IN HIS preplanning, the unit teacher must provide for individualization of instruction and for insuring depth and breadth of the individual pupil's knowledge in an area. Recently we have tried to invent a process whereby we could apply electronic processing equipment in such way as to relate preplanning of a teaching-learning situation to the needs and receptive abilities of individual pupils.

Through the use of electronic computers, the Center for Curriculum Planning of the State University of New York at Buffalo developed, coded and programmed six resource units and supplied 51 teachers with resource guides (specific printed suggestions taken from a resource unit) related to the six resource units on the 3rd grade and the 11th grade, social studies, levels. The suggestions contained in these resource guides were keyed to the analysis of the composition of the class members as a whole, as well as individual learner variables, the specific instructional objectives of the unit chosen by the teacher and/or the learners, as well as other decisions of a professional nature which the teacher might choose to make. The electronic computer, properly programmed, can accommodate the numerous variables involved in each classroom situation.

In sum, the electronic computer can perform the following functions in this context:

1. Responding to the learning objectives identified by the teacher and/or pupils, it can provide an appropriate content (subject matter) outline.

2. By taking into consideration the variables of learning objectives and the characteristic composition of the class, it can suggest:
   a. Significant large group activities
   b. Significant small group activities
   c. Significant instructional materials for the total group
   d. Significant measuring devices for the total group.
3. By taking into consideration the variables of learning objectives and the characteristics of each learner, it can suggest suitable instructional material and individual activities for each student, for each objective chosen.

Basically, this program, sponsored by the Cooperative Research Program of the United States Office of Education, used computers to help elementary and secondary school teachers in their preplanning of large, small and individual teaching-learning situations within the context of unit teaching. In order to accomplish this purpose, five specific objectives served as a guide to activities. These objectives were:

1. To gather from all sources the component parts of six resource units: three on the elementary school level, 3rd grade, three on the 11th grade level, social studies
2. To identify the specific variables, or categories, whereby all items in a resource unit could be coded for purposes of eventual retrieval by a data processing machine
3. To code all items in the resource units
4. To program the electronic data processing machinery in such a way as to relate preplanning of subject matter, materials, and means of presentation to the specific objectives of a classroom teacher
5. To program the electronic data processing machinery in such a way as to relate preplanning of materials and means of presentation to the needs and the receptive abilities of individual pupils.

**Man and Machine**

Prior to the development of plans and procedures, particular attention was given to separating the preplanning functions of the teacher from the retrieval functions of the computer.

The teacher's functions were four in number:

1. To identify the subject of the teaching unit. To identify the basic unifying theme which would serve as the center of interest in the classroom during a specific period of time.
2. To define the students' abilities, needs, characteristics and interests, as these items relate to the selections to be made within the total unit
3. To suggest possible learning outcomes in the form of behavioral skills, understandings, information, and peripheral objectives which may reasonably be expected to result from the teaching-learning situations developed throughout the unit
4. To make, if deemed necessary, certain professional decisions related to those tasks or areas which the teacher deems important for the objectives and the students in the classroom.

On the other hand, the electronic computer had to satisfy the following functions:

1. To provide the teacher with a subject matter outline or problem census related to the learning outcomes identified by the teacher
2. To suggest a significant (related to the learning outcomes and characteristics of the pupils) number of large group introductory and developmental activities

*December 1965*
3. To suggest a significant number of introductory and developmental small group activities.
4. To suggest a significant number of individual learning activities which might prove to be helpful.
5. To suggest suitable instructional materials, including reference materials, for individual students.
6. To suggest appropriate equipment, audio-visual materials, and the like, for large group and small group instruction.
7. To suggest suitable references and other materials for the use of the teacher.
8. To suggest how achievement of these proposed outcomes may be evaluated.
9. To suggest "leads" to other related units (continuous activities) which might grow out of the proposed unit.

Once the specific functions of teachers were separated from the functions of the electronic data processing equipment, the basic task of defining and organizing the data for the computer became clearer. The sets of variables which needed top consideration would obviously be related to the teacher's preplanning functions. On the other hand, it was clear that in order for the equipment to carry out its functions it would have to contain a coded reservoir of items in regard to learning outcomes, subject matter, instructional activities, instructional materials, measuring devices, references for the teachers, and suggestions for further units of instruction: in short a resource unit.

Therefore, the project staff placed major emphasis on three operational activities. First, the staff devoted considerable time to the identification of resource unit topics and the development of six resource units. Second, special concern was given to the coding of all items in each resource unit. This meant concentrating on the general categories for coding as well as the individual items within the categories in order that retrieval could be made later in terms of the screens of selection relative to unit teaching. Third, the staff was obviously concerned with programming the electronic data processing equipment so that a readable, intelligible print-out could be completed in short order and presented to a teacher.

**Coding Resource Units**

Six resource units were developed, coded and made ready for programming: on the 3rd grade level, the topics chosen were: "Transportation," "Communication," and "Foods"; on the 11th grade level, the topics chosen were: "U.S. Constitution," "Manifest Destiny" (Westward Movement), and "World War II." In order to code the units for the computer, attention was given to developing sets of variables related to the learning outcomes of a specific resource unit, the learner's characteristics, and the professional decisions which teachers have to make.

With the objectives as a base, each and every item in the resource unit was reviewed carefully by an experienced teacher in order to identify which objective or objectives were directly related to each item in the resource unit.

December 1965
Such items as IQ, reading level, grade level, interests, social class, developmental tasks, and certain vital statistics also served as a base for coding, in return, every item in the resource unit.

A third set of variables was developed which would enable the electronic equipment to do specific tasks for the teacher. These variables, related to professional knowledge about teaching, revolved about such items as major social functions, methodology, types of objectives, instructional activities, suggested approaches, instructional materials, and measuring devices.

**The Print-Out—A Resource Guide**

Once a teacher had chosen the unit topic, had indicated the specific learning outcomes and professional decisions he wished to develop in a unit, and had provided information about specific pupils in his classroom, what did he get from the data processing equipment? He received two sets of suggestions which had been typed by the electronic equipment. The first set of suggestions were related to the specific objectives the teacher identified, and the second set of suggestions were related to the individual pupils in his classroom.

Stated in other terms, the resource guide will provide for the teacher, after the electronic data processing equipment has done its work, two printed sections: the first section will outline subject matter, large and small group activities, and measuring devices as these items relate to those objectives which the teacher has chosen. The second part of the resource guide will provide the teacher with suggestions for individual activity and instructional material (for each individual pupil) related to those specific learning outcomes originally chosen by the teacher.

In order to do this the number of revisions in programming and coding were numerous and detailed. However, in terms of time factors, we can generally report that an electronic computer can digest information about 30 students and print Parts A and B of a resource guide in 45 minutes. Within a year this time-span should be cut to 15 minutes per unit, per class. The first print-out during mid-October, 1964, took over three hours. This time factor element is significant since we are concerned with millions of man-hours of work which can be done by a computer in a matter of minutes. This is basically significant, since it means that the computer can retrieve information for a teacher which has never been retrieved in any other way. Finally, this may mean that individual teachers can be helped to preplan for individualization of instruction.