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SLATE

An instructional planning simulation

*As any good teacher knows, but few student-teachers can grasp, planning effec-
tively for lessons to come is a complex and subtle matter involving a bewildering
number of circumstances, not all of which come readily to mind at any one time.
Bringing the realities of this complexity home to student teachers is a perennial
problem for teacher-training. In a progress report on his development of an in-
novative computer-managed game designed to provide this practice, Ascroft
describes the simulation of a teacher's task — having 25 students (with in
dividual differences) learn 11 subject matter units in 15 lesson periods; the range
of decisions on principle from which the player must choose; and the verdicts
given by the computer on the basis of which the player proceeds. A trial con-
ducted with practising teachers has given encouraging indications that the work
is on the right track.*

A recurring problem I have encountered in teaching the principles of in-
structional design to student teachers has been to provide experiences which will
link the theory with the application. The project approach has been successful in
illustrating the application of the principles on a small scale, such as the design
of learning packages or tape/slide presentations. Providing practice in applying
the system to the design of classroom instruction has proved more difficult.

A number of factors appear to contribute to this difficulty: the complexity
of classroom interaction which can mask the underlying planning of a lesson,
the unreliability of most teacher assessment instruments, the relatively long time
span required to plan and assess a large lesson unit, and the general reluctance of
student teachers to adopt a planning methodology at odds with the prevalent
"teaching-is-an-art" philosophy. To overcome some of these factors an in-
termediary step between the theory and the practice appeared to be necessary.

My solution to this problem was to create SLATE (Simulated Learning
And Teaching Environment). This computer-managed simulation allows players

to devise lesson strategies which will enable simulated students to "learn" subject matter units. There is no single correct strategy to achieve this goal, no real students to harm, and no supervisors to peer over the shoulder and criticize; the player is free to experiment and to learn from the experience.

Synopsis of the simulation

Each simulation participant receives a handbook which outlines the procedures governing the simulation, the possible decisions, and the procedures for having their decisions processed by the computer. Players also receive a printout containing the names of the students in their class, along with other information which may be of some use when planning strategies such as student I.Q., academic standing, family background, and comments from a previous teacher.

The players must choose, from 90 possible decisions contained in the handbook, those decisions which will enable the 25 students to reach the goal of learning 11 subject matter units. Players have up to 15 lesson periods in which to accomplish this objective.

The decisions to be made for each student include the selection of optimum instructional strategies, the subject matter unit to be learned, the cognitive objective domain category, three terms which will specify the student's terminal behaviour, instructional materials and necessary audiovisual equipment, the in-class teaching structure, and the method of evaluating the student. Ten decisions are made per period for each of the 25 students.

Players may use any of the instructional strategies, which range from the lecture to group discussion to peer tutoring. Films, programmed booklets, filmstrip/cassette units, and overhead transparencies are among the instructional material options available. Players can group from 2 to 10, or 25 students together for learning, and can operate as many as ten groups in a single period, providing the inherent demands of the strategies do not place unreasonable demands on the teacher. Evaluation instruments include most of the common objective-type test formats and informal methods such as oral questioning or checking student work. If the player desires, he or she may specify no evaluation. The alternatives are available; the player has only to match student abilities and previous learning performance with the optimum strategy, material, and method at the correct point in time.

To reduce the time required to enter the decisions into the computer, the program allows the player to treat students for which identical decisions have been made as a single instructional group. Instead of writing out ten decisions per student, the player need only write a single set of decisions and enter the names of students to which the set applies. Figure 2 illustrates a decision sheet, an interim step which aids the player in organizing his or her decisions before they are entered into the computer.

Figure 1
SAMPLE DECISIONS OPTIONS

Subject Matter Unit: Gandlemuller Species

The name *"Gandlemuller"* is formed from *Gandle* (Martian for swamp mud) and *Muller* (German for miller), hence "swamp mud miller", since *Gandlemullers* are found in the Martian swamp land of the equatorial regions. They inhabit mudflats and deep, dark, dank caves. They are almost translucent and active only at night. Below is a typical adult.
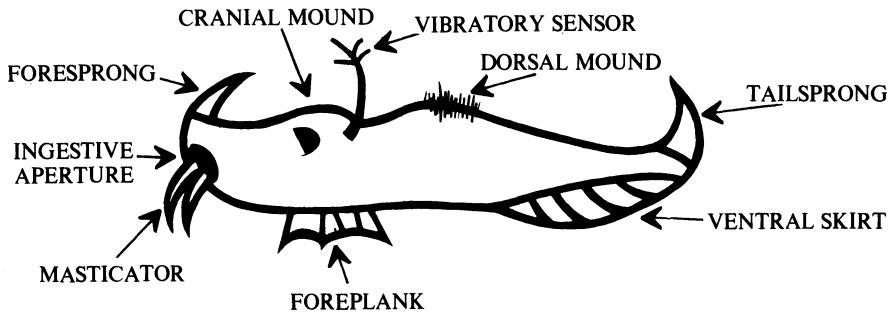
Instructional Material Unit: 16mm Film

"Grandlemullers of Mars" is a film which provides a general introduction to the fauna of Mars. You will see how the Gandlemullers and their sub-species eat, play and procreate. The film is 40 minutes long, in colour, and suitable for average to high ability students. Only one is available.

Teaching Strategy: Discussion Group

In the discussion group the desks are arranged to facilitate verbal exchanges. Teacher acts as moderator, but allows the interchange of ideas to structure the learning situation. Assign students to a discussion group by name — maximum per group: 10; minimum par group: 2.

Teaching Structure: Structure 3

State objectives clearly
Contract for evaluation of performances
Specify initial resources
Outline steps
Schedule meetings for discussion and motivation

Evaluation Format: Matching-items Test

Have students complete a matching-items test to check their learning.

Figure 2
SAMPLE DECISION SHEET

Number of groups for this period:	3
Number of students in group #1:	12
Enter names of students in this group:	michael, fiona, pepe, carol, hanna, ahmed, frank, betty, judy, kelly, sandra, jack

Unit name:	defences
Objective category:	knowledge
Objective descriptors (3):	discriminates, knows, paraphrases
Teaching strategy:	discussion group
Instructional material:	none required
Teaching structure:	structure 3
Evaluation format:	matching-item
Audiovisual equipment:	none required

With decisions made, the player proceeds to the computer terminal room where the decisions are entered into the computer using a cathode ray tube (CRT) terminal. When the player has completed the entry of decisions, the simulation program compares the decisions with the model decisions for each student and decides which student has learned the lesson unit. The player then shuts off the CRT terminal and signs on a terminal which prints out the results on paper (see Figure 3 for a sample output). Players may enter lesson plans at any time the terminal rooms are open and as often as they wish, as the simulation is entirely managed by the computer. Only the class period just processed is available to the players; they must use their own record-keeping system to keep track of who has, and who has not, learned. As student learning might be affected by the previous period's results, players are encouraged to examine and reflect upon those results before entering the next period's decisions.

Figure 3
DECISION RESULTS OUTPUT

Teacher: Jane Doe

Lesson period: 6

Teaching grouping: Discussion Group

Student	Unit learned	Student comments
Sam	Gandlers	
Mary	—	Can't remember lesson
Joan	Defences	
Alfred	—	This stuff is too hard

Additional Comments

AV equipment not booked
No such objective category
Too many students in discussion group — chaos

Design criteria

The simulation creates a dynamic situation in which the players try out in-structional strategies which in turn affect subsequent strategies. Although the model upon which the program is based does not purport to be an exact descrip-tion of the teaching/learning process, it does attempt to produce outcomes which reflect current research findings and educational practice. The program is deter-ministic in that results are the consequences of decisions and not due solely to factors involving random chance.

In designing the model I was influenced by Shavelson's (1976) characteriza-tion of effective instructional planning as a problem involving the making of ap-propriate decisions: the matching of events within the students (attention, motivation, etc.) with events within the classroom (teaching strategy, media, evaluation instruments). These decisions Shavelson considers "may be the most important ones teachers make" (p. 392). He also contends that what may be most important in assessing planning skills is not whether a particular strategy is used, but *when* it is used (his emphasis).

In order to ensure that the simulation will elicit a problem-solving approach the program incorporates a number of features which require the player to analyze given data frequently. For example, each player is assigned a class of students in which each student is given almost unique properties in terms of family background, intelligence and academic achievement. No two students in the same class, and possibly in several classes, are alike in their make-up, and they therefore will react differently to various strategies. Each student must be seen as an individual with particular needs or the player will not be able to iden-tify the student learning patterns determined by the aforementioned properties. As each student is unique, players cannot pool information or successful strategies, a feature designed to ensure that student successes are the result of decisions made only by the player who has those students.

The subject matter units which the students must learn describe the hierarchically-organized classification system of an imaginary Martian fauna. This taxonomy, created by Dr. G. Pask of Systems Research Ltd., England, was originally developed as a research instrument to assess learning style, but a number of conditions made it suitable for use in this simulation. The taxonomy is unique in order that no player has an advantage in already knowing the sub-ject matter; is capable of being learned by players in a short time; represents a reasonably complex, hierarchically-organized material; and is free of social, scientific, and other connotations which might prompt reactions irrelevant to the simulation's purpose. A reason for having subject matter at all is the note of realism it adds to the simulation, since teachers always need something to teach to students.

The players have to determine the most appropriate order of unit presentation, a feature that requires them to analyze the content thoroughly. The same unit can be taught to all students, or different units can be taught to different groups of students in the same lesson period; but a penalty is incurred by players who attempt to teach units to students who have already learned them, or who give a unit to students who have not learned the prerequisite units.

As in real life, things can go wrong, students are absent from class, audiovisual equipment does not arrive, inappropriate strategies cause chaos in class, students become bored and restless. These occurrences are incorporated into the program to create unexpected contingencies which must be dealt with in the subsequent lesson by a change of strategy. To aid players in the diagnosis of the problems, comments have been inserted into the program, and when strategies fail to produce the expected student learning, these comments are displayed in the summary report of student learning at the conclusion of the lesson.

A pilot run of the prototype

In order to assess how fully the simulation had met the design expectations, a pilot run was conducted using only the decision-processing section of the program. The main purpose of the test was to ascertain if the simulation could identify those players who were the best planners. A secondary purpose was to determine if the simulation incorporated any biases which would invalidate its use. Other test purposes are described in Ascroft (1978a, 1978b).

The prototype was tested with 21 players, 18 of whom were practising teachers. The use of teachers — who were not from the intended population of student teachers — placed limitations on the external validity of the results. However, as validation was not the primary intent of the testing, the feedback the teachers could provide more than offset such disadvantages at this time.

At the conclusion of the simulation the players were classified on the basis of their scores as "effective" or "ineffective" planners by using a median split. A Median Test for two independent samples was performed. A chi square analysis using 2 X 2 tables incorporating Yates' correction for continuity showed the two groups to be significantly different (p < .01). This significant difference suggests that the simulation is powerful enough to discriminate levels of planning ability, but whether this ability is related to planning effective classroom teaching experiences is a question for future research.

A secondary purpose of the testing was to examine the results to see if any biases had been built into the program. The simulation, since it was designed for pre-service teachers, would only be useful if factors other than the sex of the player, grade level of teaching, or years of teaching experience are responsible

for success in the simulation. The last factor, years of teaching, was particularly important. Rosenshine (1971) found that the correlations between years of teaching experience and the average achievement of teachers' students were uniformly weak. If teachers with experience proved better at planning than those without experience, any natural ability in planning would not be easily detectable at the undergraduate level.

No significant relationships were detected, using chi square analysis, between a player's simulation scores and his or her years of teaching, the sex of the player, or the grade level at which the player taught. There was also no significant relationship between the players' scores and their final grades from an instructional design course.

Reactions to the simulation, as measured by an attitudinal questionnaire given at the debriefing session, were quite positive. Eighty-one percent of the participants indicated that the simulation would be useful in demonstrating the complexity of the teaching/learning process to student teachers, while 76% replied affirmatively when asked if the simulation had been helpful in illustrating the possibilities of alternative instructional strategies. Eighty-one percent agreed that the simulation should be used again, that the process had been worthwhile; 66% reported that they had enjoyed the experience, but 23% were undecided on this question.

The overall positive response of these teaching professionals was very encouraging. The suggestions and comments obtained from them with each lesson submission provided interesting insights and many ideas for improvement, many of which have been incorporated into the present version. The simulation is presently undergoing more testing to "iron out the bugs" in what has grown into a monstrously large computer program. Final changes will be made to the program as the result of this testing, and the simulation is expected to be fully operational for the Fall of 1979.

NOTES AND REFERENCES

Ascroft, R. A. M. *Assessment of Teachers' Planning Skills Using a Computer Simulation.* Paper presented at the Annual Conference of the Canadian Educational Researchers Association, London, Ontario, June 1978.(a)

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