DESIGN OF A SIMULATION TO ASSESS PRE-INSTRUCTIONAL PLANNING SKILLS OF TEACHERS

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ABSTRACT

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A deterministically-modeled, computer-based simulation was designed to assess teachers' pre-instructional decision-making, an ability hypothesized to be possessed to a greater degree by those considered effective teachers. Participants were required to make decisions relevant to the needs of 25 simulated students which would enable the students to "learn" 10 subject matter units within 12 "periods". The thesis details the construction of the simulation, the rationale for the decisions and the pilot test run.

The majority of the 21 participants expressed positive reactions to the simulation. The simulation discriminated between players who make a substantial number of appropriate decisions and those who do not, the relationship between this ability and effective teaching (using personality trait scores as the predictor variables), was not significant ($p > .05$) when compared by multiple regression analysis. Chi square analysis detected no significant relationships between sex of player, grade level teaching and years teaching.

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INTRODUCTION

"Despite 75 years of research on the topic, relatively little is known about effective teaching", notes Brophy (1976, p. 32) in his reflective article on research in the elementary schools. The perennial search for indicative measures of teaching effectiveness by teacher-training institutions has resulted in the development of numerous but relatively unsuccessful devices based upon the perceptions of teachers as: classroom managers; or as social interaction facilitators; or as information dispensers, etc.

The difficulty in creating an effective measure stems from the complexity of the teaching-learning process. Popham (1968) suggests that the reason for this difficulty is that:

> The quality of learning which transpires in a given instructional situation is a function of particular instructional procedures employed by a particular instructor for particular students with particular goals in mind. (p. 217)

It is the wide variation in the value concepts underlying the descriptions of desirable teaching objectives and the differences in teacher role at different educational levels, in different subjects, and with different pupils, which Ryans

(1960) saw as important reasons why the identification of effective teachers is so difficult.

The need to identify effective teachers is recognized throughout the educational system; parents, school administrators, and schools of education want to identify those teachers who are the most effective in creating the kinds of educational environments and experiences which lead to optimum intellectual and emotional growth of students. This desire to identify effective teachers is tempered with the recognition that the identification of teaching ability must be assessed in the context of a dynamic and complex process which reflects the complexity of the teaching situations.

This thesis will describe the design, construction and the test run of a complex, responsive teacher assessment instrument, a computer-based simulation, which attempted to measure instructional planning skill, an ability which was hypothesised as an indicator of effective teaching.

In Chapter I the literature is reviewed and in Chapter II the theoretical basis for the simulation and its design parameters are presented. A synopsis and the rationale for the decisions are contained in Chapter III. The testing of the simulation is described in Chapter IV, the results in Chapter V, and discussed in Chapter VI.

CHAPTER I

REVIEW OF THE RESEARCH

"Generally", notes McNeil and Popham (1973, p. 229), "evaluation of student teachers is based upon the most subjective of factors". They go on to support this assertion by examining a number of common criteria used in assessing teacher competency. The use of student ratings of teacher effectiveness is widespread in situations where the day-to-day observation must be made without the presence of outside observers but contamination due to "halo" effects have been considerable. They also cite the finding of Rayder (1968) that there "...is no consistent relationship between student opinion of teacher behavior and student gain" (p. 231). After examining studies involving teacher self-evaluation McNeil and Popham conclude that there is a tendency for teachers to overrate themselves and that there are negligible relationships with self-assessment with other criteria such as student ratings and measures of student gain.

Supervisors and principals commonly use rating scales as tools for measuring teacher effectiveness however; vague wording, badly defined items, halo effect, failure to control for sampling of teacher behaviour and effect of observer on teacher performance make rating scales in the hands of supervisors, administrators and peers of little worth. Systematic observation of classroom activity is beneficial for recording and analysing teaching behaviour but "not for judging it... effective teaching cannot be proven by the presence or absence of any instructional variable -- even those with high probabilities for effecting change..." (McNeil and Popham, p. 233).

Performance-based measures such as Micro-teaching and Performance Tests, are relatively recent approaches which have had some degree of success. Micro-teaching is a combination of a conceptual system for identifying precisely specified teaching competencies and the use of videotape to record a practice lesson. The lesson is then critiqued by the instructor and/or the trainee. Peck and Tucker (1973) cite studies at Stanford which indicate that performance in the micro-teaching situation significantly predicted subsequent grades in practice teaching; however, these results are not obtained every time. Kallenback and Gall (1969) found that the micro-teaching experience did not result in significantly higher ratings of teacher effectiveness of teacher interns in comparison with interns who did not receive micro-teaching experience.

Among the many variables which have confounded the establishment of generalizable measures of effective teacher behaviour is the lack of a standard set of teaching conditions on which to evaluate teachers. In an attempt to overcome this problem Popham (1968, 1971) has devised the Performance Test or Teaching Power Test. This is a strategy in which a number of teachers are given identical or similar objectives and a sample of outcome measures to be administered to pupils following instruction. In most cases only the ends are given, the means are left up to the individual teacher. Groups of learners are assigned randomly to the teacher and the pupils' performance on the post-test becomes the criterion of effectiveness. A number of studies reviewed by McNeil and Popham suggest there is reasonable control for extraneous factors (teacher familiarity with content, pupil population) and some teachers are consistently more successful in achieving the desired results. They note however the need to verify that teachers who can produce the desired effects under the test conditions can also maintain this effect over time and in less controlled conditions.

These two performance-test approaches, micro-teaching and performance testing, suggest viable directions; however, they appear to have two limitations. Both approaches require the use of subjects who may be exposed to a wide range of teaching competence and both require a high level of instructor interaction.

These two approaches place an emphasis on the making of relevant teaching decisions, an ability viewed by Fattu (1963) and Mitchell and Shears (1974) as a fundamental skill of an educator. Shavelson (1973) also contends that "what distinguishes the exceptional teacher from his or her colleagues is not the ability to ask, say, a higher-order question, but the ability to decide _when to ask_ such a question" (p. iii). This ability is the result, either conscious or unconscious, of the complex processing of available information and study of this process presents a promising approach to the identification of effective teaching (Shavelson and Dempsey, 1976).

The making of appropriate instructional decisions is an extremely complex process and the successful creation of a test capable of effectively measuring this skill rests upon the creation of test stimuli which will elicit the real-life response. Success also rests upon providing the opportunity for the respondant to reply with a semblance of freedom of a real situation (Schalock, 1969). Twelker (1967) notes however that a faithful duplication of reality is not essential in order to have transfer from a simulation situation to a real world setting. It is these parameters which influenced the choice of a simulation as the testing mode.

Some simulations, using either stochastic or deterministic models, have been designed to assess teacher competence. One approach to test teacher decision-making has used the interaction in the classroom as the decision stimulus. Mr. Land's Sixth Grade developed by Kersh (1961) used filmed sequences which pose problems in classroom management. The student teacher is shown film sequences depicting class problems and is expected to react to the film as if it were a live classroom situation. The instructor then evaluates the response. Results indicate that with this simulation training there is a transfer in learning and an increase in readiness to resume classroom management at an earlier date than students without comparable training (Twelker, 1967). As in micro-teaching, the teacher's role is viewed as a behaviour manager and the decisions the trainees make are not related to instructional planning. The technique also requires specialized projection equipment, is costly, and appears to be capable of handling only a small number of students at a time.

Mitchell (1973), Mitchell and Shears (1974), Mitchell (1975, 1976, 1977) have developed a stochastic game to test the pre-instructional decision-making ability of teachers. A simulated class of 30 learners allows the game participants to plan a 50 minute lesson period which will enable each of the simulated students to "learn" as many mathemata (things to be learned) as possible in 15 periods. The player is given a set of 26 general instructional decisions from which to select the appropriate strategies. For each student in the class a two-state Markov model incorporating a variable probability or error responds to the decisions by updating the simulated student's aggregate capability and prints out a "learned" or "not learned" response.

Results of a preliminary evaluation suggest that the game motivated players to study a variety of references on instructional design. The development of flexibility in response to changing conditions was seen by many of the participants as a facet of the simulation which was generalizable and worthwhile (Mitchell, 1975).

Lerner and Schuyler (1974) have devised a computer simulation to enable prospective specialists in learning disabilities to practice diagnostic decision-making. The simulation consists of four programs designed to provide initial information regarding the child's situation, to analyze diagnostic decisions and to evaluate teaching decisions. The authors, although indicating a positive reaction on the part of the players, did not include information as to the effectiveness, reliability nor its transferability to actual diagnostic situations.

Flake (1975) has designed a computer program in which teacher-interns select an objective, exert an instructional move and the program simulates a student response. The intern continues until he feels his declared objective has been achieved and at this point the simulated students are given a simulated test and the intern is notified of the results. Again no indices of reliability, validity or transferability were given beyond some positive sample reactions made by the interns regarding the interaction with the computer.

A promising technique, although not computer-based nor directly related to teacher education, has been developed by McGuire and Babbott (1967) to assess problem-solving skills in the medical clinical area. The simulation involves a description of a simulated medical problem introduced by a brief verbal description or film sequence describing the patient's symptoms. The examinee is forced to choose appropriate actions described in a booklet, the decisions direct him to other sections which in turn force the continuation of actions necessitated by the previous choices. Branches bring the problem either to successful conclusions or the "patient" dies. Preliminary results indicate that this simulation technique is of value in assessing problem-solving skills in clinical medicine.

Shavelson and Dempsey (1976) in a review of teacher behaviour research involving criterions using pupil outcomes and those focusing on teacher and student behaviours note that neither paradigm has identified consistent, replicable features which can lead directly or indirectly to the valued student outcomes. They conclude that typical measures of teacher effectiveness and behaviour are too unstable to yield consistent relationships with student outcomes. This lack of stable criterion presents some problems in the attempt to establish the validity of an assessment simulation. Two studies have attempted to establish a relationship between the perception of effective teaching behaviours and teacher personality factors.

Costin and Grush (1973), using the Gordon Personal Profile and Inventory, found correlations between students' perceptions of teachers' classroom teaching skills and teachers' personality traits of: Ascendancy ($r = .67$, $p < .01$); Responsibility ($r = .29$, $p < .05$);

Original Thinking ($r = .80$, $p < .01$); Personal Relations ($r = .60$, $p < .01$); and Vigor ($r = .67$, $p < .01$). Only with the categories of Personal Relations ($r = .37$, $p < .01$) and Vigor ($r = .32$, $p < .05$) did students' perceptions of teachers' traits correlate with teachers' perceptions of their own traits.

A study by Morgan and Woerdehoff (1969) found some significant relationships between 4 factors (Ascendance, Thoughtfullness, Gross Creativity and Flexibility) on the Guilford-Zimmerman Temperament Survey and Feldhusen's Creativity Self-Rating Scale with the category "Praises or Encourages" on the Flanders Interaction Analysis Record (reduced $R^2 = .69$, $p < .01$). Ascendance, Sociability, and Gross Creativity were positively correlated in the reduced sets more often than other factors but not significantly.

Statement of the Problem

The main purpose of this thesis has been the creation of a computer-based simulation incorporating sufficient fidelity and complexity to reflect the problems encountered in real-life instructional planning while controlling as many of the extraneous variables as possible. The survey of the literature has revealed that there is a need for such an instrument and that previous attempts have had varying degrees of success. A computer-based simulation could provide the teaching power test that performance-type tests yield but would have more control over extraneous variables. It would also be less time-consuming for instructors to administer and could provide more detailed data regarding decision-making than is presently possible in tests that are not computer-based.

Secondary purposes of this thesis were to: 1) solicit reactions from participants regarding the construction and use of the simulation as a test instrument; 2) determine if any biases had been incorporated which would invalidate its use with teacher-trainees; and, 3) determine its external validity by comparing teacher personality factors with performance on the simulation.

CHAPTER II

SIMULATION DESIGN PARAMETERS

Desirable Attributes

In their review of assessment techniques of teacher competence McNeil and Popham (1973) present 3 general and 6 specific attributes a measure of teaching effectiveness should possess. The general attributes desired are: reliability, it should yield relatively consistent estimates of teaching competence; neutrally oriented, could be used by educators with a variety of instructional viewpoints; and assignment indication, a feature which would yield information about the types of instructional situations in which a given teacher functions best.

McNeil and Popham assert that the following six attributes are desirable in a teacher competence criterion measure:

1. The measure should be sufficiently sensitive to discriminate between teachers. There are decisions where knowledge of minimum levels of proficiency are not sufficient, where the variance among skill levels must be known.
2. Criterion measures should be used to measure

the results of the instructional process, not merely the process itself (p. 238).

3. The measure should yield data uncontaminated by required inferences. An attribute of considerable importance is whether a measure permits the acquisition of data with a minimum of required extrapolation on the part of the user (p. 239).
4. Adapts to teacher's goal preferences (p. 239).
5. Presents equivalent stimulus situations so that performances are comparable (p. 239).
6. The measure should be heuristic in the sense of providing theoretical concepts which suggest linkages between events and which would, at least in part, organize the perceptions of individuals regarding their strengths and weaknesses in teaching (p. 239).

In a table (p. 240) depicting how well eight of the most common competency measures meet these six attributes McNeil and Popham score the Performance Test the highest. Only in adaptation to Teacher's Goal Preferences is the Performance Test deficient.

In order to meet the majority of the attributes that McNeil and Popham deem desirable a performance-based approach must be considered as the most appropriate. Shavelson (1976) suggests that the integration of the skills needed for effective teaching could best be made through the simulation of pedagogical decision-making. It would appear that a performance-based simulation could be as complex as a performance test and would have the same attribute characteristics, with the added weakness of not directly measuring pupil growth. However, given the strengths it would possess in terms of differentiating trainees' skill levels, yielding of data, etc., this deficiency appeared acceptable to this designer since practice teaching on human subjects is not always beneficial to these subjects.

As in the design of a performance measure the successful design of a simulation requires the incorporation of desirable attributes. Barton (1970) defines a simulation as "...the dynamic execution or manipulation of a model of an object system for some purpose" (p. 6). He defines an "object system" as the system to be studied, an aspect of the real world, which in this case is teacher decision-making skills. A successful simulation model incorporates the following properties:

1. It is intended to represent all or part of an object system.

2. It can be executed or manipulated.
3. Time or repetition is one of the variables.
4. Its purpose is to aid understanding of the object system by attempting to describe (partially) the object system (pp. 27 and 28).

Barton further defines the properties as comprising a sequence of discrete operations. These operations consist of: a run, a cycling through the operations of the model for a measurable amount of simulated time ("simulated time being a variable in simulation models meant to be representative of real time" (p. 29)); a parameter, the number or symbol that remains constant during one run of the simulation, but can be changed from run to run; input variables, those arising external to the model; generated variables, those arising as a consequence of the operations of the model; starting conditions, initial values given to input and generated variables; outputs, the data obtained from a run of the simulation (p. 31).

Theoretical Basis for the Model

In conceiving of teaching as decision-making it can be assumed that teachers have a number of strategies available to help their students achieve the goals. Shavelson

(1976) contends that in choosing a strategy teachers attempt to achieve a desired end by matching student states (attention, prior learning, etc.) with environment states (classroom organization, distractions) and with particular teaching strategies. These states, or events, are not certain but occur with some probability so the teacher must subjectively use this information to make pedagogical decisions.

Shavelson sees this model as fitting the kinds of decisions made in the planning or pre-instructional phase of teaching and considers the "decisions made while planning instruction may be the most important ones teachers make" (p. 392). The importance attributed to this phase by Shavelson and others (Briggs, 1970; Gagné & Briggs, 1974; Kemp, 1971; Mager & Beach, 1967) suggest that the construction of the performance-based simulation should be limited to the decisions made in this pre-interactive phase. An instructional decision problem then is characterized as a problem in instructional planning involving (Shavelson, 1976):

> (a) specifying the outcomes of instruction, (b) specifying instructional design alternatives, (c) specifying students' entry behavior, (d) estimating the outcome of each combination of an

instructional alternative and a state of nature,
(e) choosing the optimal course of action, and
(f) evaluating instruction by observing student behavior (p. 396).

This conceptualization of teaching as decision-making describes the type of teaching which Nuthall and Snook (1973) have characterized as the "behavior-control model". Teaching is viewed as a method of controlling the conditions of learning, thereby controlling the behaviors of students. The basic premise for this model is that education is a purposeful activity, that the teaching/learning process does not function on the operation of chance processes (Gagné & Briggs, 1974). This purposeful activity results in learning which Gagné (1970) defines as "a change in human disposition or capability which can be retained and which is not simply ascribable to the process of growth" (p. 3). An inference of learning is made by comparing what behavior occurred before an individual was placed in a learning situation with the behavior that is exhibited after the learning.

The objective of "teaching" then is to form "associate bonds between subject-matter stimuli and appropriate student responses" (Nuthall and Snook, 1973, p. 55). To achieve this bond requires the careful arrangement of the external conditions that will create the learning. Implicit in this description of learning conditions is the careful analysis and the management of the teaching/learning situation, aspects which are viewed as independent of both the content which is to be learned and the particular learning conditions required for that content (Gagné, 1970).

This conceptualization of the teaching/learning process as a purposeful activity precluded the design of the simulation as a wholly stochastic or chance process. In a stochastic model identical starting conditions would produce varying outputs from run to run (Barton, p. 120), a situation hardly likely to encourage trainees to formulate strategies based upon reflection of the output of each run. A non-stochastic or deterministic simulation, one in which identical model operations, parameters, etc., produces identical outputs from run to run (Barton, p. 120) would more likely induce, and reward, a more analytical approach to strategy formation than those which a stochastic model might elicit.

Design Parameters

A "man-computer" type of simulation was chosen because it would provide the complexity in the amount and kinds of data that could be handled, provide complexity in the number of decisions that could be made, and in number of trainees that could be handled in each run. Specifically, the structure was designed as a "closed shop, batch-processed" segment (Barton, Figure 6.3, p. 89). This design entails having live responses to particular stimuli collected by an administrator who encodes the responses and delivers them to the computer for processing. Later, the administrator collects the computer output and delivers the stimuli to participants.

The choice of this particular system stemmed from several factors. A prime consideration was the relatively high cost of an on-line interactive system. This expense would further be compounded by the necessity of utilizing teletype terminals for the projected runs (21 players X 12 runs), each run requiring an estimated fifteen minutes of interactive time.

Another factor was the nature of the simulation model. Since the decisions were to be those commonly made in the pre-interactive phase, they did not require the stimulus displays associated with computer interactions. Further support for this decision comes from Mitchell (1975) who found that game participants submitting decisions through a game administrator in a closed-shop, batch-processed system reported more positive attitudes towards the game than participants who had direct access to the program through a terminal.

The language used for the program was FTN Fortran, chosen for its flexibility in handling complex routines and its compatibility and transportability between computer systems. The program was written to the designer's specifications by a student in his senior year of computer programming studies at Concordia University.

Once the general type of simulation model had been determined a number of specific parameters were incorporated which were designed to produce conditions necessary to meet the desirable attributes of a teacher competency measure previously cited by McNeil and Popham. These conditions included an enforced flexibility, frequent grouping, variation in class composition and the decision accounting system.

Enforced Flexibility

A number of studies have found that flexibility in teaching strategy has important effects. Hamachek (1969) considers the "good" (by definition effective) teacher "does not seem to be overwhelmed by a single point of view or approach to the point of intellectual myopia" (pp. 341-44). In summarizing the research evidence on variability Gage and Berliner (1975) suggest that greater student achievement tends to be positively correlated with greater variety and flexibility of teaching style. Kounin (1970) found that variety in the overt behaviour patterns of the teacher and in the pacing of materials correlated positively (r's = .83 & .52) with student work involvement in first and second grade classrooms. Rosenshine (1971a) reported positive correlations between variation in short or long teaching segments and with either student achievement or student work involvement.

The ability to plan for the utilization of a variety of materials, to introduce variation in approaches and to be flexible in encountering changing conditions would appear to be likely indicators of an effective teaching style. In accordance with the previously cited research the model has been designed to force the participants to frequently change approaches. Three successive uses of a particular teaching grouping for the same students result in a "no learning" situation and the player is given penalty points. Providing the participant chooses an effective combination of decisions at least four different patterns need to be chosen to achieve success up to the last period. Since the learning condition depends on matching student ability to appropriate teaching groupings, media and evaluation instruments, the simulation was designed to produce a good indication of deliberate flexibility on the part of the decision maker.

Grouping

The design of the program required the frequent distribution of students into various teaching groupings. Possible groupings for the full class of 25 pupils include two lecture modes and a recitation format. Groupings with 2 to 10 students include: discussion, groups of individualized learners, students assigned to independent study, small group study. The inclusion of students undertaking "individualized learning" and "independent study" into groups was to facilitate the handling of the students by the computer program. This grouping strategy encouraged the use of many groups thereby increasing the possible combinations. A final grouping, "advanced study project" was included to ensure that participants would continue to account for all students, even those who have "learned" all of the subject matter units.

The limitations imposed in terms of maximum and minimum students per group were based on grouping sizes discussed in Gage and Berliner (1975). The final numbers (i.e. 25 students; minimum of 2, maximum of 10) were decided upon subjectively.

The basis for the grouping rests upon Olson's (1971) research on styles of classroom activity and conclusions that group size should be varied to meet the changing needs of students. Grouping is apparently helpful, notes Gold (1965), but is not an automatically effective instructional adjustment. Achievement appears to improve only when grouping is accomplished by a differentiation in teacher quality, curriculum, guidance and method. Simply narrowing the ability range does not necessarily result in curriculum improvement nor in increased achievement (Goldberg, Passow & Justman, 1966). The choice of a maximum of five groups per lesson period (run) was subjective and designed to limit the complexity of the computer program during this prototype design phase.

Class Composition

Each player was assigned a "different" class of students to decrease the possibility of a pooling of strategies. Players were randomly assigned "low", "average" and "high" ability students which were different on each player's list but the majority of classes had the same mix of ability levels. Players would have to keep in mind particular student abilities when making instructional decisions each period.

Each player was given a "class List" (Figure 1, p. 26) containing the student's name, identification number, and an "Academic Achievement Score", a hypothetical score which provided an indication of the student's entry, hence ability level. A "G" represented the class level the students are presumed to be at in entering the instructional program. For example, students having a composite academic ability at the grade 10 level on entering grade 10 are represented by a G. A figure preceded by a minus or a plus sign and a number indicates the grade below or above the entry level. A G-2.00 indicates the student is two years below assumed entry level while G+3.00 indicates three years above level. Figures preceded by a decimal point (.08, etc.) indicate months above the designated G level.

The class compositions were created using a table of random numbers to select the number of "scores" within the following parameters which approximate a standard distribution i.e. 68% of students fall within 1 standard deviation of the hypothetical mean for the group; 4 (16%) are

Figure 1 - SAMPLE CLASS LIST

STUDENT	NAME	COMPOSITE SCORE
01	John A.	G-1.01
02	Mary A.	G.10
03	Susan B.	G-2.04
04	David B.	G+2.04
05	Jack B.	G-3.07
06	Harry C.	G-2.10
07	Heather C.	G-2.06
08	Brent C.	G.00
09	Frank D.	G+2.01
10	Brian D.	G-1.08
11	Richard D.	G-1.05
12	Bobby E.	G.09
13	Anne E.	G-1.10
14	George F.	G.01
15	Bill H.	G-2.04
16	Erica I.	G.01
17	Jeanie J.	G-1.04
18	Peter K.	G-1.08
19	Sandra M.	G.00
20	Mike N.	G-2.01
21	Diane O.	G+3.00
22	Allan R.	G.01
23	Jennifer T.	G-1.08
24	Carol W.	G.00
25	Sam Z.	G.00

more than 2 above and 4 (16%) are more than two standard deviations below the mean.

The classes were composed as follows:

Average class -	16%	(4)	G-2.05	to	G-2.10
	68%	(17)	G-1.00	to	G+1.00
	16%	(4)	G+1.01	to	G+2.05
Low ability class -	16%	(4)	G-3.00	to	G-2.05
	68%	(17)	G-2.06	to	G.05
	16%	(4)	G.06	to	G+1.05
High ability class -	16%	(4)	G-1.00	to	G.00
	68%	(17)	G.00	to	G+1.05
	16%	(4)	G+1.06	to	G+3.10

Decision Accounting System

In order to provide the data which could be used in the attempt to validate the simulation two records were kept. The first record consisted of the number of appropriate * decisions which could be made under given conditions (type of student, previous media and instructional strategies chosen, etc.) and the number of appropriate decisions

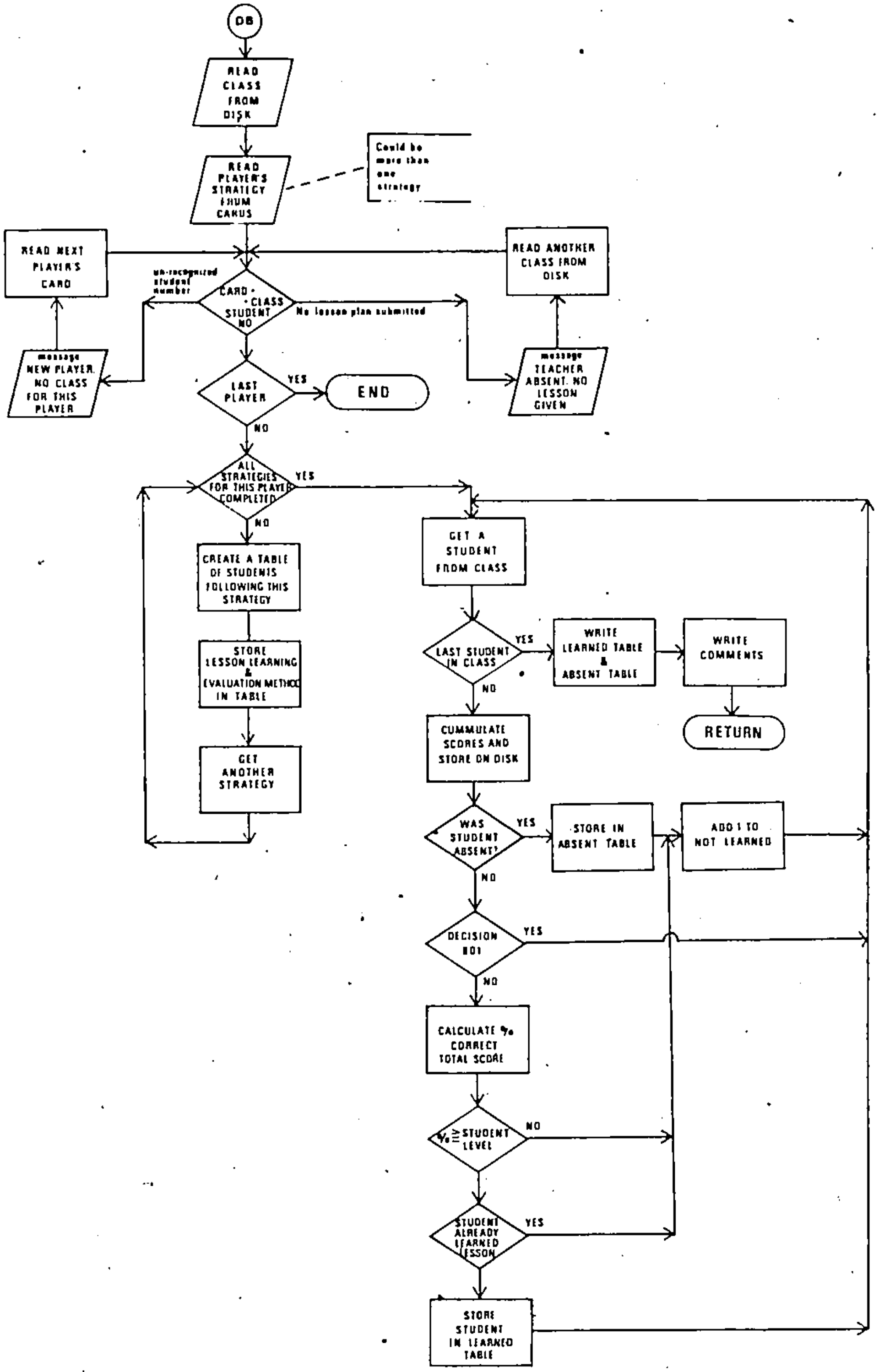
* The basis for this determination is detailed in "Simulation Decisions: Rationale", p. 31.

actually made in each period by each player. On termination of the simulation the total number of actual decisions made was divided by the total possible appropriate decisions. This produced a percentage which was labelled an "Index of Appropriateness". The accounting subroutine logic is detailed in Figure 2, p. 29.

These decisions were designated as appropriate or inappropriate to reflect current research findings or educational practice recommended for a given situation. A third decision-type was designated as an inappropriate game decision and included decisions made through carelessness. These included: assigning the same student to more than one group at the same time, specifying non-existent decisions, failing to keep within the grouping limitations by specifying more than five teaching groupings. These inappropriate game decisions added a punitive number of points (10) to the appropriate decision score total, and the second count which was the learning points total, making it impossible for a student to learn in that particular lesson period.

The second count recorded "learning points" awarded for appropriate decisions for each of the players' simulated students. Each simulated student was designated by the designer to require a minimum percentage of "learning points"

FIGURE 2. Program Accounting Logic



before the student could "learn". For "high ability" students players had to make at least 50% of the total possible learning points; for "average" students, 60% of the total possible points; for "low" students, 70% of the total possible points. On termination of the simulation the total number of actual points for all students was divided by the total of all possible points to obtain an "Index of Effectiveness".

CHAPTER III

SIMULATION DECISIONS: RATIONALE

Synopsis of the Simulation

Each simulation participant received a handbook outlining; the procedures of the simulation, descriptions of the possible decisions, a class list containing the names and composite achievement scores of each pupil, and a recording form to keep track of the units learned by each pupil.

The objective of the simulation was to have all the 25 simulated pupils "learn" 10 subject matter units within an allotted time of 12 "lesson periods". Participants had a total of 80 possible decisions out of which nine decisions had to be made for each pupil or group of pupils each lesson. The set of decisions for each lesson period included: the number of students groupings (identified as teaching strategies ranging from the lecture format to individualized instruction); the pupils assigned to each teaching grouping; the instructional objective level and objective descriptors at which the lesson unit were aimed; the subject matter unit; instructional materials choice; teaching structure; and the method of evaluation for that period. The decision sheet format can be seen in Figure 3, p. 33.

The designer, acting as the simulation manager, collected the decisions, had them keypunched, and submitted them to the computer center for processing. A run was conducted approximately every two days with the lesson results usually made available to the players the day following submission. The output consisted of the numbers of the students who had learned the lesson, the absentees (those students the player neglected to include in a group) and a numbered list of feedback comments. Sample outputs are contained in Figure 4, p. 34.

As an aid to help the player diagnose strategy failure a set of numbers would be printed under the "Comments" heading on the output sheet. These were comments, purportedly from the students, colleagues or support personnel, which would provide clues toward rectifying the learning failures. For example, if too many students had been assigned to one group comment 10 would be listed ("Too many people talking at once") or more than 10 pupils are assigned to library study comment 16 is printed ("There were too many students in the library -- the librarian sent us back!"). A number of unprogrammed comments were included on the comments list

Figure 3 - SIMULATION DECISION SHEET

ID Number	[ ][ ][ ][ ][ ][ ][ ]
Period Number	[ ][ ]
Number of groupings	[ ]
Subject Matter Choice	[2][ ][ ]
"Student's" numbers for this group	[ ][ ] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ ][ ]
Objective Category	[3][ ][ ]
Objective Descriptors	[4][ ][ ] [4][ ][ ] [4][ ][ ]
Teaching Grouping	[5][ ][ ]
Instructional materials choice	[6][ ][ ]
Teaching Strategy	[7][ ][ ]
Method of Evaluation	[8][ ][ ]
This is group number	[ ]

Figure 4 - SAMPLE OUTPUTS FOR PLAYER

PLAYER - 7799886 LESSON 6

THE FOLLOWING STUDENTS LEARNED THEIR LESSON

1	4	9	10	11
12	13	14	18	19
20	21	23	24	0
0	0	0	0	0
0	0	0	0	0

ABSENTEES

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

COMMENTS

2	13
8	2
2	0

PLAYER - 7654321 LESSON 6

TEACHER ABSENT - NO LESSON GIVEN

in the handbook and particular attention was directed to comment 25 ("Have you ever thought of another line of work?"). Participants were told that no matter how poorly they were doing they were "okay" as long as they did not receive this comment, a ruse designed to prevent excessive discouragement. The list of comments can be found in Figure 5, p. 36.

Subject Matter: Rationale

A prime reason for utilizing subject matter units in the simulation stems from the designer's belief that having to learn new material, which then had to be "taught" to students, would increase the reality of the simulation and elicit more thoughtful responses on the part of the participants. Since the structuring of subject matter for teaching is also viewed by instructional design theorists (Gagné & Briggs, 1974; Kemp, 1971) as an important, if not the most important, aspect of instructional planning, the inclusion of subject matter appeared to be a requirement.

The subject matter chosen for the simulation was an imaginary Martian fauna taxonomy developed by Dr. Gordon Pask and associates at System Research Limited, England, which met a number of conditions this designer considered essential. The taxonomy was: 1) capable of being learned

Figure 5 - COMMENTS

1 "NOT ANOTHER PROJECT, I HAVEN'T FINISHED THIS ONE YET!"
2 "TEACHER WAS REALLY DISORGANIZED TODAY!"
3 "NEVER HEARD OF <u>THIS</u> TEACHING GROUPING BEFORE"
4 "YOU HAVEN'T TIME TO KEEP TRACK OF INDEPENDENT STUDENTS NOW"
5 "WE CAN'T LISTEN TO YOU AND WORK AT THE SAME TIME"
6 "TEACHER I DON'T REMEMBER WHAT YOU TALKED ABOUT TODAY"
7 "MUST BE A HOLIDAY, WHERE ARE SOME OF YOUR STUDENTS?"
8 "STUDENT IS BORED AND RESTLESS"
9 "HOW CAN I DO ANYTHING BY MYSELF?"
10 "TOO MANY PEOPLE TALKING AT ONCE"
11 "TALK, TALK, TALK, THAT'S ALL WE EVER DO"
12 "SORRY, AV CENTRE SAYS MATERIALS ARE NOT AVAILABLE"
13 "ARE YOU SURE THIS TEACHING MATERIAL WILL REALLY WORK?"
14 "WHERE CAN I FIND STUFF ON MY PROJECT?"
15 "THIS MATERIAL IS TOO HARD"
16 "THERE WERE TOO MANY STUDENTS IN THE LIBRARY -- THE LIBRARIAN SENT US BACK"
17 "HOW COME THE TEACHER PUT ME IN THE DUMMY GROUP?"
18 "TEACHER WE GOT TOO MANY IN THIS GROUP"
19 "SOME STUDENTS ARE ABSENT"
20 "NEVER HEARD OF THIS CATEGORY BEFORE"
21 "EVALUATION RESULTS NOT AVAILABLE"
22 "I CAN'T GET ORGANIZED THIS MORNING"
23 "WHERE CAN I FIND MY BOOKS?"
24 "YOUR CLASS WAS VERY UNRULY TODAY"
25 "HAVE YOU EVER THOUGHT OF ANOTHER LINE OF WORK"
26 "NO SUCH OBJECTIVE CATEGORY"

in a short period of time by the participants; 2) was unique enough not to provide any player with an advantage of knowing the subject matter; 3) represented a reasonably complex amount of material, thereby adding to the challenge of the simulation; and 4) was free of social, scientific and religious connotations which might produce reactions irrelevant to the simulation's purpose.

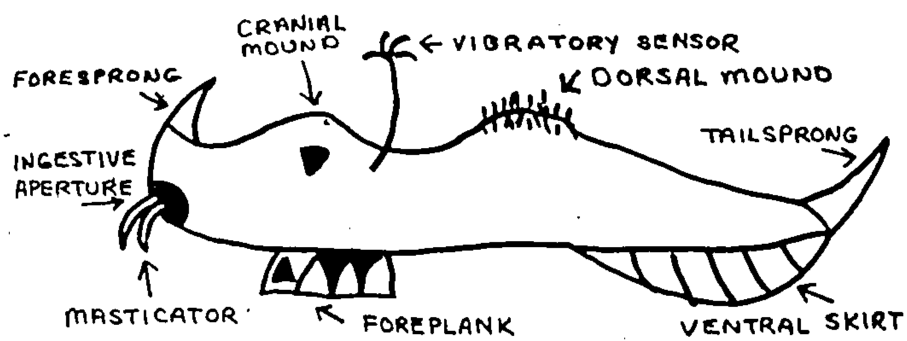
In considering the potential for extreme variation in the choice, structure and order of the possible content for each lesson period, in considering the lack of prescriptive guidelines for ordering the content, and in considering the enormity of the computer program required to handle the content decisions alone, it was decided by the designer that the subject matter decisions would not be included in the overall decision total of each player.

The content of the taxonomy was arbitrarily grouped by the designer into 10 units which appeared to deal with a unified topic. The units were: GANDLEMULLER SPECIES (Figure 6); GANDLERS; GANDLEPLONGER SUBSPECIES; M & B PLONGERS; DEFENCE AGAINST OWZARD ATTACKS; CRANIAL MOUNDS; T-GANDLE-PLONGERS; GANDLEMULLERS; PLONGERS SUBSPECIES; and GANDLE-PLONGERS. Six of the 10 units contained illustrations of the features discussed in the units. The order in which the

Figure 6 - SAMPLE SUBJECT MATTER UNIT (GANDLEMULLER SPECIES)

SPECIES (Decision 206)

The name "GANDLEMULLER" is formed from GANDLE (Martian for swamp-mud) and MULLER (German for Miller), hence "swamp mud miller", since GANDLEMULLER are found in the Martian swamp land of the equatorial regions. They inhabit mudflats and deep, dark, dank caves. They are almost transluscent and active only at night.



This is a picture of a typical adult GANDLEMULLER, approximately 2 feet 6 inches in length. The picture shows names of physical characteristics.

units appeared in the participant's handbook was randomized to provide the designer with an indication of the participant's awareness of the most appropriate order of presentation and to provide a consensus for appropriate order in future runs of the simulation.

Participants were informed that each of the units could be viewed as abstracts representing all relevant material which could be taught since the actual presentation of all the material would be too time consuming and impractical for the simulation. Participants could teach the same unit to all groups or different units to different groups at the same time.

While not evaluating the appropriateness of the chosen unit in terms of the overall hierarchical structure of the taxonomy the program recorded the units which were learned by the pupils. Once a pupil had learned a particular unit it was impossible for the student to learn it again. This precluded the use of the same unit throughout the entire simulation forcing the player to utilize all the units. A penalty was incurred by players who failed to keep track of the learned units and attempted to teach the learned unit again.

Teaching Groupings: Rationale

Lectures

The first options offered the players in the teaching grouping section were lecture (decision 501) and lecture with media (decision 502). A number of researchers (Costin, 1972; McKeachie, 1967a; Verner & Dickinson, 1967) have concluded that the lecture method is suitable when the purpose is to arouse interest in the subject, as an introduction for learning tasks and where the material must be organized and presented in a particular way for a specific group. The method is inappropriate when: long-term retention is desired; the material is complex, detailed or abstract; or when the students are below average in intelligence or educational experience.

Accordingly the lectures were successful for only those pupils designated as having high or average ability. In accordance with the general design parameters the method would not produce success more than three times in a row. The decision logic is detailed in Figure 7, pp. 42-43.

Discussion Method

The discussion method choice (503) was deemed as inappropriate by the designer on the basis of Gage and

Berliner's (1975) exposition on "field consensus". They make the distinction between subject matter areas which are highly structured and agreed upon by competent people, "high-consensus", and areas such as art, psychology, etc., in which controversy and "schools of thought" prevail, "low-consensus" fields. In high consensus fields the major objective is to inculcate a well-established body of facts, concepts and principles, as in a taxonomy of fauna, while in the low-consensus field the development of opinions, attitudes and hypotheses are more important than fact acquisition.

The content for the simulation would be classified as a high-consensus field since it represents a scientific (although pseudo) fauna taxonomy dealing with "facts and concepts", and as a high-consensus field would not be suitable as material for the discussion method (McKeachie, 1967b). A decision to use the discussion method would produce diminishing results. On the first choice all students would learn (novelty effect), the second time the average and high ability students would learn and only the high ability students would learn on the third run. The decision logic is detailed in Figure 7, p. 42.

FIGURE 7. Program Logic, series 500 and 600

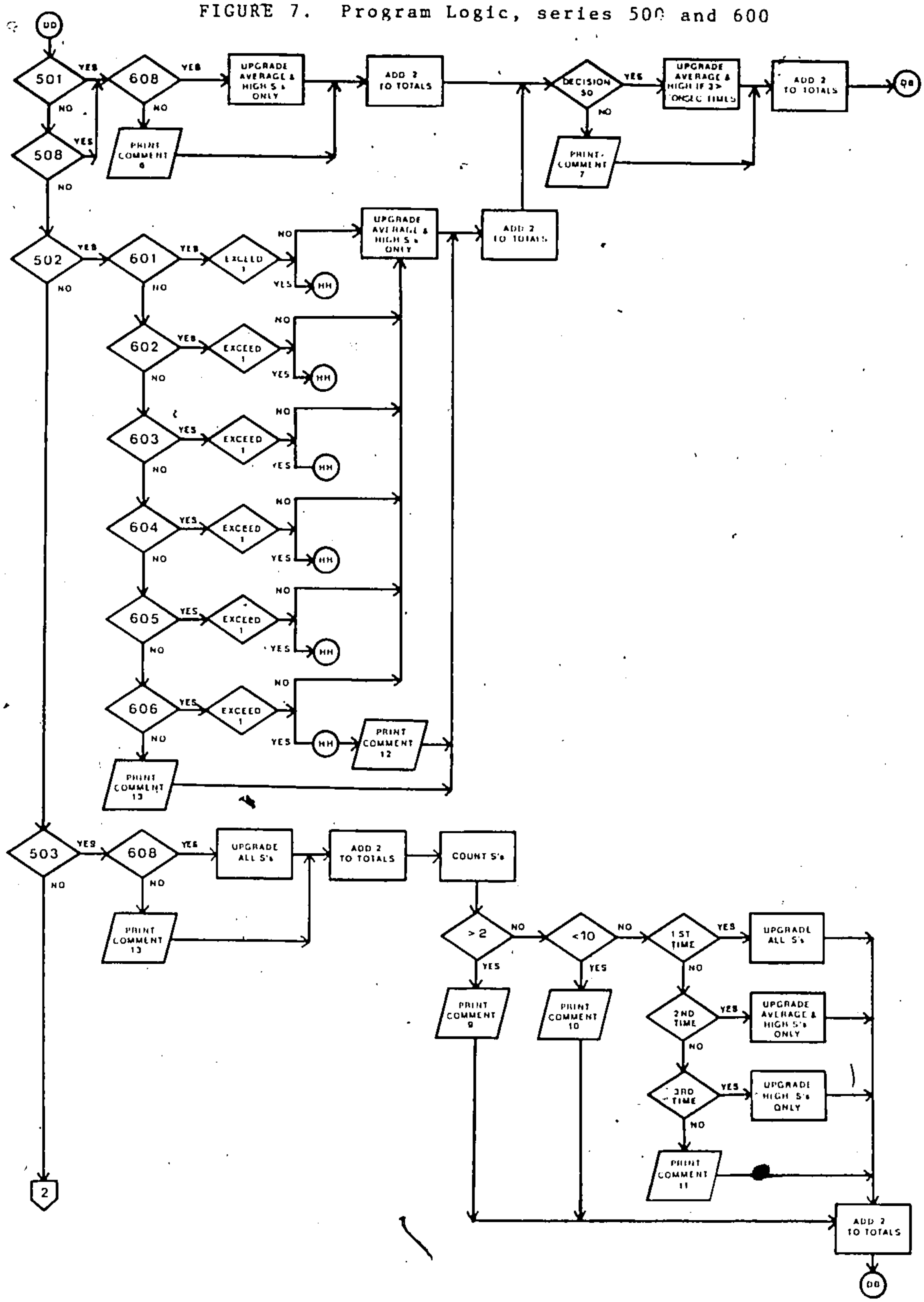
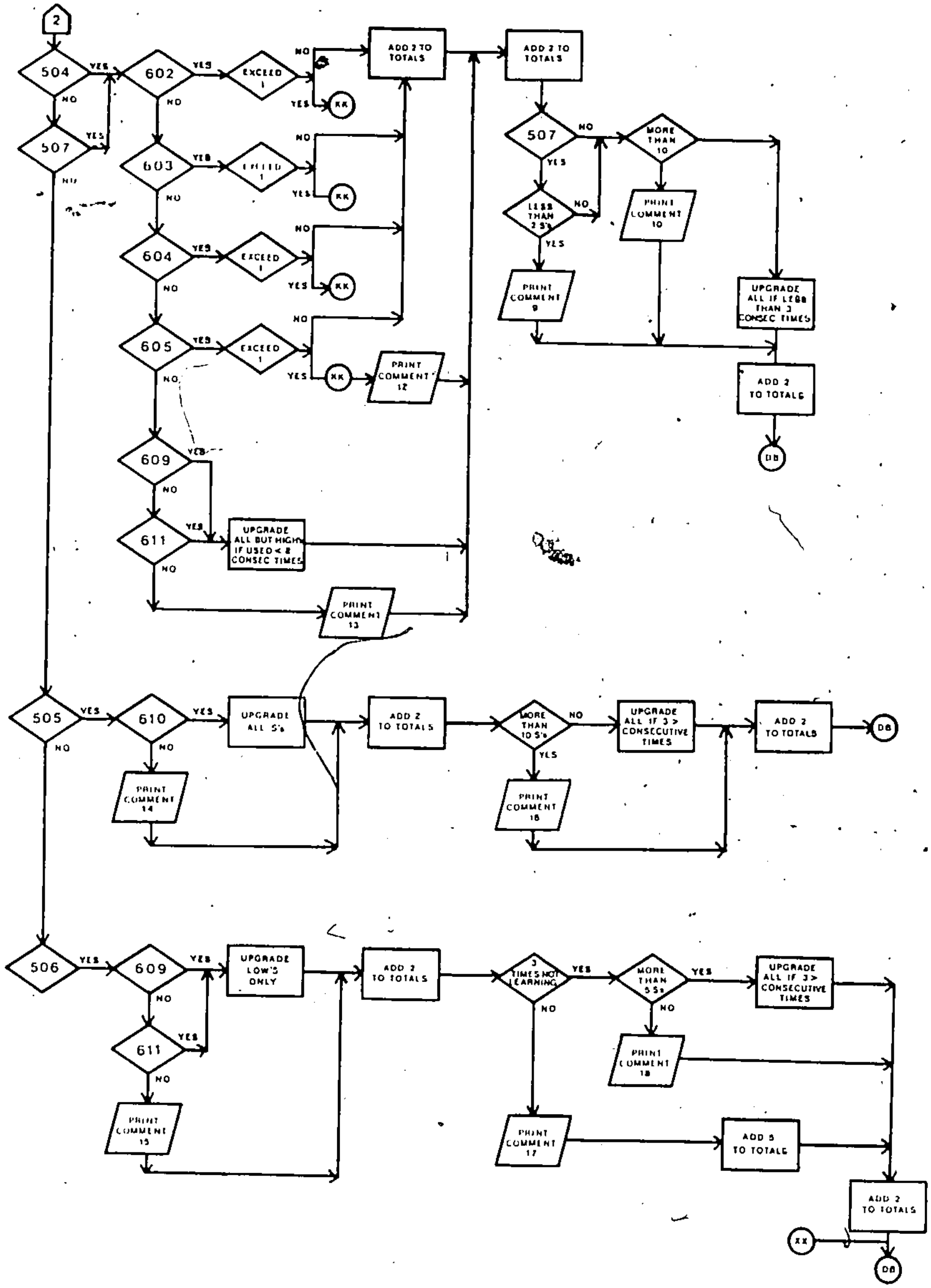


FIGURE 7 (continued).



Individualized Learning and Small Group Learning

Individualized learning (504) is characterized by self-paced instructional materials, such as programmed instruction, while small group (507) is characterized by the grouping of a small number of students with the same ability level to work in pairs or collectively on the same topic.

Olson (1971) in surveying some 18,500 classrooms in elementary and secondary schools found that styles of classroom activity that entailed small groups (small-group work, laboratory work, individual work and discussion) were associated with higher indices on an "Indication-of-Quality Rating Scale". The Quality Index was based on teacher and student behaviours that were seen to foster: 1) individualization, 2) interpersonal regard, 3) group activity, and 4) creativity.

Directed Independent Study

In directed independent study (505) the arranging of assignments last over several periods and free the student from attending formal classes during that period (Gage and Berliner, 1975). Griffin (1965) surveying 150 examples of this method found it characterized by the students seeing worthwhile goals and objectives, personally significant learning, the use of human and material resources, and the production of a product.

In studies at Antioch College Baskin (1961) found that students in independent study achieved about the same as students following traditional classes. Gruber and Weitman (1962) looking at a series of self-directed study courses found that 12 favourably affected student achievement, 3 had a negligible effect and 4 had negative effects. Independent study had more success in advanced courses and where students were provided with some guidance.

McCullough and Von Atta (cited in McKeachie, 1967b) found that students low in rigidity and need for social support are likely to profit more from independent study than students who score higher in these characteristics. Koenig and McKeachie (1959) and Patton (1955) found that students who are high in the need for achievement prefer, and learn better, in independent study.

For the simulation not more than 10 pupils could be assigned to independent study and since the model did not incorporate student personality variables the strategy would work for any pupil for up to three consecutive times (see Figure 9).

Remedial Tutorial

The simulation incorporates the possibility of providing remedial tutoring (506) to students who have not learned for 3 successive periods. The process is seen to involve the teacher, only one of actual tutor-tutee combinations, with up to 5 students. Its use precludes the utilization of any teaching mode for other groups that is teacher-centered (Figure 7, p. 42). Providing other decisions, detailed subsequently, are correct the tutees will "learn", however the player will have to wait 3 successive periods before this remedial grouping can be used again. Bernstein (1959) after reviewing over 200 studies on remedial arithmetic concluded that all of the tutoring procedures appeared to produce some good results.

Recitation

Recitation (508) is considered by Gage and Berliner (1975) as the most prevalent method of teaching. This method is typified by a pattern of teacher questioning with student responding. The question-answer pattern is usually based on readings from a textbook with the teacher talking about two-thirds of the time. Figure 7 details the program logic.

In reviewing studies on recitation as far back as 1908 Hoetker and Ahlbrand (1969) found that approximately 20-30% of teacher moves were soliciting responses and reacting to student questions. Student responding also amounted to 25-30% of all moves. The remaining percentages included combination patterns of structuring, soliciting, responding and reacting. Gage and Berliner (1975) after reviewing a number of studies consider recitation as being relatively effective for all levels of objectives in the cognitive domain.

The technique has a number of disadvantages which were taken into consideration when programming this sequence. White (1974) notes that recitation is particularly reinforcing to the teacher since it is an easy way to check student knowledge, provide attention and social reinforcement to the teacher. Correct answers come forth, however, if the questions are readily answerable, therefore only simple questions at the lowest knowledge levels will be asked. An additional factor contributing to its disadvantage is class size. Although research on class size has generally failed to show that class size makes any difference on student achievement it is unlikely that the poorer students will have their needs met. White suggests that recitation is socially reinforcing for the teacher and an easy way to assess student knowledge, therefore it could be assumed that poor students do not provide teachers with sufficient reinforcement (correct answers) to warrant a great deal of interaction so consequently the poorer students will tend to be ignored. The program has reflected this assumption by allowing only the average and high ability students to learn when engaged in this technique (Figure 7).

Instructional Materials Choices

The choices offered in series 600 (Fig. 7, pp.42-43) were based on the designer's subjective assessment of the media most commonly available in the public school system in the Montreal area. To aid the player in choosing the appropriate instructional material a short description outlined the subject matter content and indicated a recommended "suitable grade level". Limitations were imposed by the designer on the quantity of material available during any one period, a condition designed to add complexity to the decision making process.

The instructional material choices consisted of the following:

4 35mm filmstrip/cassette units with 10 workbooks
- "General Overview of Gandlemullers" (602)

- "Gandlers" (603)
- "Plongers" (604)
- "Gandleplongers" (605)

(only one unit could be used per group per lesson period)

1 set of overhead transparencies (606) relating to that part of the taxonomy to be taught that period but could only be used with the lecture-media format.

25 summary notes (608), suitable for any student level, for any particular lesson content.

25 programmed instruction booklets (609) for any lesson content but only effective for lower ability students.

Library resources (610) but only effective for high ability students on independent study.

25 workbooks (611) for students of average ability and lower for any lesson content.

2 16mm films (601 and 607) which could only be shown to the entire class in the lecture-media

grouping.

Of all the possible materials choices only one, the 16mm film entitled "Preparation for Mars" (607), was unsuitable under any circumstances since it describes content which is outside the subject matter area.

The matching of instructional materials and the instructional method was not based on specific research findings since there exists little of what could be considered as definitive prescriptive guidelines. Campeau (1974) in a survey of research in which media were used to teach adults summarized by noting that:

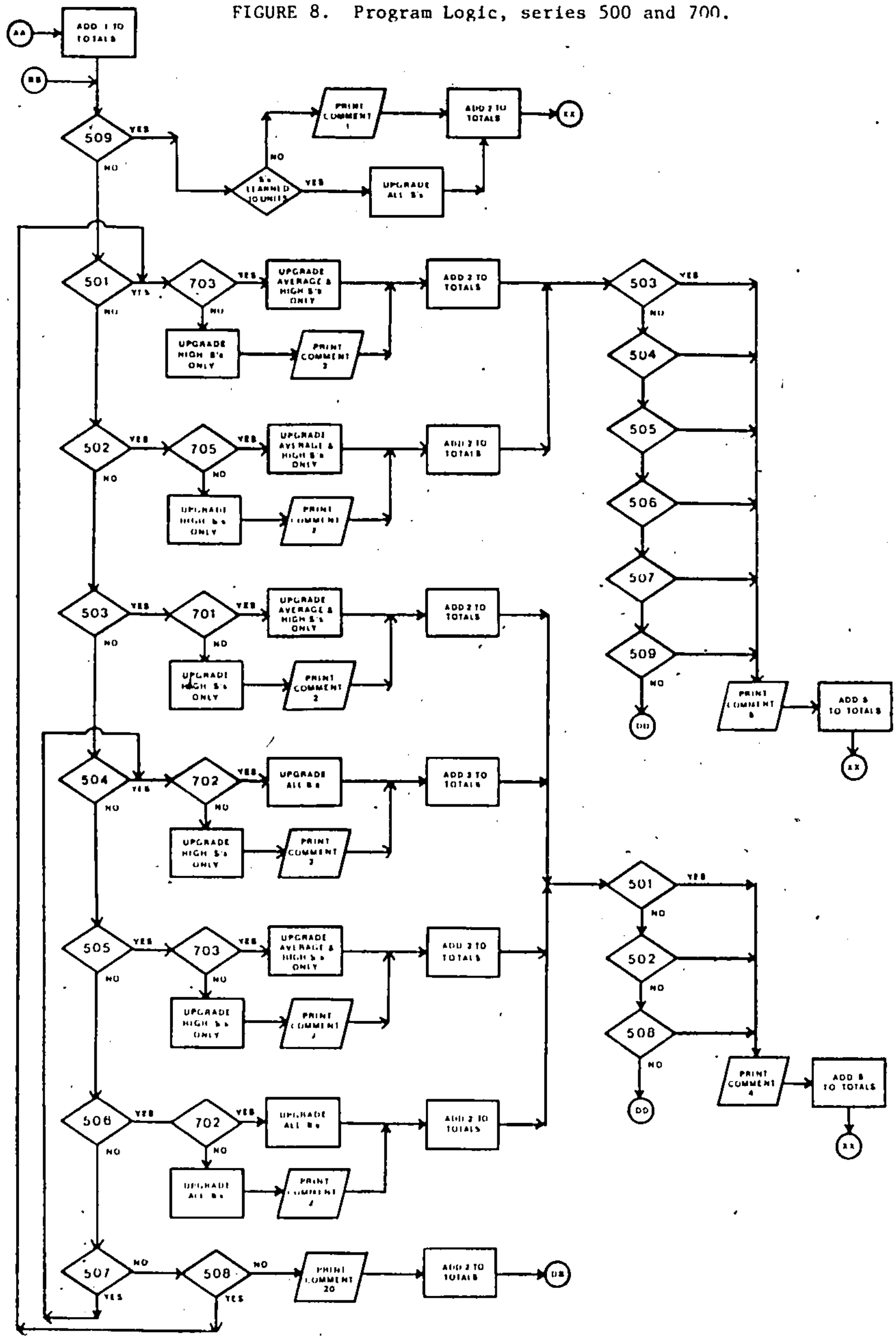
> To date, media research in post-school education has not provided decision makers with practical, valid, dependable guidelines for making these choices on the basis of instructional effectiveness. (p. 31)

Campeau also notes that instructional media are being used extensively, under many diverse conditions and indications are that decisions are being made on the basis of cost, availability and user preference, and not on research findings.

Teaching Strategies

In the pre-interactive phase the teacher must also begin to plan the pattern of interaction which will take place during the class period. The 700 series (Figure 8, p. 51)

FIGURE 8. Program Logic, series 500 and 700.



offered participants guidelines for class interaction which were related to the Teaching Strategies (series 500). As in the case of the subject matter units the steps in the interaction strategies were grouped in an effort to reduce the programming time for this pilot run.

Discussion Method

To generate effective learning through the discussion method Hill (1969) has identified nine steps (summarized in decision 701). These steps are as follows:

1) define terms and concepts to ensure all participants understand.
2) state the general message of the discussion material to ensure everyone shares the message of the common ground.
3) outline what topics or issues are raised by the discussion method.
4) formulate an initial question for every theme or subtopic and allot a time limit.
5) discuss the theme and subtopics.
6) point out how the discussion fits into other discussions, into other curriculum etc.
7) apply the issues discussed by asking how this can

lead to action, to enhance one's ability to cope with other issues.

8) on the basis of the discussions evaluate the material used to stimulate the discussion.

It should be noted that although used successfully no acceptable data exists to validate Hill's method.

Programmed Instruction and Workbooks

Decision 702 is based on principles for producing self-instructional materials formulated by Johnson & Johnson (1976) and can be applied to programmed instruction and workbooks. These include:

1) stating objectives clearly as to what the student will do.
2) objectives also indicate affective outcomes.
3) incorporation of small steps.
4) practice consistent with evaluation.
5) evaluation consistent with objectives.
6) varied input including media.

Independent Study

Ward (cited in Gage & Berliner, 1975) suggested independent learning be conducted using learning "contracts" with students. The elements of a contract (decision 703) should cover:

1) well-defined behavioural objectives.
2) ways to show what learning has taken place. Student and teacher must agree on evaluation instrument.
3) specification of initial resources.
4) the outline of the steps to be taken as students work towards their goal.
5) checkpoints for student and teachers to meet and discuss progress and problems.
6) the setting of realistic deadlines.
7) the specification of activities to be engaged in upon completion of the work.

Decision 705

Decision 705 is a collection of misconceptions and bad practices gleamed from Gage and Berliner's (1975) text which indicate prevalent views of some teachers and which appear to inhibit classroom learning. This decision-choice was not acceptable, its use incurring a 2 point penalty.

1) "Encourage independence by providing minimal guidance." The development of autonomy is a worthwhile educational goal; however most students require guidance in selecting

topics, and resources, outlining what is to be done and setting deadlines (p. 581).

2) "Ensure students find answers to all questions."
It is unrealistic to expect students to find all the answers. Often they need guidance.

3) "Persist with the topic until every student can answer the question."
Persisting with a topic in discussion until all students can answer the questions exhausts the effectiveness of the discussion and would lead to boredom on the part of the more able students (p. 550).

4) "Summarize by establishing unanimity on the topic."
Enforced unanimity on a topic increases social pressure to conform to the majority view (p. 549).

5) "Assign homework that will answer student questions."
Assigning student homework in answer to questions will usually discourage student questioning (p. 720).

Lecture and Recitation

Decision 705 is appropriate for the two lecture modes plus recitation. The organization of this mode is generally as follows (Gage & Berliner, 1975, pp. 526-27):

1) "provide a summary of the topic"

Belgard, Rosenshine and Gage (1971) found significant correlations in 2 studies measuring student ratings of the clarity of lesson aims and student achievement.

2) "ascertain what the student already knows"
Ausubel (1968) and Gagné (1970) hold that successful learning requires the prior learning of prerequisite abilities.

3) "Cover the content using part-whole, sequential or combinatorial devices".
Research for this point is hard to find; however Thompson (1967) found that disorganization affects comprehension in written communication but its effects are doubtful in oral communication.

4) "make clear using rule-example-rule patterns"
Rosenshine (1971b) reported more instances of this combination were evident in effective lectures than less effective lectures.

5) "soliciting responses from students"
Berliner (1968) in comparing the effects of inserting questions into lectures versus instructions to students to take notes or to merely pay attention found that the group receiving the questions and attempting answers performed better than students engaged in customary

activities.

6) "Summarize by relating to preceding and subsequent material

Shutes (1969) found that beginning teachers whose students scored higher on achievement tests used "post-organizer techniques".

Objective Category and Descriptors

The choice of an objective category (series 300), objective descriptors (series 400) and evaluation decisions (series 800), although presented separately in the participant's handbook, were viewed by this designer as interrelated. The decision logic for these three series can be found in Figure 10, pp. 64-65.

The generally recognized framework within which educational objectives can be organized are the taxonomies of objectives developed for various learning domains. The specification of objectives was limited for the simulation to the main categories of the Taxonomy of the Cognitive Domain, developed by Bloom, Englehart, Furst, Hill and Krathwohl (1956); Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. Players had only to specify the category and then choose 3 descriptors which would operationalize behaviours for the chosen category (series 400). Figure 11 shows the choices available which were taken from a series of descriptors presented in Gronlund (1970, pp. 20-21). Similar descriptors can be found in Gage and Berliner (1975); Metfessel, Michael and Kirsner (1969); and in Kibler, Cegala, Barker and Miles (1974).

Although research on using objectives has produced conflicting results (Du Chastel & Merrill, 1973) there appears to be no serious objections to the formulation and use of objectives if teachers remain flexible enough to recognize the dangers and limitations of one-sided approaches (Gage & Berliner, 1975).

Evaluation Decisions

The last series from which the players had to make an appropriate decision was series 800, the choosing of an evaluation strategy or instrument. The construction of evaluation instruments is viewed by instructional designers as one of the key elements in the pre-instructional phase (Mager & Beach, 1967; Briggs, 1970; Kemp, 1971; Gagné & Briggs, 1974). In turn evaluation specialists (Bloom, Hastings & Madaus, 1971; Stanley & Hopkins, 1972; Cronbach, 1976) view the construction of evaluation instruments in conjunction with the choice and level of instructional

Figure 9 - SPECIFIC TERMS TO IDENTIFY OBSERVABLE ACTIONS FOR COGNITIVE DOMAIN CATEGORIES

401 DESIGN	411 INTERPRETS	421 SYNTHESIZE
402 SEPARATES	412 CREATE	422 KNOWS
403 ---------	413 NAMES	423 EXPLAINS
404 LISTS	414 PARAPHRASES	424 DESCRIBES
405 GENERATES	415 PREDICTS	425 COMPUTES
406 RELATES	416 GENERALIZES	426 PRODUCES
407 DISCRIMINATES	417 UNDERSTANDS	427 CONCLUDES
408 GIVES EXAMPLES	418 ILLUSTRATES	428 RECOGNIZES
409 DEMONSTRATES	419 DIFFERENTIATES	429 JUSTIFIES
410 IDENTIFIES	420 CATEGORIZES	430 APPRECIATES

objectives.

No Evaluation Decision

The first decision, number 801, is a distractor since the aforementioned evaluation specialists contend that frequent evaluation is necessary to assess learning, particularly in activity-based and individualized learning situations. The option however was given to use the strategy once with the first lesson without incurring any penalties. Players choosing 801 however did not receive a status report on their students since this information would only logically be available from some type of assessment instrument or strategy had been applied.

Essay Instrument Decision

The option of using an essay exam as an evaluation instrument was not considered a valid choice. Comparisons between essay and objective-type examinations, summarized by Chauncey & Bobbin (1963), lead to the conclusion that given two equally competent examiners, one constructing an essay and one an objective examination instrument, the examiner who builds the objective-type test can provide more valid and reliable estimates of student achievement with the possible exception of creative writing skills, than can the essay test builder. Since the subject matter and objectives dealt with factual material the choice of an essay exam was considered inappropriate.

Checking and Verifying Strategies

Ward (cited in Gage & Berliner, 1975) advocates learning contacts (decision 803) as a method of providing evaluations and student feedback for independent study. Decision 809, verifying project work and giving feedback, is an equivalent choice, as is decision 807, checking exercises in a student workbook.

True-False Instrument

The administration of a true-false exam (804) was considered an appropriate choice in conjunction with the selection of Knowledge, Comprehension or Application as the objective domain objective category (Stanley & Hopkins, 1972).

Matching-item Instrument

Decision 808 was also considered appropriate if one of the three lowest categories of the objective taxonomy had been chosen (Stanley & Hopkins, 1972).

Question and Answer Strategy

Having students give answers verbally, although not a reliable nor thorough method of testing, does provide teachers with indications of student learning. White (1974) in reviewing the recitation process speculates that the process is by far the easiest, least time consuming and tedious method of assessing knowledge. One disadvantage however is that correct answers come forth only if questions are readily answerable and hence questioners tend to concentrate on asking those which require only simple facts. Research by Winne (cited in Gage & Berliner, 1975) indicates that teachers who ask more questions at higher, more complex levels of the taxonomy (application and above) also tend to elicit student behaviour, although not necessarily achievement, at relatively higher levels.

Multiple-choice Instrument

The most acceptable evaluation instrument is a properly constructed multiple-choice examination. Carefully constructed multiple-choice exams can measure any behaviour in the cognitive domain, with the exception of synthesis, better than any other form (Stanley & Hopkins, 1972; Cronbach, 1976).

Decision 806 was appropriate with all except the choice of the synthesis category.

FIGURE 10. Program Logic, series 300, 400 and 800.

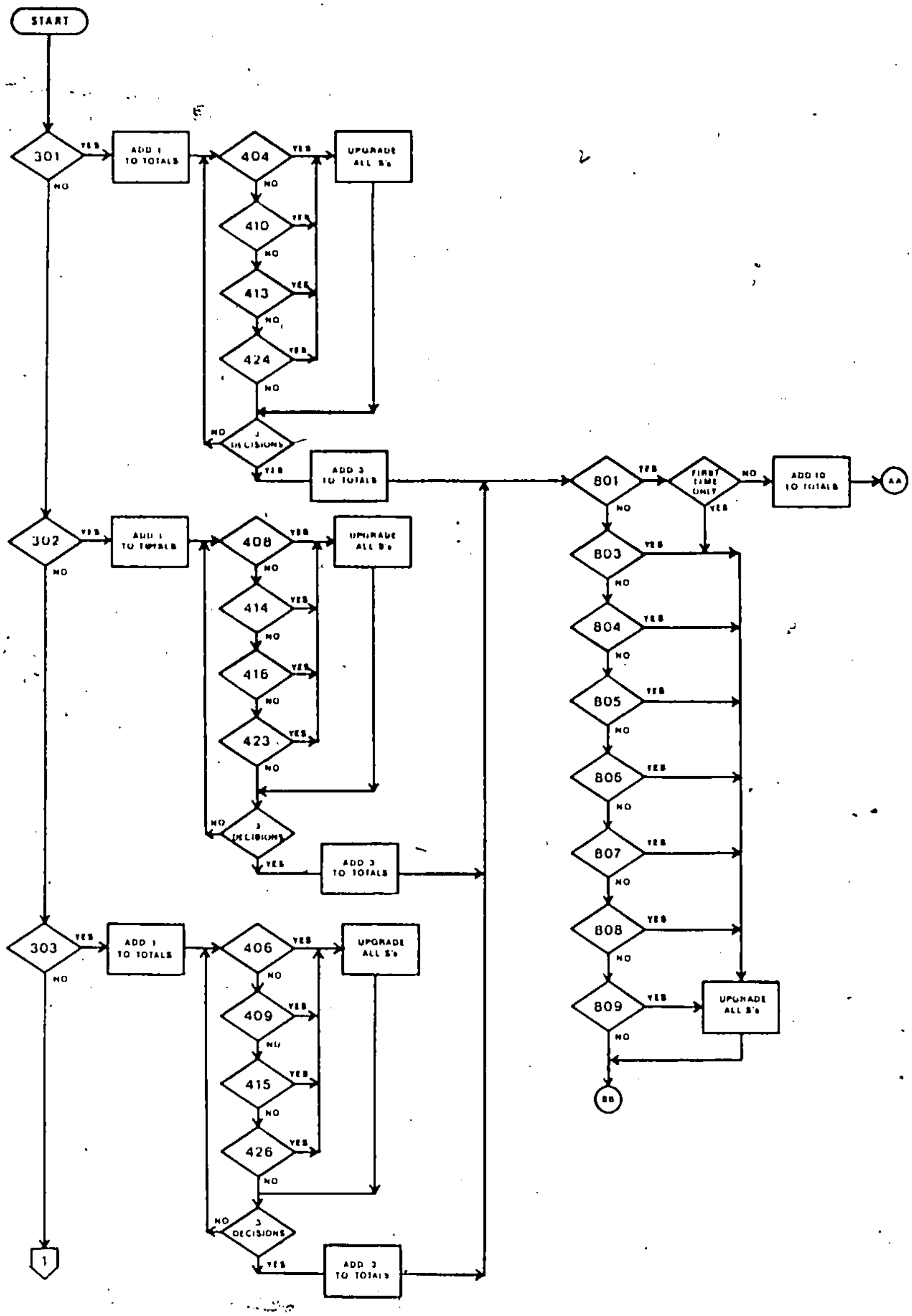
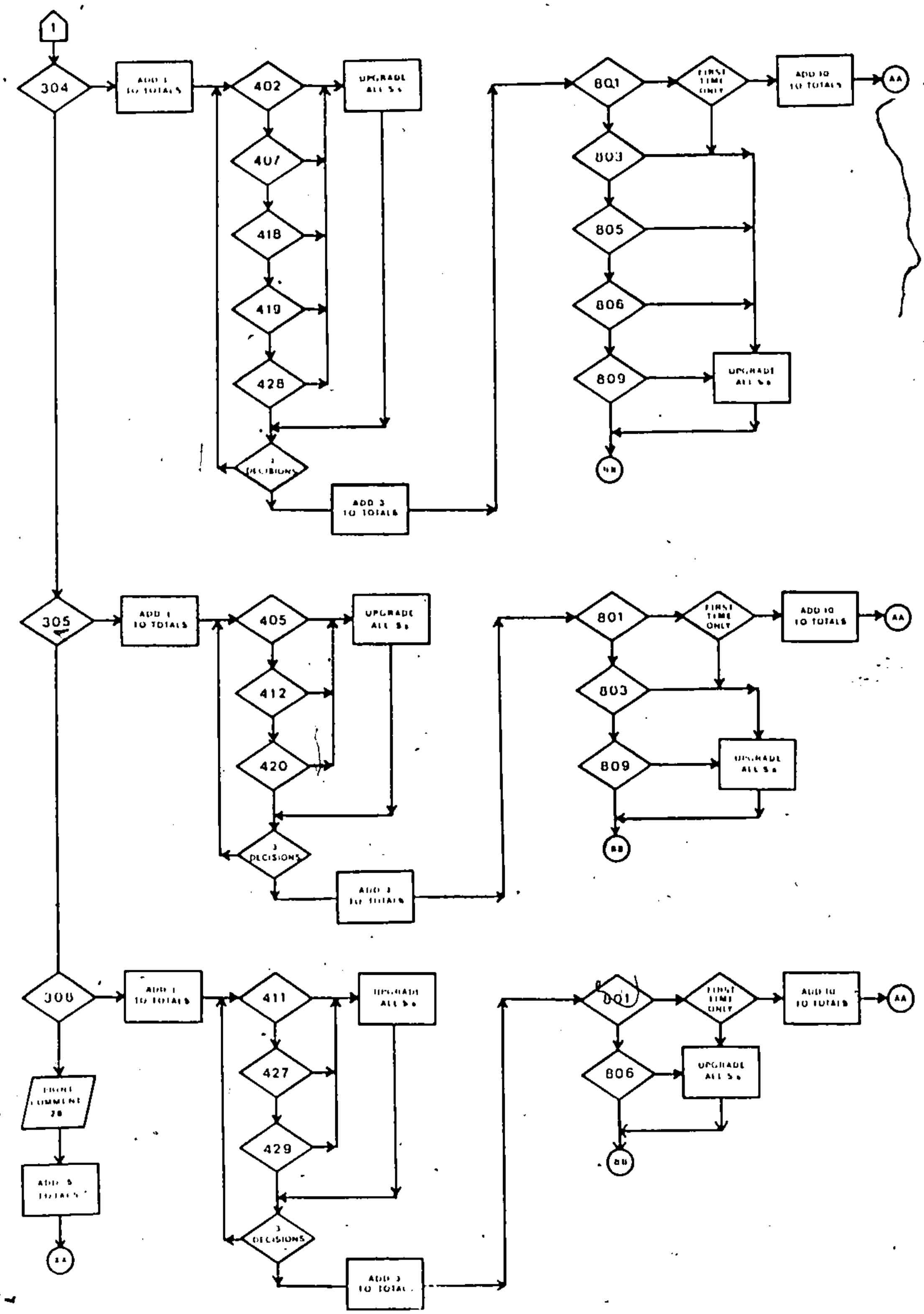


FIGURE 10 (continued).



CHAPTER IV

TESTING OF THE SIMULATION

The primary objective of this thesis as previously stated was the design of a simulation which would ultimately serve as an evaluation instrument in the assessment of the pre-interactive instructional planning ability of teacher-trainees. In order to achieve this goal a number of guidelines from various sources were followed in designing this simulation.

Four attributes of a teacher competence criterion outlined by McNeil and Popham (1973) were incorporated into the model: 1) sensitivity in discriminating between teachers; 2) uncontaminated data; 3) presenting equivalent stimuli; and 4) heuristic in the sense of providing theoretical concepts between the events. It was not designed to meet the other two attributes, adaptation to teacher's goal preferences and measurement of actual student gain, because of the nature of the simulation process.

The simulation also was designed to fulfill the properties which Barton (1970) defined as incorporated into successful simulations; represents and aids in the understanding of a real world process; can be manipulated; and contains entities which can take on different values. It attempted to meet the characteristics of Shavelson's (1976) decision problem model in instructional planning cited previously.

In order to assess how fully the simulation had met the design parameters a pilot run was conducted. The purposes of this testing were to: 1) determine if the simulation did discriminate between teachers with varying levels of planning ability; 2) determine if any biases had been incorporated into the model which might invalidate its use with teacher-trainees; and 3) determine its external validity by comparing simulation performance with personality factors.

In order to test the above assumptions a number of hypotheses were formulated:

1) there would be no relationship between performance on the simulation and sex of the player or grade level teaching.

2) players who had been teaching the longest would not make more decisions considered appropriate than players with limited or no teaching experience.

3) players who made the largest number on appropriate decisions on the simulation would also score the highest on selected factors measured by a personality test.

This first hypothesis was formulated with the expectation that no statistically significant relationship would be found. The simulation, since it was designed to be used with pre-service teachers, would only be useful if factors other than sex, grade teaching and years teaching are responsible for success in the simulation. The formulation of the second hypothesis was based on the findings of Rosenshine (1971b) that the correlations between years of teacher experience and average achievement of teachers' students were uniformly weak.

The theoretical justification for the third hypothesis stems from the findings of: Costin and Grush (1973) that correlations exist between students' perceptions of teachers' personality traits (ascendancy, responsibility, personal relations, original thinking and vigor) and their perception of teacher skill; and Morgan and Woerdehoff's (1969) that the personality factors of ascendance, thoughtfulness, gross creativity and flexibility were significantly related to the Flanders Interaction category of Praises or Encourages.

Operational Definitions of the Variables

Effective Teachers	Those players whose combined Indexes of Appropriateness and Effectiveness fell into sections 1 and 2 on a scattergram bisected by lines located at the means of the two indexes.
Ineffective Teachers	Those players whose combined Indexes of Appropriateness and Effectiveness fell into sections 3 and 4 of the scattergram grid.
Index of Appropriateness	A percentage obtained by dividing the total number of appropriate decisions made by a player by the total number of appropriate decisions which could possibly be made.
Index of Effectiveness	A percentage obtained by dividing the total points awarded for appropriate decisions made relevant to individual students by

	the total points which could have been awarded.
Appropriate Decisions	Those decisions which a review of the research and current instructional practice indicated would produce optimal learning for particular students in particular situations and with particular abilities.
Effective Teacher Personality Factors	Those factors: Ascendance; Sociability; and Creativity, measured by non-projective tests of personality, found by Morgan and Woerdehoff (1969), to be significantly related to behaviours in class identified with effective teaching.

Research Hypotheses

The specific hypotheses formulated for testing in this study were:

1) there will be no significant relationship between

the sex of the player, the grade level the player regularly teaches and his/her sector position when the Indexes of Appropriateness and Effectiveness are plotted on a scattergram.

2)- there will be no significant relationship between the number of years the player has been teaching and the sector position obtained from the plotting of his/her Indexes on the scattergram.

3) Players whose combined Indexes of Appropriateness and Effectiveness designate them as effective teachers will have significantly higher scores on the factors of Ascendance, Sociability and Original Thinking on a non-projective personality test than will players who score lowest on the combined Indexes and on the three personality factor scores.

Method

Population and Sample

The sample was drawn from students enrolled in a diploma level program in educational media in the 1977 summer session at McGill University. The subjects were 12 male and 9 female students (mean age 30.28; range 23-49 years). A thirteenth male subject dropped out of the summer session one week prior to the administration of the personality tests, hence he was not included in any totals.

All subjects had one or more university degrees, five having a Master's Degree. Eighteen were certified teachers, two were audiovisual technicians and the remaining subject was a dietitian. Ten subjects were teaching grades at the elementary level; six at the secondary level and one was teaching in a university. They had all volunteered to participate in the simulation and no attempt was made to include or exclude people with any particular qualities or qualifications. The subjects were at the same level of understanding regarding instructional design since 18 were enrolled in an instructional design course concurrent with their participation in the simulation.

The sample chosen was not representative of the intended population, pre-service teachers, however this was intentional. In the attempt to establish the validity of the simulation the designer felt that using practicing teachers would control for educational and teaching experiences so that only an ability to make appropriate decisions would hopefully be measured. Since, it was reasoned, they are already certified teachers they must possess, to various degrees, the ability to structure effective learning situations, an ability which pre-service teachers cannot be presumed to possess. Another factor influencing their choice as a sample was the expectation that their collective experience and practical orientation to teaching would provide the designer with feedback which would aid in the subsequent design of a more reactive, complex and representative model.

Design

The experimental design used in this study was an *ex post facto* design using criterion and non-criterion subject groups. The design is diagrammed as follows (Tuckman, 1972):

$$\begin{array}{cccc} O_1 & C & O_2 & O_3 \\ \hline O_4 & & O_5 & O_6 \end{array}$$

Each participant had their decision and learning points scores, (actual scores divided by possible scores), recorded throughout the simulation which were combined at the termination. (O_1, O_4,) The results were plotted on a scattergram and subjects were designated either effective or ineffective on the basis of their position on the grid. (C). At the conclusion of the simulation subjects were administered the Gordon Personality Profile and Inventory (O_2, O_5), and a background questionnaire regarding their sex, age, years teaching, grade teaching and degrees (O_3, O_6). A simulation attitudinal questionnaire was also administered, however the responses were made anonymously to obtain freely expressed opinions about the simulation and therefore were not included.

The variables identified for this design were as follows:

The criterion variable was the combined Indexes of Appropriateness and Effectiveness. For the analysis using the nominal data the indexes were plotted on a scattergram and the sector in which the combined scores were located determined if the subject was in the criterion group. A high appropriateness and effectiveness, or a low appropriateness and high effectiveness sector position constituted the designation as an effective teacher.

The predictor variables were: 1) ascendancy, sociability and original thinking, factors measured by the Gordon Personality Profile and Inventory; 2) years teaching; 3) grade level teaching; 4) sex of the player.

The control variables were: 1) simulation content, task and order; 2) post-secondary education; 3) knowledge of instructional design process.

The external validity of the simulation is questionable since the sample was not drawn from the intended population, however since this is a development study no attempt is made to draw generalizations.

Internal validity is also threatened by the decision to use batch-processing thus spreading the time required to run the simulation over a period of 5 weeks, thereby making the control of history difficult. The choice of this particular population in regard to age, experience and training should have lessened this threat and the threat of maturation. Internal validity may have also been threatened by participants exchanging experiences and strategies in an attempt to discover successful strategies. To lessen this threat each participant was randomly assigned a different class composition so that no players had students with common abilities.

Instrumentation

The subject's personality factors were measured using the Gordon Personal Inventory and the Gordon Personal Profile. In the research on which this was based (Morgan and Woerdehoff, 1969) the personality factors were measured by the Guilford-Zimmerman Temperament Survey and Feldhusen's

Creativity Self-Rating Scale. Since these two measures were unavailable in time, the Gordon tests were used. Correlations between the Guilford-Zimmerman and Gordon tests (Gordon, 1963) are: Ascendence, $r = .58$, $p < .005$, one tail test; Sociability, $r = .65$, $p < .005$, one tail test. No comparison could be found between the Gordon Inventory factor, "original thinking" and the "Gross Creativity" factor on Feldhuson's Creativity Self-Rating Scale.

Split-half reliability indexes, corrected by the Spearman-Brown formula, for each of the three Gordon personality factors used as predictor variables are: Ascendency, .88; Sociability, .84; and Original Thinking, .83.

A Simulation Attitudinal Questionnaire (Appendix II) was designed according to procedures outlined by Edwards (1957). A preliminary version was critiqued by three people and changes were made to some questions. A total of 30 positively and negatively phrased questions were assembled on a random basis into a final instrument. The questionnaire was administered to the participants at the debriefing session at the termination of the simulation.

A split-half correlation (odd versus even questions) was calculated to establish the internal reliability of the questionnaire (Ferguson, 1976). The coefficient was calculated using the Statistical Package for the Social Sciences program for the Pearson Product-Moment Correlation Coefficient. A one tailed test was used to establish the significance level (Nie, Hull, Jenkins, Steinbrenner & Brent, 1975). The questionnaire had a reliability coefficient of .538 (df = 19, $p < .006$), corrected by the Spearman-Brown formula for whole test reliability (Ferguson, 1976), to r_2 = .70 (see Appendix II, Raw Data).

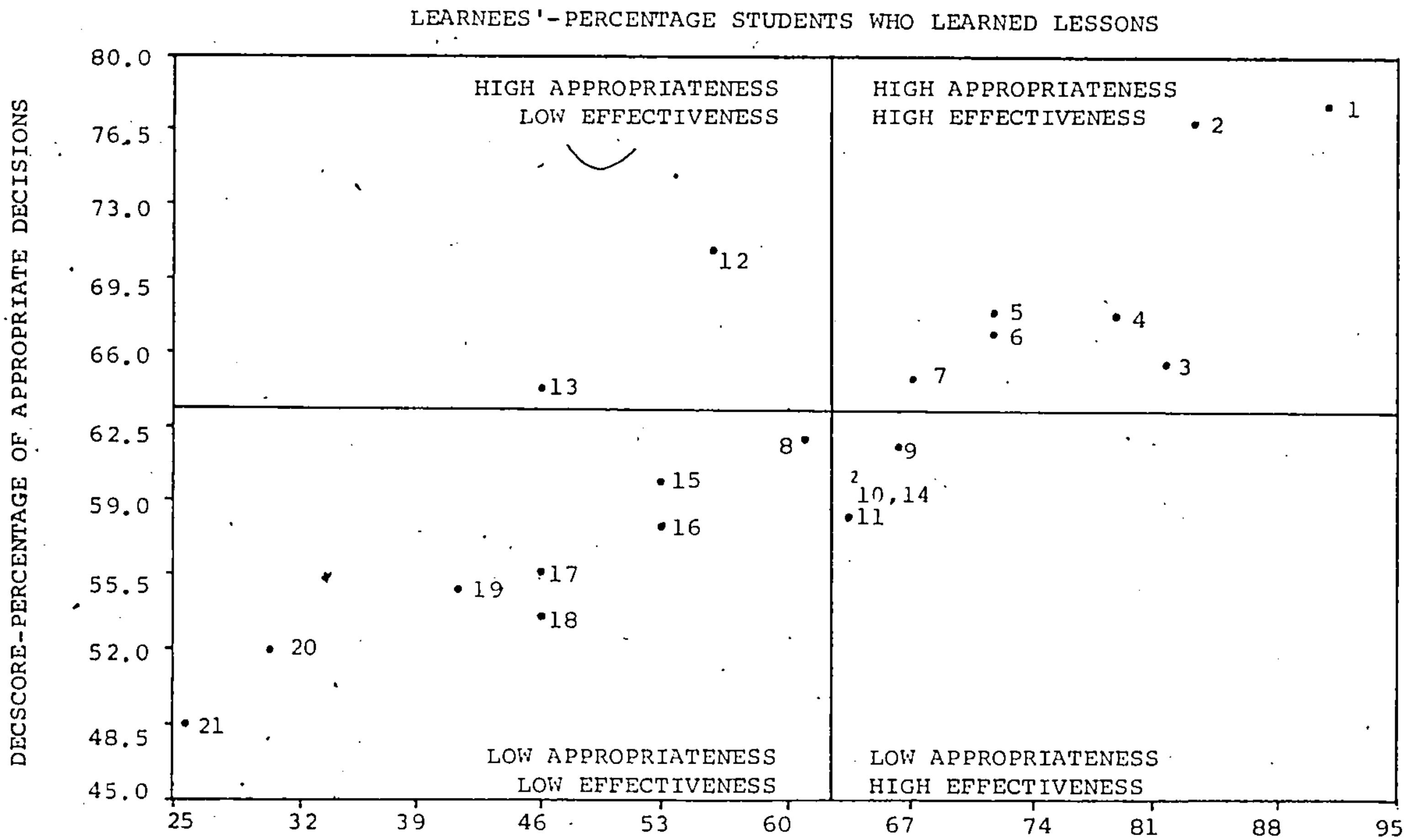
Data Analysis

The data were analyzed using the programs in the Statistical Package for the Social Sciences (SPSS), Version 6.5 (Nie, Hull, Jenkins, Steinbrenner & Brent, 1975). To analyze the internal data from the simulation decision totals (criterion variable) and the three personality factors; Ascendence, Sociability and Original Thinking (predictive variables), a stepwise multiple regression program was used. All eight personality factors measured by the Gordon Profile and the Inventory were entered into the calculation in single steps from the variable which explained the greatest amount of variance in conjunction with the criterion variable until variables ceased to meet internal program statistical criteria. The choice of a multiple regression analysis rests on the recommendation of Cronbach and Snow (1977) that this is the most appropriate statistical technique for examining individual interactions between a dependent or criterion variable and several independent or predictor variables.

In order to use the interval data (Indexes of Appropriateness and Effectiveness) with the nominal data; years teaching, sex, and grade level teaching, in the crossbreaks program the two indexes of each player was plotted on a scattergram (see Figure 11). A line was drawn at the "Appropriate Decisions" mean and another slightly above the mean on the "Effectiveness Index". Sector 1 designated players who had high appropriate and effectiveness scores; sector 2, those with low appropriateness and high effectiveness; sector 3, high appropriateness and low effectiveness; and sector 4, low appropriateness and effectiveness scores. The sector number, given the variable name of "Simscore", was used in the Crosstabs program of SPSS.

The subjects' trait scores on the Profile and Inventory were converted to appropriate percentile-rank equivalents using Table 1, Percentile Ranks by Sex for College Students, in the test manuals (Gordon, 1963).

FIGURE 11 - SCATTERGRAM OF SIMULATION SCORES



CHAPTER V

RESULTS

On the basis of their sector positions on the scattergram the subjects were classified as either "effective teachers" (N = 10, $\bar{X}$ = 140.6) or "ineffective teachers" (N = 11, $\bar{X}$ = 105.6). In order to determine if the two groups were sufficiently different from each other to warrant considering them as two distinct categories a Median Test for two independent samples was performed (Ferguson, 1976). A chi square calculation for 2 X 2 tables using a formula incorporating Yates' correction for continuity showed the two groups to be significantly different (x^2 = 8.14, df = 1, $p < .01$; see table 1).

Table 1

Contingency table showing observed and expected frequencies of Effective and Ineffective teachers

	Above the Median	Below the Median	
Effective Teachers	9 (5.23)	1 (4.76)	10
Ineffective Teachers	2 (5.76)	9 (5.23)	11
	11	10	21

Results from the multiple regression analysis showed that there were no significant differences between the criterion variable, the combined Indexes of Appropriateness and Effectiveness, and <u>any</u> of the predictor variables, personality traits measured by the Gordon Personal Profile and Inventory. The *F* scores for the three traits hypothesized to be related to the Indexes were: $F = .970$ for Original Thinking; $F = .572$ for Ascendance; $F = .469$ for Sociability; $p > .05$. The findings are summarized in Table 3, p. 83.

No significant differences were detected by chi square analysis, 2 X 4 table, between the 4 Simscore categories (obtained from the sector positions on the scattergram, Figure 11), and subjects with 5 or less years of teaching and those with between 6 and 25 years ($x^2 = 1.747$, df = 3, $p > .05$. See Table 2, p. 82).

No significant differences were detected between the predictor variables (Simscore categories) and sex of the player ($x^2 = .875$, df = 3, $p > .05$. See Table 4, p. 84), or with the grade level at which the subject taught ($x^2 = 11.512$, df = 9, $p > .05$. See Table 5, p. 85).

Table 2

Contingency table showing relation between Simscore categories and years subjects have been teaching

Simscore category	0 - 6 years	7 - 25 years	
High Appropriateness High Effectiveness	5 (3.66)	2 (3.33)	7
Low Appropriateness High Effectiveness	2 (2.09)	2 (1.90)	4
High Appropriateness Low Effectiveness	1 (1.04)	1 (0.95)	2
Low Appropriateness Low Effectiveness	3 (4.19)	5 (3.80)	8
	11	10	21

Table 3

Summary table of multiple regression F tests between combined simulation scores and 7 personality factors

Variable	Multiple R	R^2	Adjusted R^2	Std. Dev.	Analysis of Variance	DF	Sum of Squares	Mean Square	F	p
CAUTION	.198	.039	-.011	23.993	Regression Residual	1 19	446.525 10937.759	446.525 575.671	.775	.389
ORIGINAL THINKING	.311	.097	-.002	23.893	Regression Residual	2 18	1108.047 10276.238	554.023 570.902	.970	.398
EMOTIONAL STABILITY	.382	.146	-.004	23.913	Regression Residual	3 17	1662.731 9721.554	554.243 571.856	.969	.430
VIGOR	.392	.154	-.057	24.532	Regression Residual	4 16	1754.732 9629.553	438.683 601.847	.728	.585
ASCENDANCE	.400	.160	-.119	25.244	Regression Residual	5 15	1824.924 9559.361	364.984 637.290	.572	.720
SOCIA-BILITY	.409	.167	-.189	26.018	Regression Residual	6 14	1906.676 9477.608	317.779 676.972	.469	.820
PERSONAL RELATIONS	.415	.172	-.273	26.922	Regression Residual	7 13	1961.529 9422.756	280.218 724.827	.386	.894

The variable Responsibility was not included in the calculation since it did not meet internal criteria in the equation.

$p > .05$

Table 4

Contingency table showing relation between Simscore and player's sex

Simscore Category	male	female	
High Appropriateness High Effectiveness	5 (4)	2 (3)	7
Low Appropriateness High Effectiveness	2 (2.28)	2 (1.71)	4
High Appropriateness Low Effectiveness	1 (1.14)	1 (.85)	2
Low Appropriateness Low Effectiveness	4 (4.57)	4 (3.42)	8
	12	9	21

Raw chi square = .875, df = 3, $.05 < p < .831$

Table 5

Contingency table showing relation between Simscore and grade level the subject teaches

Simscore Category	Grade level Element-ary	Second-ary	Univer-sity	Non-teacher	
High Appropriateness High Effectiveness	4 (3.33)	0	1 (.33)	2 (1)	7
Low Appropriateness High Effectiveness	3 (1.90)	1 (1.33)	0	0	4
High Appropriateness Low Effectiveness	0	2 (.66)	0	0	2
Low Appropriateness Low Effectiveness	3 (3.80)	4 (2.66)	0	1 (1.14)	8
	10	7	1	3	21

Raw chi square = 11.512, df = 9, $.05 < p < .242$.

Results: Attitudinal Questionnaire

Reactions to the simulation, as measured by the attitudinal questionnaire, were quite positive. 76% of the participants said the simulation was helpful in illustrating the possibilities of alternative instructional strategies while 81% said the simulation would be useful in demonstrating to teacher-trainees the complexity of the teaching/learning process. 81% disagreed with the statement that the simulation should not be used again. 66% reported that they had enjoyed the experience while 23% were undecided.

71% disagreed with the statement that they didn't learn anything they didn't already know. 81% reported that their decisions were based on classroom experience and their decisions were made without reference to research or theory. Table 6 summarizes the responses to selected questions. A complete summary can be found in Appendix II.

Table 6

Summary of selected responses from the simulation attitudinal questionnaire. Figures indicate number of responses in each category from Strongly Agree to Strongly Disagree.

Question Number	SA	A	U	D	SD
1. Simulation was helpful in illustrating possibilities of alternative strategies	8	8	3	1	1
3. I don't think practicing teachers would find the simulation very stimulating	0	2	6	9	4
10. I enjoyed my participation in this simulation	3	11	5	2	0
13. I did not feel as if the simulated students existed, they were only numbers to me	6	5	1	6	3
16. This simulation is only a game having little relevance to teaching	0	2	5	13	1
18. Education students would find the simulation useful in demonstrating the complexity of the teaching/learning process	6	11	1	2	1
20. I didn't learn anything in this simulation that I didn't already know	1	2	3	10	5
25. The decisions I made were based on practical experience and not on any book references	5	12	2	2	0
26. I don't think this simulation should be used again	0	2	2	9	8

CHAPTER VI

DISCUSSION

The first objective of this project, the design and construction of a computer-based simulation to assess decision-making ability, was achieved. The significant differences detected between the two categories of player ability lead to the conclusion that the simulation is powerful enough to discriminate between those who make a substantial number of appropriate decisions and those who do not. The relationship between this ability and effective teaching however remains to be established.

Since the simulation was designed to be used ultimately with teacher-trainees, the failure to detect any significant relationships between the nominal variables (sex of player, years and grade level teaching) and simulation performance is viewed as positive findings. The failure to detect a relationship between performance and years teaching was expected since Rosenshine (1971b) found that years teaching and student achievement were correlated uniformly weakly. Since effective teachers exist at all levels and in all subjects areas the lack of a relationship between performance and grade teaching appears to indicate that the model does not give a particular advantage to any grade level teacher. Again, the lack of a significant interaction between sex of the player and performance indicates that no biases have been incorporated with regard to sex. The model appears to be general enough to detect decision-making ability of varying degrees regardless of teaching speciality and appears to have no biases which would invalidate its use with the intended audience of pre-service teachers.

The second purpose of the study, the establishment of the validity of the simulation, was not achieved. Although it appears that the simulation discriminates between two levels of ability, these groupings have no relationship to any of the personality factors measured by the Gordon tests. This result could possibly be due to several reasons: a) the simulation does not detect the ability hypothesized to be related to effective teaching, the ability to make appropriate pre-instructional decisions; b) a relationship exists but was not detected because of the small sample; c) the relationship between classroom performance and personality traits detected by Morgan and Woerdehoff (1969) were the result of random chance and no relationship exists between the two; or d) that the ability detected is not related in any way to teaching effectiveness.

Of the possible explanations the third one appears the most plausible at this time. The category of "praises" identified using Flander's Interaction Analysis, and indeed the whole interaction classification, is probably not related to instructional planning decisions but rather an ability to make ad hoc decisions, which this simulation is not intended to measure.

The lack of other research supporting Morgan and Woerdehoff's finding suggest that attempts to establish the validity of the simulation using personality factors is unproductive. Further attempts at establishing the predictive validity of the simulation might utilize combinations of pupil ratings, achievement scores, supervisor ratings and performance testing. Some attempt at comparing the game playing ability of participants and their simulation performances might provide answers regarding possible interactions of this ability. Future validation attempts should also be conducted using larger samples, 100 or more in each group (Cronbach & Snow, 1977).

The overall feedback from the participants during the simulation and in the debriefing session was useful and encouraging. Some aspects did not work particularly well such as the 700 series in which players had to match descriptions of teaching structures to teaching strategies. Each player had their own idea regarding which elements should have been included and consequently most players did rather poorly in this decision area. The choice of appropriate objective descriptors also created some problems since unanimity in the choice of action verbs is not achieved even among the "experts" (Gronlund, 1970; Johnson & Johnson, 1975; Kibler et al., 1974). A different format and a wider range of appropriate descriptors would probably rectify this problem.

Another weakness of the simulation stemmed from the necessity of using numbers for the input. As mentioned previously this was designed to expedite the programming and processing time but from the comments of the players lessened the realism of the exercise. Over half of the players did not feel that the simulated students "existed" but were only regarded as numbers.

On the whole, however, the teaching professionals who acted as subjects indicated that for the most part the experience had been worthwhile. A great many had contributed suggestions and comments as to where the simulation could be improved and 81% said that the simulation should be used again. Responses to one question on the attitudinal questionnaire, question 15, were very surprising. With 80 possible decisions to choose from for 25 students in each of 12 lesson periods, 90% of the participants said that the simulation needed still more decision options. A second, more complex version is currently under development and incorporates the suggestions and modifications which evolved from this prototype in the effort to design a valid measure of teacher competence.

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APPENDIX I

SIMULATION PARTICIPANT'S HANDBOOK

This simulation is an attempt to design an experimental program which will assess the lesson planning abilities of teacher-trainees. Your participation in this initial testing of the prototype will provide valuable data and feedback to assess its effectiveness, and to improve the design.

The simulation program, stored in a computer, represents an abstraction of the types of decisions which teachers make when planning classroom instruction. The decisions which you will use for the simulation, given later on in this manual, will obviously not include all possible decisions. Some strategies which you may use with success in your actual teaching situation may also not be included, however, you are asked to choose from the available decisions those most closely resembling your own.

Your decisions for each of the simulated lesson periods will be evaluated by a computer program based on contemporary teaching theory and practice. A computer print-out will inform you of the consequences of your decisions by indicating how many of your simulated students have "learned".

Your participation in the testing of this prototype is appreciated and your comments, opinions and suggestions will be given very careful consideration in an effort towards improving the design.

PROCEDURES

SYNOPSIS

Contained in this handbook are all the decisions which can be utilized in planning lessons for your simulated class. There are 80 possible decisions out of which you are to choose 9 for each class grouping you decide upon.

Simulation Participant Objective

You are to devise teaching strategies which will enable all of the simulated students to learn the subject matter units within the allotted time.

Number of Students

You have been assigned 25 "students" who have varying academic abilities. Successful strategies would depend upon the matching of available strategies and student abilities.

Lesson Periods

As in real life you have a fixed amount of time in which all students must learn the material. There are 15 periods available, with each period representing about 40 minutes of instruction.

Teaching Groupings

You have the option of grouping the students into one large class group or up to 5 smaller units within the class. The groupings can be changed for any lesson period.

Submitting Lesson Plan Decisions

The decisions you make for each group in each lesson period will be entered by you onto a DECISION SHEET form. The completed decision sheets will be submitted at the times indicated by the simulation administrator.

Reports to Participants

After submitting your DECISION CARDS to the instructor, within 24 hours, you receive a computer print-out informing you of the students who have learned. You will need to keep track of learners and so a CLASS EXAMINATION LIST has been supplied and will be found at the back of this manual.

Pre-Instructional Decisions

The 80 decisions contained in this manual represent the types of decisions which a teacher makes before entering a classroom. Decisions, such as discipline handling, etc. which require an interaction between student and teacher are not dealt with in this simulation.

It is likely that the most successful strategies will be those which take individual student differences into account.

The simulation decisions involve choosing instructional objective categories, assigning students to groups, choosing teaching groupings and teaching strategies, choosing objective descriptors, teaching materials and methods of evaluation.

Submission of Decisions

The computer program is designed to process all players' decisions as a "batch" for each of the simulated lesson periods. Consequently should you miss a particular submission deadline it will simulate what happens when you are absent from your regular class and no qualified substitute teacher is available, no students will learn and a period is wasted.

Assistance

If questions or difficulties arise do not hesitate to contact me in Room 106, EMC 392-8876 or home 679-3673.

CLASS LIST

Immediately following this section is a list of simulated students which you have been assigned. The list contains 3 columns of information:

01	John A.	G - 1.06
STUDENT NUMBER	STUDENT NAME	COMPOSITE ACHIEVEMENT SCORE

Student Number

Each "student" is identified by a number. Please use this number when assigning students to the groupings, the computer can only identify them by number, not by name.

Student Names

All simulated students have been assigned names to make it easier for you to deal with them. You must not interchange the student number or names: John A. is always 01; Anne F. always 13; Mike N. always 20; etc.

Composite Achievement Scores

The COMPOSITE ACHIEVEMENT SCORES of the simulated students have been included to provide you with information which may be of some use in formulating your decisions.

The "G" represents a hypothetical academic ability as measured by a composite test of general reasoning, mathematical and reading abilities, presumably administered to the students at the beginning of the school year.

EXAMPLE: Students entering the grade having an ability to do the work at that grade level would be represented by a G.
(a student entering grade 5 with an ability to do grade 5 work would be G.00)

IT IS LEFT TO YOUR IMAGINATION WHAT LEVEL YOU ARE "TEACHING"

If a student entering the hypothetical grade has the ability to do work <u>above</u> the entering level then the achievement score will contain figures to indicate by how much.

EXAMPLE: if the student is a bit ahead, say by 4 months, then the level will be G.04.

if the student is really ahead, say by 2 years, then the level will be G+2.00.

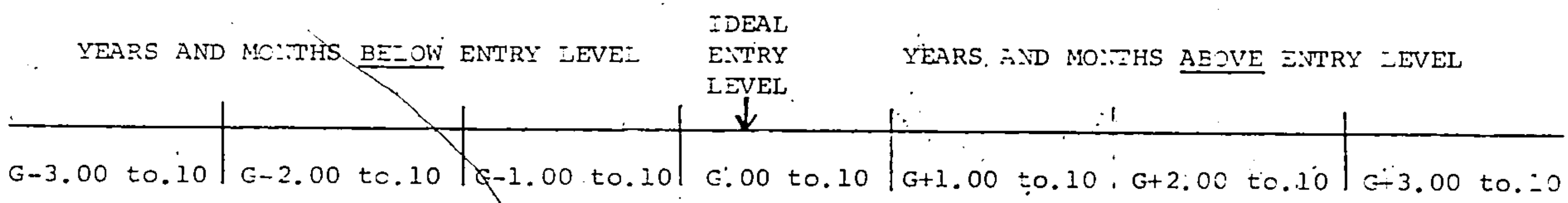
(YEARS are represented by numerals after the G and MONTHS (10 per school year) are indicated by figures preceded by a decimal point and follow the G)

Conversely if a student entering the hypothetical grade is not at the level considered to be the entry level* (G) then scores are preceded by a minus sign and indicate the YEAR AND MONTHS below the assumed level.

EXAMPLE: a student entering the grade slightly one year and one month below the assumed entry level would be represented by G-2.10.

Obviously this student will exhibit some difficulty learning.

The guide on the next page will aid you in understanding where a particular student stands in relation to the assumed entry level.


YEARS AND MONTHS BELOW ENTRY LEVEL
IDEAL ENTRY LEVEL
YEARS AND MONTHS ABOVE ENTRY LEVEL
G-3.00 to.10
G-2.00 to.10
G-1.00 to.10
G.00 to.10
G+1.00 to.10
G+2.00 to.10
G+3.00 to.10

SIMULATION DECISION SHEETS

Included at the back of this handbook are a number of DECISION SHEETS. Additional sheets are available upon request.

The DECISION SHEETS are designed to aid you in organizing your strategies and in keeping track of the groupings.

The decisions you enter on the forms will be keypunched onto computer cards before submitting them to the computer. Please make sure that your numbers are clear to ensure that your decision is correctly keypunched.

Below (p. 114) is a sample form with simulated decisions. Make sure that each box contains the appropriate number.

The ID NUMBER box refers to your McGill student number and will be used to let the computer know who is submitting the particular decisions.

For each of the simulated lesson periods you must submit a DECISION SHEET for <u>each</u> student grouping you have chosen. These groupings, known as TEACHING GROUPINGS, are found on pages 135 to 138 of this manual.

YOU MAY DIVIDE YOUR CLASS INTO AS FEW AS 1 OR AS MANY AS 5 GROUPS FOR EACH LESSON PERIOD.

SIMULATION DECISION SHEET

ID Number	7 7 8 8 9 9 6
Period Number	0 3
Number of groupings	4
Subject Matter Choice	2 0 5
"Student's" numbers for this group	01 08 11 13 15 18 20 21
Objective Category	3 0 2
Objective Descriptors	4 0 7 4 1 1 4 1 5
Teaching Grouping	5 0 3
Instructional materials choice	6 0 4
Teaching Strategy	7 0 4
Method of Evaluation	8 0 3
This is group number	2

SIMULATION FEEDBACK FORM

During this testing of the prototype you will also be asked to complete a short attitudinal check after working on the decisions. Also please keep track of the time you spend on making decisions for each lesson period as the information will be extremely valuable in detecting trouble spots, an accurate record is essential. In addition please write down any comments, good or bad; frustrations encountered, if any; "bugs" detected or general observations.

The forms are located at the back of this manual. Additional forms are available upon request.

COMPUTER PRINT-OUT

After your decisions have been submitted to the computer a print-out will be returned to you. The print-out will contain two sets of numbers.

The first set of numbers will be the numbers of the students who have learned the subject matter unit you have given them. Check off on the CLASS EXAMINATION LIST those students who were successful. It will be your responsibility to keep track of those who have learned, just as you do in a regular class situation.

If a number of a student does not appear then the strategies you have chosen to help the student learn were not successful and you will possibly have to devise alternative strategies.

COMMENTS

As an aid to help you diagnose why particular strategies did not work a second set of numbers may appear. These are feedback comments from students, colleagues or support personnel which provide clues towards rectifying the learning failures.

A list of keyed numbers and comments will be found on the next page.

COMMENTS

1 "NOT ANOTHER PROJECT, I HAVEN'T FINISHED THIS ONE YET!"
2 "TEACHER WAS REALLY DISORGANIZED TODAY!"
3 "NEVER HEARD OF THIS TEACHING GROUPING BEFORE"
4 "YOU HAVEN'T TIME TO KEEP TRACK OF INDEPENDENT STUDENTS NOW"
5 "WE CAN'T LISTEN TO YOU AND WORK AT THE SAME TIME"
6 "TEACHER I DON'T REMEMBER WHAT YOU TALKED ABOUT TODAY"
7 "MUST BE A HOLIDAY, WHERE ARE SOME OF YOUR STUDENTS?"
8 "STUDENT IS BORED AND RESTLESS"
9 "HOW CAN I DO ANYTHING BY MYSELF?"
10 "TOO MANY PEOPLE TALKING AT ONCE"
11 "TALK, TALK, TALK, THAT'S ALL WE EVER DO"
12 "SORRY, AV CENTRE SAYS MATERIALS ARE NOT AVAILABLE"
13 "ARE YOU SURE THIS TEACHING MATERIAL WILL REALLY WORK?"
14 "WHERE CAN I FIND STUFF ON MY PROJECT?"
15 "THIS MATERIAL IS TOO HARD"
16 "THERE WERE TOO MANY STUDENTS IN THE LIBRARY - THE LIBRARIAN SENT US BACK"
17 "HOW COME THE TEACHER PUT ME IN THE DUMMY GROUP?"
18 "TEACHER WE GOT TOO MANY IN THIS GROUP"
19 "SOME STUDENTS ARE ABSENT"
20 "NEVER HEARD OF THIS CATEGORY BEFORE"
21 "EVALUATION RESULTS NOT AVAILABLE"
22 "I CAN'T GET ORGANIZED THIS MORNING"
23 "WHERE CAN I FIND MY BOOKS?"
24 "YOUR CLASS WAS VERY UNRULY TODAY"
25 "HAVE YOU EVER THOUGHT OF ANOTHER LINE OF WORK"
26 "NO SUCH OBJECTIVE CATEGORY"

S I M U L A T I O N   D E C I S I O N S

ID NUMBER

Enter your McGill student number or the 7 digit number which you have been assigned. This NUMBER SHOULD BE ENTERED ON ALL OF THE DECISION SHEETS YOU SUBMIT.

PERIOD NUMBER

Enter the period number on each decision sheet. For the first 9 periods enter a zero in the first box.

EXAMPLE: | 0 | 3 |

GROUPING OF STUDENTS

The set of decisions regarding the assigning of students will usually be undertaken in conjunction with the choice of a TEACHING GROUPING-DECISION 500 series.

You may choose to teach the entire class during one lesson period or you can re-structure the class into as many as 5 separate teaching groups in a lesson period.

You can also change your group selection and/or the students in them for any new lesson period.

INDICATE THE NUMBER OF GROUPINGS BY ENTERING A NUMBER FROM ONE TO FIVE ON EACH DECISION SHEET.

EXAMPLE: if there are 3 groupings the number 3 should be in the groupings box on all 3 sheets.

TURN TO THE NEXT PAGE AND CHOOSE ONE SUBJECT MATTER UNIT TO "TEACH" TO EACH OF YOUR GROUPS.

DECISION SEQUENCE 200 - SUBJECT MATTER

Your objective for this simulation will be to teach this subject matter, which is in the form of a taxonomy, to the simulated class. You are free to organize and structure the units and present them to the students in any order as long as you keep the content of each numbered unit intact.

Limitations

Since the actual presentation of material contained in each unit would be too time-consuming and impractical, each of the numbered units can be viewed as abstracts representing all relevant material which can be taught.

It will be necessary, therefore, since each unit represents a substantial amount of information, to limit the number of subject matter units you can give to one per group. You may teach the same unit to all the groups at the same time, or different units to different groups at the same time.

The simulation will conclude when all 25 students have learned all of the 10 subject matter units or when you have submitted 15 lesson period plans.

ONCE YOU HAVE MADE YOUR SUBJECT MATTER UNIT SELECTIONS FOR EACH GROUP, ENTER THE NUMBERS ON EACH DECISION SHEET IN THE BOX BEGINNING WITH THE NUMBER 2.

BACKGROUND INFORMATION

(assume the class has had this information in an introduction)

In recent surveys of Mars, zoologists have classified a species of fauna, the GANDLEMULLER,* into a series of 13 distinct subspecies on the basis of physical characteristics observed on laboratory specimens.

Some subspecies differ with respect to more than one physical characteristic; there are, therefore, alternative ways of making distinctions. The GANDLEMULLER subspecies also exhibit differences in terms of behavioural habits.

MASTICATORS are used to propel mud into the ingestive aperture, through a grid-like filter which prevents large

*The author is indebted to Drs. G. Pask and B. Scott of Systems Research Ltd. for their permission to use this taxonomy.

objects entering. SPRONGS are horned spikes protruding from either the fore or tail end and are used primarily for defense.

GANDLEMULLER TAXONOMY

2 0 1 GANDLERS

The name GANDLER is a corruption of the species name.

There are four GANDLER subspecies: two M-GANDLERS and two B-GANDLERS. The subspecies are distinguished by the type of cranial mound, single or double. The type is indicated by suffixes: I (single mound), II (double mound). This gives names: M-GANDLER-I; M-GANDLER-II; B-GANDLER-I; and B-GANDLER-II.

All GANDLERS have retractible sensors and a smooth dorsal mound. GANDLERS have a single masticator as in picture:

Masticator of GANDLERS

2 0 2 GANDLEPLONGER SUBSPECIES

There are 5 GANDLEPLONGER subspecies:

one M-GANDLEPLONGER-α; one T-GANDLEPLONGER-α

one B-GANDLEPLONGER-Ω; and two T-GANDLEPLONGER-Ωs

GANDLEPLONGERS have distinct modes of propelling themselves through a watery medium. The other species types can travel only over earth and mud surfaces.

M-GANDLEPLONGER- α uses its single tail in an up-down motion (like a whale).

T-GANDLEPLONGER- α beats down with the two outer tails as it beats up with the centre tail and vice versa.

B-GANDLEPLONGER- Ω and the two T-GANDLEPLONGER- Ω's beat their tails up and down in unison.

2 0 3 M and B PLONGERS

Suffixes A and B are used three times in the classification; twice for differences in type of vibratory sensor, once for differences in type of dorsal mound.

The B-PLONGERS are distinguished from each other by the type of dorsal mound, hairy or smooth. The B-PLONGER-A has a smooth dorsal mound. The B-PLONGER-B has a hairy dorsal mound. The hairs are thick and silky and believed to function as insulators, conserving heat generated by digestive processes.

M-PLONGER-A has retractible vibratory sensors. The sensors are important for detecting OWZARD'S wing beats. During attack the M-PLONGER-A retracts its sensors.

The M-PLONGER-B has fixed vibratory sensors. The sensors are important for detecting OWZARD'S wing beats. The M-PLONGER-B has a slightly longer fore-sprong which serves to protect its sensors.

2 0 4 DEFENCES AGAINST OWZARD ATTACKS

SPRONGS, when worn, are used as a defence against predators chiefly the OWZARD or Martian night vulture.

GANDLERS have no sprongs. They avoid OWZARDS by excreting all mud being processed, collapsing the FOREPLANK and lying flat below the surface of the mud swamp.

PLONGERS have two SPRONGS, fore and tail. When attacked by OWZARDS, PLONGERS jacknife their bodies rapidly, splashing with both sprongs.

GANDLEPLONGER-α , with its single sprong at the fore end pivots on its ventral skirts, slashing with its sprong, when attacked.

GANDLEPLONGER , with its single sprong at the tail end pivots, when attacked, on its foreplank and slashes with its sprong.

2 0 5 CRANIAL MOUNDS

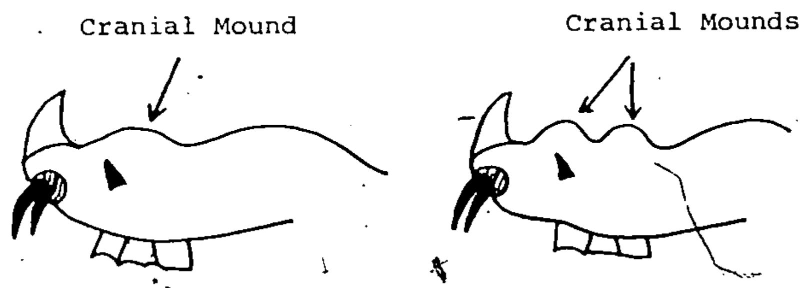
Neurophysiologists note that single and double cranial mounds do not differ in total volume, but behavioural studies do show differences between GANDLERS in their abilities to discriminate, generalize and learn.

The double mound subspecies are superior in these respects, significantly so, probably owing to the double cranium having a more convoluted surface.

Since the more intelligent creatures have a greater chance of survival; it is expected that eventually the single mound forms will become extinct. At present GANDLER-II's appear to outnumber GANDLERS-I's by 4 to 1.

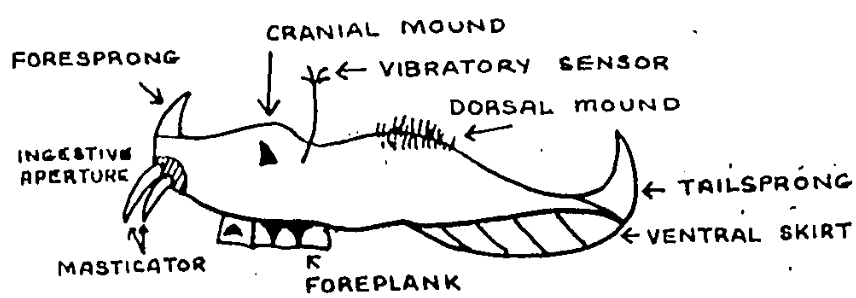
All PLONGERS have single cranial mounds.

All GANDLEPLONGERS have double mounds. Behavioural studies again show intellectual abilities are superior for double cranial mounded creatures.



2 0 6 SPECIES

The name "GANDLEMULLER" is formed from GANDLE (Martian for swamp-mud) and MULLER (German for Miller), hence "swamp mud miller", since GANDLEMULLER are found in the Martian swamp land of the equatorial regions. They inhabit mudflats and deep, dark, dank caves. They are almost transluscent and active only at night.



This is a picture of a typical adult GANDLEMULLER, approximately 2 feet 6 inches in length. The picture shows names of physical characteristics.

2 0 7 T-GANDLEPLONGERS

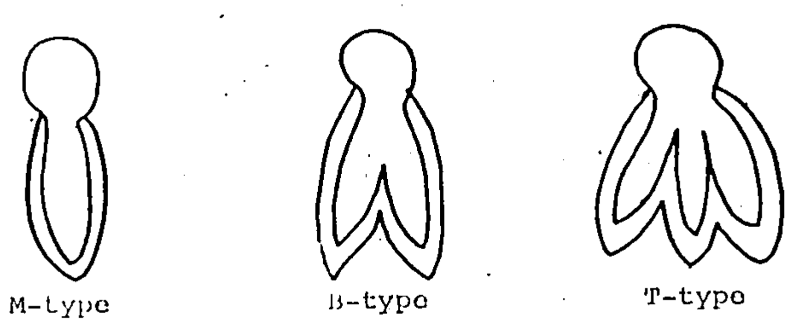
The characteristic used to distinguish the two T-GANDLEPLONGER Ω's from each other is the type of vibratory sensor.

The T-GANDLEPLONGER-Ω-A has a retractible sensor.
The T-GANDLEPLONGER-Ω-B has a fixed sensor.
All GANDLEPLONGERS have a hairy dorsal mound.

GANDLEPLONGERS have distinct modes of propelling themselves through a watery medium. The other species types can only travel over earth and mud surfaces.

2 0 8 GANDLEMULLERS can have three bodies. Subspecies are found with one, two and three bodies joined laterally as diagrammed below. A prefix to the subspecies name indicates the number of bodies:

M(mono) = one body
B(bi) = two bodies
T(tri) = three bodies



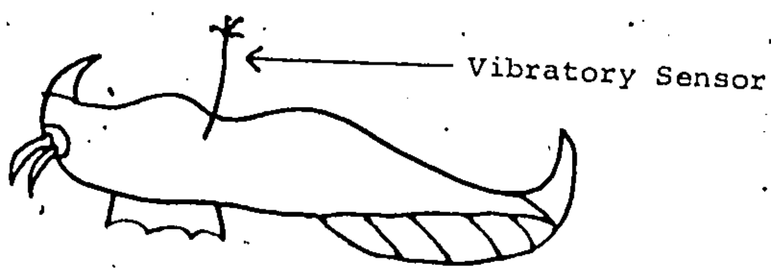
There are three main subspecies types: GANDLERS, PLONGERS and GANDLEPLONGERS. All three types have subspecies with one and two body forms. Only GANDLEPLONGERS have three body forms.

2 0 9 PLONGERS SUBSPECIES

The name PLONGER is from the Martian verb PLONGE, to prick or stab. PLONGERS have two SPRONGS, fore and tail.

There are four PLONGER subspecies:, two M-PLONGERS and two B-PLONGERS.

The M-PLONGERS are distinguished from each other by the type of vibratory sensor, retractible or fixed.



Masticator of PLONGERS

PLONGERS have two MASTICATORS with pointed ends (as in the above picture).

B-PLONGERS all have fixed sensors.

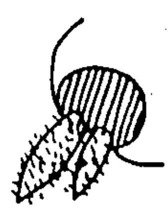
2.1.0 GANDLEPLONGERS

GANDLEPLONGERS (of which there are two main subtypes) were the most recent species type to be discovered, hence the mixed name, which also indicates the creatures have but one sprong (fore or tail).

There are two main subtypes of GANDLEPLONGER:

1. GANDLEPLONGER-α which has its single sprong at the fore end. When OWZARDS attack, the creature pivots on its ventral skirt and slashes with its sprong.

2. GANDLEPLONGER-Ω has its single sprong at the tail end. When OWZARDS attack the creature pivots on its foreplank and slashes with its sprong.



Masticator of GANDLEPLONGER-α

GANDLEPLONGERS have two MASTICATORS which are spoon shaped. The surface of the spoon-shaped MASTICATORS of the GANDLEPLONGER-α is hairy.


Masticator of GANDLEPLONGER-Ω

The surface of the spoon shaped MASTICATOR of the GANDLEPLONGER-Ω is smooth.

GANDLEPLONGERS, with the exception of T-GANDLEPLONGER-Ω A have fixed sensors.

PROCEED TO THE NEXT SECTION, PAGE 130 FOR INSTRUCTIONS ON ASSIGNING STUDENTS TO GROUPS.

ASSIGNING STUDENTS

You can assign all 25 students to one group, providing the grouping allows for this number (Lectures, recitation), by using the number 50.

Each grouping has minimum and maximum numbers of students which can be assigned to it so take careful note of these limits.

ASSIGN STUDENTS TO THE GROUP BY ENTERING STUDENT NUMBERS IN THE BOXES ON THE DECISION SHEETS FOR EACH GROUPING.

If the student number has a zero in it include the zero:

EXAMPLE: if Mary A., Harry C. and Heather C. are placed in a group the identifying numbers should be entered on the DECISION SHEET as

0	2	0	6	0	7

DECISION SEQUENCE 300 - TEACHING OBJECTIVE

Now that you have chosen a particular 200 level unit to teach to one or more student groupings it will be necessary to inform the students in each group of the objective level at which you will be aiming the unit. (You have to teach all 10 200 level units to all of the students but do not have to keep the same objectives everytime. You might possibly use the same objectives for all students or the same objectives for high or average or low students or different objectives for the same students every time. As in real life there are a great many options. Some will be successful, some will not be so successful.)

EXAMPLE: If you have decided upon 3 groups then

GROUP I (high student) Objective 304

GROUP II (low student) Objective 306

GROUP III (average student) Objective 301

In order to aid the students in understanding the unit you have chosen in section 200 it would be helpful if you inform them of the objective category for this lesson.

FROM THE FOLLOWING 300 LEVEL DESCRIPTIONS CHOOSE 1 OBJECTIVE CATEGORY AND ENTER THE NUMBER IN THE BOX BEGINNING WITH THE NUMBER 3.

3 0 1 KNOWLEDGE - defined as the remembering of previously learned material involving the recall of a wide range of material from specific facts to complete theories. Knowledge represents the lowest level of learning outcomes in

the cognitive domain.

3 0 2 COMPREHENSION - defined as the ability to grasp the meaning of material. May be shown by translating material from one form to another (words to numbers) or by explaining or summarizing. These learning outcomes represent the lowest level of understanding.

3 0 3 APPLICATION - refers to the ability to use material in new and concrete situations. May include the application of such things as rules, concepts, principles, laws and theories. Application requires a higher level of understanding than those outcomes under comprehension.

3 0 4 ANALYSIS - refers to the ability to break down material into its component parts so that its organizational structure may be understood. May include the identification of parts or the analysis of relationships between parts. Learn-

ing outcomes here represent a higher intellectual level than comprehension and application because they require an understanding of the material's content and structure.

3 0 5 SYNTHESIS - Synthesis refers to the ability to put parts together to form a new whole. Learning outcome stress creative behaviours, such as the production of a unique communication (theme or speech) or product (sculpture, song, etc.)

3 0 6 EVALUATION - Evaluation is concerned with the ability to judge the value of material (statement, novel, poem, research report) for a given purpose. The judgements are based on definite criteria. Learning outcomes in this area are highest in the cognitive hierarchy because they contain elements of all the other categories, plus conscious value judgements based on clearly defined criteria.

DECISION SEQUENCE 400 - OBJECTIVE DESCRIPTORS

In order to ensure the measurement of the objectives it would be helpful to choose words to use in objectives which will provide guidelines for <u>observable performances</u>, a necessary condition for measurement.

EXAMPLE: If you were teaching art and had chosen SYNTHESIS as the objective category then words such as paint, design, draw, create (product) would provide guidelines for observable performances.

Choose 3 of the following words which best describe observable performances for the objectives categories you have chosen for each grouping:

4 0 1	DESIGN	4 1 1	INTERPRETS	4 2 1	SYNTHESIZE
4 0 2	SEPARATES	4 1 2	CREATE	4 2 2	KNOWS
4 0 3	__________	4 1 3	NAMES	4 2 3	EXPLAINS
4 0 4	LISTS	4 1 4	PARAPHRASES	4 2 4	DESCRIBES
4 0 5	GENERATES	4 1 5	PREDICTS	4 2 5	COMPUTES
4 0 6	RELATES	4 1 6	GENERALIZES	4 2 6	PRODUCES
4 0 7	DISCRIMINATES	4 1 7	UNDERSTANDS	4 2 7	CONCLUDES
4 0 8	GIVES EXAMPLES	4 1 8	ILLUSTRATES	4 2 8	RECOGNIZES
4 0 9	DEMONSTRATES	4 1 9	DIFFERENTIATES	4 2 9	JUSTIFIES
4 1 0	IDENTIFIES	4 2 0	CATEGORIZES	4 3 0	APPRECIATES

ENTER YOUR 3 CHOICES FOR EACH OBJECTIVE CATEGORY YOU HAVE CHOSEN FOR EACH GROUPING IN THE BOXES WITH THE NUMBER 4.

EXAMPLE: If you have chosen KNOWLEDGE as the category, and you have already decided to break the class up into four groups, you will need to put the number 301 and the three 400 level choices in their appropriate boxes on four separate DECISION SHEETS.

DECISION SEQUENCE 500 - TEACHING GROUPINGS

All 25 students must be grouped and accounted for in each lesson period. The placement and chosen grouping will be in effect for the current lesson period. Using your computer print-outs you may wish to change subsequent groupings and students within the groupings. To keep the class manageable it is suggested that you limit any groupings to an absolute maximum of 5 groups.

The students may be grouped into any of the following after consideration of relevant abilities and their relation to the characteristics of the groupings. Remember that each student can be in only one group per lesson, for the entire lesson.

5 0 1 LECTURE (assign all students to this using Decision No. 50)

Typified by students seated in regular rows. Teacher provides most of the information orally.

5 0 2 LECTURE SUPPLEMENTED WITH MEDIA (assign all students to this using Decision No. 50)

As above but with the use of appropriate media.

5 0 3 DISCUSSION GROUP (assign students by number - maximum per group 10; minimum 2)

Classroom seating arranged to facilitate verbal interchange. Teacher moderates but allows the interchange of ideas to structure the learning situation.

5 0 4 INDIVIDUALIZED LEARNING (assign students by number, maximum per group 10)

At their desks students complete self-paced instructional programs with the teacher available for questions and clarification providing the teacher is not committed to another teaching strategy requiring full-time attention.

5 0 5 DIRECTED INDEPENDENT STUDY

(assign students by number; maximum 10)

Student pursues his own course of study in the topic under the guidance of the teacher, requires alternative teaching materials.

5 0 6 REMEDIAL TUTORING

(assign students by number, because of its tutorial nature only 5 students can be accommodated in each period)

An intensive tutorial session designed to remediate subject learning problems, requires teacher's full attention, requires supplementary material. Should only be used for students with 3 successive failures.

5 0 7 SMALL GROUP STUDY

(assign students by number, 2 - 10 students per group)

This arrangement groups students working on common material in a section of the classroom, requires self-instructional materials and/or workbooks, etc., little teacher-student interaction required.

5 0 8 RECITATION

(assign all students using No. 50)

Students seating is fixed, facing forward; question-answer format based on readings with the teacher conducting the class.

5 0 9 ADVANCED STUDY PROJECT (CAN ONLY BE USED IF STUDENT HAS COMPLETED 10 LESSONS SUCCESSFULLY)

(assign students by number)

Independent study for those students who have completed this instructional unit and who are waiting for the rest of the class to finish.

DECISION SEQUENCE 600 - INSTRUCTIONAL MATERIALS

Unfortunately the taxonomy is so new that regular texts on Martian life do not contain any information. The following materials have been provided by a friend who works for the Martian Exploration Company. Since there will be other teachers using this material you will be limited to the number of media available per lesson period as indicated with each decision. There is a materials choice suitable for each TEACHING GROUPING.

6 0 1 16mm FILM

"Gandlemullers of Mars". The film provides a general introduction on the fauna of Mars. You will see how the Gandlemullers and their sub-species, eat, play and procreate. The film is in colour and suitable for levels G to G + 3. Only one available per period.

6 0 2 35mm FILMSTRIP/CASSETTE - WORKBOOK - 10 available

"General Overview of Gandlemullers"

1 available per period.

6 0 3 35mm FILMSTRIP/CASSETTE - WORKBOOK - 10 available

"GANDLERS"

1 available per period.

6 0 4 35mm FILMSTRIP/CASSETTE - WORKBOOK - 10 available

"PLONGERS"

1 available per period.

6 0 5 35mm FILMSTRIP/CASSETTE - WORKBOOK - 10 available

"GANDLEPLONGERS"

1 available per period.

The above filmstrip/cassette set was conceived and produced to stimulate and encourage student interest in the variety and wonder of the Martian world. They are uniquely adaptable for use in G and up levels. The workbook provides exercises and supplementary learning materials.

6 0 6 OVERHEAD TRANSPARENCIES

Series of overheads relating to that part of the taxonomy you will be teaching in any particular unit. Can only be used in conjunction with the choice of a lecture-format. Suitable for G.00 to G+3.10 level students. Only one set available per period.

6 0 7 16mm FILM

"Preparation for Mars". Produced by the Martian Exploration Company, the film introduces the planning procedures which the Exploration Company used in going to Mars to examine the Gandlemuller series. The film is specially designed to arouse and motivate the viewer towards an understanding of the complexity of the operation. Several notable experts, including the originator of the Russian taxonomy, provide viewpoints on the expedition purposes and preparation. Suitable for levels G-3.00 to G+3.10. Only one film available.

6 0 8 SUMMARY NOTES

Notes on that part of the taxonomy you will be teaching in any particular unit. Contains no illustrations. Twenty-five available. Suitable for levels G-3.00 to G+3.10.

6 0 9 PROGRAMMED INSTRUCTION BOOKLETS

Program on that part of the taxonomy you will be teaching in any particular unit. Booklets only cover objectives specified and requires an entire lesson period for their use. Programs are small-step, linear-ily sequenced and contain the same illustrations as in the teacher's notes. Suitable for G-3.00 to G.00 levels. Twenty-five available.

6 1 0 LIBRARY RESOURCES

Assorted reference material in books, pamphlets and assorted printed matter. Suitable for G.00 to G+3.10 levels. Can accommodate 25 students.

6 1 1 WORKBOOK

Study material and exercise on that part of the taxonomy you will be teaching in this lesson period. Work-book will only cover objectives specified. Workbook difficulty level is G-3.00 to G.00. Twenty-five available.

ENTER YOUR DECISION IN THE BOX BEGINNING WITH THE NUMBER 6.

DECISION SEQUENCE 700 - TEACHING STRUCTURE

The descriptions which follow describe in general terms the types of instructional decisions which may be appropriate to the teaching groupings detailed in section 500.

For each grouping you have chosen it will be necessary to choose one of the following to describe how this teaching strategy should be organized. Each decision represents a summary of actions deemed to help achieve the teaching/learning goals.

7 0 1 Define terms and concepts

State general message of material

State major themes and subtopics

Allocate time for each initial topic

Debate the themes and subtopics

Integrate material with other knowledge

7 0 2 Objectives state clearly what the student can do

Objectives indicate intended student attitudes

Small steps are incorporated

Practice consistent with evaluation is provided

Varied input

7 0 3 Objectives stated clearly

Contract for evaluation of performances

Initial resources specified

Outline of steps

Meetings for discussion and motivation

Specification of deadlines

7 0 4 Encourage independence by providing minimal guidance

Ensure students find answers to all questions

Persist with the topic until every student can answer the questions

Summarize by establishing unanimity on the topic

Assign homework that will answer student questions

7 0 5 Provide a summary of the topic

Ascertain what the student already knows

Cover the content using part whole, sequential or combinatorial devices

Make clear and explicit by using rule-example-rule patterns

Summarize by relating to preceding and subsequent material

DECISION SEQUENCE 800 - METHOD OF EVALUATION

You now have the option of deciding whether or not you will evaluate student learning at this time. Please enter one evaluation decision number for the lesson you are now planning.

8 0 1 No evaluation necessary for this lesson.

8 0 2 Administer an essay exam.

8 0 3 Utilize learning contracts as a method of providing evaluations and student feedback.

8 0 4 Administer a true-false-type exam.

8 0 5 Have students give answers verbally in response to oral questions.

8 0 6 Give the students a multiple-choice exam.

8 0 7 Check exercises in workbook.

8 0 8 Have students complete a matching-item test, to check their learning.

8 0 9 Verify project work and give feedback.

GROUP NUMBER

In the last box on the decision sheets indicate what sheet this is of the total number of sheets you are submitting for that lesson period. The total number must not exceed 5.

APPENDIX II

SIMULATION ATTITUDINAL QUESTIONNAIRE

AND SUMMARY OF RESPONSES

QUESTIONNAIRE RAW DATA

SIMULATION ATTITUDINAL QUESTIONNAIRE

Please read each of the following statements carefully. You are to express, on a five-point scale, the extent of agreement between the feelings expressed in each statement and your own personal feeling. You are to circle the letter(s) which best indicates how closely you agree or disagree with the feeling expressed in each statement AS IT CONCERNS YOU. The five points of expression are: Strongly Agree (SA); Agree (A); Undecided (U); Disagree (D); and Strongly Disagree (SD).

	SA	A	U	D	SD
1. The simulation is helpful in illustrating the possibilities of alternative strategies of instruction.	8*	8	3	1	1
2. The challenge was to discover the theoretical model upon which the simulation was based.	5	11	3	2	0

*(Numbers indicate responses in each category)

		SA	A	U	D	SD
3.	I don't think practicing teachers would find the simulation very stimulating.	0	2	6	9	4
4.	I am now more aware of various teaching/learning strategy possibilities than I was before the simulation.	6	7	3	3	2
5.	The instructions for the simulation adequately explained the operating procedures.	6	8	3	4	0
6.	Learning to become a teacher is hard enough without having to engage in this kind of activity.	0	2	5	10	4
7.	Only people with some specialized knowledge in instructional design could be successful in this simulation.	2	0	4	8	7
8.	People participating in this simulation in the future will find it's not that interesting.	1	0	8	10	2
9.	If I had been given more time I would have found better strategies for each lesson period.	3	4	3	7	4
10.	I enjoyed my participation in this simulation.	3	11	5	2	0
11.	The application of the instructional design process would appear to be useful in my situation.	4	9	5	2	1
12.	I had enough time to properly plan each period's teaching decisions.	3	8	1	7	2
13.	I did not feel as if the simulated students existed, they were only numbers to me.	6	5	1	6	3

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		SA	A	U	D	SD
14.	The simulation model was general enough that any practicing teacher could find successful strategies.	4	9	4	2	2
15.	I had enough time to adequately plan the lesson strategies.	12	7	2	0	0
16.	This simulation is only a game, having little relevance to teaching.	0	2	5	13	1
17.	Instructional design may be good in theory but is not practical in a real school setting.	3	0	4	9	5
18.	Education students would find the simulation useful in demonstrating the complexity of the teaching/ learning process.	6	11	1	2	1
19.	I felt as if the simulated students somehow existed.	5	5	3	3	5
20.	I didn't learn anything in this simulation that I didn't already know.	1	2	3	10	5
21.	This simulation should be tried out on a larger scale.	5	8	7	1	0
22.	People can be trained to become effective teachers.	5	10	3	1	2
23.	There was always a rush to submit the lesson plans and I didn't really spend the amount of time I felt was necessary to formulate successful strategies.	2	2	4	8	4
24.	The explanations and instructions given remained confusing to me throughout the simulation.	2	1	3	13	2
25.	The decisions I made were based on practical experience and not on any book references.	5	12	2	2	0

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		SA	A	U	D	SD
26.	I don't think this simulation should be used again.	0	2	2	9	8
27.	Practicing teachers would find this kind of simulation a challenge.	5	9	7	0	0
28.	Good teachers are born, not made.	2	1	6	7	5
29.	I referred to some educational and/or psychology texts in formulating some decisions strategies.	0	4	5	4	8
30.	I was only interested in formulating strategies solely to beat the computer.	1	7	6	4	3

SIMULATION ATTITUDINAL QUESTIONNAIRE - DATA

Subject	Q1	Q3	Q5	Q7	Q9	Q11	Q13	Q15	Q17	Q19	Q21	Q23	Q25	Q27	Q29
1	4	4	3	5	3	5	1	5	4	2	2	5	4	4	3
2	4	3	2	4	4	5	5	5	4	5	4	2	4	4	3
3	5	3	5	3	1	4	2	5	1	2	5	4	4	5	3
4	3	4	4	5	4	2	4	5	4	4	3	4	4	3	1
5	5	5	4	1	4	3	4	4	4	4	4	5	2	5	1
6	4	4	2	5	2	3	5	4	4	5	4	4	4	4	2
7	3	2	4	3	2	3	4	5	1	3	4	1	5	5	1
8	4	3	3	5	3	3	2	5	4	3	4	4	3	3	4
9	4	4	5	4	4	5	1	4	3	1	4	4	2	4	3
10	4	4	3	4	2	4	4	4	3	4	4	4	4	4	2
11	5	4	5	4	5	2	1	5	4	1	5	1	5	3	2
12	1	3	4	5	5	1	1	5	5	1	3	4	4	3	1
13	5	4	2	3	4	4	5	5	5	5	5	4	4	3	4
14	2	5	5	4	5	3	1	5	4	2	3	3	4	3	4
15	3	3	4	3	3	4	2	3	3	3	3	3	3	3	1
16	5	4	5	1	1	4	4	4	5	5	5	3	5	5	1
17	4	4	4	4	4	4	2	4	4	4	4	2	4	4	2
18	5	2	4	4	4	4	2	5	3	1	3	5	5	4	3
19	5	5	5	5	2	5	3	3	[illegible]	5	3	3	5	4	1
20	4	3	2	4	1	4	4	4	5	4	3	3	4	4	4
21	5	5	4	5	5	4	1	5	5	1	5	5	4	5	1

Mean 53.524 Std. Err. .938
Variance 18.462 Std. Dev. 4.297
Sum 1124.000

Subject	Q2	Q4	Q6	Q8	Q10	Q12	Q14	Q16	Q18	Q20	Q22	Q24	Q26	Q28	Q30
1	4	1	3	4	3	1	1	3	4	2	2	3	2	3	2
2	5	5	3	3	3	2	3	3	4	5	1	2	5	2	2
3	4	5	4	3	4	2	5	4	5	4	5	4	4	5	3
4	3	3	4	3	4	4	3	4	3	2	4	4	3	4	5
5	5	4	5	1	4	2	5	4	1	4	5	4	5	5	2
6	4	4	5	4	4	2	3	4	4	4	4	4	4	4	4
7	4	3	2	3	4	4	4	3	5	4	5	4	4	1	1
8	4	4	4	4	4	2	4	4	4	3	3	4	4	3	4
9	4	3	5	4	4	4	5	4	4	3	4	4	5	3	3
10	3	4	4	4	4	3	2	4	4	4	3	4	4	3	3
11	5	3	4	3	3	5	4	4	5	3	4	4	4	3	2
12	4	1	4	3	2	3	1	2	2	1	4	1	4	4	2
13	2	5	3	4	5	5	4	4	5	5	4	5	5	4	5
14	4	2	4	4	4	2	4	2	4	4	1	4	5	4	2
15	4	4	3	3	2	4	3	3	4	4	4	4	3	3	3
16	5	5	2	5	5	2	4	4	4	4	4	5	5	1	3
17	4	2	4	4	3	4	4	5	2	4	4	4	2	4	4
18	4	4	4	3	4	4	2	4	4	5	4	3	4	4	2
19	3	5	3	5	5	4	5	2	5	5	3	3	5	5	3
20	2	5	4	4	3	1	4	4	4	4	5	1	4	3	5
21	5	4	5	4	4	5	4	4	5	5	5	4	5	5	4

Mean 54.333 Std. Err. 1.567
Variance 51.533 Std. Dev. 7.179
Sum 1141.000

SPSS PEARSON CORRELATION COEFFICIENTS PROGRAM

$r = .5387$
$N = 21$
$Df = (N-2)\,19$
$p < .006$

SPEARMAN-BROWN FORMULA FOR WHOLE TEST RELIABILITY

$$r_2' = \frac{2r}{1 + r}$$

$$r_2 = .70$$

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APPENDIX III

MEDIAN TEST DATA

The median was calculated according to procedures described by Ferguson (1976, pp. 51-54) using the following formula:

$$\text{Median} = L + \frac{N/2 - F}{f_m} h$$

where L = exact lower limit of interval containing median

F = sum of all frequencies below L

f_m = frequency of interval containing median

N = number of cases

h - class interval

$$\text{Median} = 119.5 + \frac{21/2 - 8}{5} 8 = 123.5$$

The median test was calculated according to procedures described by Ferguson (1976, pp. 384-385):

	Above Median	Below Median	
Effective	A 9	1 B	10
Ineffective	C 2	9 D	11
	11	10	21

The median test was calculated using a 2 X 2 table chi square formula with Yates' correction for continuity:

$$x^2 = \frac{N\left(\left[AD - BC\right] - N/2\right)^2}{(A+B)(C+D)(A+C)(B+D)}$$

$$x^2 = 8.14 \quad df = 1 \quad \underline{p} < .01$$

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APPENDIX IV

RAW DATA OF EACH PLAYER

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
01	78	90	168	12	58	58	40	50	94	67	59	1	0	M	4
02	77	83	160	79	99	93	40	07	60	67	01	1	10	M	3
03	66	82	148	97	51	93	29	26	67	14	10	1	5	M	1
04	68	79	147	44	64	07	72	71	21	14	53	1	4	M	1
05	68	71	139	94	76	98	46	26	79	89	10	1	1	M	1
06	67	71	138	06	37	77	75	71	69	72	81	1	8	F	1
07	65	67	132	43	92	52	80	95	40	45	64	1	0	F	4
08	62	61	123	37	44	09	69	37	69	87	11	4	1	F	2
09	62	66	128	55	10	22	80	44	99	91	17	2	17	F	1
10	61	63	124	87	44	45	89	52	81	72	28	2	9	F	1
11	59	63	122	68	81	33	66	82	32	14	88	2	5	M	2
12	71	56	127	62	44	38	01	71	32	60	18	3	8	M	2
13	64	46	110	67	99	52	85	92	47	66	33	3	2	F	2
14	61	63	124	10	04	28	03	05	05	02	22	2	4	M	1
15	60	53	113	99	71	96	38	65	94	59	70	4	12	F	1
16	58	53	111	74	70	97	77	77	46	52	97	4	25	M	2
17	56	46	102	79	51	90	24	07	96	92	26	4	2	M	1
18	54	46	100	49	31	02	50	06	81	27	20	4	8	F	1
19	55	41	096	03	20	19	82	64	46	24	53	4	12	M	2
20	52	30	082	82	31	82	12	09	69	32	07	4	15	F	2
21	49	25	074	88	95	86	34	14	67	28	18	4	0	M	4

A B C D E F G H I J K L M N O P

A-Subject
B-Index of Appropriateness
C-Index of Effectiveness
D-Combined Indexes
E-Caution personality trait score
F-Original Thinking trait score
G-Personal Relations score
H-Vigor score
I-Ascendance score
J-Responsibility score
K-Stability
L-Sociability
M-Simscore Category
N-Years Teaching
O-Sex
P-Grade Level Teaching

CODES

Simscore Categories (M)

(1) High Appropriateness
High Effectiveness

(2) Low Appropriateness
High Effectiveness

(3) High Appropriateness
Low Effectiveness

(4) Low Appropriateness
Low Effectiveness

Grade Level Teaching (P)

(1) Elementary (2) Secondary (3) University (4) Not a Teacher

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APPENDIX V

SIMULATION COMPUTER PROGRAM

```
      PROGRAM  MG300 (INPUT,OUTPUT,DISKIN,DISKOT,
                TAPE5=INPUT,TAPE6=OUTPUT,TAPE1=DISKIN,
                TAPE2=DISKOT)
C
C
C     THIS PROGRAM SIMULATES A CLASS OF STUDENTS WHO WILL LEARN THEIR
C     LESSON BASED ON A TEACHERS PRE-INSTRUCTIONAL DECISIONS  A CLASS
C     LIST IS PRODUCED BY TEACHER , SHOWING THOSE STUDENTS WHO LEARNED,
C     ABSENTEES, AND VARIOUS CLASS DILEMNAS THAT MIGHT OCCUR
C
C
      INTEGER STUD(25,26),DECIS(6,22),STUDNT(11),TGRP(6),MESSAGE(51)
      INTEGER POINTS,LEVEL,TYPE,PLAYER,LESSON,ST509(11),STLRND(11)
      INTEGER A,B,C,D
      INTEGER X,Y,Z,T,CTR
      INTEGER IM1,IM2,IM3,IM4,IM5,IM7,LEARND(25),ABSENT(25),SCORE,TSCORE
C
C    THIS SECTION CONTROLS THE READING OF THE CARD AND DISK FILE, AS
C     WELL AS THE NORMAL END OF PROGRAM ROUTINE
C
      DECIS(1,1)=0
      CTR=1
      CALL CCC(STUD,PLAYER,LESSON)
      CALL EEE(DECIS,TGRP,CTR)
      CTR=2
   50 IF(DECIS(1,1)-PLAYER)100,200,300
  100 WRITE(6,110)
  110 FORMAT(1H1,10X,3H300,42X,19HDESIGN  (432 - 209),58X)
      WRITE(6,120)DECIS(1,1),DECIS(1,2)
  120 FORMAT(1H0,10X,9HPLAYER - ,I7,10X,9HLESSON - ,I2,85X)
      WRITE(6,130)
  130 FORMAT(1H-,20X,38HNEW PLAYER--- NO CLASS FOR THIS PLAYER,74X)
      CALL EEE(DECIS,TGRP,CTR)
      GO TO 50
  200 IF(PLAYER.EQ.9999999)GO TO 4300
      D=1
      A=1
      IM1=1
      IM2=1
      IM3=1
      IM4=1
      IM5=1
      IM7=1
      MESSAGE(1)=99
  210 IF(DECIS(A,1).EQ.9999999)GO TO 4000
      B=5
      C=1
  220 IF(DECIS(A,B).EQ.0)GO TO 230
      STUDNT(C)=DECIS(A,B)
      IF(STUDNT(C).EQ.50)GO TO 221
      X=STUDNT(C)
      STUD(X,26)=DECIS(A,4)
      STUD(X,20)=DECIS(A,22)
```

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2


```
      GO TO 223
  221 IF(C.NE.1)GO TO 224
      X=1
  222 STUD(X,26)=DECIS(A,4)
      STUD(X,20)=DECIS(A,22)
      X=X+1
      IF(X.LE.25)GO TO 222
  223 C=C+1
  224 B=B+1
      IF(B.LE.14)GO TO 220
      C=11
  230 STUDNT(C)=99
      GO TO 1000
  240 A=A+1
      GO TO 210
  250 CALL CCC(STUD,PLAYER,LESSON)
      CALL EEE(DECIS,TGRP,CTR)
      GO TO 50
  300 WRITE(6,310)
  310 FORMAT(1H1,10X,3H300,42X,19HDESIGN  (432 - 209),58X)
      WRITE(6,320)PLAYER,LESSON
  320 FORMAT(1H0,10X,9HPLAYER - ,I7,10X,9HLESSON - ,I2,85X)
      WRITE(6,330)
  330 FORMAT(1H-,20X,32HTEACHER ABSENT - NO LESSON GIVEN,80X)
      CALL DDD(STUD,PLAYER,LESSON)
      CALL CCC(STUD,PLAYER,LESSON)
      GO TO 50
C
C
C     THIS SECTION OF THE PROGRAM AWARDS POINTS TO EACH STUDENT IN A
C     PLAYERS CLASS DEPENDING ON THE PLAYER S DECISIONS
C     LEVELS - 50 HIGH   60 HIGH + AVERAGE   70 ALL
C     15 LOW   25 LOW + AVERAGE
C
C                                DECISION 301     KNOWLEDGE
C
 1000 IF(DECIS(A,15).NE.301)GO TO 1100
      POINTS=1
      TYPE=0
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      TYPE=1
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      DO 1030 X=16,18
      IF(DECIS(A,X).EQ.404)GO TO 1010
      IF(DECIS(A,X).EQ.410)GO TO 1010
      IF(DECIS(A,X).EQ.413)GO TO 1010
      IF(DECIS(A,X).EQ.424)GO TO 1010
      GO TO 1020
 1010 TYPE=0
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 1020 TYPE=1
 1030 CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
```

POOR PRINT


```
1040 IF(DECIS(A,22).EQ.801)GO TO 1070
     IF(DECIS(A,22).EQ.803)GO TO 1050
     IF(DECIS(A,22).EQ.804)GO TO 1050
     IF(DECIS(A,22).EQ.805)GO TO 1050
     IF(DECIS(A,22).EQ.806)GO TO 1050
     IF(DECIS(A,22).EQ.807)GO TO 1050
     IF(DECIS(A,22).EQ.808)GO TO 1050
     IF(DECIS(A,22).EQ.809)GO TO 1050
     GO TO 1060
1050 TYPE=0
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
1060 TYPE=1
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     GO TO 2000
1070 IF(LESSON.LE.1)GO TO 1050
     POINTS=10
     LEVEL=70
     GO TO 1060
C
C
C                                    DECISION 302     COMPREHENSION
1100 IF(DECIS(A,15).NE.302)GO TO 1200
     POINTS=1
     TYPE=0
     LEVEL=70
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     TYPE=1
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     DO 1130 X=16,18
     IF(DECIS(A,X).EQ.408)GO TO 1110
     IF(DECIS(A,X).EQ.414)GO TO 1110
     IF(DECIS(A,X).EQ.416)GO TO 1110
     IF(DECIS(A,X).EQ.423)GO TO 1110
     GO TO 1120
1110 TYPE=0
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
1120 TYPE=1
1130 CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     GO TO 1040
C
C
C                                    DECISION 303     APPLICATION
1200 IF(DECIS(A,15).NE.303)GO TO 1300
     POINTS=1
     TYPE=0
     LEVEL=70
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     TYPE=1
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     DO 1230 X=16,18
     IF(DECIS(A,X).EQ.406)GO TO 1210
     IF(DECIS(A,X).EQ.409)GO TO 1210
     IF(DECIS(A,X).EQ.415)GO TO 1210
```

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```
      IF(DECIS(A,X).EQ.426)GO TO 1210
      GO TO 1220
 1210 TYPE=0
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 1220 TYPE=1
 1230 CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 1040
C
C                               DECISION 304      ANALYSIS
C
 1300 IF(DECIS(A,15).NE.304)GO TO 1400
      POINTS=1
      TYPE=0
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      TYPE=1
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      DO 1330 X=16,18
      IF(DECIS(A,X).EQ.402)GO TO 1310
      IF(DECIS(A,X).EQ.407)GO TO 1310
      IF(DECIS(A,X).EQ.416)GO TO 1310
      IF(DECIS(A,X).EQ.419)GO TO 1310
      IF(DECIS(A,X).EQ.428)GO TO 1310
      GO TO 1320
 1310 TYPE=0
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 1320 TYPE=1
 1330 CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      IF(DECIS(A,22).EQ.801)GO TO 1370
      IF(DECIS(A,22).EQ.803)GO TO 1350
      IF(DECIS(A,22).EQ.805)GO TO 1350
      IF(DECIS(A,22).EQ.806)GO TO 1350
      IF(DECIS(A,22).EQ.809)GO TO 1350
      GO TO 1360
 1350 TYPE=0
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 1360 TYPE=1
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 2000
 1370 IF(LESSON.LE.1) GO TO 1350
      POINTS=10
      LEVEL=70
      GO TO 1360
C
C                               DECISION 305      SYNTHESIS
C
 1400 IF(DECIS(A,15).NE.305)GO TO 1500
      POINTS=1
      TYPE=1
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      DO 1430 X=16,18
      IF(DECIS(A,X).EQ.405)GO TO 1410
```

POOR PRINT


```
      IF(DECIS(A,X).EQ.412)GO TO 1410
      IF(DECIS(A,X).EQ.420)GO TO 1410
      GO TO 1420
 1410 TYPE=0
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 1420 TYPE=1
 1430 CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      IF(DECIS(A,22).EQ.801)GO TO 1470
      IF(DECIS(A,22).EQ.803)GO TO 1450
      IF(DECIS(A,22).EQ.809)GO TO 1450
      GO TO 1460
 1450 TYPE=0
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 1460 TYPE=1
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 2000
 1470 IF(LESSON.LE.1)GO TO 1450
      POINTS=10
      LEVEL=70
      GO TO 1460
C
C                             DECISION 306     EVALUATION
C
 1500 IF(DECIS(A,15).NE.306)GO TO 1600
      POINTS=1
      TYPE=1
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      DO 1530 X=16,18
      IF(DECIS(A,X).EQ.411)GO TO 1510
      IF(DECIS(A,X).EQ.427)GO TO 1510
      IF(DECIS(A,X).EQ.429)GO TO 1510
      GO TO 1520
 1510 TYPE=0
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 1520 TYPE=1
 1530 CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      IF(DECIS(A,22).EQ.801)GO TO 1570
      IF(DECIS(A,22).EQ.806)GO TO 1550
      GO TO 1560
 1550 TYPE=0
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 1560 TYPE=1
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 2000
 1570 IF(LESSON.LE.1)GO TO 1550
      POINTS=10
      LEVEL=70
      GO TO 1560
C
C                             NO SUCH DECISION
C
 1600 POINTS=5
```

```
      TYPE=1
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      IF(D.GE.51)GO TO 2000
      MESSAGE(D)=26
      D=D+1
      MESSAGE(D)=99
      GO TO 2000
C
C                             DECISION 509     ADVANCED STUDY PROJECT
C
 2000 IF(DECIS(A,19).NE.509)GO TO 2100
      X=1
      Y=1
      ST509(1)=99
 2010 IF(STUDNT(X).EQ.99)GO TO 2040
      Z=STUDNT(X)
      IF(STUD(Z,16).EQ.99)GO TO 2030
      ST509(Y)=STUDNT(X)
      Y=Y+1
      ST509(Y)=99
 2020 X=X+1
      GO TO 2010
 2030 IF(D.GE.51)GO TO 2020
      MESSAGE(D)=1
      D=D+1
      GO TO 2020
 2040 TYPE=1
      LEVEL=70
      POINTS=10
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      TYPE=0
      CALL AAA(STUD,ST509,POINTS,TYPE,LEVEL)
      GO TO 240
C
C                             DECISION 501 -   LECTURE
C                    AND      DECISION 508     RECITATION
C
 2100 IF(DECIS(A,19).EQ.501)GO TO 2110
      IF(DECIS(A,19).NE.508)GO TO 2300
 2110 IF(DECIS(A,21).NE.703)GO TO 2120
      TYPE=0
      LEVEL=60
      POINTS=2
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 2135
 2120 IF(D.GE.51)GO TO 2130
      MESSAGE(D)=2
      D=D+1
      MESSAGE(D)=99
 2130 TYPE=0
      LEVEL=50
      POINTS=2
```

```
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 2135 CALL BBB(STUDNT,STUD)
      X=D
      CALL DEF(TGRP,STUD,STUDNT,MESSAGE,D)
      IF(X.NE.D)GO TO 240
      IF(DECIS(A,20).NE.608)GO TO 2170
      TYPE=0
      POINTS=2
      LEVEL=60
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 2160 TYPE=1
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 2190
 2170 IF(D.GE.51)GO TO 2180
      MESSAGE(D)=6
      D=D+1
      MESSAGE(D)=99
 2180 POINTS=2
      GO TO 2160
 2190 CALL HHH(STUD,DECIS,STUDNT,A)
      IF(STUDNT(1).EQ.50)GO TO 2200
      IF(D.GE.51)GO TO 2210
      MESSAGE(D)=7
      D=D+1
      MESSAGE(D)=99
      GO TO 2210
 2200 POINTS=2
      LEVEL=60
      CALL GGG(STUD,STUDNT,POINTS,LEVEL,MESSAGE,D)
 2210 POINTS=2
      LEVEL=70
      TYPE=1
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 240
C
C                              DECISION 502     LECTURE WITH MEDIA
C
 2300 IF(DECIS(A,19).NE.502)GO TO 2500
      IF(DECIS(A,21).NE.705)GO TO 2310
      TYPE=0
      LEVEL=60
      POINTS=2
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 2320
 2310 IF(D.GE.51)GO TO 2315
      MESSAGE(D)=2
      D=D+1
      MESSAGE(D)=99
 2315 TYPE=0
      LEVEL=50
      POINTS=2
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
```

[POOR PRINT]


```
2320 CALL BBB(STUDNT,STUD)
     X=D
     CALL DEF(TGRP,STUD,STUDNT,MESSAGE,D)
     IF(X.NE.D)GO TO 240
     IF(DECIS(A,20).NE.601)GO TO 2330
     IF(IM1.LT.1)GO TO 2400
     IM1=IM1-1
     GO TO 2380
2330 IF(DECIS(A,20).NE.602)GO TO 2340
     IF(IM2.LT.1)GO TO 2400
     IM2=IM2-1
     GO TO 2380
2340 IF(DECIS(A,20).NE.603)GO TO 2350
     IF(IM3.LT.1)GO TO 2400
     IM3=IM3-1
     GO TO 2380
2350 IF(DECIS(A,20).NE.604)GO TO 2360
     IF(IM4.LT.1)GO TO 2400
     IM4=IM4-1
     GO TO 2380
2360 IF(DECIS(A,20).NE.605)GO TO 2370
     IF(IM5.LT.1)GO TO 2400
     IM5=IM5-1
     GO TO 2380
2370 IF(DECIS(A,20).NE.606)GO TO 2390
2380 TYPE=0
     LEVEL=60
     POINTS=2
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     GO TO 2410
2390 IF(D.GE.51)GO TO 2410
     MESSAGE(D)=13
     D=D+1
     MESSAGE(D)=99
     GO TO 2410
2400 IF(D.GE.51)GO TO 2410
     MESSAGE(D)=12
     D=D+1
     MESSAGE(D)=99
2410 TYPE=1
     LEVEL=70
     POINTS=2
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     CALL HHH(STUD,DECIS,STUDNT,A)
     IF(STUDNT(1).EQ.50)GO TO 2420
     IF(D.GE.51)GO TO 2430
     MESSAGE(D)=7
     D=D+1
     MESSAGE(D)=99
     GO TO 2430
2420 POINTS=2
     LEVEL=60
     CALL GGG(STUD,STUDNT,POINTS,LEVEL,MESSAGE,D)
```

POOR PRINT


```
 2430 POINTS=2
      LEVEL=70
      TYPE=1
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 240
C
C                          DECISION 503    - DISCUSSION GROUP
C
 2500 IF(DECIS(A,19).NE.503)GO TO 2700
      IF(DECIS(A,21).NE.701)GO TO 2510
      TYPE=0
      LEVEL=60
      POINTS=2
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 2530
 2510 IF(D.GE.51)GO TO 2520
      MESSAGE(D)=2
      D=D+1
      MESSAGE(D)=99
 2520 TYPE=0
      POINTS=2
      LEVEL=50
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 2530 CALL BBB(STUDNT,STUD)
      X=D
      CALL ABC(TGRP,STUD,STUDNT,MESSAGE,D)
      IF(X.NE.D)GO TO 240
      IF(DECIS(A,20).NE.608)GO TO 2540
      POINTS=2
      TYPE=0
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 2550
 2540 IF(D.GE.51)GO TO 2550
      MESSAGE(D)=6
      D=D+1
      MESSAGE(D)=99
 2550 TYPE=1
      POINTS=2
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      CALL HHH(STUD,DECIS,STUDNT,A)
      X=1
 2560 IF(STUDNT(X).EQ.99)GO TO 2570
      IF(STUDNT(X).NE.50)GO TO 2565
      X=X+25
      GO TO 2560
 2565 X=X+1
      GO TO 2560
 2570 X=X-1
      IF(X.GE.2)GO TO 2580
      IF(D.GE.51)GO TO 2699
      MESSAGE(D)=9
```

```
      D=D+1
      MESSAGE(D)=99
      GO TO 2699
 2580 IF(X.LE.10)GO TO 2590
      IF(D.GE.51)GO TO 2699
      MESSAGE(D)=10
      D=D+1
      MESSAGE(D)=99
      GO TO 2699
 2590 X=1
      Y=1
      STLRND(1)=99
      POINTS=2
      TYPE=0
      LEVEL=70
 2600 IF(STUDNT(X).EQ.99)GO TO 2698
      IF(STUDNT(X).EQ.50)GO TO 2660
      Z=STUDNT(X)
      IF(STUD(Z,18).NE.1)GO TO 2630
 2610 STLRND(Y)=Z
      Y=Y+1
      STLRND(Y)=99
 2620 X=X+1
      GO TO 2600
 2630 IF(STUD(Z,18).NE.2)GO TO 2640
      IF(STUD(Z,1).LE.60)GO TO 2610
      GO TO 2620
 2640 IF(STUD(Z,18).NE.3)GO TO 2650
      IF(STUD(Z,1).LE.50)GO TO 2610
      GO TO 2620
 2650 IF(D.GE.51)GO TO 2620
      MESSAGE(D)=11
      D=D+1
      MESSAGE(D)=99
      GO TO 2620
 2660 IF(X.NE.1)GO TO 2620
      Z=1
 2665 IF(STUD(Z,18).NE.1)GO TO 2680
 2670 STLRND(Y)=Z
      Y=Y+1
      IF(Y.GE.11)GO TO 2695
      STLRND(Y)=99
 2675 Z=Z+1
      IF(Z.LE.25)GO TO 2665
      CALL AAA(STUD,STLRND,POINTS,TYPE,LEVEL)
      Y=1
      STLRND(Y)=99
      GO TO 2620
 2680 IF(STUD(Z,18).NE.2)GO TO 2685
      IF(STUD(Z,1).LE.60)GO TO 2670
      GO TO 2675
 2685 IF(STUD(Z,18).NE.3)GO TO 2690
      IF(STUD(Z,1).LE.50)GO TO 2670
```

```
      GO TO 2675
 2690 IF(D.GE.51)GO TO 2675
      MESSAGE(D)=11
      D=D+1
      MESSAGE(D)=99
      GO TO 2675
 2695 CALL AAA(STUD,STLRND,POINTS,TYPE,LEVEL)
      Y=1
      STLRND(1)=99
      GO TO 2675
 2698 CALL AAA(STUD,STLRND,POINTS,TYPE,LEVEL)
 2699 TYPE=1
      POINTS=2
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 240
C
C                            DECISION 504     INDIVIDUALIZED LEARNING
C                  AND       DECISION 507     SMALL GROUP STUDY
C
 2700 IF(DECIS(A,19).EQ.504)GO TO 2710
      IF(DECIS(A,19).NE.507)GO TO 3000
 2710 IF(DECIS(A,21).NE.702)GO TO 2720
      TYPE=0
      POINTS=2
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 2740
 2720 IF(D.GE.51)GO TO 2730
      MESSAGE(D)=2
      D=D+1
      MESSAGE(D)=99
 2730 TYPE=0
      POINTS=2
      LEVEL=50
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 2740 CALL BBB(STUDNT,STUD)
      X=D
      CALL ABC(TGRP,STUD,STUDNT,MESSAGE,D)
      IF(X.NE.D)GO TO 240
      CALL HHH(STUD,DECIS,STUDNT,A)
      IF(DECIS(A,20).NE.602)GO TO 2750
      IF(IM2.LT.1)GO TO 2850
      IM2=IM2-1
      GO TO 2860
 2750 IF(DECIS(A,20).NE.603)GO TO 2760
      IF(IM3.LT.1)GO TO 2850
      IM3=IM3-1
      GO TO 2860
 2760 IF(DECIS(A,20).NE.604)GO TO 2770
      IF(IM4.LT.1)GO TO 2850
      IM4=IM4-1
      GO TO 2860
```

```
2770 IF(DECIS(A,20).NE.605)GO TO 2780
     IF(IM5.LT.1)GO TO 2850
     IM5=IM5-1
     GO TO 2860
2780 IF(DECIS(A,20).EQ.609)GO TO 2790
     IF(DECIS(A,20).EQ.611)GO TO 2790
     IF(D.GE.51)GO TO 2870
     MESSAGE(D)=13
     D=D+1
     MESSAGE(D)=99
     GO TO 2870
2790 X=1
     Y=1
     STLRND(1)=99
     TYPE=0
     POINTS=2
     LEVEL=70
2800 IF(STUDNT(X).EQ.99)GO TO 2815
     IF(STUDNT(X).EQ.50)GO TO 2820
     Z=STUDNT(X)
     IF(STUD(Z,18).GE.3)GO TO 2810
     IF(STUD(Z,1).LE.50)GO TO 2810
     STLRND(Y)=Z
     Y=Y+1
     STLRND(Y)=99
2810 X=X+1
     GO TO 2800
2815 CALL AAA(STUD,STLRND,POINTS,TYPE,LEVEL)
     GO TO 2870
2820 IF(X.NE.1)GO TO 2810
     Z=1
2825 IF(STUD(Z,18).GE.3)GO TO 2830
     IF(STUD(Z,1).LE.50)GO TO 2830
     STLRND(Y)=Z
     Y=Y+1
     IF(Y.GE.11)GO TO 2835
     STLRND(Y)=99
2830 Z=Z+1
     IF(Z.LE.25)GO TO 2825
     CALL AAA(STUD,STLRND,POINTS,TYPE,LEVEL)
     Y=1
     STLRND(1)=99
     GO TO 2810
2835 STLRND(11)=99
     CALL AAA(STUD,STLRND,POINTS,TYPE,LEVEL)
     Y=1
     STLRND(1)=99
     GO TO 2830
2850 IF(D.GE.51)GO TO 2870
     MESSAGE(D)=12
     D=D+1
     MESSAGE(D)=99
     GO TO 2870
```

```
2860 TYPE=0
     LEVEL=70
     POINTS=2
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
2870 TYPE=1
     LEVEL=70
     POINTS=2
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     X=1
2880 IF(STUDNT(X).EQ.99)GO TO 2890
     IF(STUDNT(X).NE.50)GO TO 2885
     X=X+25
     GO TO 2880
2885 X=X+1
     GO TO 2880
2890 X=X-1
     IF(DECIS(A,19).NE.507)GO TO 2900
     IF(X.LT.2)GO TO 2910
2900 IF(X.LE.10)GO TO 2920
     IF(D.GE.51)GO TO 2930
     MESSAGE(D)=10
     D=D+1
     MESSAGE(D)=99
     GO TO 2930
2910 IF(D.GE.51)GO TO 2930
     MESSAGE(D)=9
     D=D+1
     MESSAGE(D)=99
     GO TO 2930
2920 LEVEL=70
     POINTS=2
     CALL GGG(STUD,STUDNT,POINTS,LEVEL,MESSAGE,D)
2930 POINTS=2
     LEVEL=70
     TYPE=1
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     GO TO 240
C
C                             DECISION 505     DIRECTED INDEPENDANT STUDY
C
3000 IF(DECIS(A,19).NE.505)GO TO 3100
     IF(DECIS(A,21).NE.703)GO TO 3010
     TYPE=0
     LEVEL=60
     POINTS=2
       CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     GO TO 3030
3010 IF(D.GE.51)GO TO 3020
     MESSAGE(D)=2
     D=D+1
     MESSAGE(D)=99
3020 TYPE=0
     LEVEL=50
```

```
      POINTS=2
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
 3030 CALL BBB(STUDNT,STUD)
      X=D
      CALL ABC(TGRP,STUD,STUDNT,MESSAGE,D)
      IF(X.NE.D)GO TO 240
      IF(DECIS(A,20).NE.610)GO TO 3040
      TYPE=0
      POINTS=2
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 3050
 3040 IF(D.GE.51)GO TO 3050
      MESSAGE(D)=14
      D=D+1
      MESSAGE(D)=99
 3050 TYPE=1
      POINTS=2
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      CALL HHH(STUD,DECIS,STUDNT,A)
      X=1
 3060 IF(STUDNT(X).EQ.99)GO TO 3070
      IF(STUDNT(X).NE.50)GO TO 3065
      X=X+25
      GO TO 3060
 3065 X=X+1
      GO TO 3060
 3070 X=X-1
      IF(X.LE.10)GO TO 3080
      IF(D.GE.51)GO TO 3090
      MESSAGE(D)=16
      D=D+1
      MESSAGE(D)=99
      GO TO 3090
 3080 POINTS=2
      LEVEL=70
      CALL GGG(STUD,STUDNT,POINTS,LEVEL,MESSAGE,D)
 3090 POINTS=2
      LEVEL=70
      TYPE=1
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 240
C
C                        DECISION 506     REMEDIAL TUTORING
C
 3100 IF(DECIS(A,19).NE.506)GO TO 3300
      IF(DECIS(A,21).NE.702)GO TO 3110
      TYPE=0
      POINTS=2
      LEVEL=15
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 3120
```

[POOR PRINT]


```
3110 IF(D.GE.51)GO TO 3120
     MESSAGE(D)=2
     D=D+1
     MESSAGE(D)=99
3120 CALL BBB(STUDNT,STUD)
     X=D
     CALL ABC(TGRP,STUD,STUDNT,MESSAGE,D)
     IF(X.NE.D)GO TO 240
     IF(DECIS(A,20).EQ.609)GO TO 3130
     IF(DECIS(A,20).NE.611)GO TO 3140
3130 TYPE=0
     POINTS=2
     LEVEL=15
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     GO TO 3150
3140 IF(D.GE.51)GO TO 3150
     MESSAGE(D)=15
     D=D+1
     MESSAGE(D)=99
3150 TYPE=1
     POINTS=2
     LEVEL=70
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     CALL HHH(STUD,DECIS,STUDNT,A)
     X=1
3160 IF(STUDNT(X).EQ.99)GO TO 3170
     IF(STUDNT(X).NE.50)GO TO 3165
     X=X+25
     GO TO 3160
3165 X=X+1
     GO TO 3160
3170 X=X-1
     IF(X.LE.5)GO TO 3175
     IF(D.GE.51)GO TO 3260
     MESSAGE(D)=18
     D=D+1
     MESSAGE(D)=99
     GO TO 3260
3175 X=1
     Y=1
3180 IF(STUDNT(X).EQ.99)GO TO 3260
     IF(STUDNT(X).EQ.50)GO TO 3220
     Z=STUDNT(X)
     IF(STUD(Z,19).GE.3)GO TO 3210
     STUD(Z,22)=5+STUD(Z,22)
     IF(D.GE.51)GO TO 3200
     MESSAGE(D)=17
     D=D+1
     MESSAGE(D)=99
3200 X=X+1
     GO TO 3180
3210 IF(STUD(Z,1).LT.70)GO TO 3200
     STUD(Z,23)=2+STUD(Z,23)
```

```
      STUD(Z,25)=1+STUD(Z,25)
      GO TO 3200
 3220 IF(X.NE.1)GO TO 3200
      Z=1
 3230 IF(STUD(Z,19).GE.3)GO TO 3250
      STUD(Z,22)=5+STUD(Z,22)
      IF(D.GE.51)GO TO 3240
      MESSAGE(D)=17
      D=D+1
      MESSAGE(D)=99
 3240 Z=Z+1
      IF(Z.LE.25)GO TO 3230
      GO TO 3200
 3250 IF(STUD(Z,1).LT.70)GO TO 3200
      STUD(Z,23)=2+STUD(Z,23)
      STUD(Z,25)=1+STUD(Z,25)
      GO TO 3240
 3260 TYPE=1
      LEVEL=70
      POINTS=2
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 240
C
C                             NO SUCH TEACHING GROUP
C
 3300 IF(D.GE.51)GO TO 3310
      MESSAGE(D)=20
      D=D+1
      MESSAGE(D)=99
 3310 TYPE=1
      POINTS=5
      LEVEL=70
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      GO TO 240
C
C     THIS SECTION OF THE PROGRAM WILL DO THE FOLLOWING - DETERMINE
C     WHETHER OR NOT STUDENT HAS LEARNED, PRINT OUT PLAYERS SHEET, AND
C     UPDATE PLAYERS DISK RECORD
C
 4000 DO 4002 X=1,25
 4002 LEARND(X)=0
      DO 4004 X=1,25
 4004 ABSENT(X)=0
      X=1
      Y=1
      Z=1
 4010 IF(X.GT.25)GO TO 4100
      STUD(X,2)=STUD(X,2)+STUD(X,22)
      STUD(X,3)=STUD(X,3)+STUD(X,23)
      STUD(X,4)=STUD(X,4)+STUD(X,24)
      STUD(X,5)=STUD(X,5)+STUD(X,25)
      IF(STUD(X,22).NE.0)GO TO 4030
      ABSENT(Z)=X
```

[POOR PRINT]


```
      Z=Z+1
4015  IF(STUD(X,19).GE.9)GO TO 4020
      STUD(X,19)=STUD(X,19)+1
4020  X=X+1
      GO TO 4010
4030  IF(STUD(X,20).EQ.801)GO TO 4020
      SCORE=STUD(X,23) * 100
      TSCORE=SCORE/STUD(X,22)
      IF(TSCORE.LT.STUD(X,1))GO TO 4015
      T=6
4040  IF(T.GE.15)GO TO 4060
      IF(STUD(X,T).EQ.0)GO TO 4050
      IF(STUD(X,T).EQ.STUD(X,26))GO TO 4015
      T=T+1
      GO TO 4040
4050  STUD(X,T)=STUD(X,26)
      STUD(X,19)=0
      LEARND(Y)=X
      Y=Y+1
      GO TO 4020
4060  IF(STUD(X,15).NE.99)GO TO 4015
      GO TO 4050
4100  WRITE(6,4110)
4110  FORMAT(1H1,10X,3H300,42X,19HDESIGN   (432 - 209),58X)
      WRITE(6,4120)PLAYER,DECIS(1,2)
4120  FORMAT(1H0,10X,9HPLAYER - ,I7,10X,9HLESSON - ,I2,85X)
      WRITE(6,4130)
4130  FORMAT(1H0,10X,45HTHE FOLLOWING STUDENTS LEARNED THEIR LESSON-,
     -          17X,10HABSENTEES-,50X)
      WRITE(6,4140)LEARND(1),LEARND(2),LEARND(3),LEARND(4),LEARND(5),
     -                  ABSENT(1),ABSENT(2),ABSENT(3),ABSENT(4),ABSENT(5)
4140  FORMAT(1H0,10X,I2,5X,I2,5X,I2,5X,I2,5X,I2,32X,I2,5X,I2,5X,I2,5X,
     -              I2,5X,I2)
      WRITE(6,4150)LEARND(6),LEARND(7),LEARND(8),LEARND(9),LEARND(10),
     -                  ABSENT(6),ABSENT(7),ABSENT(8),ABSENT(9),ABSENT(10)
4150  FORMAT(1H0,10X,I2,5X,I2,5X,I2,5X,I2,5X,I2,32X,I2,5X,I2,5X,I2,5X,
     -              I2,5X,I2)
      WRITE(6,4160)LEARND(11),LEARND(12),LEARND(13),LEARND(14),
     -   LEARND(15),ABSENT(11),ABSENT(12),ABSENT(13),ABSENT(14),
     -     ABSENT(15)
4160  FORMAT(1H0,10X,I2,5X,I2,5X,I2,5X,I2,5X,I2,32X,I2,5X,I2,5X,I2,5X,
     -              I2,5X,I2)
      WRITE(6,4170)LEARND(16),LEARND(17),LEARND(18),LEARND(19),
     -   LEARND(20),ABSENT(16),ABSENT(17),ABSENT(18),ABSENT(19),
     -     ABSENT(20)
4170  FORMAT(1H0,10X,I2,5X,I2,5X,I2,5X,I2,5X,I2,32X,I2,5X,I2,5X,I2,5X,
     -              I2,5X,I2)
      WRITE(6,4180)LEARND(21),LEARND(22),LEARND(23),LEARND(24),
     -    LEARND(25),ABSENT(21),ABSENT(22),ABSENT(23),ABSENT(24),
     -     ABSENT(25)
4180  FORMAT(1H0,10X,I2,5X,I2,5X,I2,5X,I2,5X,I2,32X,I2,5X,I2,5X,I2,5X,
     -              I2,5X,I2)
      WRITE(6,4190)
```

```
 4190 FORMAT(1H-,10X,10HCOMMENTS -,112X)
      D=1
 4200 X=0
      Y=0
      IF(MESSAGE(D).EQ.99)GO TO 4230
      X=MESSAGE(D)
      D=D+1
      IF(MESSAGE(D).EQ.99)GO TO 4210
      Y=MESSAGE(D)
      D=D+1
 4210 WRITE(6,4220)X,Y
 4220 FORMAT(1H ,10X,I2,10X,I2,108X)
      GO TO 4200
 4230 CALL DDD(STUD,PLAYER,LESSON)
      GO TO 250
C
C        THIS SUBROUTINE WILL UPDATE STUDENT SCORES OR STUDENT TOTALS
C
      SUBROUTINE AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      INTEGER I,K,TYPE,POINTS,LEVEL,STUDNT(11),STUD(25,26)
      K=1
 5000 IF(STUDNT(K).EQ.99)GO TO 5095
      IF(STUDNT(K).EQ.50)GO TO 5020
      I=STUDNT(K)
      IF(TYPE.EQ.0)GO TO 5010
      STUD(I,22)=POINTS+STUD(I,22)
      STUD(I,24)=1+STUD(I,24)
      GO TO 5060
 5010 IF(LEVEL.LT.50)GO TO 5075
      IF(LEVEL.LT.STUD(I,1))GO TO 5060
 5015 STUD(I,23)=POINTS+STUD(I,23)
      STUD(I,25)=1+STUD(I,25)
      GO TO 5060
 5020 IF(K.GT.1)GO TO 5060
      I=1
 5030 IF(TYPE.EQ.0)GO TO 5040
      STUD(I,22)=POINTS+STUD(I,22)
      STUD(I,24)=1+STUD(I,24)
      GO TO 5050
 5040 IF(LEVEL.LT.50)GO TO 5085
      IF(LEVEL.LT.STUD(I,1))GO TO 5050
 5045 STUD(I,23)=POINTS+STUD(I,23)
      STUD(I,25)=1+STUD(I,25)
 5050 IF(I.EQ.25)GO TO 5060
      I=I+1
      GO TO 5030
 5060 K=K+1
      GO TO 5000
 5075 IF(LEVEL.NE.15)GO TO 5080
      IF(70.LE.STUD(I,1))GO TO 5015
 5080 IF(60.LE.STUD(I,1))GO TO 5015
      GO TO 5060
 5085 IF(LEVEL.NE.15)GO TO 5090
      IF(70.LE.STUD(I,1))GO TO 5045
      GO TO 5050
 5090 IF(60.LE.STUD(I,1))GO TO 5045
      GO TO 5050
 5095 RETURN
      END
```

POOR PRINT


```
C
C     THIS SUBROUTINE WILL CHECK TO SEE THAT WHILE A GROUP ACTIVITY
C     IS IN PROGRESS A LECTURE IS NOT BEING GIVEN BY THE PLAYER
C
      SUBROUTINE ABC(TGRP,STUD,STUDNT,MESSAGE,D)
      INTEGER TGRP(6),STUD(25,26),STUDNT(11),MESSAGE(51)
      INTEGER K,D,POINTS,TYPE,LEVEL
      K=1
 5700 IF(TGRP(K).EQ.999)GO TO 5720
      IF(TGRP(K).EQ.501)GO TO 5710
      IF(TGRP(K).EQ.502)GO TO 5710
      IF(TGRP(K).EQ.508)GO TO 5710
      K=K+1
      GO TO 5700
 5710 TYPE=1
      LEVEL=70
      POINTS=5
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      IF(D.GE.51)GO TO 5720
      MESSAGE(D)=4
      D=D+1
      MESSAGE(D)=99
 5720 RETURN
      END
C
C      THIS SUBROUTINE CHECKS TO MAKE SURE THAT A STUDENT HAS NOT ALREADY
C      COMPLETED ALL OF HIS LESSONS. IF HE HAS, STUDENT IS PENALIZED.
C
      SUBROUTINE BBB(STUDNT,STUD)
      INTEGER STUDNT(11),STUD(25,26),ST509(11),K,L,I,POINTS,TYPE,LEVEL
      K=1
      L=1
      ST509(1)=99
 5100 IF(STUDNT(K).EQ.99)GO TO 5170
      IF(STUDNT(K).EQ.50)GO TO 5130
      I=STUDNT(K)
      IF(STUD(I,15).EQ.99)GO TO 5110
      ST509(L)=STUDNT(K)
      L=L+1
      ST509(L)=99
 5110 K=K+1
      GO TO 5100
 5130 IF(K.NE.1)GO TO 5110
      I=1
 5140 IF(STUD(I,15).EQ.99)GO TO 5150
      ST509(L)=I
      L=L+1
      IF(L.GE.11)GO TO 5160
      ST509(L)=99
 5150 I=I+1
      IF(I.LE.25)GO TO 5140
      TYPE=1
      POINTS=10
      LEVEL=70
      CALL AAA(STUD,ST509,POINTS,TYPE,LEVEL)
      L=1
      ST509(1)=99
      GO TO 5110
```

```
5160 ST509(11)=99
     POINTS=10
     TYPE=1
     LEVEL=70
     CALL AAA(STUD,ST509,POINTS,TYPE,LEVEL)
     L=1
     ST509(1)=99
     GO TO 5150
5170 TYPE=1
     LEVEL=70.
     POINTS=2
     CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
     POINTS=10
     CALL AAA(STUD,ST509,POINTS,TYPE,LEVEL)
     RETURN
     END


C
C          THIS SUBROUTINE SELECTS AND AND READS 26 RECORDS
C          FROM THE DISK FILE
C
     SUBROUTINE CCC(STUD,PLAYER,LESSON)
     INTEGER STUD(25,26),L,M,PER,TS,SC,TD,DEC,SML(11),IMC,IMCC
     INTEGER NL,PLAY,LES,PLAYER,LESSON,N,T
     L=1
5200 READ(1,5210)PER,TS,SC,TD,DEC,SML,IMC,IMCC,NL,PLAY,LES
5210 FORMAT(I2,4I4,11I2,I3,2I1,I7,I2)
     IF(EOF(1))5270,5215
5215 IF(L.EQ.1)GO TO 5240
     T=L-1
C          FILL FIRST 9 SLOTS OF TABLE
     STUD(T,1)=PER
     STUD(T,2)=TS
     STUD(T,3)=SC
     STUD(T,4)=TD
     STUD(T,5)=DEC
     M=6
     DO 5220 N=1,11
     STUD(T,M)=SML(N)
5220 M=M+1
     STUD(T,17)=IMC
     STUD(T,18)=IMCC
     STUD(T,19)=NL
     DO 5230 N=20,26
5230 STUD(T,N)=0
5235 IF(L.EQ.26)GO TO 5280
     L=L+1
     GO TO 5200
C          FILLS THE PLAYER AND PREVIOUS LESSON NUMBER
5240 PLAYER=PLAY
     LESSON=LES
     GO TO 5235
5270 PLAYER=9999999
5280 RETURN
     END
```

POOR PRINT


```
C
C      THIS SUBROUTINE WRITES OUT ONTO DISK A PLAYS RECORDS
C
       SUBROUTINE DDD(STUD,PLAYER,LESSON)
       INTEGER STUD(25,26),PER,TS,SC,TD,DEC,SML(11),IMC,IMCC
       INTEGER NL,PLAY,LES,PLAYER,LESSON,L,M,N,X
       L=1
       PER=0
       TS=0
       SC=0
       TD=0
       DEC=0
       DO 5300 X=1,11
 5300  SML(X)=0
       IMC=0
       IMCC=0
       NL=0
 5305  PLAY=PLAYER
       LES=LESSON+1
       WRITE(2,5310)PER,TS,SC,TD,DEC,SML,IMC,IMCC,NL,PLAY,LES
 5310  FORMAT(I2,4I4,11I2,I3,2I1,I7,I2)
       IF(L.EQ.26)GO TO 5330
       PER=STUD(L,1)
       TS=STUD(L,2)
       SC=STUD(L,3)
       TD=STUD(L,4)
       DEC=STUD(L,5)
       M=6
       DO 5320 N=1,11
       SML(N)=STUD(L,M)
 5320  M=M+1
       IMC=STUD(L,17)
       IMCC=STUD(L,18)
       NL=STUD(L,19)
       L=L+1
       GO TO 5305
 5330  RETURN
       END
```

[POOR PRINT]


```
C
C     THIS SUBROUTINE MAKES SURE THAT WHILE A CLASS LECTURE IS IN
C     PROGRESS, GROUPS HAVE NOT ALSO BEEN CHOSEN AS A TEACHING STRATEGY
C
      SUBROUTINE DEF(TGRP,STUD,STUDNT,MESSAGE,D)
      INTEGER TGRP(6),STUD(25,26),STUDNT(11),MESSAGE(51)
      INTEGER K,D,TYPE,POINTS,LEVEL
      K=1
 5600 IF(TGRP(K).EQ.999)GO TO 5620
      IF(TGRP(K).EQ.503)GO TO 5610
      IF(TGRP(K).EQ.504)GO TO 5610
      IF(TGRP(K).EQ.505)GO TO 5610
      IF(TGRP(K).EQ.506)GO TO 5610
      IF(TGRP(K).EQ.507)GO TO 5610
      IF(TGRP(K).EQ.509)GO TO 5610
      K=K+1
      GO TO 5600
 5610 TYPE=1
      LEVEL=70
      POINTS=5
      CALL AAA(STUD,STUDNT,POINTS,TYPE,LEVEL)
      IF(D.GE.51)GO TO 5620
      MESSAGE(D)=5
      D=D+1
      MESSAGE(D)=99
 5620 RETURN
      END
```

```
C
C      THIS SUBROUTINE WILL READ CARDS AND CREATE A TABLE(DECIS OF
C      THE PLAYERS GROUPS. IT WILL ALSO CREATE A TABLE OF 500 DECISIONS
C
      SUBROUTINE EEE(DECIS,TGRP,CTR)
      INTEGER DECIS(6,22),TGRP(6),PLAY,PER,GRP,L2,L100(10),L3
      INTEGER L4(3),L5,L6,L7,L8,L,M,N,T,CTR
      M=1
      L=1
      IF(DECIS(1,1).EQ.9999999)GO TO 5460
      DECIS(1,1)=9999999
      IF(CTR.NE.1)GO TO 5420
 5400 READ(5,5410)PLAY,PER,GRP,L2,L100,L3,L4,L5,L6,L7,L8
 5410 FORMAT(I7,I2,I1,15X,I2,10I2,8I3,9X)
      IF(EOF(5))5460,5415
 5415 IF(DECIS(M,1).NE.PLAY)GO TO 5450
 5420 DECIS(L,1)=PLAY
      DECIS(L,2)=PER
      DECIS(L,3)=GRP
      DECIS(L,4)=L2
      N=5
      DO 5430 T=1,10
      DECIS(L,N)=L100(T)
 5430 N=N+1
      DECIS(L,15)=L3
      DECIS(L,16)=L4(1)
      DECIS(L,17)=L4(2)
      DECIS(L,18)=L4(3)
      DECIS(L,19)=L5
      DECIS(L,20)=L6
      DECIS(L,21)=L7
      DECIS(L,22)=L8
      L=L+1
      M=L-1
      GO TO 5400
 5450 IF(DECIS(M,1).NE.9999999)GO TO 5460
      GO TO 5420
 5460 DECIS(L,1)=9999999
      L=1
      TGRP(1)=999
 5470 IF(DECIS(L,1).EQ.9999999)GO TO 5480
      TGRP(L)=DECIS(L,19)
      L=L+1
      TGRP(L)=999
      GO TO 5470
 5480 RETURN
      END
```

```
C
C     THIS SUBROUTINE MAKES SURE THAT A STUDENT HAS NOT HAD THE SAME
C     INSTRUCTIONAL MATERIALS CHOICE THREE OR MORE TIMES
C
      SUBROUTINE GGG(STUD,STUDNT,POINTS,LEVEL,MESSAGE,D)
      INTEGER STUD(25,26),STUDNT(11),POINTS,LEVEL,TYPE
      INTEGER I,L,K,STLRND(11),MESSAGE(51),D
      TYPE=0
      STLRND(1)=99
      K=1
      L=1
 5500 IF(STUDNT(K).EQ.99)GO TO 5580
      IF(STUDNT(K).EQ.50)GO TO 5530
      I=STUDNT(K)
      IF(STUD(I,18).GE.3)GO TO 5520
      STLRND(L)=I
      L=L+1
      STLRND(L)=99
 5510 K=K+1
      GO TO 5500
 5520 IF(D.GE.51)GO TO 5510
      MESSAGE(D)=8
      D=D+1
      MESSAGE(D)=99
      GO TO 5510
 5530 IF(K.NE.1)GO TO 5510
      I=1
 5540 IF(STUD(I,18).GE.3)GO TO 5570
      STLRND(L)=I
      L=L+1
      IF(L.GE.11)GO TO 5560
 5550 STLRND(L)=99
 5555 I=I+1
      IF(I.LE.25)GO TO 5540
      CALL AAA(STUD,STLRND,POINTS,TYPE,LEVEL)
      L=1
      STLRND(1)=99
      GO TO 5510
 5560 STLRND(11)=99
      CALL AAA(STUD,STLRND,POINTS,TYPE,LEVEL)
      L=1
      GO TO 5550
 5570 IF(D.GE.51)GO TO 5555
      MESSAGE(D)=8
      D=D+1
      MESSAGE(D)=99
      GO TO 5555
 5580 CALL AAA(STUD,STLRND,POINTS,TYPE,LEVEL)
      RETURN
      END
```

POOR PRINT


```
C
C     THIS SUBROUTINE WILL UPDATE THE STUDENTS INSTRUCTIONAL MATERIALS
C     CHOICE
C
      SUBROUTINE HHH(STUD,DECIS,STUDNT,A)
      INTEGER STUD(25,26),DECIS(6,22),STUDNT(11),A,I,K
      K=1
      I=1
 5710 IF(STUDNT(K).EQ.99)GO TO 5780
      IF(STUDNT(K).EQ.50)GO TO 5740
      I=STUDNT(K)
      IF(STUD(I,17).EQ.DECIS(A,20))GO TO 5730
      STUD(I,17)=DECIS(A,20)
      STUD(I,18)=1
 5720 K=K+1
      GO TO 5710
 5730 IF(STUD(I,18).GE.9)GO TO 5720
      STUD(I,18)=STUD(I,18)+1
      GO TO 5720
 5740 IF(K.NE.1)GO TO 5720
      I=1
 5750 IF(STUD(I,17).EQ.DECIS(A,20))GO TO 5770
      STUD(I,17)=DECIS(A,20)
      STUD(I,18)=1
 5760 I=I+1
      IF(I.LE.25)GO TO 5750
      GO TO 5720
 5770 IF(STUD(I,18).GE.9)GO TO 5720
      STUD(I,18)=STUD(I,18)+1
      GO TO 5760
 5780 RETURN
      END
```