Center's program are based upon the objective of changing (improving) school operations and programs so that the personal-social adjustment characteristics and employment potentialities of the pupils, and their levels of performance and achievement meet or exceed the specified levels of performance and accomplishment deemed necessary for entry into institutions of higher education, or a specific cluster of jobs (e.g. commercial fields, industrial production, etc.).

Since there is great variation in the "characteristics", "potentialities",

and learning abilities of the pupils, various sets of performance objectives corresponding to research and demonstration projects selected for inclusion in the Center program must be employed. The levels of these performance objectives should be established on the basis of the capability of the "projects" to accomplish selected educational goals within the usual available time devoted to the programs under consideration.

The structure of the system associated with the Center is based upon the relationships between such elements as: program objectives, content of the various types of educational research and demonstration programs included in the endeavors of the Center, policies and procedures of various management and "instructional" operations, personnel (including instructional staff and management groups), facilities, equipment and general administrative coordination. These elements must be structured and arranged so that an efficient program (of analysis and demonstration of educational resources) results.

The success of the Center's program will depend greatly upon the competence of its staff to implement the "systems" design. Consistent with the "systems approach" is the need for program flexibility in terms of modifications called for through "feedback" operations resulting from the process of continuous testing and evaluation of program effectiveness in

attaining specified objectives. The "feedback" technique also dictates that an organized scheme for program modification, to cope with discrepancies between actual and desired performance, is needed. The important elements of such a scheme are: (a) the capability of the staff to recognize discrepancies; (b) the staff's ability to analyze the problems and construct suitable solutions; (c) the ability of appropriate personnel to implement the changes that will result in program modification which solves the problems; (d) freedom for the staff to act with dispatch; and (e) the provision of channels and administrative processes to produce these "changes" in an organized and objective manner.

Sub-Systems Composing the Center

At the present time the Center for the Analysis and Demonstration of Educational Resources is envisioned to be composed of the following sub-systems:

1. Audio-Visual Production Center
2. Audio-Visual Utilization Center
3. Mass Comunications Center
4. Computing and Data Processing Center
5. Experimental Instructional Media Center
6. Counseling and Guidance Laboratories
7. Selected Areas of the Speech and Hearing Clinic.

A general representation of the management structure of the Center is presented in Figure 1.

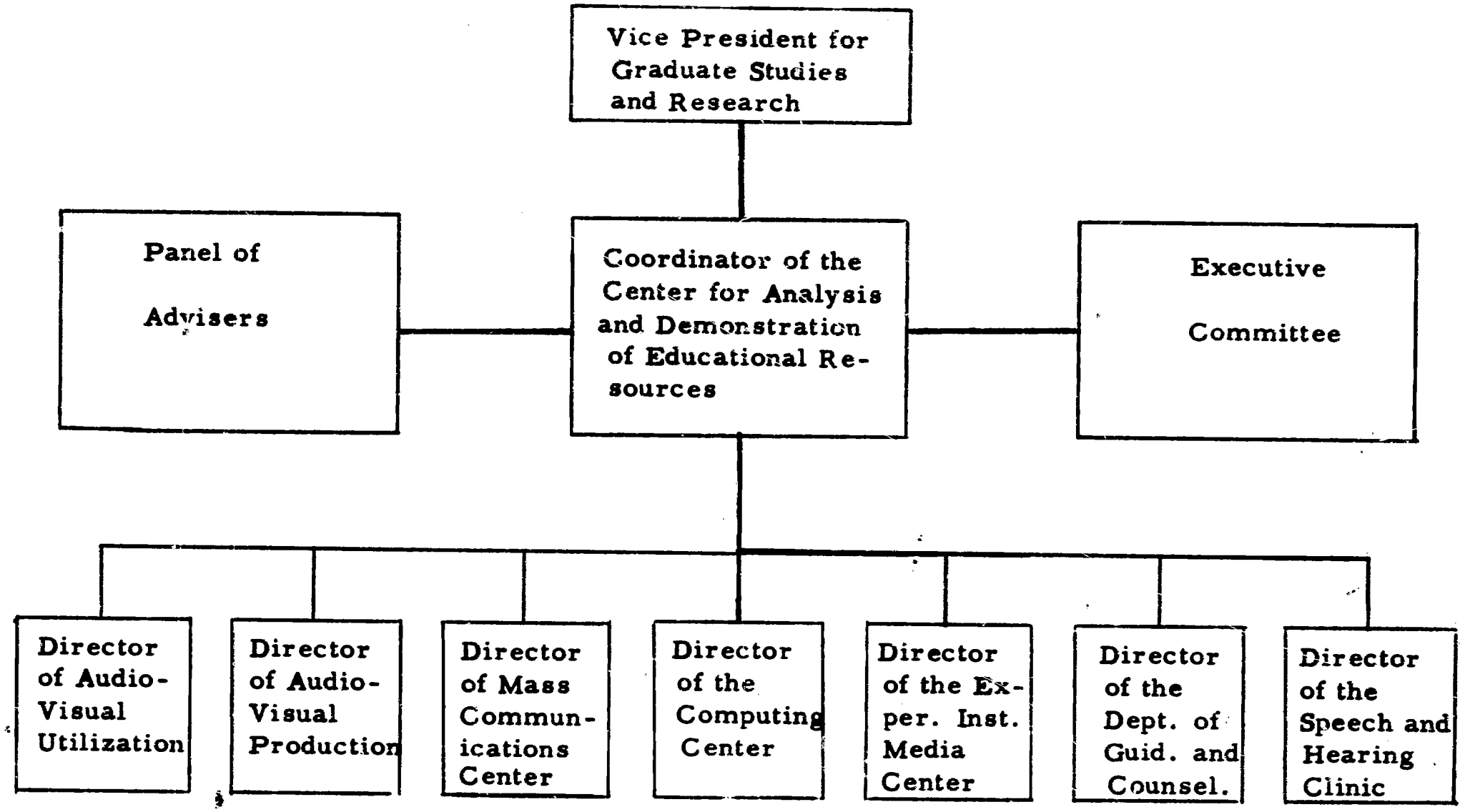

FIGURE 1. MANAGEMENT STRUCTURE OF SUB-SYSTEMS COMPOSING THE CENTER FOR THE ANALYSIS AND DEMONSTRATION OF EDUCATIONAL RESOURCES.

It should be noted that the details of organization, administration and operation of the respective sub-systems elements of the Center are not presented in the figure. This omission is intentional and is in deference to the individuality aspect of these elements concerning the design and implementation of ideas and approaches concerning the various types of instructional, production and operational programs for which they might be responsible in the operations of the Center.

A brief description of the facilities involved in the operations of the sub-systems composing the structure of the Center for the Analysis and Demonstration of Educational Resources is as follows:

1. <u>The Experimental Instructional Media Center</u>.

This Center is designed to include: (a) a demonstration classroom, which is equipped to provide for group observation of the classroom, and observation of the area through the media of film, "live" television and video tape; (b) a control room equipped to accommodate television and film productions; (c) a commercial broadcast quality video tape recorder (cost $48,000); (d) assorted television and film production cameras; and (e) other facilities and materials necessary to the processes of production, analysis, and demonstration. In the First Quarter Progress Report, the Experimental Instructional Media Center was proposed to be the main physical facility of the Center for the Analysis and Demonstration of Educational Resources.

2. The Computing and Data Processing Center.

Many aspects of the analysis and demonstration programs of the Center can be conducted in the laboratory and seminar facilities of the Computing and Data Processing Center of Wayne State University. The large scale electronic digital computing system available in the Computing and Data Processing Center can be used to analyze and demonstrate selected aspects of educational research findings and other related resources.

Included in the equipment and space available to the Resource Center through the facilities of the Computing and Data Processing Center are:

a. An IBM 7070 computer with a capacity of 10,000 words of storage; 12 tapes; automatic floating point; and a 1301 disc unit.

b. Two IBM 1401's for off-line printing and card to tape (or tape to card) operations compatible with binary computers; one machine with 4,000 positions of storage; and the other with 8,000 positions of storage; one machine with one tape drive and 4 others switchable to the 7070, the other machine with 2 tapes; all equipment forming the 1401 complex (e.g. 1402 and 1403) compatible with all other elements of the operation.

c. Tabulating equipment including an IBM 407 accounting machine, 3 sorters, 2 collators, 2 interpreters, key punches and verifiers.

d. Conference-seminar room, a classroom and adequate space for laboratory demonstrations.

e. Spacious assembly area for large group meetings.

f. Classroom equipment such as: student desks, black-boards, projectors and other similar types of equipment.

g. A sizable collection of literary works pertaining to the computer sciences and all areas of automatic data processing.

3. <u>The Mass Communications Center.</u>

The programs of analysis and demonstration of educational resources that are related to the areas of radio, speech and television have excellent facilities and equipment available to them in the Mass Communications Center of the University. Housed in two edifices that collectively include: three television studios, a huge engineering control room, five radio broadcasting rooms, a series of seminar rooms, and a large number of classrooms; the physical facilities of the Mass Communications Center are more than adequate for the potential demands that might be placed upon them by the systems approach of the Center for the Analysis and Demonstration of Educational Resources.

In addition to its generous space accommodations, the Mass Communications Center can boast of excellent equipment for programs in speech, radio, and television. Designed to provide total laboratory experiences for professional persons in these respective fields of endeavor, the equipment available includes four commercial quality video-tape recorders, three portable video-tape recorders, and, in general, a totally equipped commercial radio and television station. Tape recorders, observation instrumentalities and related materials are available to analysis and demonstration programs in the area of speech.

4. The Counseling and Guidance Laboratories.

The observation galleries of the counseling and guidance laboratories house approximately forty observation-listening stations, Each station is equipped with a desk service, a headphone set receiver, a one-way vision carrel, and, in some cases, an inter-stations microphone. Large and small tape recording equipment, in addition to one inch tape portable video recorders accompanied by specially constructed small portable video cameras are available as needed.

These facilities have proved especially helpful in analyzing and demonstrating interview techniques for applications in the area of programed instruction. Other programs of individual and small group counseling projects (with the permission of the participants) have been used as demonstrations for seminar groups and special classes of students.

5. The Audio-Visual Production Center.

The facilities and equipment of the Audio-Visual Production Center are commensurate with those found to be associated with most commercial film production companies in the greater metropolitan area of Detroit. Although the structure which houses the Center at the present time is to be razed for purposes of campus expansion and improvement, the "new" facility will include modest sound stage capabilities, and adequate space to house the various types of equipment used in high quality commercial film production.

The Audio-Visual Production Center provides an excellent sub-system capability for the production of demonstration packages in the forms of films, slides and graphics. The quality of work produced by the Center is such that the installation has won various film and graphics awards over the past few years. The personnel, facilities, and equipment of the Production Center has excellent potential for contributing highly significant "inputs" and "outputs" in associating with the system structure of the Center for Analysis and Demonstration of Educational Resources.

6. The Audio-Visual Utilization Center.

With a good capability for conducting seminars, regular classes and demonstration programs that accommodate between thirty and fifty participants, the Audio-Visual Utilization Center is well-equipped to function as an integral part of the system composing the Center for the Analysis and Demonstration of Educational Resources. In addition to this capability, the Audio-Visual Utilization Center has excellent facilities for distributing films, slides, tapes, textual materials and graphic arts display innovations throughout the local, state and national communities.

Boasting a staff of professional persons, supplemented by a group of well-trained technicians, the Center provides an excellent human resource for a variety of analysis and demonstration endeavors in the fields of elementary, secondary, undergraduate and graduate levels of education. In addition to these human resources, the Utilization Center has an excellent film library, readily available audio-tape materials, and an efficient operation for procuring films, slides, tapes, graphic displays, and other selected forms of written materials from commercial concerns that might have application in the broad area of the analysis and demonstration of education resources.

At the present time the Audio-Visual Utilization Center is one of the key elements in the system of the Center for the Analysis and Demonstration of Educational Resources. The Utilizations Center's "input" capability is

enhanced by its capability in the "output" dimensions of the System. The "outputs" of the Center are measured in terms of its two-way channels of communications within the University and with the local, state, and national communities. In these dimensions, the Utilization Center will serve the System as an agency for packaging programs and dissemenating information in various forms of audio-tapes, slides, films, graphic arts displays and related written materials.

7. Areas of the Speech and Hearing Clinic.

The present facilities of the Speech and Hearing Clinic are to be razed for the purposes of campus expansion and improvement. The "new" facilities of the Clinic will be well-equipped for allowing the staff of that unit to meaningfully participate in selected aspects of a University program for the analysis and demonstration of educational resources. With an excellent staff, and well-equipped in modern electronic devices, the Speech and Hearing Clinic group is capable of making highly significant contributions to analysis and demonstration programs in the broad area of special education. An example of these types of contributions can be found in Appendix A.

Management Organization of the System.

Figure 1 illustrates the management organization of the system composing the Center for the Analysis and Demonstration of Educational Resources. The administrative structure of the Center system is designed

to coordinate, unify and strengthen the programs of demonstration and analysis sponsored by the units, or elements, participating in the operation. An entity established under the auspices of the Division of Graduate Studies and Research, the Center system is a cooperative endeavor that provides facilities, equipment and staff for the development of analysis and educational programs projects; and an agency which provides channels of communication between these projects and appropriate elements of the University, local, state, and national communities. The Center system is not designed to offer a program of instructional offerings. Such programs, if they are to be a part of the System, must be provided by appropriate academic units of the University structure.

In terms of its elements, the management organization of the System functions as follows:

Panel of Advisers. As the need arises for guidance and counsel in the development and testing of certain programs of analysis and demonstration of educational resources, persons from business, industry, public and private educational institutions, governmental agencies, and the general community, will be invited to make contributions of their particular talents to these endeavors through membership on the Panel of Advisers. Through the panel configuration a rich variety of knowledge and experience will become available to the Center system. Because of

its design, the membership of the Panel of Advisers will be a dynamic and changing one.

The Executive Committee. The membership of the Executive Committee will be composed of persons selected from the various academic, service, and research units of the University that are included in the system of the Center for the Analysis and Demonstration of Educational Resources. The Coordinator of the System will serve as an ex-officio member of the Committee.

The Chairman of the Committee shall be elected by the membership for a term of three years. The Secretary of the Committee will be the Coordinator of the Center system.

The major responsibilities of the Executive Committee will be:

1. To establish governing policies of the Center system.
2. To help provide channels of communication between elements and projects included in the Center system and interested groups in the University, and those located in certain local, state and national communities.
3. To serve in an advisory capacity concerning matters of: personnel, finance, principles of operation, and general direction of the Center systems program of projects.

4. To advise on admission, continuance, or termination of projects included in the analysis and demonstration programs of the Center.

5. To advise on educational programs and matters of curriculum development for segments of the Center system's offerings that might be sponsored by participating academic units of the University.

The Coordinator. The Coordinator of the Center system will be appointed by the President after consultation with appropriate administrators and faculty members of the University.

The major responsibilities of the Coordinator will be:

1. To administer the governing policies of the Center system that are related to budget, personnel and central program.

2. To coordinate the various projects of the participating units of the Center system.

3. To maintain channels of communication with interested elements of the University, local, state, and national communities.

4. To assist in seeking financial support for the project activities of the Center system, and for the system itself.

5. To work with University and Community Agency officers in the provision of necessary facilities, equipment, and services for the program of projects of the Center system.

The Directors. The Directors of the Center system will be certain faculty members appointed by the participating units to coordinate the programs of the respective units in such a fashion as to sustain the development of analysis and demonstration of educational resources projects that might be sponsored by individual faculty members, departments or divisions of the University and associated school systems or industries. The role of the Director of a given unit will develop and evolve around the function of that unit as a contributing element to the Center system.

Types of Projects.

Appendix A contains three pilot study projects of the types of programs that can be sponsored by a systems approach to a Center for the Analysis and Demonstration of Educational Resources. To demonstrate the diversity of the systems approach one of the projects is in the realm of reading instruction, one of the other two is in programed instruction, and the third is a highly specialized project in speech.

In addition to these projects, the field of Computer Assisted Instruction has been investigated in "miniature" dimensions. The Computing and Data Processing Center in cooperation with IBM has explored the possibility of a two-position console operation to be established at the Computing Center, and a four position console remote operation to be established in an off-campus site associated with a basic literacy instruction program to be

sponsored by a grant from the Office of Economic Opportunity. (See Appendix C for example of IBM Computer Assisted Instruction description and program).

(b) Time Table for Establishment of the Resource Center

Since the system of the Educational Resources Center will be composed of a number of units and elements, the time table for its establishment can best be presented as follows:

1. Alterations of the Experimental Instructional Media Center were completed by February, 1964, and the facility is available to the System.

2. Selected Educational Resources Center programs have been housed in the Experimental Instructional Media Center since April 15, 1964.

3. Programs associated with public school research efforts are currently being processed through two sources: (1) The Field Services Division of the College of Education, and (2) the Metropolitan Detroit Bureau of School Studies (these operations are discussed under the section dealing with plans for the dissemination of information).

4. Through the various consortia of the Institute for Educational Sciences research findings emanating from projects developed

and executed in the laboratories and other similar types of facilities of the University can be funneled through the Educational Resources Center to the public schools as rapidly as the University sources make them available. At the present time this process is being effected in connection with the findings resulting from the investigations of the Modern Language Audio Visual Project. Data from this project are being distributed to selected public school systems, and arrangements are being made to demonstrate the methods and materials that have been developed in conjunction with the research program of the project.

5. Throughout the first quarter of the planning phase of the Center for the Analysis and Demonstration of Educational Resources certain projects were selected for inclusion in a pilot study to determine methods and techniques of analyzing and demonstrating educational research findings and curriculum innovations for the consumption of national organizations and institutions of higher education throughout the country. For example, the Department of Elementary Education in the College of Education has begun an experimentation involving the development of Student Teaching Centers established in communities located at some distance from the Wayne State campus. The American Association of Colleges for Teacher Education (AACTE) became interested in

the "Centers" approach, and made plans to have representatives from the Elementary Education department report significant findings to the convention of the AACTE to be held in February 1964.

In order to explore the possibility of presenting analysis and demonstration programs on a national scale, certain faculty members participating in the development and operation of Teaching Centers have been granted small sums of money, from the "feasibility" study account, to collect data that would have significance for teacher preparation programs across the nation. At the present time the media of video tape is being explored as a good device for demonstrating the effectiveness of Teaching Centers. Supplementary to the data produced by the video tape medium will be those produced by means of questionnaires, interviews, and specially prepared inventories pertaining to the student teaching experience. Other ventures undertaken in the pilot study dimension are reported in Appendix A and Appendix C.

In summary: (1) the time table of the establishment of physical facilities to be associated with the Center for the Analysis and Demonstration of Educational Resources has been established, and if completed according to present estimates will be avaiable during February 1964. (2) Resource

Programs are being planned with selected public schools systems through the auspices of the Field Services Division of the College of Education and the Metropolitan Detroit Bureau of School Studies. (3) Programs of analysis and demonstration connected with findings from University research projects are being conducted for selected public school systems, various areas of the University, national organizations, and selected institutions of higher education throughout the nation; through the operational channels of the Institute for Educational Sciences. (4) All of the endeavors involving analysis and demonstration of educational resources have employed various media of communication. To date; film, video tape, slides and various types of literature have been used in the pilot study efforts. The elements composing the system of the Center for the Analysis and Demonstration of Educational Resources have been instrumental in implementing the ideas involved throughout this period of time. (5) Selected faculty committees are continuing to work on further questions concerning personnel, equipment, program and facilities to be included in an expanded structure of the system forming the Center for Analysis and Demonstration of Educational Resources.

(c) Plans for the Dissemination of Information

Three channels for the dissemination of information will be employed to reach the local, state, and national communities. Dissemination of information to local and state areas will be handled by the Field Services

Division of the College of Education and the Metropolitan Detroit Bureau of School Studies. Appendix B contains a copy of the by-laws of the "Metropolitan Bureau" and the mailing list of the Superintendent's and Personnel Officers over a Six-County Area in Southeastern Michigan. Since the director of Field Services for the College is also the Director for the Metropolitan Bureau, and in view of the fact that the staffs of both operations are housed in the same suite of offices in the College of Education building, communications between personnel of the Center for the Analysis and Demonstration for Educational Resources and staff members of the Division and the Bureau are excellent. It should be noted that the Field Services Division of the College and the Metropolitan Detroit Bureau actively participate in all aspects of programs sponsored by the State Department of Public Instruction. Through this participation many opportunities will be made available to the Center for the Analysis and Demonstration for Educational Resources to conduct demonstrations of many different types of research findings and educational program innovations.

The Institute for Educational Sciences provides the opportunity for the Center for the Analysis and Demonstration of Educational Resources to communicate with departmental areas within the University and selected institutions of higher education throughout the nation. Through the consortia of the Institute, analysis and demonstration programs can

be conducted on both intra-university and inter-university bases. The Audio-Visual Utilization Center has provided an excellent distribution in agency for the System, and works with each of the three channels of communication with local, state and national communities.

The third channel of communication which provides the means for the Resource Center to communicate with school systems, professional organizations, and community agencies on local, state and national levels is that of the University faculty. By involving faculty members in planning, presenting, analyzing, demonstrating, and evaluating programs, projects and operations of the Resource Center, a natural two way channel of communication is provided between the Center and local, state and national communities.

At the present time seven faculty members, four from the College of Liberal Arts and three from the College of Education, are involved in pilot study analysis and demonstration programs. From data produced by these efforts, further planning for refinement of processes and channels for the dissemination of information to: (1) the community, (2) public school systems, and (3) institutions of higher education; are continuing to be made. The Directors of the seven participating units forming the System at the present time will continue to seek solutions to problems arising in this area of concern.

(d) Demonstration of Systems Developed at the Center

Systems of educational resources developed on the campus of the University will be demonstrated, depending upon the nature of the developed system, in classrooms, in the Experimental Instructional Media Center, the Computing and Data Processing Center, Counseling and Guidance Laboratory, Audio-Visual Production Center, and selected areas of the Speech and Hearing Clinic. Off-campus demonstrations can be accomplished by means of: (1) educational television, employing the $48,000 commercial broadcast quality tape recorder in conjunction with a mobile unit from the Mass Communications Center of the University; (2) films released to educational institutions and systems through the facilities of the Audio Visual Utilization Center of the University; and (3) personal demonstrations conducted in field settings by faculty members involved in on-campus experimentations concerning educational resources.

Although discussions with Michigan Bell Telephone Company and the Columbia Broadcasting System concerning the feasibility of using coaxial cable equipment during the 9 hours of "down" time which exists during each 24-hour period of operation did not produce the desired results, this area of interest is being explored further to determine if some type of arrangements can be made for this service, at little or no cost to the educational institution involved. If this plan can be effected, it would be possible for programs involving analysis and demonstration of

educational resources to be transmitted across the nation by the sponsoring university.

(e) Budgetary Requirements

On July 1, 1965 the presidency of Wayne State University will be occupied by a person other than the one who filled the position at the time the feasibility study was proposed. Under the circumstances complete information concerning Budgetary Requirements for the establishment and operation of a System for a Center for the Analysis and Demonstration of Educational Resources cannot be made at this time. The fact that a system for a Resource Center established on the campus of Wayne State University would be an element of the structure of the Institute for Educational Sciences (see Appendix B for diagram of Institute structure), and as such would be using already established campus facilities available to the Institute, tends to complicate conclusions drawn about budgetary matters associated with the establishment and operation of the Center.

Elements of the budget that can be confirmed at this writing are the following:

1. Personnel

Coordinator of the Center System

Seven Directors of Units composing the System

Secretarial and clerical staff

Research assistants

Consultants

2. Equipment and Supplies

Equipment

Rentals of: (1) space; (2) video tape equipment (production, broadcast and educational); (3) film and slide production equipment; (4) movile unit equipment; (5) computing and data processing equipment; (6) publication facilities; and (7) field settings equipment.

3. Supplies

Video tapes, film, photographic materials and other related production matterials.

Office supplies.

4. Travel

For: (1) personnel associated with the Center System and (2) consultants employed by the System.

5. Miscellaneous

Costs accruing to factors other than those covered by previously stated categories.

Mailing Cost.

Under existing circumstances, no effort will be made in this report to estimate the most probable amount of money necessary to establish a System for a Center for the Analysis and Demonstration of Educational Resources on the campus of an institution of higher education. At a time considered appropriate by the University President's Office, the budget in question will be prepared.

In concluding the report it should be noted that based upon experiences and other data provided by the "feasibility" study, the operation of a System for a Resource Center implies a greater sphere of activity than that which was originally envisioned by early planners of the agency. For example, a dimension that was not foreseen as a potential channel for dissemination of information to the national community was that of affiliations with commercial publishing concerns, and the great potential of the Audio-Visual Utilization Center in this area of concern. Since many publishing houses are giving serious consideration to film, slides, and video tape supplemented by workbooks and textbooks as excellent devices for covering a given subject matter area, the help of the staff of the Audio-Visual Utilization Center should prove invaluable in these dimensions. The willingness of publishing concerns to deal with a Resource Center System is manifestly evident by experiences and dealings which have accrued between many different publishing concerns

and the University during the "feasibility" study. In all, this approach to dissemination of information appears to be most promising at the time of this writing.

APPENDIX A

STUDY I.

TEACHER EDUCATION

This is an interim report on the first phase of the study entitled: An Exploratory Study of the Wayne State University Elementary Student Teaching Cooperative Centers Project. The study is a part of the Wayne State University Cooperative Centers Project under way in the Department of Elementary Education. This project seeks to explore the impact of cooperative planning on the Wayne State University Elementary student teaching program.

At the present stage in the development of teacher education programs, some form of cooperation between teacher education institutions and public schools is vital to both. Teacher education institutions cannot provide student teaching experiences for all of their students in campus schools. Public school systems eagerly seek out well qualified teachers for employment.

The fundamental question is whether or not, within the context of student teaching, university-school cooperation at the level of decision-making and planning will provide higher quality laboratory experiences than will unilateral approaches. As greater numbers of teacher education students are ready to begin their student teaching experiences and as more of these student teachers are concentrated in urban areas the need

for joint university-school ventures in student teaching is apparent. The continued improvement of programs to prepare effective elementary school teachers requires new approaches which more fully utilize the resources of school and university.

The major purpose of this pilot study is to demonstrate the effectiveness of the cooperative teaching center concept. During the course of the study a fundamental concern has been the perception of appropriate roles in student teaching of school principals, supervising teachers, and university supervisors. Does the development of cooperative teaching centers change the perceptions of role of those involved? Do those involved in the Wayne State University Elementary Student Teaching Program believe that the cooperative teaching center approach provides a more effective student teaching experience than the plan which it replaced?

Two serious problems have curtailed the progress of this pilot study:

a. It has not yet been possible to find an instrument that is a simple and direct means for getting estimates of role perceptions from supervising teachers, principals, and university supervisors. Several ideas have been tested and found to be inadequate. The search is continuing.

b. While there are certain basic principles that characterize a cooperative teaching center, each center is unique in that the roles of supervising teachers, principals, and university supervisors differ from one center to another.

These two problems have led us to seek ways of intensively studying the development of individual centers -- with primary emphasis on changes in role perception. Several sub-studies are now under consideration.

STUDY II.

SPEECH

I. Title

An Investigation of the Relationship of Tongue Positions and Hypernasal Voice Quality in Cleft Palate Speech.

II. Review of the Literature

Various authors have suggested for several years that the hypernasality usually associated with cleft palate speech is not only a function of velo-pharyngeal closure but is related, also, to the tongue positions assumed during the articulation of the certain hypernasal sounds. This has been indicated by Kantner,[5] Subtelny,[9] Berry,[1] McWilliams,[7] and Counihan.[3]

Nohrstrom and Anderson[8] have found through x-ray study that the shapes of the tongues of cleft palate children in swallowing are irregular and inconstant as compared with normal children. This becomes pertinent since it has been determined that tongue action in swallowing, chewing and sucking is directly related to articulatory movements of the tongue.[10]

An acoustic analysis of cleft palate speech by Hanson[4] made no attempt to relate the data to the physiology of the tongue.

To date no research has been found to confirm the concept that the tongue, in addition to the velum, is directly related to hypernasality.

Buck,[2] however, has indicated that there is no significant difference between cleft palate and normal speakers with regard to tongue positions assumed in the production of four English vowels.

III. Statement of Problem

It is proposed, therefore, that a real contribution to the understanding and habilitation of the cleft palate child would be made by a study designed to determine whether tongue positioning is a contributing factor to the hypernasality.

IV. Hypothesis

There is a significant difference between the tongue positions assumed in the articulation of voiced fricative continuent speech sounds by children with cleft palate speech and by children with normal speech.

V. Procedures

A. Selection of Subjects

1. The experimental group will consist of twenty hypernasal cleft palate children, seven to nine years of age, whose palatal repairs represent the work of several surgeons.
2. A control group of twenty children with normal articulation and with no apparent hypernasality as determined by a standard articulation test and with normal lip and palatal structures as determined by physical examination will be matched with the experimental group according to age,

sex, I.Q., and use of General American speech. All subjects will have hearing within normal limits re: American norms, intelligence quotients will be taken from official school records.

3. The degree of nasality present in the connected speech of the cleft palate group will be rated by three speech pathologists as being "mild," "moderate" or "severe." This will be from high fidelity tape recordings made in a sound treated environment. A relatively equal distribution of the degree of nasality will thus be gained through the experimental group.

4. Tape recordings of the control group will be randomized with the recorded speech of the experimental group in order to aid in the establishment of the reliability of judgments.

B. Radiographic Recordings

1. Lateral radiographs of the head and neck will be made during the production of the voiced continuant fricative speech sounds /v, ɣ, z, ʒ / using Keiekot equipment with 3000x image intensification. This work will be done at Children's Hospital of Michigan.

   a. All radiographs will be taken by the Chief X-ray Technician at Children's Hospital of Michigan.

b. The Chief of Radiology of Children's Hospital of Michigan will supervise the filming as well as the measurements taken from the films. He will also be responsible for determining the length of exposure time for each subject.

2. Lateral radiographs will be taken of the control group articulating the same utterances as were used with the experimental group.

3. Each subject will be seated between the anode and cassette of the x-ray equipment with the head in position for left lateral-x-rays.

4. A head positioner similar to that described by Kelly and Highley[6] will be used to maintain constancy of the head during the filming of a subject's utterances. This equipment will also provide constancy of the head positions among the various subjects. Each head will be fixed with the Frankfort Plane parallel to the floor. The seat of the subject's chair will be adjustable so as to raise or lower the subject the distance necessary to accommodate his head in the positioner. This will allow the head positioner to remain in a fixed position. The cassette unit and the anode unit will also be held in a constant relationship for all exposures.

5. A radio-opaque material will be applied to the midline of the tongue to provide adequate definition of this structure.

6. Upon receiving a manual signal, the subject will initiate a pre-arranged utterance. The x-ray technician will allow one second to elapse before exposing the film. The subject will maintain production for an additional second following the exposure before being given a signal to terminate the utterance.

7. A tape recording will be made of each utterance simultaneous with the filming of its production. An Ampex 351 full-track recorder with an Electro-Voice Cardioid 666 microphone will be used for this.

8. A grid constructed from Dietzgen millimeter graph paper and of such material as to render the lines radio-opaque will serve as a calibrating tool. This will be placed at the midline of the head positioner after each subject is filmed and an x-ray made of it. This x-ray can then be superimposed upon a film of any subject as a check of inter-subject variation relative to the x-ray equipment. The grid will also be superimposed upon a selected film for the purpose of making the measurements described below.

C. Measurement Techniques

1. In order to gain measurements from the radiographs each film, together with its grid, will be visualized from a standard x-ray view box.

2. One line will be constructed along the Frankfort Plane. Another line will be constructed through the anterior-most point of the tubercle of the atlas bone. This will intersect the first line so as to form an approximate right angle.

3. A line perpendicular to the Frankfort Plane will then be constructed to the high point of the midline of the tongue. This will be measured with a Kouffel and Esser half-millimeter ruler in order to gather information regarding relative tongue positioning.

4. A line perpendicular to the line through the tubercle of the atlas bone will be constructed to the most posterior point of the soft palate. This will be measured with the same ruler in order to gain information regarding velo-pharyngeal stricture.

D. Nasality Ratings

1. The speech sounds of the experimental group will be judged on two occasions by a panel of three expert listeners from

the tape recordings made during the filming procedures. Hypernasality will be rated on a three-point scale as "mild," "moderate," or "severe."

2. Judgments will be statistically analyzed for inter- and intra- judge reliability.

3. This information will be compared with relative tongue positions and with velopharyngeal strictures in order to determine relationships between degree of nasality, articulatory position of the tongue and amount of velopharyngeal stricture.

E. Details of Statistical Analysis

1. Radiographic Measurements

a. Tongue position measurements will be analyzed using an appropriate statistical technique.

b. Group differences and physiological relationships will be evaluated using an appropriate statistical technique.

2. Reliability of Judges

Inter- and intra- judge reliability will be assessed by correlation techniques.

VI. Results

If differences in relative tongue positions are found between the experimental and control groups implications would be in the direction of increased emphasis on articulation therapy with cleft palate speakers.

In addition, the assumption that hypernasality is often a function of articulation will be, in part, either proved or disproved with regard to the population studied.

Finally, the application of techniques devised for this study could prove to be of importance in making other educational and medical recommendations for the training and welfare of the person with a cleft palate.

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9. Subtelny, Joanne D., and Subtelny, J. Daniel, "Intelligibility and Associated Physiological Factors of Cleft Palate Speakers," Journal of Speech and Hearing Research, 2, 4, December, 1959, p. 353.

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I. Title: An Investigation of the Relationship of Tongue Positions and Hypernasal Voice Quality in Cleft Palate Speech.

II. Summary:

It is proposed that a study be undertaken which will show whether a group of cleft palate children articulate hypernasal speech sounds with the tongue positions of children having no apparent speech or voice problems.

In order to accomplish the stated objective, twenty children with repaired cleft palates, ages seven to nine years, will be selected and matched with twenty normals according to age, sex, IQ, use of General American Speech and having normal hearing.

Specific continuant speech sounds, judged to be hypernasal by a speech pathologist, will be selected for the study. The subjects within each group will be recorded on x-ray film as they produce each sound selected for the study. These are to be lateral views. The utterances will be tape recorded simultaneously.

A technique for measuring relative tongue positions has been devised which will result in millimeters of distance from the Frankfort Plane. An adaptation of this technique has also been devised to measure distance between the soft palate and the posterior pharyngeal wall.

A statistical analysis of the acquired data will be performed in order to determine significant differences, if any, in tongue positions for the various sounds between groups.

It is anticipated that the results of this study will, at least in part, either substantiate or refute the assumption that hypernasality is often a function of articulation. Also, if differences in relative tongue positions are found, implications would be in the direction of increased articulation therapy with cleft palate speakers. Finally, some of the techniques devised for this study should prove helpful in making certain other medical and educational determinations concerning the person with a cleft palate.

STUDY III

PROGRAMED INSTRUCTION

Financial support together with personal encouragement of the Director of the Institute of Educational Sciences, has contributed to the demonstration of the feasibility of increasing the role of programed instruction as an important dimension in the science of education. This support has facilitated the introduction of exploratory research in the use of programed instruction with educational psychology college students, gifted students in a local school district, and also with culturally deprived Negro students in Detroit who have shown indications of a marked educational disability. Furthermore, the establishment of the Detroit Society for Programed Instruction, now a chapter of the National Society for Programed Instruction, was made feasible by the early financial support from the Institute of Educational Sciences.

The extent of support and the importance of the contribution from the Institute of Educational Sciences to the development of programed instruction will be better understood following reference to the specific undertakings listed below, all of which were either directly or indirectly supported by the Institute of Educational Sciences. They are in chronological order:

I. The Detroit Society for Programed Instruction; II. Attendance at the National Society for Programed Instruction Convention, 1964;

III. Demonstration of Feasibility of Using Programed Instruction with Culturally Deprived and Educationally Disabled Students.

I. The Detroit Society for Programed Instruction

Following attendance at the National Society for Programed Instruction Convention in San Antonio in March, 1963, it became apparent that Detroit was most probably lagging behind most other metropolitan areas in the organization of a central group which might serve as a focal point for the advancement of programed instruction. Accordingly, discussions were held with the Director of the Institute for Educational Sciences concerning the possibility of receiving some financial support to cover postage, supplies, and other expenses involved in calling a first meeting of people interested in programed instruction. The prime purpose of the meeting was to determine the extent of involvement in the general area of programed instruction by industrial personnel, the schools, and college faculty in Detroit. Support was promised for this initial undertaking and a first meeting was held in 1963. It was attended by 40 to 50 local leaders in education and industrial training. As a result of this first meeting, it was decided to embark upon monthly meetings for the purposes of dissemination of information and for group discussion of the issues involved

in programed instruction. During the past twelve months, monthly meetings have been held and the Society has become the first organized group in Michigan and also the first chapter of the NSPI in Michigan and the fourteenth such chapter in the Nation. (Please see the attached report.)

II. Attendance at the National Society for Programed Instruction Convention, 1964.

Approval and financial support has been provided by the Institute for Educational Sciences which enabled a faculty member to attend the 1964 National Society for Programed Instruction Convention held in San Antonio. This opportunity undoubtedly provided access to numerous research reports directly related to projects underway and projected for Wayne State University.

The impact of the National Society for Programed Instruction Convention held in 1963 was such that membership grew from a few hundred to 2,500 and 10 or more chapters were organized nationally.

III. Demonstration of Feasibility of Using Programed Instruction With Culturally Deprived and Educationally Disabled Students.

A pilot project to determine the extent to which programed instruction can be used to increase the efficiency and effectiveness of the learning process with culturally deprived and educationally deprived has been undertaken with financial support from the

Institute of Educational Sciences.

The project was approved by the Director of the Institute for Educational Sciences and funds have been provided for a research assistant ($400) and also for materials ($100).

The high degree of success and acceptance of this project in the early weeks indicated that a major research project was certainly feasible. A research proposal is currently in preparation.

Summary

In summary, the Institute for Educational Sciences has provided strong support which has led to the establishment of the Detroit Society for Programed Instruction, designed to provide a central organization for the discussion and dissemination of research and related matters. Continued growth and use of this resource group is providing stimulation for research among Wayne State University faculty and students, as well as leaders in industry. The Institute has also provided support for research using programed instruction with culturally deprived-educationally disable students. Support for travel to the National Society for Programed Instruction has also been provided for by the Institute.

DETROIT SOCIETY FOR PROGRAMED INSTRUCTION

1963 - 64

This past year has been devoted to building the organization and to determining the status of programed instruction in the Metropolitan Detroit Area.

Formation of the group was a direct outgrowth of attendance at the NSPI convention by Dr. Derek Nunney of Wayne State University. Support was enlisted from several Wayne faculty members and from local industrial personnel interested in programed instruction. Following this, Dr. Nunney called an introductory meeting in April, 1963 which attracted forty people. Initially, it was decided that the group should operate independently but that affiliation with NSPI would be sought when the group became well established. This was done in the fall of 1963.

Monthly meetings have been held regularly during the past year. These meetings have consistently drawn thirty to forty people with as many as sixty people present on some occasions. Appended to this report is a list and description of the meetings which gives a good indication of the breadth of topics discussed and the extent of member participation.

In addition to the monthly meetings for exchange of information, members have given talks and workshops for teachers and PTA groups.

One very successful venture was a one day institute of Michigan Junior College Administrators. Presentations by Dr. Felix Kopstein of Burroughs Corporation, Mr. Glen Valentine of Michigan Bell Telephone Company, and Dr. Derek Nunney of Wayne State University were followed by a lengthy discussion period. Follow-up talks have resulted in increasing acceptance of programed instruction.

It should be noted, also, that the preparation of a constitution for the group has been a major project which resulted in clarifying the purposes of the organization.

After a very successful first year, the group is well established. Possibly future activities will be directed more at dissemination of information outside of the group and provision of leadership to schools and industry in Southeastern Michigan

SUMMARY OF MONTHLY MEETINGS

DETROIT SOCIETY FOR PROGRAMED INSTRUCTION

1. April 29, 1963. . . This meeting featured a display of programed instruction materials and teaching machines. The display was followed by a discussion of "The Status of Programed Instruction Today" consisting of a presentation of reports of events at the 1963 National Conventions and Conferences.

Following this first meeting, a questionnaire was sent out to the membership asking them to indicate program and format choices for the following meeting and future meetings.

2. May 27, 1963 . . . A. B. F. Skinner film on "Learning and Behavior" was shown. Mr. Glen Valentine of the Michigan Bell Telephone Company gave "A Comparison of the Traditional Method of Instruction and Programed Instruction." This was followed by small group and then entire group discussion.

3. June 26, 1963. . . This meeting was held in conjunction with the National Conference on Selection and Use of Programed Instruction. Along with conference members, the group viewed video tapes on closed circuit TV. Two of the group members discussed their work with programed instruction.

The following officers were also elected at this meeting:

1. President — Dr. Derek N. Nunney, Wayne State Universit
2. Vice President — Dr. Felix Kopstein, Burroughs Corporation
3. Secretary — Dr. John Barson, Wayne State University
4. Treasurer — Mr. Glen Valentine, Michigan Bell Co.

(Note: Dr. Barson left the Detroit area last fall and was replaced as secretary by Dr. James Dunn, Wayne State University.)

4. October 14, 1963 . . . Dr. Felix Kopstein, Director, Auto Instructional Systems Division, Burroughs Corporation, spoke on "Keesler Programed Instruction Project: HOW TO LEARN FROM MISTAKES."

5. November 11, 1963 . . . At this meeting a film was presented entitled: "Teaching Machines and Programed Learning," which showed the three points of view of Lumsdaine, Glaser and Skinner. Norman Licht discussed "The Role of the Teacher in Programed Instruction" which involved group participation in the program "How to Read Transistors." The main speaker was Dr. Juanita Collier who spoke on "Relation of Creativity and Conformity to Programed Instruction." Discussants were Dr. James Dunn and Dr. Derek Nunney.

6. December 9, 1963 . . . Held at the Michigan Bell Technical Training School, this meeting featured a description and discussion of the facilities and programs in use in the school as well as a tour of

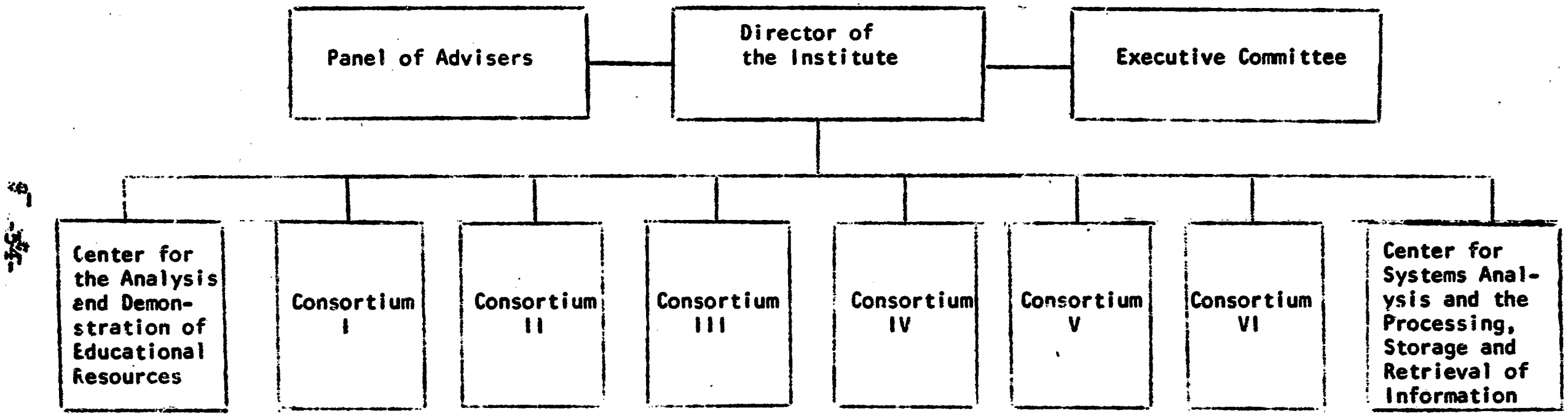
facilities. In addition, Paul V. Hunt, Director, Detroit Special Education Vocational Rehabilitation Project, spoke on "Can Programed Instruction Aid in Service-Trade Preparation?"

7. January 13, 1964 . . . This meeting presented a research report by Dr. Alvin Ugelow of the Burroughs Corporation on "Critical Analysis of Selected Research Articles in Programed Instruction." Also featured was a panel discussion which asked, "Are the Schools Ready to Accept and Utilize Programed Instruction? If so, How Can the Implementation be Facilitated? If Not, Why Not?" Educators participating were: Mrs. Florence Streiph, Dr. Albert Goldberg, Dr. Wandell Hough, and Dr. Robert Lankton. Suburban as well as city schools were represented.

8. February 10, 1964 . . . Edex Multi-Media Teaching Systems were demonstrated and exhibited at this meeting. The featured report on "Selection and Use of Programs" was given by Mrs. Florence Streiph, Programed Instruction Coordinator, Garden City Public Schools with Dr. James A. Dunn, Wayne State University, as discussant.

9. March 9, 1964 . . . This forthcoming meeting will present Mr. Carl Powers, Data Processing Sales Training, Burroughs Corporation. He will report on "An Evaluation of a Programed Instruction Format."

APPENDIX B



SCHEMATIC STRUCTURE OF INSTITUTE FOR EDUCATIONAL SCIENCES

WAYNE STATE UNIVERSITY

BY-LAWS

METROPOLITAN DETROIT BUREAU OF SCHOOL STUDIES

Revised April 12, 1947, May 22, 1947,
January 20, 1948, December 12, 1951,
December 10, 1953, October 6, 1954,
December 12, 1956, October 2, 1957,
December 11, 1957, December 13, 1961,
and December 12, 1962

I. PURPOSE

To define problems of common interest to the member schools, to encourage and coordinate the research programs of these schools, to conduct research on matters of concern to these schools, and to disseminate the results of the research of member schools as well as other research relating to the problems of these schools.

II. MEMBERSHIP

Any school system in the Detroit metropolitan area including Wayne, Macomb, Oakland, Washtenaw, Monroe, and St. Clair Counties will be eligible for active subscription membership in this organization and upon such subscription shall have the right of participating in all meetings and decisions and an equal vote in the organization. The School of Education of the University of Michigan, the College of Education of Wayne State University, and Eastern Michigan University shall have equal and

participating membership in the organization with the public schools represented. Any school or educational institution outside these counties indicated above may apply for non-voting membership (associate) which will include the subscription for publications at the rate of $100 annually.

III. MEETINGS

The annual meeting shall be held on the second Wednesday of December of each year. Other meetings shall be subject to call by the Board of Directors through its Chairman.

IV. OFFICERS

The officers of the organization shall consist of a Chairman, a Vice-Chairman, and a Secretary-Treasurer to be elected by the active subscribing members at the annual meeting.

V. EXECUTIVE BOARD

The Executive Board shall consist of the officers and eight other members elected as the terms of the members of the Executive Board expire, for terms of three years, according to the following classifications: one representing school systems with less than 150 teachers, one representing school systems from 150-250 teachers, two representing school systems with more than 250 teachers, excluding Detroit; one to

Present experimental systems, developed at the Thomas J. Watson Research Center, consist of standard IBM equipment such as:

1. Large-capacity storage units
2. A central processing or computing unit
3. A transmission control unit or message "traffic" regulator
4. A buffer or temporary storage unit
5. Student teaching stations.

Computer-assisted instruction generally follows the pattern of programmed instruction, but represents a significant advance over previous forms of this learning concept. IBM researchers have used computer-assisted instruction to explore a number of techniques that represent major advances over earlier approaches to programmed instruction.

Author

The Coursewriter enables the author to organize the course however he wishes, evaluating the student's capabilities, learning his background, giving him assignments, asking questions, and then directing him to the parts of the course that best suit him. The author may use various sequences of questions, statements, and instructions. He may use the familiar "frames" of programmed instruction, or he may turn to a method of instruction quite dissimilar to it. Not only can he write his course while the students are taking it, but he can also go back and revise immediately if he wishes. The computer's statistical analysis of the students' reactions gives the author an accurate report of the results of his course. Such reports facilitate his readily revising and improving the course based on actual experience even before the students have completed it.

As he receives the reports, he continuously realizes how he can better adapt the course to the individual student. It takes only a few such reports to suggest to the author new and varied levels and paths for students to follow.

Student

The student paces himself, with the knowledge that the program will direct him at the proper time to the part of the course the best suits him.

Students may participate in the course at various times. No prescribed time schedule is necessary. If a student reaches an impasse, he calls for "help" from the computer in the form of the correct answer. The statistical analysis of the student's progress measures his efforts and abilities.

be the Superintendent of Schools in Detroit, or his representative; one to be the Dean of the College of Education, Wayne State University, or his representative; one to be the Dean of the School of Education, University of Michigan, or his representative; and one to be the President of Eastern Michigan University, or his representative. The members representing schools in the three classifications by size shall be elected by a mail vote respectively by the active subscribing members in each such classification.

The Executive Board shall have sole responsibility for determining the budget and appropriations of the Bureau; shall select and charge with responsibilities a Director of the Bureau to manage and carry on its specific activities; shall be responsible for the engagement of other special services needed by the Bureau; shall call special meetings of the subscribing members of the organization at which it shall make reports of progress and determine problems to be studied in the Bureau; and shall establish and maintain suitable quarters for the operation of the affairs of the Bureau. Elected members shall be ineligible for immediate re-election after serving a full term of three years.

VI. ELECTION AND TERMS OF OFFICE

The officers of the Executive Board shall be elected at the annual meeting but shall be ineligible for immediate re-election after serving

Functional Features

The Coursewriter programming system consists of:

1. A monitor to supervise writing and presenting, and
2. An assembler to enable authors to communicate with the computer when writing and revising courses.

The Coursewriter program:

1. Enables authors to write and correct course material while students are taking courses.
2. Enables a proctor, who operates the system, to undertake administrative routines.
3. Collects data on student's responses for later analysis.
4. Enables authors or programmers to add new functional capability to the Coursewriter, if they are thoroughly knowledgeable with the internal program organization.
5. Operates as many as five courses per disk pack simultaneously.

Coursewriter Language

An author writes his course by keying it on the typewriter-style IBM 1052 Printer-Keyboard in the form of sequential instructions. As a guide to the format of this course statements, the author may use a Coursewriter Instruction Sheet, Form X24-3336 (Figure 6). With the Instruction Sheet, a secretary can key in the course material thereby optimizing system time.

When the course is completed or even partially written, students may begin the course from the same or another keyboard. Although typing ability is an advantage, our experience indicates that it is not a necessity.

As the author writes the course, it is stored on the IBM 1316 Disk Pack. He can modify any part of the course at any time, even while students are actively participating in the course. The obvious restriction is that he cannot modify an argument of the course at the same time that a student happens to be at that instruction.

The Coursewriter language has two parts:

1. A sequence of statements written by the author to describe his course and to instruct the program to execute the course.
2. A set of instructions to the Coursewriter assembly to aid the author in writing his course, and to assist the proctor in operating the system.

a full term of three years. Elections shall be for terms of three years. Vacancies occasioned by resignation, death, change of position in a school system, or change of classification shall be filled for the unexpired term by the Executive Board.

VII. SUBSCRIBING MEMBERSHIP RATES

The rate of subscription shall be a uniform rate of $60 per institution subscribing, plus one dollar twenty-five cents for each professional employee in the institution subscribing, with a maximum subscription rate of $610. The School of Education of the University of Michigan and the College of Education of Wayne State University shall assume jointly one-third of the budget responsibility, to be determined by the Executive Board in conference with the respective universities. Eastern Michigan University shall pay an annual supporting fee of $610.

VIII. BENEFITS TO SUBSCRIBING MEMBERS

All schools and colleges which are active subscribing members of the Metropolitan Detroit Bureau of School Studies will be entitled to receive the services of research including the bulletins, monographs, joint research studies, and publications, as well as the privilege of submitting to the Bureau special problems for research, and of receiving research services on these problems, if the Executive Board and the subscribing membership accept them as common to the group or of special significance to the group.

Computer Assisted Instruction provides these important advantages:

A. "Individualized" - the "branching power" of the Operating System permits more effective and logical presentation of course material including various types of remedial and advanced instruction based upon the progress of the individual student.

B. Student Records - the complete detail concerning each student's responses to questions are maintained on Disk Packs. These records can be quickly analyzed on an automatic basis for purposes of directing students to material which is tailored to their specific needs and determining how the course material can be improved. Such analytical methods are extremely impractical with programmed instruction text because of the clerical work that would be involved.

C. Simplified Course Revision - The Coursewriter language provides powerful "author routines" which permit a simplified and efficient method for quickly modifying and/or relocating course material. Modifying programmed instruction text is not only tedious to the point of being impractical but also an expensive operation because of the requirement for redocumentation in hard copy form.

D. Disciplinary - The actual use of programmed instruction text must usually be left to the attitude and whim of the student. In addition, it relies on the student's "honesty" in progressing through the course because it cannot completely monitor his progress through the material. CAI is more of a disciplinarian. In other words, it can "insist" on the correct answer before the student is permitted to progress further through the course. In addition, by measuring his performance and by extensive branching it can be sure that a student's mastery is adequate before taking him on through further materia.

IX. AMENDMENT

These By-laws may be amended by a two-thirds vote of active subscribing members present at any regular or special meeting of members, written notice of the proposed amendment having been mailed to all active subscribing members at least fifteen days in advance of the meeting.

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LA    Q1          (8(99
QU    WHAT IS 2³?  TYPE YOUR ANSWER AS A NUMERAL WITHOUT A DECIMAL POINT.
CA    4
TY    CORRECT
WA    4.
WB    4.0
WB    4.00
WB    FOUR
TY    CORRECT, BUT RETYPE YOUR ANSWER AS A NUMERAL WITHOUT A DECIMAL POINT.
WA    22
TY    ³ IS AN EXPONENT, NOT ANOTHER WAY OF WRITING 2.  TRY 2³ AGAIN.
WA    2.2
TY    ³ IS AN EXPONENT, NOT ANOTHER WAY OF WRITING .2 .  TRY 2³ AGAIN.
WA    0
TY    DO NOT ADD OR SUBTRACT THE BASE AND THE EXPONENT.  2³ ≠ 2-2.
      TRY 2³ AGAIN.
UN    IF YOU DO NOT KNOW THE TERMINOLOGY OR OPERATION, ENTER ?  .  OTHERWISE,
      TRY 2³ AGAIN.
WA    ?
TY    IN THIS PROBLEM  2  IS THE BASE AND  ³  IS THE EXPONENT.  THE
      EXPONENT TELLS HOW MANY TIMES THE BASE IS MULTIPLIED BY ITSELF.
UN    2³ = 2¹⁺¹= ??
UN    2³ = 2¹⁺¹ = 2¹·2¹=??
UN    2³ = 2¹⁺¹ = 2¹·2¹ = 2·2 = ??
LA    Q2          (81((
QU    WHAT IS 2³?
CA    8
TY    CORRECT
WA    5
TY    DO NOT ADD THE BASE AND THE EXPONENT.  2³≠2+3.  TRY 2³ AGAIN.
WA    6
TY    DO NOT MULTIPLY THE BASE AND THE EXPONENT.  2³≠2·3.  TRY 2³ AGAIN.
```

SUPERINTENDENTS AND PERSONNEL OFFICERS

SIX-COUNTY AREA

SOUTHEASTERN MICHIGAN

Airport Community Schools 11270 Grafton Rd., Carleton 48117	Joseph C. Sterling, Supt.	OL 4-5601
Algonac Community Schools 1300 St. Clair Blvd. 48001	Kenneth S. King, Supt. Jack Greenstein, Dir. of Curr.	794 - 3141
Allen Park Public Schools 19001 Champaign 48101	William C. Harris, Supt. John E. Wysoski, Asst. Supt.	383 - 3300
Anchor Bay Schools, 51880 Washington New Baltimore, Michigan	William R. Nuse, Supt.	RA 5-2881
Ann Arbor Public Schools 1220 Wells 48104	Jack Elzay, Supt. Thad Carr, Dir. of Personnel	662-5564
Armada Area Schools 23550 Center Road 48005	Edward J. Stafinski, Supt.	784-4751
Avondale School District, 1435 W. Auburn Auburn Heights, Mich. 48057	George E. Shackelford, Supt.	852 - 4411
Bedford Public Schools 8486 Douglas Rd., Temperance 48182	Charles A. Scheltema, Supt.	847 - 2725
Berkley City School District 3127 Bacon 48072 2077 Oxford 48072	Dr. Donald S. Roe, Supt. Ralph F. Tyndall, Asst. Supt. in charge of Instruction	LI 3-6000 548 -1455
Birmingham Public Schools Chester at Martin Streets 48012	Dr. John B. Smith, Supt. Kenneth F. Nagley, Dir. of Personnel	MI 4-9300 Ext. 311
Bloomfield Hills School District 4200 Andover Road 48013	Eugene L. Johnson, Supt. Mrs. Ellen F. Beauchamp Administrative Assistant	647 -1224
Brandon Schools 209 Varsity Dr., Ortonville 48462	Burl A. Glendening, Supt.	NA 7 -3755
Brownstown No. 1. Fractional 28639 Division St., Flat Rock 48134	Charles Goulding, Supt. Thomas Simpson, Adm. Asst.	ST 2 -2450
Capac Community School District 201 N. Neeper Street 48014	Robert C. Sloan, Supt.	395-4321
Center Line Public Schools 6775 Ten Mile Road 48015	Clarence E. Crothers, Supt. Mrs. Nelle S. Beasley, Coordinator	757-7000
Chelsea School District Washington Street 48118	Charles S. Cameron, Supt. Charles H. Lane, Principal	GR 5-3461
Cherry Hill School District 28500 Avondale, Inkster 48141	Allan M. Mathison, Supt.	PA 8-0100

Chippewa Valley Schools 19230 Cass Ave., Mt. Clemens	48043	Robert P. Koloff, Supt.	468-0814
Clarenceville School District 20210 Middlebelt Rd., Livonia	48152	Louis E. Schmidt, Supt. Mrs. Lydia Lear, Curr. Coordinator	474-8900
Clarkston Community Schools 6595 Middle Lake Rd.	48016	Dr. Leslie F. Greene, Supt. Floyd F. Vincent, Adm. Asst.	625-1126
Clawson School District 101 John M Street	48017	Eugene N. Spencer, Supt.	588-7500
Clintondale Public Schools 35200 Little Mack, Mt. Clemens	48043	Marlynn C. Hallman, Supt. Robert D. Bradley, Asst. Supt.	465-1321
Custer School District 5003 West Albain Rd., Monroe	48161	Melvin G. Waltz, Supt.	CH 1-1450
Dearborn Public Schools 5757 Neckel	48126	Stuart L. Openlander, Supt. Paul E. Johnston, Pers. Dir.	LU 1-2018 Ext. 247
Dearborn District #4 25225 Richardson, Db. Hts.	48127	Howard E. Parr, Supt.	LO 5-0537
Dearborn District #7 4650 Mayfair Dbn. Hts.	48125	Oakley W. Best, Supt. Angelo G. Batsakis, Dir. of Instr.	CR 8-1900
Dearborn District #8 3601 Janet, Dbn. Hts.	48125	Dr. Roderick J. Smith, Supt. Ben J. Karwoski, Director Curriculum & Personnel	LO 5-1900
Detroit Public Schools 5057 Woodward, Detroit	48202	Dr. Samuel M. Brownell, Supt Dr. Robert E. LeAnderson Assistant Superintendent	833-7900 Ext. 2151
Dexter Community Schools 2710 Baker Road	48130	Nick A. Ianni, Supt.	HA 6-5861
Dublin School, White Lake Township 9260 Sandyside Drive Union Lake, Rte. #5	48085	Nelson G. O'Shaughnessy, Supt.	EM 3-4175
Dundee Community Schools	48131	Harry B. Nelson, Supt.	LA 9-2220
East China Public Schools 2380 S. Riverside Dr., St. Clair	48079	Dr. Paul H. Appel, Supt.	329-4774
East Detroit School District 15700 Nine Mile Road 15501 Couzens	48021 48021	Charles A. Goetz, Supt. Marie Daly, Dir. Elem. Educ. Dr. Charles M. Greig, Acting Dir. Secondary Education	PR 6-9700
Ecorse Public Schools 27385 W. Outer Drive	48229	Ralph E. Brant, Supt. Hans E. Lantzsch, Adm. Asst.	DU 2-8600
Fairlane School District 22586 Ann Arbor Trail, Dbn. Hts.	48127	Robert R. Rutila, Supt.	LO 1-5500
Farmington Public Schools 32500 Shiawassee	48024	Gerald V. Harrison, Supt. Marinus VanAmeyde, Assistant Superintendent	GR 4-9450 GR 4-5080

Ferndale School District 130 E. Nine Mile Road 48220	John J. Houghton, Supt.	LI 7-2200
Fitzgerald Public Schools 23200 Ryan Road, Warren 48091	Earl S. Eidt, Supt. Perry D. Chatterton, Assistant Superintendent	757-7070 539-6800
Fraser Public Schools 32101 Caroline 48026	Howard C. Richards, Supt.	293-1160
Garden City Public Schools 29155 Bardo - Box 218 48135	Dr. Edwin J. O'Leary, Supt. Bracken L. Snow, Asst. Supt.	GA 4-1500
Gibraltar School District 33494 River Road, Rockwood 48173	Bernard E. Hill, Supt.	DR 9-9615
Grosse Ile Township Schools 23270 East River Road 48138	Robert B. Smith, Supt. Clarence H. Schantz Curriculum Coordinator	676-0404
Grosse Point Public Schools 389 St. Clair 48230	Dr. Charles H. Wilson, Supt. Lawrence F. Kennedy, Dir. of Pers.	TU 5-2000
Hamtramck School District 11410 Charest 48212	John E. Tishuck, Supt.	TW 3-7420
Harper Woods School District 20225 Beaconsfield 48236	Joseph H. Gregory, Supt.	VE 9-1296
Hazel Park School District 22929 John R. 48030	Dr. Wilfred D. Webb, Supt.	LI 7-4500
Heintzen Public School District 15100 Northline, Southgate 48195	John W. Simonds, Supt. Kenneth D. Walker, Asst. Supt.	283-0550 283-0553
Highland Park Public Schools 12541 Second Avenue 48203	Norman P. Weinheimer, Supt. Dr. Paul H. Jones, Asst. to Supt. in Charge of Personnel	TO 8-1264
Holly Area Schools 805 E. Sherman 48442	George G. Garver, Supt.	637-4911
Huron School District 24820 Merriman Rd., New Boston 48164	Thomas P. Krakker, Supt.	ST 2-9668
Huron Valley Schools 2380 S. Milford Rd., Milford 48042	Erwin M. Johnson, Supt. Arthur E. Burklund, Elem. Educ.	685-1551
Ida Public Schools Ida, Michigan 48140	Harry P. Firestone, Supt.	AN 9-3110
Inkster Public Schools 29115 Carlysle 48141	Dr. Lino S. Michelson, Supt. Arthur W. Meek, Asst. to Superintendent	PA 2-5310 CR 8-4722
Jefferson Schools 5102 N. Stony Creek, Monroe 48161	Harold F. Sodt, Supt.	CH 1-1033
Lake Orion Community Schools 455 Scripps Road 48035	A. A. Reed, Supt.	MY 2-2131

Lakeview Public Schools 25901 E. Jefferson, St. Clair Shores	48081	James H. Rossman, Supt. Dr. Jerry J. Herman, Asst. Supt.	771-0200
Lamphere Public Schools 235 E. Thirteen Mile Road Madison Heights	48071	Dr. Fred D. Thorin, Supt. Dr. Kenneth H. Parker, Director of Pupil Services	588-5400
L'Anse Creuse Public Schools 38495 L'Anse Creuse Road Mount Clemens	48043	Fred V. Pankow, Supt. Harry L. Wheeler, Asst. Supt. Elem. Dr. Robert G. Lutz, Asst. Supt., Sec.	HO 3-8671
Lincoln Consolidated School 7425 Willis Rd., Ypsilanti	48197	Vernon H. Jones, Supt.	482-8710
Lincoln Park School District 1545 Southfield	48146	Everett T. Winslow, Supt. Raymond H. Lindenberg, Asst. Supt.	DU 6-4300
Livonia Public Schools 15125 Farmington Road	48154	Benton Yates, Supt. Mrs. Zena Sperry, Director Teacher Personnel	GA 2-1200
Madison District Public Schools 26524 John R, Madison Hgts.	48071	F. Foster Wilkinson, Supt. Gerald F. Bush, Asst. Supt.	LI 7-5186
Manchester Public Schools 410 City Road	48158	Harold A. Springsteen, Supt.	GA 8-9411
Marysville Public School District 1325 Michigan Avenue	48040	Norris A. Hanks, Supt.	364-7731
Mason Consolidated Schools Erie, Michigan	48133	Herbert A. Ostrander, Supt.	848-5475
Melvindale-Northern Allen Park Public Schools - 18530 Prospect Melvindale, Michigan	48122	Richard D. Evans, Supt.	DU 2-4300
Memphis, Community Schools 34165 Bordman Road	48041	Paul C. Shank, Supt.	EX 2-2550
Milan Area School District 920 North Street	48160	George Beale, Supt.	HE 9-9531
Monroe Public Schools 1275 N. Macomb Street	48161	Harold C. Rapson, Supt. Anthony P. Witham, Asst. Supt. Instr.	CH 1-0330
Mount Clemens Community School District 167 Cass Avenue	48043	William L. Berkhof, Supt.	HO 8-2613
Nankin Mills School District 31876 Ann Arbor Trail, Garden City	48135	D. Harlan Hudgins, Supt.	GA 5-2400
New Haven Community School District 30375 Clark	48048	Edward F. Siefert, Supt.	PI 9-5131
North Dearborn Heights School District 25900 W. Warren Rd., Dbn. Hts.	48127	Dr. Alton W. Cowan, Supt.	LO 1-3469
Northville Public Schools 501 West Main	48167	Russell H. Amerman, Supt. Dr. Kenneth M. MacLeod, Asst. Supt.	349-3400
Novi Community Schools 41909 Quince Drive	48050	Thomas E. Culbert, Supt.	FI 9-2110

Oak Park School District 13900 Granzon	48237	Dr. James N. Pepper, Supt. Dr. Clifford B. May, Asst. Supt. for Instruction	LI 8-0200
Oxford Area Community School District 96 N. Washington	48051	Roger D. Oberg, Supt.	628-2591
Plymouth Community School District 1024 South Mill Street	48170	Russell L. Isbister, Supt.	GL 3-0200
Pontiac City School District 40 Patterson Street	48048	Dr. Dana P. Whitmer, Supt. Lewis A. Crew, Dir. of Personnel	FE 2-9175
Port Huron Area School District 509 Stanton Street	48061	Gerald C. Bradley, Supt. Gerald S. DeGrow, Dir. of Instr.	YU 2-8548
Redford Union School District 18499 Beech-Daly Road Detroit		Russel S. Hilbert, Supt. James W. Mathieson, Assistant Superintendent, Instruction	KE 5-2000
Richmond Community School District 35320 Division Road	48062	Urey B. Arnold, Supt.	RA 7-3565
River Rouge Public Schools 1411 Coolidge Hwy.	48218	Glenn K. Bowen, Supt.	VI 2-4438
Riverview Community School District 12431 Longsdorf, Wyandotte	48194	William L. Hetzman, Supt. Willis F. Porter, Asst. Supt.	AV 2-8600
Rochester Community School District 4th & Wilcox Streets	48063	Dr. William J. Early, Supt. Douglas B. Lund, Asst. Supt., Instr.	652-9031
Romeo Community Schools 297 Prospect Street	48065	Taisto C. Filppula, Supt.	PL 2-3496
Romulus Township School District 11401 Olive Street	48174	Robert L. McConeghy, Supt. Robert C. Pregitzer, Asst. Supt.	WH 1-1600
Roseville City School District 18175 Eleven Mile Road	48066	Carl Brablec, Supt. Dan A. Shirtliff, Asst. Supt. Mrs. Margaret Bronson, Asst. Supt. for Elementary Education	PR 1-9200
Royal Oak City School District 1026 N. Main Street	48067	Donald M. Currie, Supt. Edward W. Hoot, Asst. Supt.	LI 2-9000
St. Clair Shores City School District 23100 Thirteen Mile Road	48082	Thomas L. Alberts, Supt.	293-2400
Saline Area Schools Saline-Ann Arbor Road	48176	Leo L. Jensen, Supt.	429-9260
Southfield Public Schools 24675 Lahser Road	48075	Dr. John W. English, Supt. Norman C. Olmsted, Asst. Supt.	EL 6-0400
Southgate Community Schools 13940 Leroy Avenue	48195	George N. McCormick, Supt.	AV 2-1440
South Lake Schools, 23700 Mack Ave. St. Clair Shores	48083	John W. Lewis, Supt. Philip C. Thorson, Asst. Supt.	PR 6-6400
South Lyon Community Schools 310 N. Warren Street	48178	Frank E. Bartlett, Supt.	GE 7-7981

South Redford School District 26255 Schoolcraft Rd., Detroit 48239		Merlin D. Roe, Supt.	KE 5-4000
Summerfield Public Schools Petersburg, Michigan	49270	Ross M. Cox, Supt.	BR 9-1035
Sumpter School District 23501 Sumpter Rd., Belleville 48111		Lloyd D. Daniels, Supt.	HO 1-6301
Taylor Township School District 24715 Wick Road	48180	Orville J. Jones, Supt. Simon Kachaterian, Asst. Supt.	291-1300
Trenton Public Schools 2603 Charlton Rd.	48183	Dr. Otto C. Hufziger, Supt. George E. Wendt, Asst. Supt.	676-8600
Troy Public Schools 120 Hart Street	48084	Dr. Rex B. Smith, Supt. Boyd R. Larson, Asst. Supt.	MU 9-0600
Utica Community Schools 8344 Hall Road	48087	Fred M. Atkinson, Supt. Floyd H. Ebeling, Asst. Supt.	731-7460
Van Buren Public Schools 501 W. Columbia, Belleville 48111		Harold O. Wetherell, Supt.	OX 9-2231
Van Dyke Public Schools 22100 Federal Ave., Warren 48089		Max M. Thompson, Supt.	SL 7-6600
Walled Lake Consolidated Schools 615 N. Pontiac Trail	48088	Clifford H. Smart, Supt. Rolland J. Langerman, Asst. Supt.	MA 4-1541
Warren Consolidated Schools 11044 Common Rd., Warren	48093	Dr. Paul K. Cousino, Supt. Kingsley, G. Sears, Jr., Dir. Pers.	755-0400
Warren Woods Public Schools 27450 Schoenherr Rd., Warren 48093		Robert S. Tower, Supt.	PR 5-1012
Waterford Township Schools 3101 W. Walton Blvd., Pontiac 48055		Dr. Don O. Tatroe, Supt. M. Barrett Vorce, Asst. Supt.	674-0444
Wayne Community School District 3714 South Wayne Road	48184	Dr. Clarence E. Hinchey, Supt. Donald C. Boyd, Dir. of Personnel	PA 2-1500
West Bloomfield Schools 3380 Orchard Lak Rd., Orchard Lake	48034	Dr. Leif A. Hougen, Supt.	682-3555
Whiteford Argicultural School 6655 Consear Rd., Ottawa Lake 49267		Forrest N. Armock, Supt.	856-1443
Whitmore Lake Public School District 8845 Whitmore Lake Rd.	48189	Frederick W. Krueger, Supt.	449-9881
Willow Run Public Schools 2049 E. Michigan, Ypsilanti 48197		Robert J. Stevenson, Supt.	HU 2-2870
Wyandotte City School District 639 Oak Street	48193	Peter J. Jenema, Supt. Fred P. Davenport, Asst. Supt.	AV 4-3100
Yale Public Schools 103 W. Mechanic St.	48097	Philip F. Hanson, Supt.	FU 7-3231
Ypsilanti Public Schools 300 W. Forest	48197	Dr. Paul H. Emerich, Supt.	HU 2-2970

APPENDIX C

COMPUTER ASSISTED INSTRUCTION - IBM COURSEWRITER

Programmed Instruction

For many years, self-instruction devices or "teaching machines" have been available. Although their value as "teachers" may be limited, many have been found valuable in helping the student to progress at this own rate according to his abilities. Most of these techniques can be grouped under the name of programmed instruction.

A number of educators and researchers have contributed to the recent increase in interest in teaching machines. In 1954, B.F. Skinner described an experimental teaching device designed to present a carefully programmed set of instructions. He introduced the use of constructed answers instead of multiple choice. He placed great importance on carefully organized programming of the course material, reinforcing the student's answer at each step.

As we know it today, a programmed-instruction course presents instructions, questions, answers, and other information to the individual student in a carefully planned sequence (program). Because he actively participates in the course, the student is continuously aware of his progress. Every error he makes is followed immediately with information to help him understand what led him to make the mistake, which he is often required to correct.

In a well-prepared program the student progresses according to his individual capabilities. The more capable student moves faster because he makes fewer errors. The slower student receives the practice and information he needs to aid him in learning. As he grasps the subject, he progresses through the course.

Computer-Assisted Instruction

A relatively new method of instruction with many of the advantages of the individual-student instruction is called Computer-Assisted Instruction (CAI). This method allows the instructor to use the computer as a means of disseminating his instruction to a number of students individually.

The present concept of computer-assisted instruction evolved from a system developed by William R. Uttal in 1961. Experiments were performed with a modified IBM 650 Data Processing System and specially designed electrical equipment to connect the student stations to the computer.

A 9

TY WHICH IS THE BASE AND WHICH IS THE EXPONENT? $2^3 \neq 3^2$. TRY 2^3 AGAIN.

WA -1

WB 1

WB +1

TY DO NOT SUBTRACT. $2^3 \neq (2-3)$ OR $(3-2)$. TRY 2^3 AGAIN.

WA 23

TY 2^3 IS NOT ANOTHER WAY OF WRITING 23. ^{3} IS AN EXPONENT. TRY 2^3 AGAIN.

WA 2.3

TY 2^3 IS NOT ANOTHER WAY OF WRITING 2.3 . ^{3} IS AN EXPONENT.
TRY 2^3 AGAIN.

UN IF YOU DO NOT KNOW WHICH IS THE BASE AND WHICH IS THE EXPONENT,
ENTER DEFINITION .

TY IF YOU DO NOT UNDERSTAND THE OPERATION INVOLVED, ENTER OPERATION .

TY OTHERWISE, TRY 2^3 AGAIN.

WA DEFINITION

TY THE BASE IS 2 , THE EXPONENT IS ^{3} .

WA OPERATION

TY THE EXPONENT TELLS HOW MANY TIMES THE BASE IS MULTIPLIED BY ITSELF.
FOR EXAMPLE, $5^4=5 \cdot 5 \cdot 5 \cdot 5$.

UN $2^3 = 2^{2+1} = ??$

UN $2^3 = 2^{2+1} = 2^2 \cdot 2^1 = ??$

UN IF YOU DO NOT REMEMBER THE VALUE OF 2^2, ENTER ? .
OTHERWISE, TRY 2^3 AGAIN.

WA ?

TY ALL RIGHT, TRY TO ANSWER THE QUESTION...

BR Q1 (81((A

UN $2^3=2^{2+1}=2^2 \cdot 2^1=2^2 \cdot 2=??$

UN $2^2=4$ $2^2 \cdot 2= ??$

LA Q3 (812(

QU WHAT IS 3^2+3^1?

CA 18