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ABSTRACT

This publication is part 1 of a two-part paper that presents design specifications for the Wisconsin System of Instructional Management (WIS-SIM), a computerized management system for instructional programs that are compatible with the Individually Guided Education model. WIS-SIM incorporates processes for placement testing, performance profiling, and specifying performance specifications to aid in diagnosing and identifying students' instructional needs. Once instructional needs have been identified, WIS-SIM aids in guiding the instructional process and selecting appropriate instructional activities, and in evaluating the success of the instructional program. This part of the paper first presents a theoretical overview of WIS-SIM, discusses the data base design for the system, describes the features and capabilities of the basic WIS-SIM program, and discusses various options that can be used to expand the utility and efficiency of the basic program. (Author/JG)

Working Paper No. 133 (Part 1 of 2 Parts)

DESIGN SPECIFICATIONS FOR THE GENERALIZED WISCONSIN SYSTEM FOR INSTRUCTIONAL MANAGEMENT (WIS-SIM)

by

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with

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WISCONSIN RESEARCH AND DEVELOPMENT CENTER FOR COGNITIVE LEARNING

MISSION

The mission of the Wisconsin Research and Development Center for Cognitive Learning is to help learners develop as rapidly and effectively as possible their potential as human beings and as contributing members of society. The R&D Center is striving to fulfill this goal by

- conducting research to discover more about how children learn
- developing improved instructional strategies, processes and materials for school administrators, teachers, and children, and
- offering assistance to educators and citizens which will help transfer the outcomes of research and development into practice

PROGRAM

The activities of the Wisconsin R&D Center are organized around one unifying theme, Individually Guided Education.

FUNDING

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ABSTRACT

This paper deals with design specifications of a generalized system of computer management for instructional programs which are compatible with the model of Individually Guided Education (IGE). Computer managed instruction (CMI) seeks to facilitate processing information and supplying this information at appropriate times and places so that it is directly applicable to instructional decision making.

A model for the generalized WIS-SIM is developed. This model incorporates the processes of testing, performance profiling, specifying performance expectations, diagnosing and identifying instructional needs, guiding the instructional process and selecting appropriate educational experiences and settings, instructing, and evaluating the instructional program.

The information flow in the generalized system is discussed and the related data bases are specified. The developmental schedule is given and an approach to evaluation is outlined.

I

THEORETICAL OVERVIEW OF THE WISCONSIN SYSTEM OF INSTRUCTIONAL MANAGEMENT (WIS-SIM)

The purpose of this paper is to present the design specifications of a generalized system of computer management for instructional programs which are compatible with the model of Individually Guided Education (IGE)--a comprehensive system of education designed to produce higher educational achievements through providing for individual differences between students in areas such as rate of learning and learning style. The Generalized Wisconsin System for Instructional Management (WIS-SIM) is being developed to serve the management needs of IGE. Although the overall concept of IGE includes components such as a multiunit organization, provisions for a variety of curriculum materials, evaluative procedures, and a program for home-school-community relations, it is the Instructional Programing Model (IPM) which is especially important for the design of the computer management system.

The IPM assumes the existence of a set of measurable objectives for a curriculum area. It is designed to take into account the pupil's beginning level of performance, rate of progress, style of learning, motivational level, and other characteristics important in the context of the educational program of the school. This Instructional Programing Model, presented in Figure 1, is the basis for curriculum components developed at the Wisconsin Research and Development Center for Cognitive Learning.

Development of a curriculum component includes a number of steps as shown in Figure 2. First, goals are developed for a given curriculum area.

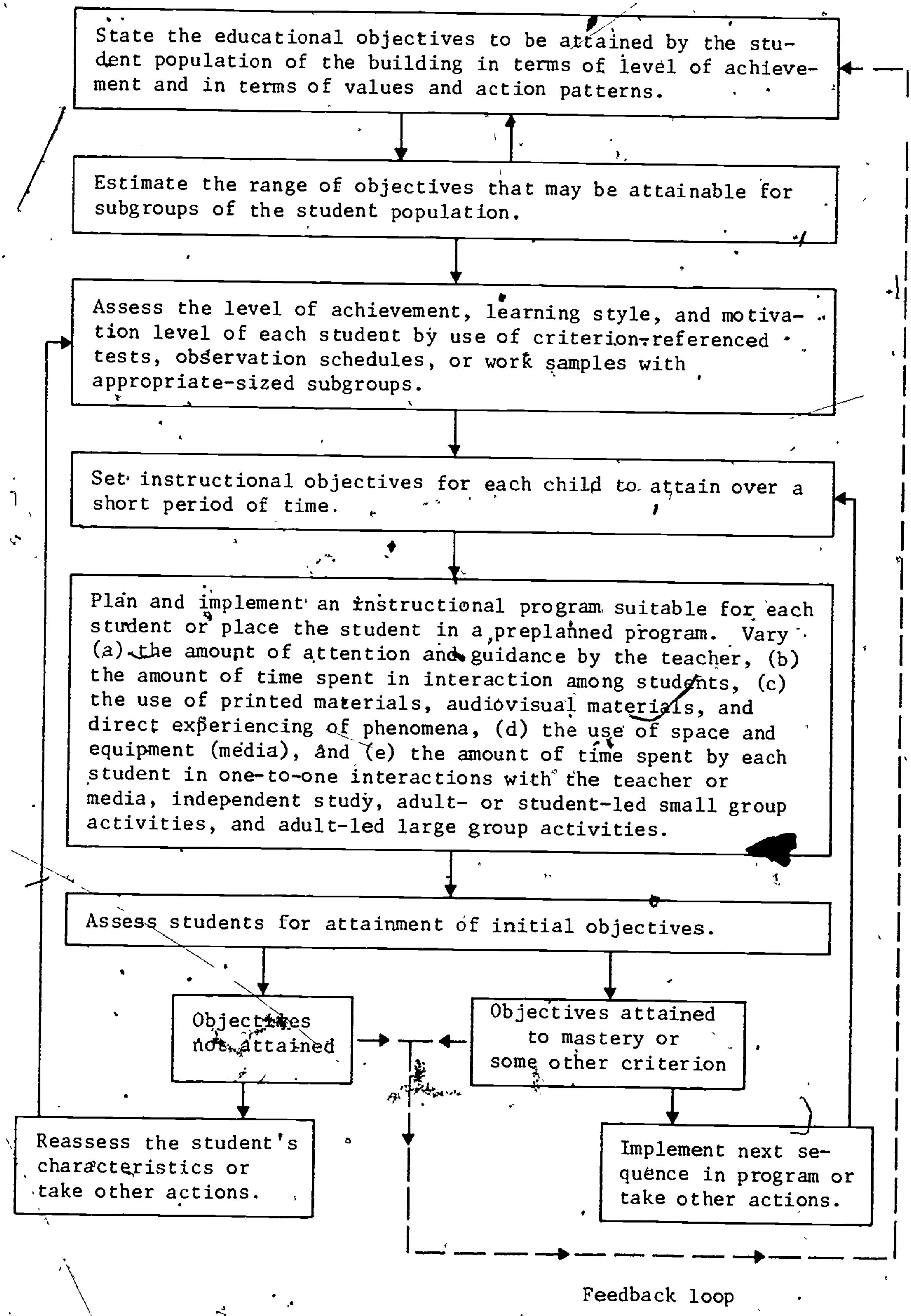

Figure 1. Instructional Programing Model in IGE.

(Based on Klausmeier, H. J., Quilling, M. R., Sorenson, J. S., Way, R. S., & Glasrud, G. R. Individually Guided Education and the Multiunit School: Guidelines for Implementation, 1971.)

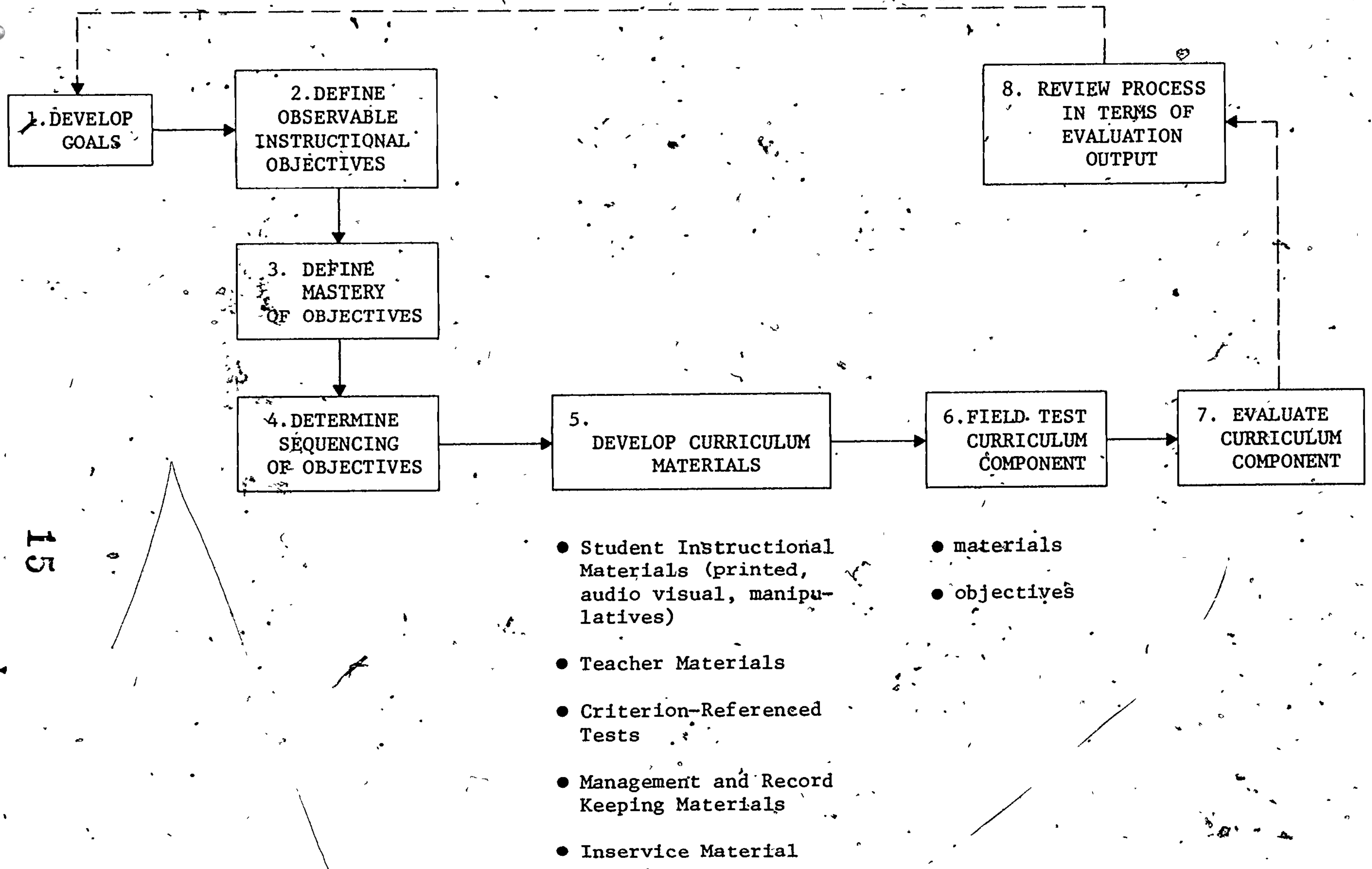

Figure 2. Steps in the development of a curriculum component.

(Belt, S. L., & Skubal, J. M. Individually Guided Education and the Wisconsin System for Instructional Management, 1974)

Within the goals, observable instructional objectives must be defined. The mastery level of those objectives must be determined and the sequencing of the objectives established. Curriculum materials, which include student instructional materials, teacher materials to facilitate instruction, criterion-referenced tests to assess mastery, and materials for management, record keeping, and inservice training, are then developed. After the curriculum materials have been prepared they are field tested. The specific materials and the program as a whole are then evaluated in terms of field test results.

The Instructional Programing Model encourages each IGE school to periodically review and restate its educational objectives to suit the characteristics of its students. Thus, although the Wisconsin R & D Center is developing curriculum components in a number of areas, an ongoing task of the staffs of individual schools is the adoption and adaptation of curricula to suit the characteristics of their students. In some cases this will mean adoption of curricula developed by the Wisconsin R & D Center. In other cases, materials developed by other research and development centers and laboratories or by commercial publishers will be adopted. Occasionally, in order to meet special community needs, schools will find it necessary to develop their own curriculum materials.

Klausmeier (1974) has identified a three-dimensional model useful in classifying individualized curricula. The three dimensions of this model, as illustrated in Figure 3, are sequenced or non-sequenced objectives, common or variable objectives, and full mastery or variable attainment. Combinations of these three variables define eight possible types of individualized curricula.

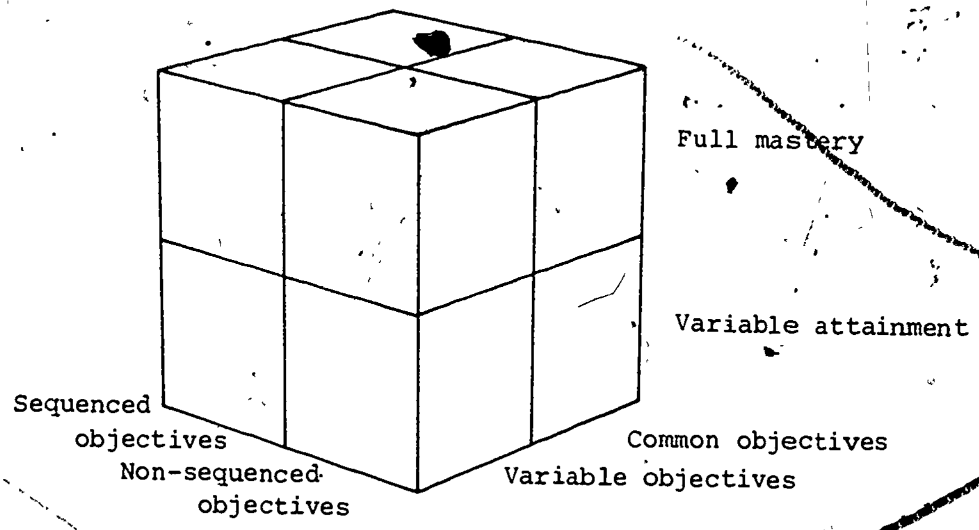

Figure 3. Dimensions defining programs of individualized education.

Spuck, Hunter, Owen, and Belt (1975, p. 5) present a hierarchy which relates instructional objectives to the overall instructional missions of the school or school district. Figure 4 uses three instructional programs which are commonly encountered in IGE settings to illustrate this hierarchy. Although all levels of the hierarchy have implications for computer managed instruction, the last two levels, instructional objectives and instructional modules, have the major impact on the design of a CMI system. Instructional objectives are the building blocks of instructional programs. It is at this level that assessment of student performance takes place, and it is this level which guides the development of specific instructional materials and activities.

Instructional mission	Mission statements of the school or district				
Instructional programs	Wisconsin Design for Reading Skill Development (WDRSD)			Developing Mathematical Processes (DMP)	Science...A Process Approach (SAPA)
Instructional area	Word Attack	Study Skills	Comprehension	Not Applicable	Not Applicable
Organization of material related to traditional grade levels	Levels A-D	Levels A-G	Levels A-G	Levels K-6	Levels K-6 (15 modules per level)
Instructional modules (Organization of material for purposes of short-term instruction and instructional group formation)	Skill Cluster	Skill Cluster	Skill Cluster	Topic	Module
Instructional objectives (Level at which assessment takes place)	Skill	Skill	Skill	Objective	Objective

Figure 4. The structure of curricula for three illustrative programs.

Curriculum developers group appropriate instructional objectives into instructional modules in order to establish efficient and effective instructional settings. When doing this, the curriculum developer must consider the following three factors:

1. Prerequisite structure
2. Compatibility of objectives
3. Logistics

Obviously, the development of instructional modules must not violate the prerequisite structure which was established in the instructional program. Compatibility has to do with the appropriateness of teaching certain objectives together and the extent to which such interaction contributes to learning effectiveness. Logistic considerations include the availability of resource materials, and such factors as space requirements and the length of time required to conduct specific demonstrations and/or experiments.

THE MANAGEMENT OF INDIVIDUALIZED INSTRUCTIONAL PROGRAMS

Individualized programs are often quite complex in design and even more complex in operation. While the task of creating an initial list of goals or objectives for a particular curriculum area may be difficult, the task of keeping track of students as they progress through the various goals or objectives is an even greater problem. The teacher's task is made difficult by the need to assess initial performance levels for each curriculum unit, make a diagnosis based on the results of that testing, guide the instructional activities and give a criterion-referenced test to ascertain levels of goal attainment for each student.

During 1974, Local Education Agency personnel were involved in a series of data collection experiences utilizing the Delbecq Nominal Group

Technique (Evers, Karges, Krupa, 1975). Nine problem areas were identified. Of these, management of individualized instruction--including planning of individualized programs, grouping of students, diagnosis, remediation, and record-keeping--was rated as a major concern. The most crucial problem involved the initially considerable support needed to provide facilities and resources and the continuing need for financial assistance to support management of individualized instruction.

A comprehensive, manually operated system of individualized instruction does not appear to be particularly feasible. Rather, it seems evident that individualized instructional programs must rely upon automated information storage, processing, and retrieval mechanisms. Areas of an individualized system which are difficult to manage manually relate to the capture, storage, and retrieval of information. Lists of objectives for each instructional area need to be formulated, filed, constantly updated, and maintained. They need to be continually reviewed in terms of both group and individual progress. Pupil performance on assigned objectives must be recorded and reviewed. Testing of pupils occurs at both pre- and post-instructional stages and machine scoring of these tests is particularly feasible and desirable, especially for comprehensive placement tests. Perhaps most important of all, reports to pupils, teachers, school administrators, and parents which can assist them in the process of decision making can be provided rapidly and frequently when a system of computer managed instruction is employed.

THE WISCONSIN SYSTEM FOR INSTRUCTIONAL MANAGEMENT

Computer managed instruction (CMI) systems seek to facilitate the processing of information and supplying this information at appropriate times and places so that it is directly applicable to instructional decision making. The instructional cycle in programs of individualized instruction may be defined as involving five processes and two decision areas. Initially, testing designed to provide placement information about students is carried out (Process 1). These placement tests are then scored (Process 2) and the results compared with mastery or performance levels which have been specified for each student and for each instructional objective. Diagnosing (Process 3) provides information leading to the identification of instructional needs (Decision 1). The teacher may compare the instructional needs of the individual student with the instructional activities which are available to assist that student in learning the content of the objective. Prescribing or guiding (Process 4) is designed to provide information useful in selecting those instructional activities (Decision 2) which are most appropriate for meeting the student's instructional needs. The selected activities are carried out systematically during instruction (Process 5) after which testing (Process 1) again takes place to determine if the student has met the instructional objectives.

The basic structure of programs of individualized instruction, as discussed by Spuck et al. (1975), leads to the following assumptions concerning instructional programs which may be supported by a generalized system of computer management:

1. There exist instructional missions and goals which are reduced to sets of measurable instructional objectives;
2. Testing instruments and/or procedures which may be used to assess mastery of the instructional objectives are available;
3. Level(s) of mastery or performance standards are specified for

each child and for each instructional objective (full mastery-variable attainment);

4. Objectives which are to form a part of each student's instructional program are delineated (common objectives--variable objectives);
5. Dependencies existing between objectives are specified (sequenced objectives--nonsequenced objectives);
6. Normative information exists, as required, for input into the specifying long-range performance expectations;
7. Educational activities and materials exist which provide individualized instructional experiences toward the accomplishment of the specified instructional objectives;
8. It is possible quantitatively and/or qualitatively to assess the individual characteristics of students essential to individualizing instructional activities;
9. It is possible quantitatively and/or qualitatively to assess the resource implications of alternative educational experiences.

The Program Data Base

A first step in implementing any management system is to define and initialize the data bases required by that system. Two data bases are fundamental to the concept of instructional management. The first of these defines the individualized program to the automated system and is referred to as the Program Data Base (PDB). The educational program of the school has been described by Spuck et al. (1975) in terms of instructional programs, instructional areas, instructional units (content/process or level/grade), instructional topics, and instructional objectives. Contained within the PDB, then, is information which relates the given instructional objective to the instructional program in terms of the intervening descriptors of areas, levels, and topics. Also contained within each objective record might be additional descriptive information, such as the name of the objective, a short description of it, and any required internal or external labeling.

Objectives have been categorized in terms of sequenced or nonsequenced, common or variable, and full mastery or variable attainment. If the sequencing of objectives is the same for all students, this sequencing information may be included in the PDB rather than the Student Data Base to be defined later.

Information related to the interpretation of objectives also may be included in the PDB. Objectives may be interrelated in several ways. For example, objectives may be related linearly, in which case the successful attainment of one objective serves as a prerequisite to attempting the next objective; an objective may have more than one prerequisite objective; or, the objectives may be completely unrelated, that is, no objective is prerequisite to any other.

When the instructional program is to be implemented as a full mastery program, that is, when the same level of mastery is to apply to each student, then this level of performance needs to be specified as a part of the PDB. It is not necessary to indicate in the PDB whether common objectives define the instructional program, but all objectives included in the program need to be specified in the Program Data Base.

As objectives are added, deleted, or modified, the PDB will need to be updated to reflect these changes. Mastery levels, compatibility codes, and prerequisites may also change, necessitating corresponding changes in the PDB. A separate PDB or section of the PDB is required for each instructional program needed to fulfill the school's mission.

The Student Data Base

The Student Data Base (SDB) specifies the instructional program for each child. The information contained in the data base for each student includes student identification, demographic information, individual profile, instructional program, performance expectations, and performance information. Student identification refers to a student number as well as the student's name. Demographic information includes background and program factors such as teacher or unit name, room number, instructional programs in which the student is enrolled, age, sex, date of enrollment in school, and home address. Student identification and demographic information will not require frequent updating but should be reviewed for accuracy at least annually.

Individual profile information includes results on achievement and aptitude tests and personality and interest inventories, as well as descriptions of learning styles. The exact information included is determined by the needs of the student's teacher and must be in accordance with district ruling and federal and state laws.

Those objectives for which the student is or is not to be responsible need to be identified. Similarly, the mastery level expected of each student for each objective needs to be defined. Included in this part of the SDB would be any specific performance goals/levels which the student is expected to master over a period of time.

The SDB also contains information on individual student performance. At the least, a record is kept of those objectives which the student has mastered and those objectives which the student still has to master. Additional information such as the actual scores on achievement tests, the number of attempts on the objective prior to mastery, the date of the last attempt, and possibly the instructional activity(ies) used may also be kept here. Performance information needs to be updated frequently, presumably at the conclusion of each unit of instruction. Performance information and instructional program information are specific to each student's instructional program and, therefore, it is required that a separate section of the SDB be included for each instructional program for which the student is responsible.

The WIS-SIM Model: An Overview

Figure 5 presents the WIS-SIM model in diagrammatic form. The model incorporates the processes and decisions of the instructional cycle, the process of achievement profiling, and the data bases. Processes are represented by the oval symbol, decisions by the diamond, and the data base by the computer tape symbol. Rectangles are used to indicate information which flows into or out of the system. Each of the major processes indicated in the WIS-SIM model is briefly referred to in the sections which follow.

Testing and Test Scoring

Testing begins and ends the instructional cycle. Testing as a preassessment or placement process determines whether a student has met the performance standards associated with a given objective or set of objectives prior to the beginning of the instructional cycle.

At the end of the instructional cycle, testing determines whether a student has mastered the content of a particular set of objectives. Test scoring is a process wherein test item responses or test performance are compared with the mastery levels or performance standards which have been set for that test and for that student. In any testing situation,

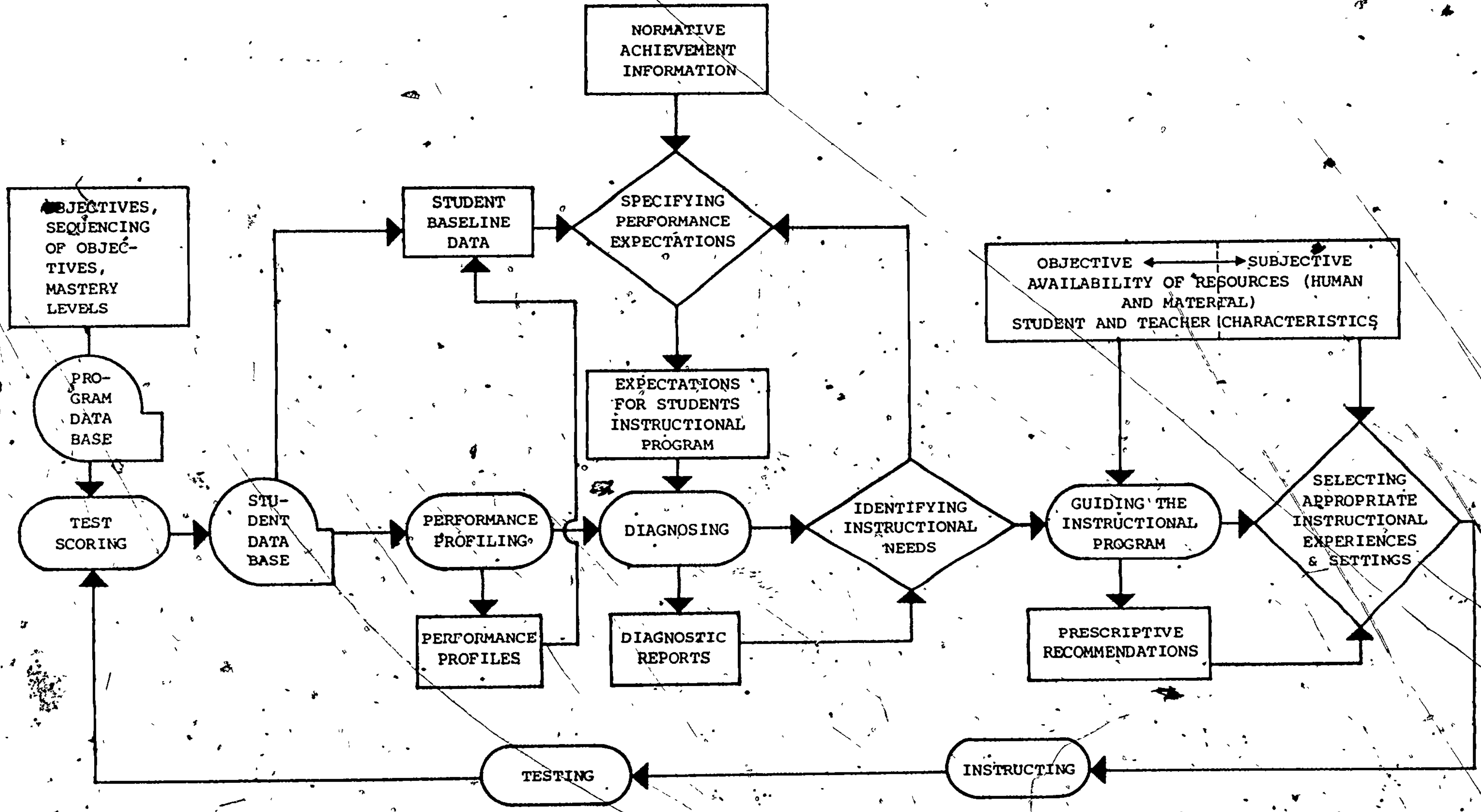

Figure 5. Wisconsin System for Instructional Management (WIS-SIM) model.

it is essential that the mastery level or performance standards be explicitly defined.

Since test results need to be entered into the data base in order to be utilized in an automated system, machine scoring can save considerable time in updating student records--the intermediate scoring, transcribing, and keypunching processes are either eliminated or automated.

Figure 5 shows that information on objectives, sequencing of objectives, and mastery levels is stored in the Program Data Base as input to the test scoring process. Placement of the PDB at this point in the model is symbolic in the sense that information contained in it is utilized in processes besides test scoring. Once the information is entered into the system, it is implied that the information is available throughout the system. Additionally, feedback loops for updating or modifying the data base are not indicated in the model but are recognized and implied.

Similarly, the specific placement of the Student Data Base in the model is symbolic; information contained in it is also available throughout the system. Certain parts of the SDB are updated from other points within the system as will be discussed later. If individual mastery levels have been set, for example, this information must be available at the time of test scoring.

Performance Profiling

Performance profiling is the next process in the WIS-SIM model. Profiles are reports of either individual or group achievement with regard to a set of objectives included in the instructional program. Considerable flexibility in the production of these reports is generally provided, allowing the person requesting the report the freedom to define the group or individual to be profiled and the range of objectives to be included within the report. Performance profiles may be used by teachers to derive an overall assessment of the placement of students within the instructional program. They might be sent to parents or utilized in parent-teacher or student-teacher conferences. They may also serve as summaries of classroom, unit, or school performance over a period of time.

Specifying Performance Expectations

The first of the three decision processes included in the model is the specifying of performance expectations. Performance expectations are specific objectives within an instructional program to be achieved over a fixed period of time. When individual expectations for a student are set, this information must be included as a part of the Student Data Base so that it will be available as required. In programs involving variable mastery and variable objectives, specifying performance expectations involves tailoring the instructional program to the needs of the student.

Diagnosing and Identifying Instructional Needs

The purpose of any system of individualized education is to serve the educational needs of individual pupils. As Figure 5 indicates, the diagnostic function of the WIS-SIM model is based upon two sets of inputs from other components of the system. Prespecified expectations, as they relate to a given set of objectives, and the data provided by the performance profiles together provide the basic information necessary to identify existing discrepancies in a pupil's knowledge of a specific curriculum area. In general, diagnosis occurs through the comparison of actual performance with performance expectations. While criterion-referenced testing remains the basis of the diagnostic process, subjective inputs of both teacher and pupil can and do become incorporated. The diagnostic function is both built upon and provides input to other parts of the system. Outputs of the diagnostic process present the degree of discrepancy between expected and attained results. They may be presented as diagnostic reports.

Guiding the Instructional Process and Selecting Appropriate Educational Experiences and Settings

Through the process of guiding the instructional program, the instructional manager determines the appropriate educational experiences and settings to meet the needs identified during the diagnostic stage. The WIS-SIM model takes into account a wide range of both subjective and objective information which may influence the selection of instructional activities. Included are teacher variables such as skill and preference for certain instructional activities; student factors such as aptitude, learning style, and learning handicaps; and interactive factors such as the existence of personality conflicts between students or between a student and a teacher. As the WIS-SIM model shows, a very important consideration at this point is the availability of resources--both human and material--to effectively conduct the selected instructional activity.

Instructing and Testing

Unlike Computer Aided Instruction (CAI) systems, Computer Managed Instruction (CMI) plays no part in the actual instruction; rather, it supports the management of the individualized system. The selected instructional activities, however, should be implemented in a manner which reflects the concern for individualization of the WIS-SIM model. Once instruction is completed, the cycle is repeated. Testing becomes a posttest for the instructional objective identified earlier. Results are compared with expected performance standards. Attainment of the objectives leads to consideration of a new objective. Failure to attain the required level may result in beginning the cycle over again for the same objectives, or it may result in the selection of a more realistic objective. In either case, the relevant data is stored, to be available as necessary for the generation of reports.

Evaluation of the Instructional Program

The CMI model focuses upon the student in the processes of testing, test scoring, achievement profiling, diagnosing, and guiding the instructional program. However, these processes may also be viewed as a means of providing information to educational decision makers regarding the instructional program being implemented. The focus of the examination, then, is on the instructional activities and the instructional program itself.

Of major importance in this discussion of the WIS-SIM model are the processes of achievement profiling, diagnosing, and guiding the instructional program. Achievement profiles may be produced which reflect the current status of performance relative to unit, building, or district goals. Certain expectations may be formulated for an instructional activity or a set of instructional activities. If these expectations are not met, it is reasonable to question the appropriateness of the activities. Diagnosis then becomes a process of identifying problems which exist within the structure or content of the instructional program. Information concerning the utility of each instructional activity for different types of students may be summarized from the student performance records. Such data will be utilized in the generation of the Instructional Activities Data Base (IADB). Such a data base will assist teachers in more closely matching the aptitudes and interests of students and specific instructional activities.

The process of guiding the instructional program is viewed as leading to the decision of selecting appropriate instructional experiences and settings (Figure 5). As a result of this selection, instructional activities may be added, modified, or deleted as they pertain to a particular instructional objective, or the sequencing of the objectives may be altered. The Program Data Base will need to be updated to reflect any changes in the instructional program. Other data bases, as they exist, may also need to be revised to reflect changes which have been made in the instructional program or instructional activities; for example, a data base which indexes instructional activities by learning styles and objectives to which they are related will be affected by changes in the instructional program. In extreme cases the instructional program may be replaced in its entirety.

The WIS-SIM model, then, is based on a "total systems" approach which permits the utilization of its concepts at classroom, building, and district levels. In a real sense, it is a model of decision making related to the instructional program as well as a model of individualized instruction for the student.

DESIGN GOALS OF THE GENERALIZED SYSTEM

As has been noted, the Wisconsin System for Instructional Management (WIS-SIM) is being developed to serve the management needs of Individually Guided Education. Currently WIS-SIM can support the Wisconsin Design for Reading Skill Development (WDRSD) and Developing Mathematical Processes (DMP). WIS-SIM is being generalized in order to support all curricular programs which might be utilized in IGE schools as well as collect and process data which will contribute to the refinement and evolution of IGE. The development and evaluation of the Generalized System will continue through the next several years and the first pilot test of the Generalized System will occur in 1977 and 1978.

During the 1974-1977 school years, pilot tests of two distinct computer management systems are being conducted; one system was developed to manage the Center's reading program--the Wisconsin Design for Reading Skill Development (WDRSD); the other system was developed to manage the Center's math program--Developing Mathematical Processes (DMP). Preliminary documentation of these two systems (WIS-SIM for WDRSD and WIS-SIM for DMP), which will be available at the end of 1975, will enable school districts to implement computer management (CMI) for WDRSD and/or DMP as separate entities. The preliminary documentation and materials for these two systems will be revised during the pilot test period. Final products will be available early in 1977.

Although implementing computer managed instruction for either WDRSD or DMP or both falls far short of implementing a CMI system for a total IGE environment, it is envisioned that having these two systems available early could contribute significantly to the widespread dissemination of CMI in IGE schools. For one thing, these two programs will allow IGE schools to get involved in CMI prior to the availability of the Generalized System. Such an incremental approach to CMI is minimally disruptive of school procedures and allows time for inservice training prior to the implementation of the full-blown Generalized System.

Once the Generalized System is developed, the separate CMI programs of WDRSD and DMP will continue to have their special virtues. Schools with limited computer resources may find it necessary to limit computer management to one or two curriculum areas. In such cases, WDRSD and DMP, which are basic subjects, would have high priority. The Generalized System will be modular in design and, thus, schools may implement it in only one or two curriculum areas if needed; however, the separate WDRSD and DMP systems have been designed specifically to manage these particular curricula.

Ultimately, a Generalized System will be required to manage schools implementing IGE. IGE schools have great diversity in their curricula as a result of each school setting its own educational objectives in accordance with the IGE Instructional Programing Model (IPM). Curricula may be developed at the Wisconsin R & D Center, by other nonprofit agencies, by commercial publishers, or locally. The Generalized System will accommodate curricula which vary in essential characteristics such as whether objectives are sequenced, and whether mastery levels are the same for all children.

Similar skills and subject matter are often found in more than one curriculum area, particularly for independently developed instructional programs. For example, the processes of describing and classifying and comparing and ordering in DMP overlap with material contained in several science curricula. The Generalized System will monitor such areas of overlap in order to minimize redundant instruction and make efficient use of available resources.

A number of design goals are being used as guides in the development of WIS-SIM activities. The following six goals are among those receiving initial emphasis (Belt & Spuck, 1974):

1. To facilitate the learning environment for each child in terms of the instructional and organizational requirements of IGE;
2. To provide information which is useful to educational decision makers at the unit, school, and district levels;
3. To improve communications with parents and upgrade the quality of reporting to them about student achievement;
4. To make minimal demands on teachers to "learn" the system;
5. To make minimal demands on teachers to perform tasks which are

different from normal classroom activities and, where possible, to reduce the paper work requirements of school personnel;

6. To make computer management of instruction available to a large number of IGE schools.

These six goals have guided the development of the two CMI programs which currently manage WDRSD and DMP and they will guide the development and evaluation of the Generalized System. The sixth goal, "to make computer management of instruction available to a large number of IGE schools," will receive heavy emphasis in the design of the Generalized System. The Generalized System will accommodate the wide diversity of curriculum offerings which are found in IGE schools. Software designs, hardware designs, and procedures will also be developed and evaluated to facilitate tailoring the wide range of existing computer systems which are available to school districts for use with the Generalized System.

A seventh goal specifically applicable to the development of the Generalized System has been added to the previous six goals:

7. To accommodate a broad range of instructional programs which are compatible with the Instructional Programing Model of Individually Guided Education.

In the chapters which follow, the design specifications for the Generalized Wisconsin System for Instructional Management (WIS-SIM) will be discussed. Chapter II details the two types of data bases fundamental to the operation of a system of computer managed instruction--the Program Data Base and the Student Data Base--and the file structures required to support each of these data bases. Several appendices relating to the storage of information in these data bases are referenced in this chapter.

The information flow in the Generalized System is discussed in two parts: the Basic Program (Chapter III) and the Extended Program (Chapter IV). Included as a part of the Basic Program are input forms, report requests, report formats for initiating and updating the Program Data Base and the Student Data Base, and for generating performance profiles, diagnostic reports, and prescribing recommendations. Additionally, several housekeeping reports are delineated. In Chapter IV, discussion of the Extended Program includes setting performance expectations, evaluation and research capabilities, and specific applications to evaluation of instructional activities, programs, and staff. A generalized capability for utilizing the information contained in WIS-SIM for user defined research is also discussed.

Chapter V focuses on available computer configurations and Chapter VI outlines the schedule for system development and evaluation.

II

DATA BASE DESIGN

Two types of data bases are fundamental to CMI application: the Student Data Base (SDB) and the Program Data Base (PDB). Both of these are established at the time that WIS-SIM is installed in a school. The PDB is seldom updated--generally only to reflect organizational or curriculum changes. The SDB is accessed and updated frequently, mainly by the input of new student performance data. The size of the SDB directly reflects school enrollment. Much of the SDB is utilized to record performance data on the instructional objectives. The SDB also contains demographic information and data on student performance expectations.

The PDB contains a number of files which reflect school organization, curriculum description, the prerequisite structures, overlaps between objectives in different instructional programs, and special capabilities which respond to local requirements. Some files in the PDB can be shared by different schools, for instance, files describing similar curricula, or they may be unique for each school, such as the school's organizational description, including the names of the teachers.

In this chapter, the approach to managing specific school organizations, different mixes of functional capabilities, and different types of curricula will be discussed. The IGE Instructional Programing Model (IPM) encourages each school to set its own educational objectives and to review them on a periodic basis, which results in the great diversity in the curricula of IGE schools.

PROGRAM DATA BASE

Since PDB files will be accessed randomly, they should be stored on a direct access device such as a disc. These files can then be organized in a manner which allows random access to data records. Two of the most widely used file organizations allowing random access are direct access and indexed sequential.

A direct access file in its simplest form is organized as a block of records which are implicitly numbered from 1 to N (or from 0 to N-1 on some systems) for a file of N-records. These records are of fixed length and are accessed by supplying a "record address," which is the number of the record in the file. This requires the program to compute the address for the record it is accessing.

There are a number of ways a program may compute a record address. The simplest method is by direct correspondence; for example, using a student number as the record address. The record address could also be "calculated" from the record key by using a hashing algorithm, which performs arithmetic or logical operations on the value of the record key. A third alternative would be a dictionary look-up approach where the program searches a dictionary of record keys to find the address of the record. The type of address chosen for a program depends upon the application and also the trade-off between speed of access and storage utilization.

Another widely used type of file organization is indexed sequential. Indexed sequential search combines direct access search with sequential search techniques. The direct access is by means of a dictionary look-up. Indexed sequential search is under the control of an index sequential file manager which is standard system software on most computing systems.

Indexed sequential files are made up of two elements: data records and an index structure. Each data record is of fixed length and contains a unique record key. These keys are called indices and are also stored in various tables which are collectively termed the index structure. The file is organized in such a way that records may be retrieved sequentially in increasing key order or they may be retrieved randomly by specifying the key of the desired record. The retrieval procedure requires accessing the various tables in the index structure to determine in which area of the direct access medium the desired record is stored.

An indexed sequential file organization requires a certain amount of overhead expense. For example, to retrieve one record, several disc accesses may be performed just to locate that record. In a comparable direct access file, depending upon the way the program determines the record address, it may be possible to retrieve the data record in one disc access. One important advantage of an indexed sequential file organization is that the record accessing mechanism is already programmed and operational on most computing systems. Also, this type of file organization may service many applications quite adequately.

Curriculum Description File

The readability of reports is enhanced when descriptive information is appropriately incorporated in the report format. Thus, it is useful to establish a curriculum file containing descriptions of instructional areas, modules, and objectives, which is conveniently accessible by different users. This file would also contain the mastery level of each objective in the case of curriculum areas with variable mastery levels. If the constraint is imposed that all descriptions be of a fixed length, this file can be organized as indexed sequential or as direct access.

When an indexed sequential file is used, a key must be computed for each description. This key can be computed easily by assigning numbers to each instructional area, to each module within an area, and to each objective within a module.[1] When these three numbers are concatenated they together generate a unique key for each description.

KEY =	Area Number	Module Number	Objective Number

Note that by using module number "0" and objective number "0" to mean "No module" and "No objective," respectively, it is possible to generate keys for instructional area descriptions and module descriptions.

When a direct access file is used, a record number must be computed for each description. One of the easiest ways to do this is by building a table which contains base addresses for the modules of each instructional area and for the objectives of each module. An example of this procedure is included in Appendix A, "A Design for a Direct Access Curriculum Description File."

Since the indexed sequential file organization will be used for other applications in WIS-SIM, such as the Prerequisite File discussed below, it is appropriate to organize the Curriculum Description File as indexed sequential, also.

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[1] In programs which are subdivided into instructional areas, such as WDRSD, each area defines a separate Program Data Base. WDRSD is therefore considered as three instructional programs: Word Attack, Study Skills, and Comprehension. The level can be coded as an instructional module and the skill as an instructional objective. Thus, the instructional module number in a WDRSD data base would be the number of the level in the alphabet (A = 1, etc.), and the skill number.

Prerequisite File

Many objective-based curriculum programs are sequenced according to a formal prerequisite structure. Some curricula, or components of curricula, have no sequenced objectives and therefore have no prerequisites. However, most curricula used in IGE schools have defined linkages between objectives or at least a continuity of progression through the curriculum.

When a new curriculum is formulated, prerequisites for the instructional objectives are specified. These prerequisites are based on some combination of expert opinion, task analysis, empirical testing, and observation. They may be loosely or strictly structured, depending on the particular curriculum and needs of the school using them. To meet the requirements of WIS-SIM, however, these prerequisites must be explicitly stated for storage in the PDB. For example, a prerequisite for a particular objective in the DMP curriculum may state: "should have experience in some objectives of Topic 26." This must be translated for computer use by specifying an assessment (in this case any assessment, M [Mastery], P [Progressing satisfactorily], or N [Needs help], would constitute "experience") and by specifying a certain number of objectives in Topic 26, not merely "some." Appendix B, "Prerequisite Coding," describes an approach to implementing a prerequisite structure in the PDB.

Sequencing may exist throughout the curriculum or only in parts of it. The Science...A Process Approach (SAPA) curriculum has several kindergarten-level modules with no prerequisites, but at all subsequent levels each module has at least one prerequisite skill.

Many curricula are designed to allow multiple sequencing possibilities. Such schemes allow not only greater possibilities for tailoring programs to the needs of individual students, but are also useful when teachers must share materials or when scheduling problems arise. There are several ways that IGE schools may vary the instructional programs they select; for example, depending on the needs of the students, they may choose to omit or add instructional modules.

The design of the Prerequisite File very much parallels that of the Curriculum Description File: Prerequisite records are kept for either modules or objectives, depending on the instructional program. Thus, unlike the Curriculum Description File, records are not kept for all modules and objectives. Since records are accessed by a unique key when an indexed sequential file organization is used, the omitted records have no effect on the file structure.

However, if a direct access organization is used, wherein each instructional area, module, and objective has an associated record address, these omitted records would leave large gaps in the file. The space can be used more efficiently if a directory of record addresses is put in the first few records of the file and the computed record address (see Appendix A) is used to index into this directory. Then only the necessary records need appear in the file and their record addresses will be stored in the directory. The entry in the directory for those modules (objectives) which do not have an associated prerequisite record would be zeroed.

The indexed sequential approach is preferred over the direct access approach for the Prerequisite File structure because of its simplicity. Since the indexed sequential file management routines are included in the program, the Curriculum Description File would also be organized in this manner to eliminate unnecessary overhead.

Some applications requiring random access may be of sufficient complexity that neither a direct access nor an indexed sequential file organization is suitable. These files are typically organized in a more complex manner utilizing list structures. To manage these files, a data base management system could be used to interface between programs requesting data and the direct access device where the data are stored. The design and development of such a system are formidable tasks that call for serious consideration of a commercially available data management system or one supplied by the computer manufacturer, rather than undertaking an in-house development.

Curricula Overlap

A certain amount of overlap of instructional objectives commonly exists among different curriculum areas. For example, the graph and table interpretation skills which are developed as part of the Study Skills area of WDRSD are also developed in a number of science, mathematics, and social studies programs. Likewise, the processes of describing and classifying and comparing and ordering in DMP overlap with material presented in many science programs. The Generalized System will monitor such areas of overlap and provide features to minimize redundant instruction, while making maximum use of available curriculum material.

When a student achieves mastery on an overlapping instructional objective, a mastery notation may be made in more than one location of the student record; a "M" (Mastery) notation will be made for the instructional objective in the instructional program in which mastery was demonstrated and a "MX" notation will be made for the instructional objective in the instructional program that contains the "identical" instructional objective. The "X" notation will indicate an instructional program in which mastery was demonstrated indirectly. Whenever prerequisites are scanned to select an appropriate instructional setting for a student, the "MX" will be treated as mastery. However, when a Performance Profile is generated, the "MX" will be printed in order to show that mastery for the instructional objective was actually demonstrated on an instructional objective of a different instructional program.

In order to implement such monitoring of overlaps, it is necessary to identify all overlaps existing between the instructional programs. For example, the following are some of the overlaps found between the DMP and SAPA programs:

DMP Objectives	SAPA Objectives
Given an attribute; chooses an object that has that attribute (Topic 1, Obj. 1)	Identify an object on the basis of color, shape, texture, and size (Module 3, Obj. 1)
Given an attribute, describes it in terms of its attributes (Topic 1, Obj. 3)	Name two or more characteristics of an object from the following characteristics: color, shape, size, and texture (Module 3, Obj. 2)
Given two objects, compares and orders them on the attribute of length (Topic 2, Obj. 1 and 2)	Demonstrate the sorting of objects into sets in which all objects of one set are of equal length (Module 8, Obj. 1)
Given more than two objects, orders them on the attribute of length from longest to shortest or shortest to longest (Topic 4, Obj. 1)	Order objects by length, from the shortest to the longest (Module 8, Obj. 2)

After all overlaps between different instructional programs have been identified as above, they can be structured into a table of equivalent instructional objectives for all instructional programs to be managed by the Generalized System in one school. For ease of referencing, this table may be further expanded into tables of equivalent instructional objectives for individual instructional programs and stored on disc files for direct access. These files are called the Instructional Objective Equivalency (IOE) Files for the corresponding instructional program. For example, the IOE File of the DMP program specifies all the instructional objectives of other instructional programs that overlap the DMP instructional objectives. Thus, whenever scores of an instructional program are stored, the corresponding equivalency table can be referenced in order that mastery notations (M and MX) can be entered in the appropriate records of the Student Data Base. Appendix C describes the IOE File in detail.

Unit-Teacher File

Another of the files in the PDB is the Unit-Teacher File. This file describes the school's administrative structure and the teachers associated with it (see Appendix D). In the multiunit school organization associated with IGE, the traditional age-grade self-contained classroom has been replaced by an organization wherein approximately four to five teachers are jointly responsible for guiding the education of 100 to 150 students whose ages typically span three or more years. Frequently, teachers are assigned to "instructional groups" as well as to units. In an instructional group students who have like educational needs are instructed in one or more specific instructional modules. When these specific instructional needs have been met, the instructional group is disbanded and the students and teacher are reassigned. "Early achievers" may leave an instructional group before it is formally disbanded and move on to another group. An instructional group generally lasts two to four weeks. Thus, in IGE environments, teachers are assigned to units on essentially a permanent basis and to instructional groups for the duration of the group.

In many IGE schools where a "homeroom teacher" concept is employed, a teacher acts as an "advisor" for 20 to 35 students for the school year. The advisor-teacher serves as a contact point for both students and parents. The advisor-teacher concept enables students to identify with a group of students smaller than the 100 to 150 which constitute the unit.

The Unit-Teacher File lists the teachers in a unit and the approximate number of students in that unit. The latter information may be used in estimating the size of print files as they are produced. Each unit is coded with an alphabetic code (A-J) and all references to a unit are made by using this code.

Each teacher associated with a unit is assigned a number, 1-9. This number is used to identify the teacher responsible for an instructional or advisory group. Each teacher will have his or her name stored in this file, accessible by unit code and teacher number.

Data in the PDB thus include descriptions of the instructional areas, modules, and objectives, the prerequisite structures, objective equivalency, and the organizational structure of the school.

STUDENT DATA BASE

The Student Data Base (SDB) contains information which is specific to each student. Such information consists of performance expectations, performance data, demographic information, family data, and any characteristics of the student that require special consideration from teachers. Because of the large amount of information in the SDB, it should be kept on a secondary storage device, such as a disc or a drum, and brought into core as required for referencing or updating. The file structure of the SDB may vary among schools depending on the computer configuration and file managing system available. An example of the structure of the SDB is presented in Appendix E.

Basically, the Student Data Base is made up of blocks of data, each of which contains information about a specific student. Each block may be stored in either a fixed-size record or a variable-size record, depending on the amount of information it contains. Both types of record structure have been ~~experimented with~~ in the 1974-1975 pilot tests. The WDRSD program uses a fixed-size record structure to store the SDB; the DMP program uses a variable-size record structure. A fixed-size record structure has the main advantages of being (1) faster and easier to use in updating records, and (2) more exportable to other computer systems. However, for the following reasons, the variable-sized record structure has been found to be more suitable for the purposes of the Generalized System:

1. The size of each record may be adjusted to the amount of information that belongs to the particular student at any time. Because each fixed-size record has to be as large as the maximum amount of information that could possibly belong to any student, a large amount of costly file space is wasted.
2. Fields can be added to or deleted from any record easily. Such need may arise especially during the developmental stage of the program.
3. The size of the SDB may be adjusted accordingly without restructuring the file. A school may choose not to implement certain fields, or it may choose to add certain fields. For example, a school may choose to store additional demographic data.
4. Ring structures can be easily implemented. These are useful for recording groups within a school.
5. Even though updates that require enlarging the file size of

the SDB may require longer computer execution time than fixed-size data bases, the overhead time is well within tolerable limits.

When a variable-size record structure is used to store the SDB, a directory of record locations, using student identification numbers or names as keys to the directory, will speed up access time. This directory, consisting of fixed-length index entries, is then part of the SDB.

Information in each student's SDB record can be divided into three categories: demographic, curriculum performance, and administrative, instructional and family grouping.

Demographic Data

The data elements in the demographic category are listed in Table 1. This set of data rarely needs updating. The data are usually stored for a student at the time he or she enters school; modifications are made as necessary.

Curriculum Performance Data

At appropriate times during the school year, students are assessed on the instructional objectives which they have been learning. The most current achievement score for each instructional objective is called the "current score"; any previous achievement scores for that instructional objective are known as "history scores." The school should decide whether history scores will be kept--history scores accumulated over time could occupy considerable storage space. The performance data on each instructional objective include the current score, date of assessment for this score, number of attempts on this instructional objective, and, if the school chooses, the history scores and their corresponding dates for assessment.

TABLE 1

DEMOGRAPHIC INFORMATION ELEMENTS

Data element	Comment
Student name	Names may be stored in the key field of the record or in the directory.
Student identification number	These numbers can be stored as the key, or they may represent the order of the student's record in file (i.e., File N contains the data of the student whose identification number is N.) In this latter case the identification number is usually assigned by the CMI system.
Sex	This may be used to generate a personal description of the student or for grouping for some physical education classes.
Birthdate	Used for computing the student's age for descriptive and research purposes.
Grade	Although IGE schools are designed to do away with the concept of grade, the level of the grade to which the student would normally belong is recorded to be compatible with schools that still utilize the grade level concept.
Special consideration reminder	This can be one or more sentences describing a physical condition or any special characteristics of the student that the teachers ought to know. The information in this element could be printed alongside the student's name whenever a grouping report is generated.
Family data	Details about the student that are common to students from that same family need to be stored in the record of only one family member. Therefore, this element might not exist in all student records.
Other personal data	This element can contain any information about the student that the school staff wishes to keep.

Current scores are used in numerous reports generated for performance profiling, diagnosing, and guiding the instructional process. The Individual Performance Profile uses both current and history scores along with the dates of their assessments. The number of attempts made on each instructional objective appears on grouping recommendation reports. The school may find that the storage of data on some instructional modules becomes less important when the student's mastery was accomplished some time ago and that this information will not be needed to show mastery of prerequisites for future instructional modules. These data may be summarized and stored separately (on tape) and erased from the student's current record. The erasure of such data is based upon a "moving window" concept in that when erasure occurs, a significant amount of the most recent history is maintained. The exact method of implementing the "moving window" is still uncertain because of the danger of destroying the prerequisite structures associated with instructional programs. One possible approach is to keep on disc a list of all the instructional modules that the student has already mastered, and to erase all performance data about those instructional modules. This approach would:

1. preserve the integrity of the prerequisite structure;
2. speed up prerequisite checking;
3. cut down the size of SDB.

It should be clear that the curriculum performance section of the SDB is being updated constantly as assessments on instructional objectives are made.

Administrative, Instructional, and Family Grouping Data

As discussed in the section of this chapter dealing with school organization, at the beginning of the school year each student is assigned to an instructional unit in accordance with his or her past academic performance. Within each unit there may be a number of advisor-teachers, each assuming the administrative responsibility for approximately 20 to 35 students assigned to the unit. The student's unit and advisor-teacher assignments generally remain the same throughout the school year. These assignments are therefore stored in the student's record. Updating occurs usually at the beginning of a school year.

At different times during the school year students are assigned to instructional groups according to their educational needs. When the student's instructional needs are met, he or she will be assigned to another appropriate instructional group. The instructional group with which a student is identified is entered on his or her record when he or she is assigned to the group, and erased when he or she leaves the group. These groups are identified by instructional unit, instructional module to be taught, teacher, and cycle number. The cycle number is used to distinguish between groups, when more than one group is formed for the same unit, instructional module, and teacher.

The data bases defined in this chapter are fundamental to the implementation of the Basic Program discussed in the next chapter. In Chapter III the flow of information into these data bases and reports resulting from accessing them are discussed. Chapter IV suggests further uses of these data bases and introduces the need for additional data bases to extend capabilities in support of the Generalized WIS-SIM.

III

THE BASIC PROGRAM

The capabilities of the Generalized System are discussed in two sections of this report. The present chapter considers the Basic Program and Chapter IV considers the Extended Program. The Basic Program consists of features and capabilities which are central to the management of the instructional programs of IGE. The Extended Program will contain options which can be conveniently appended to expand the range of applicability and increase the utility and efficiency of the Basic Program. The options of the Extended Program represent additional features and capabilities which schools need to meet instructional management requirements.

The Basic Program includes a broad range of computer capabilities that can be operated in batch, on-line, or interactive modes. The computer configurations required to support each of these operational modes are discussed in Chapter V, "Adapting to Available Computer Configurations." While differing in their requirements for computer resources and in their turn-around time, all three modes of operation support the same information flow--in all three modes the teachers receive the same reports and fill out the same forms to update files and request information.

STUDENT DATA BASE INITIATION

The nature of the information contained in the Student Data Base (SDB) is discussed in general terms in Chapter I; its structure and content are discussed more specifically in Chapter II and Appendix E. Teachers need complete only two forms for each student in their unit to initiate the SDB.

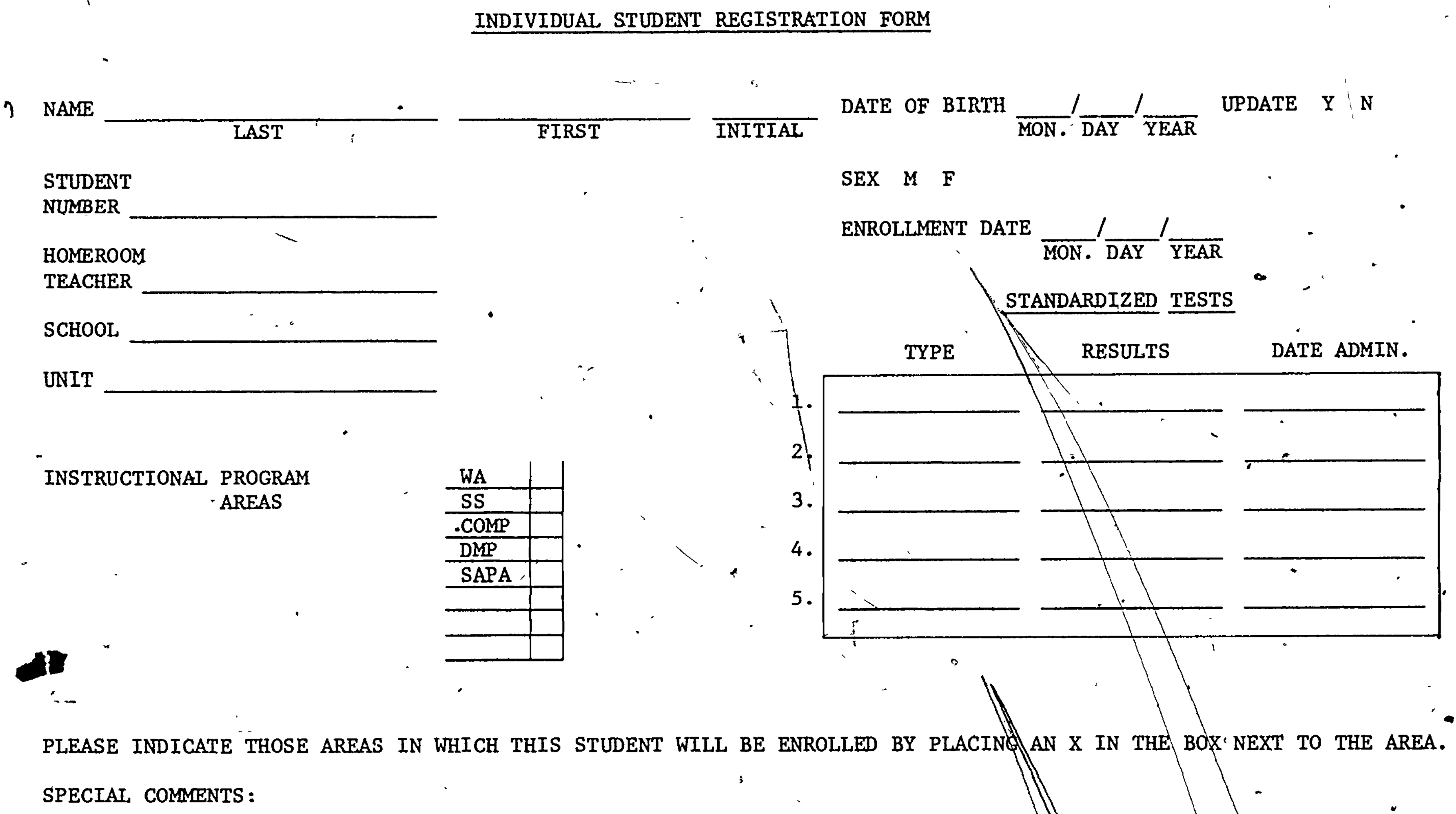
The Individual Student Registration form (Figure 6) includes demographic information, indication of enrollment in specific instructional program areas, and optionally the results of standardized tests.

Teachers specify the curriculum areas in which the student will be enrolled. WIS-SIM takes into account that children have individual needs and that not all students in the school need be enrolled in the same instructional programs. Therefore, WIS-SIM provides capabilities for enrollment in alternative educational programs as part of its Generalized System. Space is provided on this form for registration in alternative programs.

The Baseline Performance Data form (Figure 7) is used to enter initial performance data into the computer and to indicate any instructional modules (or skills) which are to be omitted from a student's program of study. The form depicted in Figure 7 is designed to be used for the Wisconsin Design for Reading Skill Development (WDRSD) program. On this example form the teacher has indicated the levels and skills the student has already studied by using percentage test scores. Raw scores or mastery-nonmastery codes can also be used as assessments. Those skill(s) which are not to be covered in the student's program are indicated through the use of the "NC" notation.

A Baseline Performance Data form is necessary for each curriculum area in which a student is enrolled. For example, if a student is in the WDRSD program, a form would be needed for each area of that program (e.g., Word Attack, Study Skills, and Comprehension) in which the student is enrolled.

In addition to initiating the data base, these forms may be used for large volumes of performance data when a new instructional program is implemented, with initial placement testing, or during a subsequent period of testing, where a number of objectives may be assessed simultaneously.



INDIVIDUAL STUDENT REGISTRATION FORM

NAME ____________ ____________ ____________
LAST FIRST INITIAL

DATE OF BIRTH ____/____/____
MON. DAY YEAR

UPDATE Y N

STUDENT NUMBER ____________

SEX M F

HOMEROOM TEACHER ____________

ENROLLMENT DATE ____/____/____
MON. DAY YEAR

SCHOOL ____________

UNIT ____________

STANDARDIZED TESTS

	TYPE	RESULTS	DATE ADMIN.
1.			
2.			
3.			
4.			
5.			

INSTRUCTIONAL PROGRAM AREAS

WA	☐
SS	☐
.COMP	☐
DMP	☐
SAPA	☐
	☐
	☐
	☐

PLEASE INDICATE THOSE AREAS IN WHICH THIS STUDENT WILL BE ENROLLED BY PLACING AN X IN THE BOX NEXT TO THE AREA.

SPECIAL COMMENTS:

Figure 6. Individual Student Registration form.

BASELINE PERFORMANCE DATA

PROGRAM: WDRSD

AREA: WORD ATTACK (X)
or
STUDY SKILLS ( )
or
COMPREHENSION ( )

DATE: 5/01/75

SCHOOL GEO. WASHINGTON ELEMENTARY

UNIT

RAW SCORES ( )
or
PERCENTILE SCORES (X)

UPDATE Y N

STUDENT																						
NUMBER	NAME	LEVEL COMPLETED	PRESENT LEVEL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	* * *
8888	Jones, John	B	C	79	76	82	63														

Figure 7. Baseline Performance Data form.

These two forms can also be used to enroll new students or to transfer students to appropriate instructional programs and to update information in the Student Data Base.

UPDATING THE STUDENT DATA BASE

The information in the Student Data Base which requires the most frequent updating is student performance data. The teacher initiates an update of student performance data by completing a Score Submission form. Whenever the appropriate hardware is available, mark-sense Score Submission forms are used, on which scores can be entered directly into the computer via a mark-sense reader. Figure 8 illustrates the mark-sense sheet used in DMP and SAPA. WIS-SIM also supports score submission on a Hollerith card, another mark-sense format.

The pupil roster section of Figure 8 is generated by computer and affixed to the mark-sense sheet. For on-line and interactive systems, the roster is generated by the school terminal, while in batch systems, it is generated by a printer at the central facility and delivered to the schools.

With the roster attached to the mark-sense sheet as shown in Figure 8, the teacher marks the boxes which identify the instructional group, the topic or module number, and the objective number for the appropriate instructional program. Performance data are entered in the rows across from each student's name. Figure 8 shows that Andy Andrews mastered DMP objectives 1 and 2 of topic 9.

In systems lacking mark-sense capability, the Score Submission form shown in Figure 9 is used. The teacher fills in the instructional area, the level and skill, and the appropriate assessment. Figure 9 is an ex-

TEACHER -- ANDERSON
GROUP -- A121
PROGRAM -- DMP
TOPIC -- 9
OBJECTIVES -- 1, 2, 3, 4
DATE -- 08-05-74
REPRESENTS NUMEROUSNESS PHYSICALLY

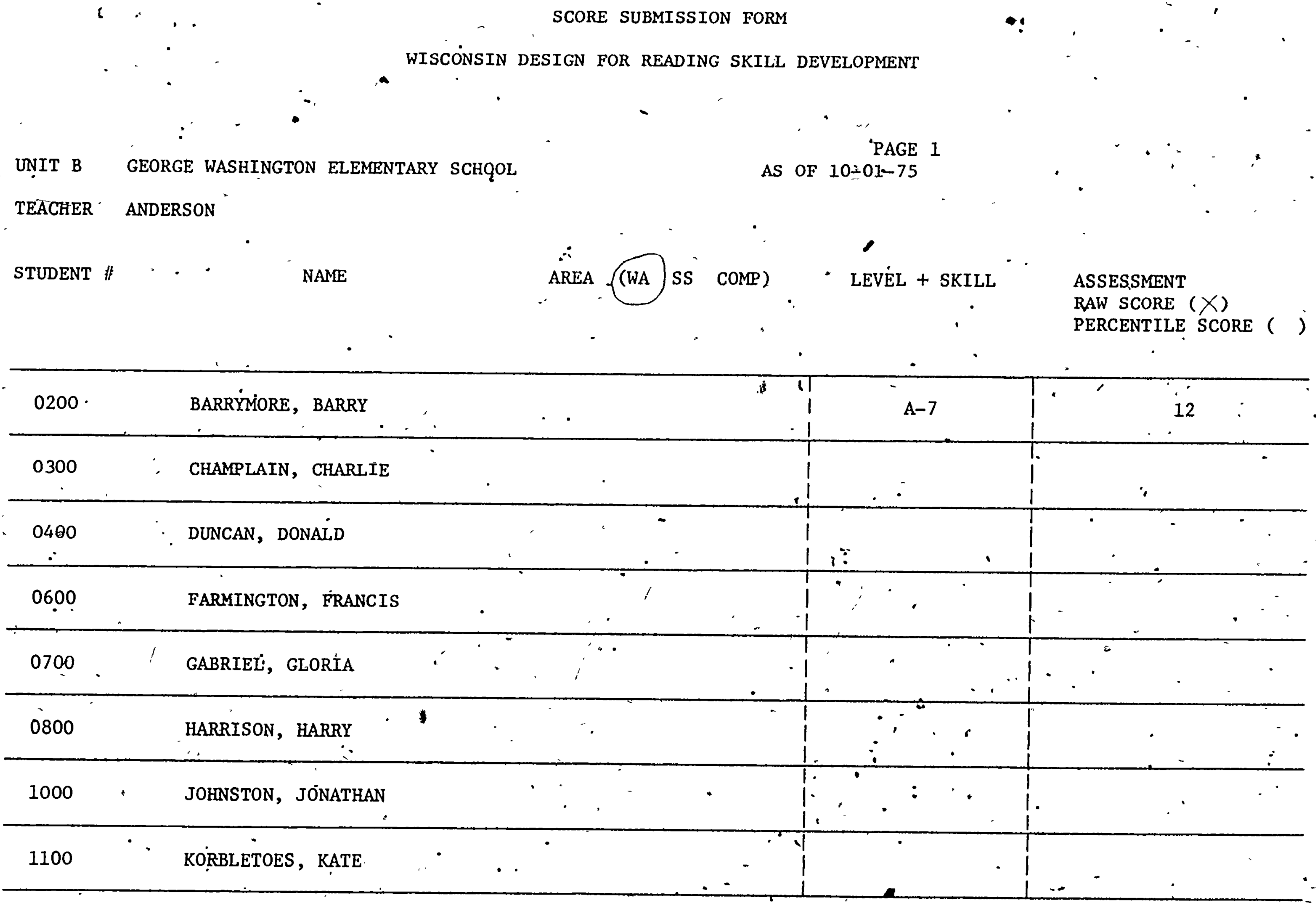
SCORE SUBMISSION

GROUP ID A B C D E F G H I
1st DIGIT 1 2 3 4 5 6 7 8 9
2nd DIGIT 1 2 3 4 5 6 7 8 9
3rd DIGIT 1 2 3 4 5 6 7 8 9
TOPIC/MODULE 1 2 3 4 5 6 7 8 9
10 20 30 40 50 60 70 80 90
100

PROGRAM ☒ DMP ☐ SAPA ☐ OTHER
MASTERY TYPE ☒ REGULAR ☐ MT ☐ MP

	OBJECTIVE #			1	4	7	2	5	8	3	6	9
				M	P	N	M	P	N	M	P	N
ANDREWS, ANDY A	1	→	1	=	=	=	=	=	=	=	=	=
BARRYMORE, BARRY B	2	→	2	=	=	=	=	=	=	=	=	=
CHAMPLAIN, CHARLIE C	3	→	3	=	=	=	=	=	=	=	=	=
DUNCAN, DONALD D	4	→	4	=	=	=	=	=	=	=	=	=
ELLSWORTH, ELLIE E	5	→	5	=	=	=	=	=	=	=	=	=
FARMINGTON, FRANCIS F	6	→	6	=	=	=	=	=	=	=	=	=
GABRIEL, GLORIA G	7	→	7	=	=	=	=	=	=	=	=	=
HARRISON, HARRY H	8	→	8	=	=	=	=	=	=	=	=	=
INGLEWOOD, ISAAC I	9	→	9	=	=	=	=	=	=	=	=	=
JOHNSTON, JONATHAN J	0	→	10	=	=	=	=	=	=	=	=	=
KORBLETOES, KATE K	1	→	11	=	=	=	=	=	=	=	=	=
LEMMONWORTH, LEON L	2	→	12	=	=	=	=	=	=	=	=	=
MORGANFIELD, MCKINLEY M	3	→	13	=	=	=	=	=	=	=	=	=
NELSON, NELLIE N	4	→	14	=	=	=	=	=	=	=	=	=
OPPENHEIMER, ORTON	5	→	15	=	=	=	=	=	=	=	=	=
		→	16	=	=	=	=	=	=	=	=	=
		→	17	=	=	=	=	=	=	=	=	=
		→	18	=	=	=	=	=	=	=	=	=
		→	19	=	=	=	=	=	=	=	=	=
		→	20	=	=	=	=	=	=	=	=	=
		→	21	=	=	=	=	=	=	=	=	=
		→	22	=	=	=	=	=	=	=	=	=
		→	23	=	=	=	=	=	=	=	=	=
		→	24	=	=	=	=	=	=	=	=	=
		→	25	=	=	=	=	=	=	=	=	=
		→	26	=	=	=	=	=	=	=	=	=
		→	27	=	=	=	=	=	=	=	=	=
		→	28	=	=	=	=	=	=	=	=	=
		→	29	=	=	=	=	=	=	=	=	=
		→	30	=	=	=	=	=	=	=	=	=

Figure 8. Mark-sense Score Submission form with pupil roster attached.



SCORE SUBMISSION FORM

WISCONSIN DESIGN FOR READING SKILL DEVELOPMENT

UNIT B GEORGE WASHINGTON ELEMENTARY SCHOOL

PAGE 1
AS OF 10-01-75

TEACHER ANDERSON

AREA ([✓ WA] SS COMP)

STUDENT #	NAME	LEVEL + SKILL	ASSESSMENT RAW SCORE (X) PERCENTILE SCORE ( )
0200	BARRYMORE, BARRY	A-7	12
0300	CHAMPLAIN, CHARLIE		
0400	DUNCAN, DONALD		
0600	FARMINGTON, FRANCIS		
0700	GABRIEL, GLORIA		
0800	HARRISON, HARRY		
1000	JOHNSTON, JONATHAN		
1100	KORBLETOES, KATE		

Figure 9. Non mark-sense Score Submission form.

ample of a Score Submission form for WDRSD. It shows that Barry Barrymore has received a score of 12 on skill 07 in level A of the Word Attack instructional area. This form can be used in all three modes where mark-sense capability does not exist. It serves as input for keypunching in the batch mode, and for terminal keying in the on-line and interactive modes.

Assessment is tailored to the curriculum area being reported. For example, in the WDRSD program, assessment can be entered in code form or with test scores (raw or percentage). The codes used are Mastery (M), Mastery by Teacher Certification (MT), Mastery by Pretest (MP), Nonmastery (N), and Not Covered (NC).

The M and N are used typically when the skills are assessed through teacher observation, and the MT code is used when the teacher wishes to certify mastery below a previously set level or where the normal testing procedure is deemed inappropriate, but mastery is demonstrated to the teacher's satisfaction. The MP may be used when mastery has already been demonstrated by pretesting. The NC code is used to omit skills which the teacher feels are not appropriate or necessary for the needs of the student.

In the math program (DMP), one other code is used in addition to those used in WDRSD. This code, Progressing Satisfactorily (P), serves as prerequisite fulfillment for many objectives in DMP.

The need for flexibility is evident not only in assessment schemes but also in available computer hardware, software and computer configurations. WIS-SIM accommodates schools having a mark-sense card reader capability or an optical data sheet scanner capability. These capabilities may be utilized in any of the three modes of computer operation. Operation in the interactive mode allows direct, on-site submission of update scores.

and the Grading Update Report can be received in a matter of minutes. The Grading Update Report (Figure 10) is used to verify performance updates to the SDB, and has space for making corrections if any information contained in the report is in error.

PERFORMANCE PROFILING

Teachers have a great deal of flexibility in requesting Performance Profile Reports. On a single request form, teachers may request their choice of three different reports. The example (Figure 11) illustrates the flexibility of the request form. The teacher's use of request forms remains the same whether the school's mode of operation is batch, on-line, or interactive.

Figure 12 illustrates the Performance Profile Report for an individual student for topics 11 through 14 of the DMP program. The date of the latest attempt and the assessment for each objective appears to the far left under the topic requested by the teacher. Individual Performance Profile Reports may be used to monitor a student's progress in a given curriculum area and are especially useful in parent-teacher conferences. Schools may also opt to send them home in place of or in addition to report cards.

Figure 13 represents a Unit Performance Profile Report for each objective in DMP Topics 21 through 24 for Unit A George Washington School. Some of these students, Francis Farmington, for example, have not yet been assessed on any of these topics and, therefore, nothing appears after the names of these students.

Unit Performance Profile Reports, as well as Group Performance Profile Reports, which have a similar format, indicate to the unit teacher the

```
GRADING UPDATE REPORT                                                        PAGE 1
GROUP A12  GEORGE WASHINGTON ELEMENTARY SCHOOL                              AS OF 06-06-75

TOPIC 29:  REPRESENTING JOINING AND SEPARATING SITUATIONS
TEACHER:   MARY JONES

                         *** ENTER ANY CHANGE IN CORRECTION COLUMN ***

                                          LAST         LAST
ID #              NAME                    SCORE        ATTEMPT          ATTEMPTS        CORRECTION

OBJECTIVE 1:  WRITES JOINING OR SEPARATING SENTENCE 0-20

0103         CHAMPLAIN, CHARLIE C.                                          0
1014         GABRIEL, GLORIA G.                                             0
0167         JOHNSTON, JONATHAN J.         N           06-06-75             1
0256         ORTONFISK, ORVILLE O.         P           06-06-75             1
0577         STUBBLEFIELD, STUBBY S.       P           06-06-75             1

1236         VACCINATED, VERY V.           P           06-06-75             1
1987         ZODIAC, ZULU Z.               M           06-06-75             2

OBJECTIVE 2:  CHOOSING JOINING OR SEPARATING SENTENCE 0-20

0103         CHAMPLAIN, CHARLIE C.                                          0
1014         GABRIEL, GLORIA G             N           06-06-75             1
0167         JOHNSTON, JONATHAN J.         N           05-07-75             1
0256         ORTONFISK, ORVILLE O.         M           06-06-75             3
0577         STUBBLEFIELD, STUBBY S.       P           05-07-75             1

1236         VACCINATED, VERY V.           P           06-06-75             2
1987         ZODIAC, ZULU Z.               M           06-06-75             1
```

Figure 10. Grading Update Report.

WISCONSIN DESIGN FOR READING SKILL DEVELOPMENT

PERFORMANCE PROFILE REQUEST

UNIT DESIGNATION ☐

DATE ____________

SCHOOL ____________

TEACHER ____________

REQUEST FOR THE ENTIRE UNIT ☐

REQUEST FOR STUDENTS ASSIGNED TO TEACHER ONLY ☐

CURRICULAR AREA WDRSD, DMP, SAPA (WA, SS, COMP) ☐

LEVEL AND SKILL
or
MODULE AND OBJECTIVE ☐

REQUEST FOR INDIVIDUAL STUDENTS ☐

1. STUDENT NAME & NUMBER ____________ ______ CURRICULAR AREA LEVEL & SKILL or MODULE & OBJECTIVE ____________ ____________
2. STUDENT NAME & NUMBER ____________ ______ CURRICULAR AREA LEVEL & SKILL or MODULE & OBJECTIVE ____________ ____________
3. STUDENT NAME & NUMBER ____________ ______ CURRICULAR AREA LEVEL & SKILL or MODULE & OBJECTIVE ____________ ____________
4. STUDENT NAME & NUMBER ____________ ______ CURRICULAR AREA LEVEL & SKILL or MODULE & OBJECTIVE ____________ ____________
5. STUDENT NAME & NUMBER ____________ ______ CURRICULAR AREA LEVEL & SKILL or MODULE & OBJECTIVE ____________ ____________

Figure 11. Performance Profile Request form.

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PERFORMANCE PROFILE:  INDIVIDUAL STUDENT                              PAGE 1
UNIT A   GEORGE WASHINGTON ELEMENTARY SCHOOL                   AS OF 08-05-74

KORBLETOES, KATE K.

TOPIC 11    REPRESENTING NUMEROUSNESS PICTORIALLY

     OBJECTIVE 1 -- REPRESENTS NUMEROUSNESS PICTORIALLY
     05-21-74  M     04-28-74  P     04-22-74  P     04-01-74  N

     OBJECTIVE 2 -- USES PICTORIAL REPRESENTATIONS TO COMPARE AND ORDER SETS
     05-27-74  M     05-07-74  P     04-26-74  N     04-23-74  P
     04-03-74  N

TOPIC 12    TALLYING

     OBJECTIVE 1 -- TALLIES
     03-26-74  M     03-22-74  N

TOPIC 13    TIME

     NOT YET ASSESSED ON ANY OBJECTIVE

TOPIC 14    REPRESENTING NUMEROUSNESS SYMBOLICALLY

     OBJECTIVE 1 -- STATES NUMBER FOR SET
     12-15-73  M     12-01-73  P     11-27-73  N

     OBJECTIVE  2 -- REPRESENTS NUMBER
     NOT YET ASSESSED ON THIS OBJECTIVE

     OBJECTIVE 3 -- READS NUMBER
     12-18-73  P     12-02-73  N

     OBJECTIVE 4 -- CHOOSES NUMBER FOR SET
     NOT YET ASSESSED ON THIS OBJECTIVE
```

Figure 12. Individual Performance Profile Report.

DEVELOPING MATHEMATICAL PROCESSES

PERFORMANCE PROFILE: UNIT RECORD
UNIT A GEORGE WASHINGTON ELEMENTARY SCHOOL

PAGE 1
AS OR 08-05-74

TOPIC:	21					22		23					24				
NAME OBJECTIVE:	1	2	3	4	5	1	2	1	2	3	4	5	1	2	3	4	5
ANDREWS, ANDY A.	N	P	N		N	N	N										
BARRYMORE, BARRY B.	M	M	M	M	M	M	M	M	P	M	N	P	N	P		N	
CHAMPLAIN, CHARLIE C.						N											
DUNCAN, DONALD D.	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
ELLSWORTH, ELLIE E.	N	N	P	N		N	N										
FARMINGTON, FRANCIS F.																	
GABRIEL, GLORIA G.	P	N	P	P	P	P	N	M	P	N		M					
HARRISON, HARRY H.																	
INGLEWOOD, ISAAC I.	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
JOHNSTON, JONATHAN J.	N	P			N	N											
KORBLETOES, KATE K.																	
LEMMONWORTH, LEON L.	P	P	M	P	P	P	M	P	N		N	N					
MORGANFIELD, MCKINLEY M.	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
ORTONFISK, ORVILLE O.	N	P	N	N	N	N	N	N		P		N					

Figure 13. Unit Performance Profile Report.

progress of a group or unit as a whole. They can be used to point out problem areas in new curricula when, for instance, a whole group of students is having difficulty mastering certain objectives. This may signal the need to modify the prerequisite structure or instructional activities associated with such objectives. Unit and Group Performance Profile Reports are also frequently used prior to the request for Grouping Recommendations.

DIAGNOSING

Diagnostic reports provide teachers with information useful for identifying the instructional needs of the students. As part of the Basic Program, WIS-SIM monitors student performance and generates weekly progress reports, listing students who have not mastered any objectives for N weeks (where N is user specified). The example (Figure 14) is a list of students who have not mastered a skill in the Word Attack area of WDRSD for six weeks or more. The report gives the last skill mastered and the date of that mastery for those students. The purpose of this report is to flag those students whose lack of progress may have otherwise gone unnoticed.

A second diagnostic report is especially valuable in curriculum areas such as DMP, which have a very involved prerequisite structure. In the example (Figure 15), the teacher has received a Topic Deficiency Report listing the students in the unit not eligible for Topic 9 of the DMP program. The report lists the topic, its title, and the results of the search through the performance information section of the Student Data Base and the prerequisite section of the Program Data Base, explaining why these students are not ready for Topic 9. Requests for Topic Deficiency Reports are usually made in conjunction with Grouping Requests, discussed below.

SCHOOL: LAKEWOOD ELEMENTARY
TEACHER: G. BROWNING

DIAGNOSTIC REPORT

AS OF MARCH 2, 1975

WISCONSIN DESIGN FOR READING SKILL DEVELOPMENT

STUDENTS WHO HAVE NOT MASTERED A SKILL FOR SIX OR MORE WEEKS

NUMBER	NAME	LAST SKILL MASTERED	DATE
1358	DAVIS, DAVID D.	B-8	DECEMBER 15, 1974
1236	DENTON, DENTON D.	B-10	JANUARY 19, 1975
1379	LARRY, LAWRENCE L.	C-1	JANUARY 19, 1975
1204	NASH, NELLIE N.	C-2	JANUARY 12, 1975
1362	RINSE, RUTH R.	C-1	JANUARY 19, 1975

Figure 14. Weekly Diagnostic Report.

DEVELOPING MATHEMATICAL PROCESSES

TOPIC DEFICIENCY REPORT: TOPIC 9 PAGE 1
UNIT A GEORGE WASHINGTON ELEMENTARY SCHOOL AS OF 08-05-74

"REPRESENTING NUMEROUSNESS PHYSICALLY"

PREREQUISITES: M OR P RATING ON OBJECTIVES 1 THRU 4 OF TOPIC 7.

THE FOLLOWING PUPILS ARE NOT READY FOR TOPIC 9 BECAUSE OF INSUFFICIENT ACHIEVEMENT OR ACHIEVEMENT NOT YET ASSESSED (INDICATED BY A BLANK).

	TOPIC: 7			
NAME	OBJECTIVE: 1	2	3	4
BARRYMORE, BARRY B.	P	N		
FARMINGTON, FRANCIS F.	P	M	P	N
JOHNSTON, JONATHAN J.	N	N	P	
NADAR, NELLIE N.	P	P	M	N
RACKENSTROKE, RALPH R.	P	N	N	N
WOBBLEMUCH, WIMBLY W.	M	M	P	N

Figure 15. Topic Deficiency Report.

In addition to the specific reports mentioned, teachers may also use the Performance Profile Reports when diagnosing student needs and when grouping students to meet those needs.

GUIDING THE INSTRUCTIONAL PROGRAM

The need for CMI systems is based on their ability to assist in the effective implementation of programs for individualizing instruction. Although diagnosing and performance profiling may take place on an individual level, nothing presented thus far in the discussion of WIS-SIM has provided for the individualization of the instructional program. It is the guiding or recommending process, the associated decision of selecting appropriate educational experiences and settings, and the subsequent instructing function which individualize the educational program.

By utilizing the Performance Profile and Diagnostic Reports, the teacher can derive a general notion of those skills and objectives which are associated with student needs, and where instruction may be required. Through the process of guiding the instructional program, a selection is made as to the appropriate educational experiences and settings to meet the identified needs. At present, two computer based resources, a Program Data Base and a Student Data Base, are used in making recommendations to teachers for guiding the instructional program. The Program Data Base contains the prerequisite structure for each instructional program. The Student Data Base contains, in addition to some demographic and administrative data, pupil performance data for each instructional program.

Grouping recommendations are obtained by means of a Grouping Request form (Figure 16). With this form, the teacher requests the computer to form groups of children who are eligible (have attained prerequisite

GROUPING REQUEST/TOPIC DEFICIENCY REPORT

School George Washington Date 10/01/74

Unit A Teacher West

Area (WA, SS, COMP) [✓ DMP] SAPA
Level & Skill / Topic Number / Module Number 9
Topic Deficiency ☑

Area (WA, SS, COMP) [✓ DMP] SAPA
Level & Skill / Topic Number / Module Number 10
Topic Deficiency ☑

Area (WA, SS, COMP) [✓ DMP] SAPA
Level & Skill / Topic Number / Module Number 11
Topic Deficiency ☑

Area (WA, SS, COMP) DMP SAPA
Level & Skill / Topic Number / Module Number ________
Topic Deficiency ☐

Area (WA, SS, COMP) DMP SAPA
Level & Skill / Topic Number / Module Number ________
Topic Deficiency ☐

Figure 16. Grouping Request and Request for Topic Deficiency Report.

mastery level) for those topics, modules, or skills he or she wishes to teach next. Note that with the form illustrated, groupings can be requested for either the reading program (Word Attack, Study Skills, or Comprehension), the math program (DMP), or the science program (SAPA). Requests for several instructional groups are also accommodated on this form. If the teacher wishes to receive a Topic Deficiency Report in addition to the grouping reports, the appropriate box is checked.

As a result of this request, the teacher receives three grouping reports. The first is an Instructional Grouping Recommendation (Figure 17). This report, for Topic 9, includes the unit (A) and school (George Washington Elementary); the program (Developing Mathematical Processes); the topic (9) and the objectives within that topic (1 and 2); the title (Representing Numerousness Physically); and the prerequisite mastery for topic 9 (M [illegible] P rating on objectives 1 through 4 of topic 7). The report then lists those students eligible for Topic 9. In this example, all but two of the students have attempted objectives within the topic previously, so the last assessment and its date are also given. Since the request was for topics 9, 10, and 11, the teacher would receive Grouping Recommendation Reports for 10 and 11 also.

The second report is the Intersection Report (Figure 18), which lists students eligible for one or more skills. This example is from the Word Attack area of the WDRSD program. On it the teacher has requested grouping recommendations for the levels and skills listed at the top of the report ranging from B-06 to D-05. The matrix graphically depicts (by the X's) the skills for which each student is eligible, the total number of skills for which the student is eligible, and the total number of students eligible for each skill. This report calls attention not only to those skills most

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                    DEVELOPING MATHEMATICAL PROCESSES

INSTRUCTIONAL GROUPING RECOMMENDATION:  TOPIC 9                    PAGE 1
UNIT A  GEORGE WASHINGTON ELEMENTARY SCHOOL                  AS OF 08-05-74

                  "REPRESENTING NUMEROUSNESS PHYSICALLY"

PREREQUISITES:  M OR P RATING ON OBJECTIVES 1 THRU 4 OF TOPIC 7.

SEQ      NAME                     OBJECTIVE:   1    2           DATE OF LAST
                                                                 ASSESSMENT

 1       ANDREWS, ANDY A                        N    P             05-21-74
 2       DUNCAN, DONALD D                       MT   P             05-21-74
 3       ELLSWORTH, ELLIE E
 4       HARRISON, HARRY H                      M    P             05-10-74
 5       INGLEWOOD, ISAAC I                     N                  05-21-74
 6       LEMMONWORTH, LEON L                    N    N             05-21-74
 7       MORGANFIELD, MCKINLEY M
 8       PROGEOUSKI, PENELOPE P                 MT   P             05-21-74
```

Figure 17. Instructional Grouping Recommendation Report.

```
                    <****INTERSECTION REPORT****>   03-19-75

                  WISCONSIN DESIGN FOR READING SKILL DEVELOPMENT

SUMMARY OF THOSE WHO ARE ELIGIBLE FOR ONE OR MORE SKILLS                PAGE 1
UNIT B  GEORGE WASHINGTON ELEMENTARY SCHOOL                        AS OF 10-01-74

    WORD ATTACK SKILL ----- B-06 RHYMING ELEMENTS
    WORD ATTACK SKILL ----- B-07 SHORT VOWELS
    WORD ATTACK SKILL ----- B-09 COMPOUND WORDS
    WORD ATTACK SKILL ----- C-12 CONSONANT DIGRAPHS
    WORD ATTACK SKILL ----- C-04 LONG VOWELS
    WORD ATTACK SKILL ----- C-16 SYNONYMS, ANTONYMS
    WORD ATTACK SKILL ----- D-03 SILENT LETTERS
    WORD ATTACK SKILL ----- D-05 ACCENT

                                 A    A    A    A    A    A    A    A      TOTAL SKILLS
                                 B    B    B    C    C    C    D    D    STUDENT ELIGIBLE
                                 0    0    0    0    0    0    1    1         FOR
STUDENT NO. - NAME               6    7    9    4    5    7    2    6

1630  ALLMAN, AARON                        X                                  1

1640  ANDREWS, ANDY              X    X    X                                  3

2140  CHAMPLAIN, CHARLIE                        X         X                   2

1690  INGLEWOOD, ISAAC           X    X    X                                  3

1470  LEMMONWORTH, LEON                         X    X                        2

1930  SMITH, JERRY               X         X                                  2

TOTAL STUDENTS ELIGIBLE          3    2    4    2    1    1    0    0         13
FOR SKILLS
```

Figure 18. Intersection Report.

appropriate for the group but also identifies those students who have limited eligibility for the requested level and skills.

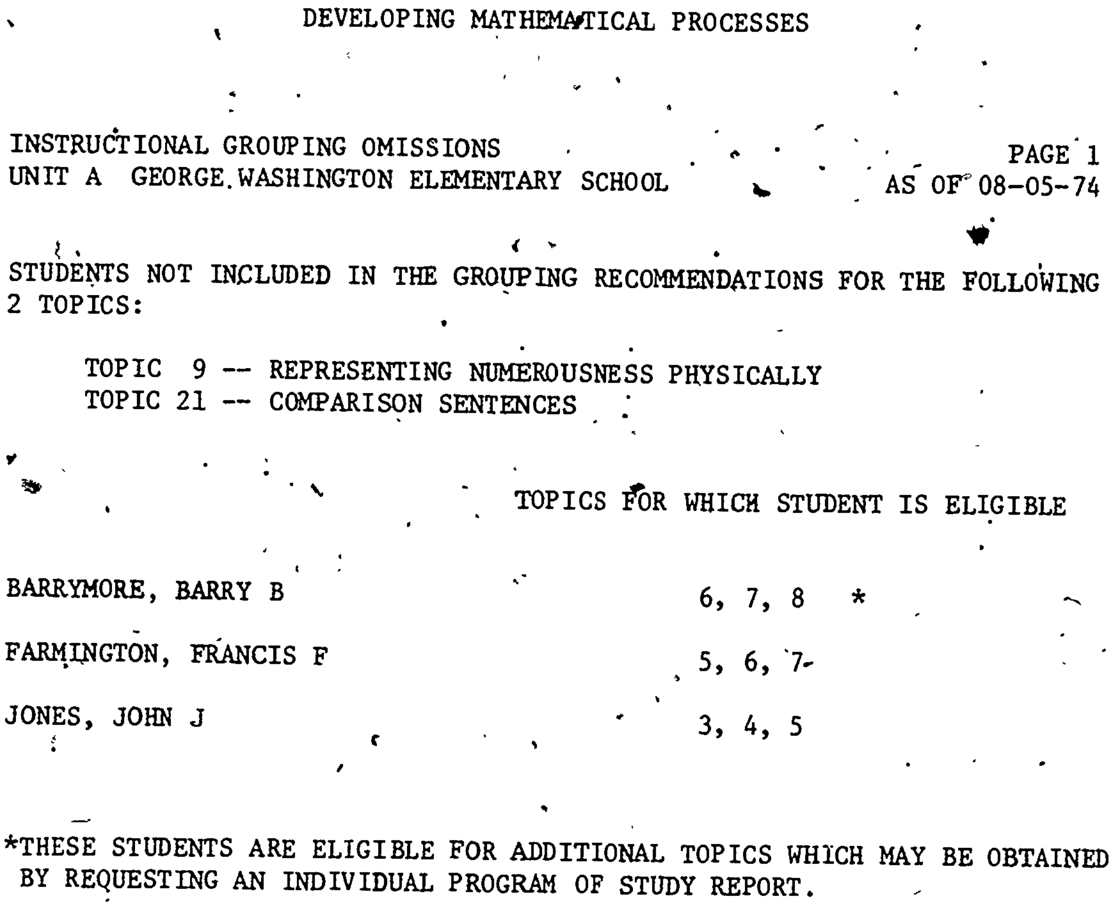
The third report generated is the Instructional Grouping Omissions Report (Figure 19). This example shows those students not eligible for either of the two requested topics, 9 and 21. To the right of the students' names are three topics for which each student is eligible. If they are eligible for more than three topics, the asterisk will appear as well. This starring indicates that the teacher may wish to process an Individual Program of Study Request (Figure 20) to get a complete list of topics for which the student is eligible. This request allows the teacher to examine each curriculum area in which the student is enrolled. The report (Figure 21) lists each topic for which the student is eligible and also the student's history of performance in each one, thus giving the teacher a comprehensive view of where the student's efforts can be best directed.

HOUSEKEEPING REPORTS

In addition to its instructional component, WIS-SIM provides a series of reports designed to facilitate accurate and consistent record keeping. Programs of individualized instruction need record-keeping systems which are able to efficiently update and modify existing data, and so accurately portray existing student assignments and demographic data.

WIS-SIM has several record-keeping or logistical functions which facilitate housekeeping reports. Report functions are listed in Table 2.

To make these changes in the data base, the same two forms used to initiate the data base are used: the Individual Student Registration form and the Baseline Performance Data form. To indicate that the information is an update, the Y on the form is circled (see Figures 6 and 7).



DEVELOPING MATHEMATICAL PROCESSES

INSTRUCTIONAL GROUPING OMISSIONS PAGE 1
UNIT A GEORGE WASHINGTON ELEMENTARY SCHOOL AS OF 08-05-74

STUDENTS NOT INCLUDED IN THE GROUPING RECOMMENDATIONS FOR THE FOLLOWING 2 TOPICS:

TOPIC 9 -- REPRESENTING NUMEROUSNESS PHYSICALLY
TOPIC 21 -- COMPARISON SENTENCES

	TOPICS FOR WHICH STUDENT IS ELIGIBLE
BARRYMORE, BARRY B	6, 7, 8 *
FARMINGTON, FRANCIS F	5, 6, 7
JONES, JOHN J	3, 4, 5

*THESE STUDENTS ARE ELIGIBLE FOR ADDITIONAL TOPICS WHICH MAY BE OBTAINED BY REQUESTING AN INDIVIDUAL PROGRAM OF STUDY REPORT.

Figure 19. Instructional Grouping Omissions Report.

STUDENT NUMBER	STUDENT NAME	CURRICULAR AREA
1880	BARRYMORE, BARRY B.	Circle: WA, SS, [✓ DMP,] COMP

Figure 20. Individual Program of Study Request form.

INDIVIDUAL PROGRAM OF STUDY REPORT

FOR JOHNNY JONES

SCHOOL: PARKVIEW ELEMENTARY

UNIT: A

PAGE: 1
AS OF 08-05-74

CURRICULAR AREA: DMP

TOPIC 2		ASSESSMENT	DATE OF LAST ASSESSMENT
OBJECTIVES	1	MT	03-03-74
	2	M	03-05-74
	3	N	03-10-74

TOPIC 3		ASSESSMENT	DATE OF LAST ASSESSMENT
OBJECTIVES	1	M	03-11-74
	2	M	04-12-74
	3	M	04-13-74
	4	M	04-14-74
	5		

CURRICULAR AREA: WORD ATTACK

LEVEL A		ASSESSMENT	DATE OF LAST ASSESSMENT
SKILLS	1	MT	04-11-74
	2	M	04-15-74
	3	MT	05-11-74
	4	M	06-11-74
	5	N	09-03-74
	6		
	7		

Figure 21. Individual Program of Study Report.

TABLE 2

HOUSEKEEPING REPORT

	REPORT	FUNCTION	PERIODICITY
1.	Unit Additions and Deletions	To list students who have been added to or removed from a unit.	As updated plus monthly summary.
2.	School Additions and Deletions	To list students who have been added or removed from a school.	As updated and summarized each semester.
3.	Unassigned Students	To list students who are not currently assigned to an instructional group.	As grouped plus weekly summary.
4.	Overassigned	To list students who are assigned to two or more instructional groups.	Weekly.
5.	Demographic Data Changes	To list students with the changes that have been made in the demographic data in the record.	As updated and yearly.
6.	Missing Data	To list students whose records contain missing data in certain specified data fields.	Each semester.
7.	Teacher Transfers	To list teachers who have been reassigned or transferred within or outside the school district.	As updated.

A composite housekeeping report is shown in Figure 22. The numbers in the far left column refer to the types of reports as listed in Table 2. Thus, report type 1 is a Unit Additions and Deletions Report, and it shows that Tom Smith was transferred from Unit A, Mr. Jones, to Unit B, Mrs. White, in school number 3. The other listings under the report type column also refer to reports listed in Table 2. This report form could be used to indicate student and teacher transfer during the school year and as a format for generating class records for school reorganization from one year to the next.

The Basic Program has been designed to manage the informational flow for a variety of curricula, as well as to facilitate some logistic functions of administration. The input and output forms of the Basic Program have been described as they relate to the processes of individualized instruction. These forms can be adapted to the needs of the schools using them.

WIS-SIM HOUSEKEEPING REPORT

School ____________________

Date ____________________

Student Report ☐

Teacher Report ☐

REPORT TYPE	STUDENT NAME AND NUMBER	From				To				Unassigned	Over-Assigned	Missing Data	Demographic Data Changes
		Unit	Teacher	School	District	Unit	Teacher	School	District				
1	SMITH, TOM 0103	A	JONES	3	2	B	WHITE	3	2				
2	BROWN, MARY 1014	A	JONES	3	2	A	GREEN	4	2				
3	JONES, BILL 0167									X			
4	THOMAS, JOE 0256										X		
5	DUNCAN, DON 0577												Code 3 354-3210
6	SMART, SHEILA 1236											6	
7		A	SMITH	3	2	B	SMITH	4	2				

Figure 22. Composite Housekeeping Report form.

IV

THE EXTENDED PROGRAM

The Basic Program has been designed to manage a primary implementation of IGE. In the Extended Program, additional WIS-SIM applications are conceptualized to expand the scope of WIS-SIM and thus increase its utility. The Extended Program represents a natural outgrowth of the Basic Program and its development will proceed incrementally. The discussion is essentially exploratory and is not intended to indicate all areas of future concern. It is intended, rather, to identify those options which can readily or conveniently be appended to the Basic Program or which refer to obvious but as yet unmet instructional or informational management needs of the schools. Some of these concerns occur in curriculum areas and include:

1. Goal setting in which performance expectations are assigned and used in conjunction with actual performance in diagnostic processes.
2. Testing and Test Scoring which includes placement or pretesting and posttesting, utilizing mark-sense technology.
3. Pupil progress reporting to parents in which information on pupil progress is summarized and reported to parents.
4. Selection of instructional activities which is the identification of activities and settings appropriate for meeting specific instructional needs.
5. Monitoring and evaluating the instructional program which is the capability of generating summary data useful in program and staff evaluation at both the formative and summative levels.

Potential administrative concerns include:

6. The utilization of a <u>Data base management system</u> which will manage and maintain data in a form useful in several user specified applications.
7. <u>Administrative reports</u> which provide information for evaluation and utilization of the computer management system and other housekeeping reports required by administrators for monitoring of the instructional program.

GOAL SETTING

One of the decision areas identified in the WIS-SIM model is that of specifying performance expectations for students. Expectations are set for individual students in terms of the number of instructional objectives to be attained in a specified time period.

Establishing goals for individual students is implicit throughout the Instructional Programing Model. Increasing a child's self-direction and his motivation to learn are major objectives of teacher-student goal setting. The theoretical underpinnings and procedures for conducting teacher-student goal setting conferences have been developed in <u>Individually Guided Motivation</u> (Klausmeier, Jeter, Quilling, Frayer, & Allen, 1975). Since the teacher's input to goal setting is based on his or her professional judgment of the student's capability, utilizing all available achievement and aptitude data, deviations from the goals can be diagnostic, both in the case of individuals and for subgroups of the student population.

The implementation of goal setting can be illustrated by several hypothetical reports which may be generated as part of the Extended Program. The reports which follow refer to the Word Attack area of the Wisconsin

Design for Reading Skill Development (WDRSD), but their formats may be generalized to other curriculum programs.

Figure 23 shows an example input form for submitting expectations of student performances in the Word Attack area of WDRSD. The teacher fills in the expected performance level for each student by listing the number of skills each student is expected to master in the first and second semesters. Although Figure 23 indicates that the teacher has submitted expectations for both semesters on September 2, 1975, it is possible to modify second semester expectations by making later submissions. Alternatively, specification of second semester expectations could be entered after progress in the first semester is assessed. The form shows the number of skills previously mastered, which provides baseline information to assist the teacher in arriving at expectations for individual students.

Student performance expectations together with past and current performance can be summarized into a form useful to teachers when they are assessing progress made by individual students at the end of a semester or year. Figure 24 shows a Summary Report to Teacher, which gives expected and actual numbers of skills mastered by individual students. This report also indicates the approximate skill levels for each student at the beginning and end of the school year. The example is of a report issued near the end of the school year 1975-1976. This information assists teachers in assessing student progress and in diagnosing learning needs.

The determinations of whether or not an optimum learning environment has been established and whether or not maximum use is being made of school resources are continually evaluated. Responsibility for quality control functions is shared by the staff of the Instruction and Research unit, the Instructional Improvement Committee (IIC) of the building, and the

Individual Performance Expectations

Unit: A

School: Thomas Washington

Teacher: Abe Madison

Date Submitted: 9/2/75

Reporting Period: 9/2/75 to 6/15/76

Student Number	Student Name	Number of Skills Previously Mastered	Expected Number of Skills to be Mastered	
			Semester 1	Semester 2
3025	Byron, Jill	30	6	5
2878	Tate, Mary	27	5	5
2920	English, Tom	26	5	7
2265	Sutherland, Jim	21	5	5
3488	James, Barry	18	5	5
2836	Jones, Andrew	18	5	5
3005	Bellairs, Ellen	16	4	5
2901	Robinson, Janet	15	4	4
3352	Winkler, Paul	12	3	4
2809	Smith, Dan	9	2	4

Figure 23. Individual Performance Expectations form.

it: B

School: Thomas Washington

Teacher: Abe Madison

Specifying Performance Expectations

WDRSD

Word Attack

Date Issued to Teacher: 6/18/76

				Skills - Semester 1		Skills - Semester 2		Year-End Totals		
Student Number	Student Name	Number of Skills Previously Mastered	Approx. Skill Level	Number Expected to be Mastered	Number Actually Mastered	Number Expected to be Mastered	Number Actually Mastered	Total Skills Mastered	Approx. Skill Level	Total Skills Expected to be Mastered
3025	Byron, Jill	30	C-10	6	5	5	5	40	D-2	41
2878	Tate, Mary	27	C-7	5	5	5	5	37	C-17	37
2920	English, Tom	26	C-6	5	2	7	7	35	C-15	38
2265	Sutherland, Jim	21	C-1	5	5	5	5	31	C-11	31
3488	James, Barry	18	B-11	5	5	5	4	27	C-7	28
2836	Jones, Andrew	18	B-11	5	5	5	6	29	C-9	28
3005	Bellairs, Ellen	16	B-9	4	5	5	5	26	C-6	25
2901	Robinson, Janet	15	B-8	4	4	4	5	24	C-4	23
3352	Winkler, Paul	12	B-5	3	4	4	3	19	B-12	19
2809	Smith, Don	9	B-2	2	4	4	3	16	B-9	15

Figure 24. Summary Report to Teacher.

System-wide Program Committee (SPC) of the district. Such determinations involve the evaluation of the relative effectiveness of competing instructional strategies and procedures and the determination of whether various subgroups of the student population are achieving mastery levels consistent with their abilities and goals.

Performance expectations of individual students and their actual performance are combined and summarized for various subgroups of the school population. These reports are updated during the school year and are distributed to the appropriate instructional decision makers. Each unit may be divided into three groups, ranking the students in order of their baseline skill level. Thus, a unit of 90 students could be divided into three groups of 30 students each. Dividing the students into three groups and describing the performance of each group, utilizing a group mean, provides a better description of unit performance than would a single performance index, such as a mean for the entire group. Thus, the first group includes those students who have mastered the fewest objectives and the third group those who have mastered the largest number of objectives at the beginning of the semester. It should be clear that the groups referred to in this section are not meant to be considered as instructional groups. That is, there is no intention to cluster and conduct instruction on the basis of inclusion in any of these groups; rather these groups are created solely for the purpose of reporting unit performance.

The computer synthesizes similar information in terms of unit level by district. These sets of printouts are generated and distributed three times a year, with the information indicated, in accordance with the following schedule: baseline data and expectations at the beginning of the year; baseline data, expectations, and actual first semester performance at the end of the first semester; and baseline data, expectations and first semester and year-end performance at the end of the school year.

Figures 25 and 26 illustrate the end-of-year printouts for various subgroups of the student population. Figure 25 is an example of a printout for a unit. This printout is for the unit staff and the IIC. Figure 26 is an example of a printout which considers all students at a given unit level throughout the school district. This printout is for the IIC of each building and the SPC of the district.

Figure 27 is an Exceptional Performance Report which lists students who deviate from expected performance levels (either above or below) by a predetermined amount. If an exceptional performance level has been set at two skills, students who are either two skills below or two skills above their expected levels are listed on the Exceptional Performance Report. These reports can be generated at either a fixed interval or on an ad hoc basis. If they are generated regularly, the teacher specifies the reporting period (e.g., every five weeks). A teacher may prefer to have the reports generated on an ad hoc basis to list students who deviate from their expected performance levels at different times (e.g., by one skill early in the semester or by two skills later in the semester).

TESTING AND TEST SCORING

In IGE, as in most approaches to individualizing education, testing plays a much more significant role than the testing requirements of traditional elementary education. Traditional elementary education is characterized by group teaching on a common curriculum. In the traditional classroom, testing is required for the following three reasons:

SCHOOL: KENSINGTON
UNIT: D

AS OF 6/18/76

GROUP INSTRUCTIONAL OBJECTIVES

BY UNIT

WISCONSIN DESIGN FOR READING SKILL DEVELOPMENT

WORD ATTACK SKILLS

	BASELINE PROFILE		EXPECTED PROFILE FIRST SEM.		ACTUAL FIRST SEM. PROFILE		EXPECTED PROFILE YEAR END		ACTUAL YEAR END PROFILE	
CLASS GROUPS	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL
FIRST GROUP	15	B-8	18	B-11	17	B-10	21	C-1	20	B-13
SECOND GROUP	25	C-5	31	C-11	32	C-12	37	C-17	38	C-18
THIRD GROUP	35	C-15	43	D-5	44	D-6	45	D-7	44	D-6

Figure 25. Group instructional objectives by unit (with first semester and year-end data).

SCHOOL: DISTRICT-WIDE
UNIT: INTERMEDIATE PRIMARY

AS OF 6/18/76

GROUP INSTRUCTIONAL OBJECTIVES

UNIT LEVEL BY DISTRICT

WISCONSIN DESIGN FOR READING SKILL DEVELOPMENT

WORD ATTACK SKILLS

	BASELINE PROFILE		EXPECTED PROFILE FIRST SEM.		ACTUAL FIRST SEM. PROFILE		EXPECTED PROFILE YEAR END		ACTUAL YEAR END PROFILE	
CLASS GROUPS	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL	AVERAGE NO. OF SKILLS MASTERED	APPROX. SKILL LEVEL
FIRST GROUP	14	B-7	17	B-10	15	B-8	30	C-10	28	C-8
SECOND GROUP	23	C-3	29	C-9	23	C-3	40	D-2	36	C-16
THIRD GROUP	30	C-10	39	D-1	34	C-14	45	D-7	43	D-5

Figure 26. Group instructional objectives at unit level by district.

Unit: B Exceptional Performance

School: Thomas Washington WDRSD

Teacher: Jones Word Attack Skills 1/8/76

Student Number	Student Name	SEMESTER I		Difference Between Expected and Actual Masteries
		Expected Number of Skills to be Mastered	Actual Number of Skills Mastered	
2920	English, Don	5	2	-3
2809	Smith, Don	2	4	+2

Figure 27. Exceptional Performance Report.

1. To accumulate normative performance data on each student for purposes of reporting to parents and for certifying performance for grade promotion and school graduation.
2. To provide feedback to students ostensibly for motivational purposes since in the traditional classroom there is minimum provision for individual diagnosis and prescription.
3. To provide information to those teachers who attempt to gear their teaching to the median or modal level of the class.

Testing in the traditional classroom is generally accomplished by giving the same test to all of the students in the class at the same time. If the individual teacher has a commitment to only the first reason above, to certify performance, as some traditional teachers do, testing need only take place at relatively infrequent intervals.

In IGE, as in other programs of individualized education which are characterized by continuous progress and individual programs of study, testing is required frequently, and only occasionally can the same test be administered to all the students in the unit at the same time.

The IGE Instructional Programing Model (presented in Chapter I) requires that appropriate tests be given to each child at specific stages in the instructional cycle. Placement tests are required in each instructional program to determine the student's point of entry. Pretests provide information to help the teacher determine whether a student can skip an instructional module or what specific instruction is required. Posttests show which objectives in an instructional module have been mastered and whether the student may proceed to another objective or requires remediation. Such a program of testing, specific for each child, ensures continuous progress education and supports a diagnostic-prescriptive educational environment.

Testing in IGE can take the form of performance tests, work samples, and teacher observation/certification, although the usual paper and pencil tests are predominant. In any testing situation, however, it is essential that the mastery level or performance standards be explicitly defined.

In many instances machine scoring of tests is feasible and desirable. Since test results need to be entered into the data base in order to be utilized in an automated instructional management system, machine scoring of tests can save considerable time in updating student records. This is because the intermediate manual processes of scoring, transcribing, and keypunching are either eliminated or automated.

Because of the variety of testing which may take place, it is reasonable to conclude that not all tests are machine scorable. Performance tests, work samples, and teacher observation are not usually conducive to machine scoring. Further, it may be that certain paper and pencil tests are not as efficiently machine scored as they are hand scored. Hand scoring may be more efficient when the number of items to be scored is small, when the nature of the response sheet is not readily handled by scanning equipment, or when suitable scoring equipment is not easily accessible.

In addition to the machine scoring of tests, an on-line computer system can contribute significantly to the IGE Instructional Programing Model by generating tests which are specific to each child. Tests can be constructed which, for each child, most effectively measure the level of retention of previously mastered objectives as well as test, during one test session, mastery or non-mastery of objectives across several instructional programs. The tests could be administered interactively at the school terminal or unique tests for each child could be printed on the school terminal and the responses indicated on a mark-sense sheet. When the test is administered interactively at the terminal, the branching capability of the computer could be utilized to arrive at mastery-nonmastery decisions more quickly and reliably.

PUPIL PROGRESS REPORTING TO PARENTS

In its generalized form, WIS-SIM contains large amounts of data on pupil performance. As part of the Extended Program, WIS-SIM will offer a variety of formats for reporting pupil performance in addition to the Performance Profile forms discussed in Chapter III. Several possible approaches to progress reporting in WIS-SIM will be considered. One approach is to program the system to print out student data on standardized report card forms. Some schools have established their own systems for doing this. However, as a general strategy for WIS-SIM, this approach does not seem feasible for two reasons. First, the variety of reporting schemes in use and the emphasis which is placed on flexibility indicate that many schools would be unwilling to use a standardized WIS-SIM form. Second, the information available in the system is more detailed and specific than the information that is usually reported. Typical report card forms include global items such as "reads with understanding" or "uses math skills to solve unfamiliar problems" which require a synthesis of the mastery-nonmastery data that WIS-SIM provides.

An alternative approach is to make no changes in the system but to make specific suggestions for using the information as it is now generated. Pupil Performance Profiles, for instance, could be used for planning and conducting parent conferences, as a guide in filling out report cards, or in the writing of narrative reports. Exception reports could be used to indicate the need for conferences with parents, and the procedure for specifying performance expectations could be incorporated into the conferences.

The third approach is to design new forms which summarize only the information that parents need or want and can interpret easily. Such reports could be produced at times specified by the school, and either sent home with the school's regular report cards or discussed in parent-teacher conferences. The report should be less detailed than a Performance Profile but should still provide information about both the quantity and content of the student's work. The description of the skills on which the student has been working should be brief but meaningful to parents. Examples may be helpful. The use of graphs is an easy way to show students' progress over time, their progress relative to the unit or age cohort, and their position relative to the terminal objective of the program or expectations set for them.

A fourth approach is one that provides both a student summary sheet used by the teacher in parent-teacher conferences and a student report card, which is the parents' record of the student's progress. Flexibility in selecting report card formats is needed to accommodate individual preferences of schools.

A basic issue of reporting student progress is the reporting of normative information in addition to criterion-referenced information. If normative data are to be provided, the appropriate norm reference groups must be determined.

As part of the WIS-SIM pilot test, surveys will be conducted to determine which options are most viable. The study will include parents as well as teachers and administrators. Those choices that seem to be most useful will be explored further, keeping in mind that models should remain adaptable to provide for a range of local school needs.

SELECTION OF INSTRUCTIONAL ACTIVITIES

The WIS-SIM model is conceptualized to take into account a wide range of both subjective and objective information which is useful for determining appropriate educational experiences and settings to meet specified educational needs. Factors which may influence the selection of instructional activities are teacher variables such as skill in teaching, and preference for teaching certain instructional activities, and student factors such as aptitude, learning style and learning handicaps. An additional factor might be an incompatibility between a student and a teacher. Another important consideration is the availability of both human and material resources to effectively discharge the selected instructional activities. Thus, information about personnel, instructional materials, equipment, and facilities would need to be provided, each in a separate data base, and integrated into one management system. Complementing these data bases is an Instructional Activities Data Base designed to index instructional activities which may be used to assist a student in learning the content of a particular objective. The Instructional Activities Data Base contains information which identifies and describes each instructional activity and defines the instructional resources required in its use. When a particular objective is to be taught, this index may be used to determine which instructional resources are currently available to teach the objective.

The Instructional Activities Data Base can also be used to answer general inquiries about what instructional materials are available commercially or otherwise, within the district or from other sources, to meet certain instructional needs.

MONITORING AND EVALUATING THE INSTRUCTIONAL PROGRAM

A computerized management information system allows flexibility in the length of time records may be kept, from relatively short term to almost permanent. Storage on tape of a large volume of data is relatively inexpensive. One of the features of the Extended Program is the ability of WIS-SIM to generate milestone reports and files. These reports can be user designed and can provide information on students' progress over prespecified time periods. For instance, a school district might specify that the number of topics mastered in each unit during each six weeks period of the school year be collected and stored for a period of two years. The information from these reports could be used when determining the effectiveness of various programs, teaching techniques, facilities, or other factors.

A system of computer managed instruction can be designed so as to retain a record of the use and effect of instructional activities, sequencing of instructional objectives, equipment, and space. Activities can be evaluated through a net success ratio (actual objectives mastered divided by total possible objectives mastered for that activity) and broken down by various student classifications (ability level, socio-economic status, etc.) in order to assess the effectiveness of the activities for certain student groups. Comparing the actual success rates with the expected rates creates a diagnostic assessment of the effectiveness of an instructional activity. The diagnostic assessment, or success ratio, points to areas in which instructional programs might be improved. It also permits the comparison of objectives and programs which elicit the same or similar behaviors or knowledge outcomes. Through this process, instructional programs or individual activities can be reviewed systematically and omitted, improved, or replaced if they do not meet school or district needs.

Instructional equipment and space cannot be evaluated as readily as instructional activities, but utilization reports can, over time, show use patterns within various curriculum programs. The sequencing of objectives might be evaluated through regression analysis or other statistical analysis of mastery/nonmastery/not attempted patterns among objectives in a program. This analysis, when computed over many students, could give a weighted value for each objective in terms of its impact on mastery of later objectives. In this way the sequencing structure can be verified or altered to better serve the curriculum program.

As the system of program evaluation is further developed, a program budgeting system could be implemented. Both the absolute cost and the cost per benefit (of instructional programs) can be more accurately computed with a CMI system. This "total systems" approach to computer management of instructional programs leads to better, more timely information to teachers and instructional decision makers at all levels.

DATA BASE MANAGEMENT SYSTEM

Generalized Data Base Management Systems are currently at the forefront of computer software development. With generalized Data Base Management Systems, information applications can be designed, installed and operating in days or weeks rather than months or years. State-of-the-art Data Base Management Systems provide capabilities to catalogue, store, access, and manipulate data as the user desires. A most impressive capability is the ability to generate reports in terms of unique calculations and formats triggered by an ad hoc request in the form of a nearly English command. For example, the command below will cause a report to be generated which will list, for each student in the Emerson School, the total number of WDRSD skills mastered as of the end of the year and the number of WDRSD skills mastered during the current year.

LIST/TITLE (NAME OF SCHOOL), (DATE, LIST/TITLE, STUDENT,NAME,
TOTAL NUMBER + OF WDRSD SKILLS + MASTERED + YEAR END,
NUMBER OF WDRSD + SKILL MASTERED + DURING YEAR/
(NAME OF STUDENT), (JUNE 1975 TOPIC TOTAL MILESTONE),
(JUNE 1975 TOPIC TOTAL MILESTONE) - (SEPTEMBER 1974 TOPIC
TOTAL MILESTONE), STUDENT NAME ORDERED ALPHABETICALLY
WHERE SCHOOL EQ EMERSON AND INSTRUCTIONAL PROGRAM EQ WDRSD.

Figure 28 shows the report. In order to generate such a report a certain type of history must be maintained in the SDB, i.e., milestone records which periodically record the total number of skills mastered. Once a repertoire of milestone records has been identified, and a strategy for storing them has been developed, a number of ad hoc research and administrative reports could be generated with a minimum of data storage and data manipulation. Thus, a Data Base Management System has the potential for providing educational decision makers with a tool for accessing the data at their disposal in a timely and efficient manner.

ADMINISTRATIVE REPORTS

It is convenient to consider administrative reports in WIS-SIM as belonging to one of three categories:

1. Housekeeping Reports which are required to monitor the accuracy and consistency of the information which is utilized in classroom management.
2. Reports which are required by local and state educational agencies.

EMERSON SCHOOL JUNE 1975

STUDENT NAME	TOTAL NUMBER OF WDRSD SKILLS MASTERED AT YEAR END	NUMBER OF WDRSD SKILLS MASTERED DURING YEAR
ALLMAN, AARON	75	30
ANDREWS, ANDY	50	20
CHAPLAN, CHARLIE	58	23
HANSON, HANNAH	48	19
INGLEWOOD, ISAAC	63	25
LEMMONWORTH, LEON	53	21

Figure 28. Sample *ad hoc* report.

3. Reports which are required for monitoring and accounting for computer resource utilization.

The WIS-SIM Housekeeping Report requirements are discussed in Chapter III. The reporting requirements for local and state educational agencies in the United States cover a broad spectrum and it is probably appropriate for the WIS-SIM developmental effort at the Wisconsin Research and Development Center to address only those requirements which are fairly common and which can be conveniently satisfied by the data which are routinely available in WIS-SIM.

For example, in most states, school districts are required to generate a yearly attendance report to the state Department of Education. If the student's attendance record is stored in the Student Data Base (SDB), an annual report could be generated quite easily. Student-related data such as date of entry in school, date of departure, age, and sex can be summarized and available on request. Such information could be used to forecast enrollment trends through an enrollment projection program. Discrepancy analysis for deviation from projected growth can also be reported. Demographic information including addresses and familial relationships can be of use for completing research oriented questionnaires. Summary data, for instance, showing the number of students studying the various subjects offered in the school, are occasionally required by state education authorities. The volume and kind of data individual school districts should keep are determined by the types of reports they choose to have generated by the computer and also by the nature of the administrative data they communicate to educational agencies.

A different type of report useful to the administrator and available in the Extended Program is a monthly report designed to provide educational decision makers with information helpful in directing and evaluating a computer managed instructional system.

This report will point out ways of improving inservice procedures and user documentation, and will point out system design errors which have been documented. The report can indicate the load placed on the system by tallying the number of lines printed and giving the computer time allocations. This information aids in system design and permits a per student cost-benefit analysis for each curriculum program. Each school will keep a log to document errors and one will be kept at the computer center. The monthly report will also include the content of these logs.

Figure 29 shows that a teletype (TTY) has printed 1015 lines using 3 hours, 2 minutes, and 15 seconds of central processing unit (CPU) time while being connected for 111 hours, 37 minutes, and 2 seconds. This information is for the period of January 1 to February 1, 1975. Also reported is a hardware malfunction with a card reader (CR) at Madison Elementary on January 15.

A related administrative concern is the cost of computer services. Computers are a relatively scarce and expensive resource for schools. Schools are never likely to have as much computer time as they are able to use. The factor of expense will force WIS-SIM users to constantly monitor their utilization of available computer resources in terms of the benefits to instructional programs and to make appropriate adjustments.

There are a number of ways to adjust the utilization of computer resources. Computer resources can be allocated to instructional programs depending upon the relative importance of the program in the overall mission of the school. Also, the utilization of computer resources can

WIS-SIM

MANAGEMENT REPORT

DISTRICT Appleton

SCHOOL Madison Elementary

UNIT B

DATE 2/10/75

FOR THE PERIOD 1/1/75

TO 2/1/75

FACILITY		REQUESTS		PROBLEMS		
CODE #	TYPE	LINES PRINTED	TIME ALLOCATION	CODE #	EXPLANATION	DATE
			GPU/HOOKUP			
37	TTY	1015	3:02:15/111:37:02			
38	CR	--		08	Hardware mal-function	1/15/75

Figure 29. WIS-SIM Management Report.

be adjusted to reach an appropriate compromise between the requirements of an instructional program and the level of service provided. For example, computer resource utilization is directly related to the time taken to process information. The WIS-SIM program facilitates such adjustments in level of service by providing complete WIS-SIM capabilities in the batch, on-line and interactive modes of computer operation (see Chapter V).

Because of the scarcity of computer resources, there is a need to adjust computer resource allocations between instructional programs and levels of service within programs. This requires the WIS-SIM user to have accurate and appropriate records of actual computer resource utilization. Figure 30 shows a form for reporting which computer resources were used and the cost of each one.

The Extended Program discussed in this chapter has sought to provide for further applications of WIS-SIM. The importance of the administrative tasks which were presented above seems to be unchallenged. Facilitation of these and other administrative tasks supports the use of computers. WIS-SIM has been designed for use with maximum flexibility to accommodate a wide variety of potential applications.

ACCOUNTING AND

RESOURCE ALLOCATION

SCHOOL ____________________

DISTRICT ____________________

INSTRUCTIONAL PROGRAM ____________________

CATEGORY	UTILIZATION	RATE	CHARGES DATE / / FOR THE PERIOD / / TO / /
#DESCRIPTOR			
01 LINE PRINT ALLOC.			
02 LINE PRINT LINES			
03 REMOTE TTY ALLOC. TIME			
04 REMOTE TTY LINES			
05. MAG TAPE ALLOC. TIME			
06 MAG TAPE RECORDS			
07 MAG TAPE HUNDREDS OF WORDS			
08 DISC ACCESS			
09 DISC TRANS/ 100's WORDS			
10 CARD READER ALLOC.			
11 CARD READER CARDS			
12 TAPE STORAGE			
13 # OF TAPES			
14 DISC STORAGE # OF TRACKS			

Figure 30. Accounting and Resource Allocation Report.

National Evaluation Committee

Francis S. Chase, Committee Chairman
Emeritus Professor, Department of Education
University of Chicago

Helen Bain
Past President
National Education Association

Lyle E. Bourne, Jr.
Institute for the Study of Intellectual Behavior
University of Colorado

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L. R. Goulet
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Chester W. Harris
Department of Education
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Department of Education
Howard University

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State of Wisconsin

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Teachers' College, Columbia University

Executive Committee

Richard A. Rossmiller, Committee Chairman
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R & D Center

William R. Bush
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Joel R. Levin
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