Production and Evaluation of a Self-Instructional Module on Technologies of Instruction

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ABSTRACT

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This thesis equivalent addresses the problem of developing instruction to fulfill special demands from both students and teachers. It was determined that instructional development was needed in the course "Fundamentals of Educational Technology" of the Graduate Programme of Educational Technology at Concordia University. Subsequently, a self-instructional module was produced and evaluated. Its contents were determined from the input received from students and subject matter experts, the latter composed of faculty members of the Educational Technology programme. Formative Evaluation was carried out with both one-to-one and small group format. Results indicated that the module helped students learn the topic involved, and that few modifications are needed for future use of this module.

DEDICATION

To my parents, with love and gratitude.

ACKNOWLEDGEMENTS

I would like to thank the following people for the important contributions they made to this work.

To my advisor Jesús, for his expert guidance. To Mariela, for her interest and support. To all the students who volunteered their time making this thesis possible. And to Bob, for his support and encouragement.

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1. RATIONALE

Educational Technology is a field of study which involves an extremely varied range of knowledge, concepts and skills. Therefore, the planning of an introductory course on the subject makes the designer/teacher face the problem of deciding what should or should not be included in order to provide students with the basic knowledge on the topic. This is often solved from the instructor's point of view: his/her own perceptions of what is important to know will determine the content of the course. However, student expectations and needs should not be overlooked and, if taken into consideration, can be very helpful for the design of such a course.

This thesis equivalent addresses the problem of developing instruction to fulfill special demands from both students and teachers. The starting point of this process is an attempt to find out which areas students are more interested in, as well as those areas subject matter experts consider relevant.

The context in which the instructional development was needed concerned the course "Fundamentals of Educational Technology" in the Graduate Programme in Educational Technology at Concordia University. A

self-instructional module was produced and evaluated. Its contents were determined from the input received from students and subject matter experts. To that end, a questionnaire was designed and applied to students who had already taken an introductory course in Educational Technology. The purpose was to find out which topics they were more concerned about, in order to design a self-instructional module that would meet needs and expectations of future students. Input from subject matter experts was also considered. The module does not in itself constitute an introductory course to Educational Technology, but includes some aspects that aim to serve as enrichment material for such an introductory course.

Instructional processes typically include discussion, demonstration, simulation and the acquisition of practical skills. To some extent, such aspects require interaction between students, instructors, and facilities provided by an institution. Thus, the produced materials complement the course in giving students the alternative to go through some topics at their own pace, freeing classtime for discussion of other issues. While allowing students to go through instruction at their own pace, this module also gives them the chance to look for additional

information and references on the topic.

2. PRODUCTION PROCEDURE

2.1 PRODUCTION DESIGN

The 'model' of instructional design was based on the systems approach model proposed by Romiszowski (1981). This approach contains several activities which have to be worked out together in order to achieve the intended purpose:

- Defining the problem: to identify what objectives one wishes to achieve.
- Analysing the problem: to generate and compare alternative means of achieving the objectives.
- Developing the most appropriate or realistic of the means identified. (The 'optimal solution').
- Implementing the solution and observing the results.
- Evaluating these results and feeding back this information in order to revise or improve the solution where necessary. (Romiszowski, 1979).

These stages for the design of instruction involve a process of establishing objectives, planning viable

routes and testing them out, and evaluation followed by feedback into the approach.

2.1.1 PROBLEM DEFINITION AND ANALYSIS

During the problem definition stage, a statement was made as to what is, and what should be happening. An overall objective was then established. Having identified the need for instructional materials, the topic and content of the module (based on the needs analysis done) and the overall goals of the materials were then stated. At this stage, the problem identified was the need for instructional materials to complement the course Ed. Tech. 504 "Fundamentals of Educational Technology". This course gives students an introduction to the field of educational technology. There are many areas in which educational technology is applicable; therefore the course is necessarily limited to cover a certain number of topics. The use of instructional materials in such a course would give students the alternative to go through some of the content areas at their own pace, freeing classtime for discussion of other issues.

In the following stage of production design, the topic of instruction was identified. During this stage

a thorough and complete understanding of the problem took place, along with the selection of possible solutions and ways of implementing them.

2.1.1.1 SUBJECT OF INSTRUCTION

To determine the content of instruction, a questionnaire (see Appendix 1) was designed for the target population and subject matter experts, who were then asked for their opinions on 20 areas of Educational Technology. They rated each topic from 'not important' to 'very important', considering them to be part of an introductory course in Educational Technology.

The following topics were considered 'very important' by the target population. (Chosen by more than 50% of the subjects, n = 17).

- TECHNOLOGIES OF INSTRUCTION 70.6 %
- COMPUTERS IN EDUCATION 64.7 %
- THE ROLE OF THE EDUCATIONAL TECHNOLOGIST 52.9 %

Subject matter experts considered the following topics 'very important'. (Chosen by more than 60% of the subjects, n = 5).

- TECHNOLOGIES OF INSTRUCTION 80 %
- LEARNING PRINCIPLES 60 %
- EVALUATION OF INSTRUCTIONAL MEDIA 80 %
- THE ROLE OF THE EDUCATIONAL TECHNOLOGIST 100 %
- BASIC MODELS OF INSTRUCTIONAL DESIGN 60 %

Thus, the topics considered 'very important' by both target population and subject matter experts were:

- TECHNOLOGIES OF INSTRUCTION
- THE ROLE OF THE EDUCATIONAL TECHNOLOGIST

Following this analysis, "Technologies of Instruction" has been chosen as the subject matter of the module to be developed.

2.1.1.2 TOPIC ANALYSIS

Once the problem has been defined and the topic of instruction identified, a topic analysis by the input/output route was carried out. This approach, as mentioned by Romiszowski (1981), analyses a topic by

starting with its definition, content and examples, and ends by defining the tests and instruments used to evaluate the acquisition of knowledge. This analysis forms part of the second stage in the systems approach mentioned earlier. Following a topic analysis, the important and worthwhile teaching elements of instruction are identified.

The procedure to follow for such an analysis contains the following steps: (Romiszowski, 1981).

1. Select a topic worth teaching.
2. Analyse it to identify the important elements of information.
3. Order the information in a logical sequence for presentation and expand it into a set of very short sentences which flow logically (a set of teaching points or rules).
4. State the general aims of teaching this topic.
5. Use a taxonomy of knowledge to label each element of information with the appropriate level of testing.

6. Develop appropriate test items for each information element.
7. Build from these a final test of appropriate difficulty.
8. Examine the test items for necessary prerequisite skills or knowledge and prepare an entry test to check these.
9. Combine the logical presentation with the appropriate test items to develop an instructional sequence.

Having followed the previous steps, the topics mentioned above were identified as being relevant for the instruction this module is aimed at. After a brief explanation on the inclusion of certain topics, and a justification of the use of the term "Technologies of Instruction", a complete outline of the subject matter of instruction follows.

Many of the different instructional methods or, as called by Heinich et al (1982), "Technologies of Instruction", have different learning theories as a theoretical background. Programmed Instruction, for example, is clearly based on reinforcement theory, and many others incorporate, although not in their totality, certain aspects of learning theories.

With this in mind, Reinforcement Theory, Bruner's Cognitive Developmental Theory and Landa's Theory of Instruction were selected to provide students an introduction on the application of theory and technology in education, through "Technologies of Instruction". However, after discussion with a subject matter expert (the instructor on Learning Theories), it was decided to include as well a humanistic approach to Education (in this case, Montessori's).

It should be explained here why the term 'Technologies of Instruction ' is used, and not 'Strategies of Instruction' or 'Methods of Instruction', instead. As explained earlier, the topic was determined by a questionnaire given to both students and faculty members in the Educational Technology program at Concordia University. As far as students were concerned, the questionnaire was applied after the completion of the course Ed. Tech. 504 'Fundamentals of Educational Technology' since it was thought that after going through the course the students would be in a position to answer the questionnaire which sought information on the topics covered by the course, asking specifically what topics they considered of primary relevance for such an introductory course. The text used by the instructor in that course was 'Instructional Media' by

Heinich, Molenda and Russell (1982). The chapter 'Technologies of Instruction' included in that book was part of the material covered by the course. It seemed only appropriate to refer to the present module content in the same terms the students had.

From this, a uniformity of meaning regarding 'Technologies of Instruction' was found among the students. As far as faculty members were concerned, the topic 'Technologies of Instruction' was also rated among the highest. It is not known whether agreement exists in the meaning and use of such a term in this group.

Since the module is directed to students enrolled in the Diploma Programme in Instructional Technology, it was decided to keep the use of the term 'Technologies of Instruction'.

2.1.2 INSTRUCTIONAL DEVELOPMENT

2.1.2.1 GENERAL OBJECTIVES.

After completion of the module, the student will be familiar with:

1. What is meant by Technologies of Instruction.

2. The basic assumptions underlying reinforcement theory.
3. The principal features present in Programmed Instruction.
4. The characteristic features of Linear and Intrinsic programming.
5. How simulations and games can be used in an educational context.
6. What makes simulations and games a Technology of Instruction.
7. The aspects of Bruner's Cognitive Developmental theory that can be found in simulations and games.
8. The basic assumptions underlying Landa's Theory of Instruction.
9. The basic aspects of Montessori's approach to teaching.

As well the student should be better equipped to:

10. Identify an example of a Technology of Instruction from a given list, and explain what makes it such a Technology.

11. Identify whether a simulation, a game or a simulation/game was used in a given example.

12. Build an algorithm based on Landa's Theory of Instruction for a given educational problem.

13. Discuss when the algorithmic approach to instruction is most appropriate:
    a) for the designer (e.g. in topic analysis)
    b) for the learner (as a learning strategy)
    c) for the teacher (as a teaching strategy)

14. Given a specific instructional problem, select the most adequate Technology of Instruction for that problem (from the ones covered in the module). Explain why it was chosen and how it could be implemented.

One feature of the systems approach is that it is based on objectives. General objectives can be used to develop instructional objectives which will help as 'controls' in every stage of instruction. For the formative evaluation purposes of this thesis only general objectives were considered, in order to test the general objectives, several techniques and tools will be used.

2.1.2.2 FORMAT AND MEDIA SELECTION

Many factors must be taken into consideration when selecting the appropriate 'media' for instruction. Among them, Romiszowski (1981) identifies factors such as: effective communication, reasonable cost, practical constraints, etc. All of them influence the selection of media to be used in instruction. According to Romiszowski:

> " The basis of each selection procedure is in the analysis stage when we identify the content of the lesson and the appropriate information which the learner should receive in order to learn."

After doing a Topic Analysis and identifying the content to be taught, we are in a better position to make decisions on media selection. At this stage, we have stated the general objectives. The next step is to decide what media is most suitable for effective communication of the content. As mentioned before, following the classifications proposed by Romiszowski on decision for media selection, we can conclude that since the topic deals with concepts not themselves observable then it was decided that a delivery system of individualized instruction using self-instructional

modules would be used, and the 'media' would consist of printed materials. Also taken into consideration was the economic factor. Although a portion of the content could have been effectively transmitted by an audiovisual media (slide-tape presentation), the high cost involved in producing these materials as well as the low budget available for this project made it prohibitive to incorporate this kind of media in the self-instructional module.

The instructional module provides the student with an introduction to Technologies of Instruction, and at the same time explains the theoretical basis of some of these technologies. In order to achieve that, three different learning theories were chosen, and the instruction focuses on how these form the basis of some of the technologies that are and have been used in education. The module incorporates examples of theory applications. While going through instruction, students encounter different exercises to be solved, which serve as indicators of their mastery of the content and prepares them for a final exercise. Feedback is incorporated in the module.

Mastery level of achievement is required in every section of the module as a prerequisite for the following section. The contents of the instructional

module are described in Table 2.1. The module as it was used for the one-to-one evaluation can be found in Appendix 2.

TECHNOLOGIES OF INSTRUCTION

I THE ROLE OF TECHNOLOGY IN EDUCATION
- What are Technologies of Instruction

II LEARNING THEORIES IN EDUCATION
- Reinforcement Theory
- Bruner's Cognitive Developmental Theory
- Landa's Theory of Instruction

III SOME APPLICATIONS OF LEARNING THEORIES
- Programmed Learning
- Simulations and Games
- Instructional Algorithms

IV SIMILARITIES AND DIFFERENCES BETWEEN THE TECHNOLOGIES COVERED

V RESOURCES

TABLE 2.1

CONTENTS OF THE SELF-INSTRUCTIONAL MODULE "TECHNOLOGIES OF INSTRUCTION"

2.1.2.3 TARGET POPULATION

The target population for whom these materials are intended are graduate students enrolled in the Diploma Program in Instructional Technology at Concordia University.

This kind of program calls the attention of people from very diverse backgrounds and occupational fields. For many, their motivation to enroll in such a program is:

- to learn new and creative ways of teaching
- to design educational materials
- to become industrial trainers
- to produce audiovisual materials

It is felt that for such a heterogeneous population, the chance of going through some of the class content in a self-instructional fashion will facilitate instruction.

Only when the planning was done, was the actual production of the instructional materials started. An overall curriculum structure, including strategies of instruction, objectives and exercises was developed. The actual unit was produced. Decisions on the kind of

communication media and evaluation procedure were also made, according to the initial plan.

The following stages of implementation and evaluation were worked out together, since we did not want to fully implement a product that most probably needed corrections. Therefore, formative evaluation was performed to improve the product, which was revised and refined. This leaves the product in a better situation to be fully implemented, and summative evaluation can then be performed.

3. EVALUATION PROCEDURE

Formative evaluation was carried out following the method proposed by Stake (1967). The design of formative evaluation used in this thesis followed a two step procedure. First a one-to-one evaluation was conducted with subjects from the target population in order to find weaknesess in the instruction and revise and modify it. After this first step a group evaluation was also carried out.

3.1 EVALUATION METHOD

The procedure used is one proposed by Robert Stake. This procedure uses a two by three matrix to analyze evaluation data and to prescribe suitable revisions for an instructional product or process.

According to Stake, evaluation comprises two phases: descriptive and judgment. For our purposes, we will consider only the former, which involves:

a) Examining the logical contingencies that exist between intended antecedents, transactions, and outcomes.
b) Determining the congruence between intended and observed antecedents, transactions and

outcomes; and

c) Determining the empirical contingencies between observed antecedents, transactions and outcomes.

The matrix and information to gather, proceed as follows:

	INTENT	OBSERVATION
ENTRY CONDITIONS	Description of the intended learner population	Actual entry level
INSTRUCTION	Implementation Strategy	Descriptions of Implementation
OUTCOMES	Objectives	Results of all 'after' Measurements

Table 3.1

After completing the matrix, a number of comparisons should be made to analyze the evaluation data: Within the "Intent" column we can have experts appraise the contingencies or degree of appropriateness among the intended learners, procedures and objectives. We can also compare each cell with the corresponding cell in the same row to check the congruence between intent and observations. These comparisons enable us to make various formative and summative decisions.

	INTENT	OBSERVATIONS
ENTRY CONDITIONS	CONTINGENCIES	CONGRUENCE
INSTRUCTION		CONGRUENCE
OUTCOMES		CONGRUENCE

Table 3.2

Operations such as looking for contingencies and congruencies are suggested as appropriate methods for analyzing the data collected in an evaluation study.

Applying this method to our case, we obtain the following matrix: (see Table 3.3)

INTENTS

ENTRY CONDITIONS:

Graduate students enrolled in the Diploma Program at Concordia University.

INSTRUCTION:

Students are required to work through a printed self-instructional module on "Technologies of Instruction", answering embedded tests, and doing the required assignments. At the time the module is returned, the instructor conducts a class discussion in which the participation of the students is required. At this time, the topic of instruction is discussed asking students to provide different examples of situations in which the Technologies could be used. Students are finally asked to complete an assignment in which they identify an instructional problem, explain how the application of a particular technology of instruction would solve it and compare this solution with other alternatives.

OUTCOMES:

Given a specic Instructional problem, the student will be able to select the most adequate 'Technology of Instruction' (from the ones covered in the module), as well as discuss the basic assumptions of the different learning theories presented in the module.

Table 3.3
TABLE OF INTENTS

3.2 FORMATIVE EVALUATION PROCEDURE: ONE TO ONE EVALUATION

3.2.1 DESCRIPTION

A common strategy suggested by Dick and Carey (1978) to carry out a one-to-one evaluation is to choose three subjects from the target population: one above average, one average, and one below average student. This part of the evaluation was carried out with the purpose of collecting information on the actual stage of the material in order to revise and improve it. The materials were given to the students, and the designer stayed with them while going through the materials, answering any doubts, clarifying any confusing instructions, and making notes of all the problems encountered to enable revision of the materials. The students were asked to complete all the activities and tests included, and to answer an attitude questionnaire to obtain information about their attitudes towards practice exercises, structure of the lesson, clarity of instruction, tests, general comments, etc. Results from these activities were used in the production of a second (revised) version of the materials.

The instructional materials were also given to one

subject matter expert (the instructor of the course "Fundamentals of Educational Technology") in order to include her observations and feedback in the first stage of revision and improvement of the product.

3.2.2 PROCEDURE

Two subjects from the intended target population participated in the one-to-one evaluation. The designer was present all the time to assess the subjects if any difficulties were found. On six different occasions both students required help. The data was used to correct and improve the materials prior to the small group evaluation, which took place a few days later.

Corrections made to the materials as a result of the one-to-one evaluation were as follows:

- the comparison between the three theoretical approaches was changed to a tabular form (p.6 & 7).
- a definition of the term "lean" was added in the appraisal checklist, (p. 15).
- an explanatory title was added to the figure on p. 33.

- a "conclusion" was added to the module.

Major changes to the self-tests and questionnaires were as follows:

- Question # 1 (p. 16) which asks for a comparison between linear and intrinsic programming, was changed only in format, since it appeared to be confusing.
- in the second self-test, in the part of identifying descriptors, the instructions appeared to be confusing; these were rewritten.

The answer section of the module had the following changes:

- Instructions for the first part were rewritten and the key words in question # 1 were underlined to serve as a guide for students correcting their own responses.

- Instructions for the post-test were modified. Question # 4 was changed in the following way:

BEFORE:

4. Bruner's Developmental Theory argues for:

a) expository teaching

b) discovery-oriented learning

c) verbal learning

AFTER:

4. Bruner's Instructional Theory argues for:

a) expository teaching

b) discovery-oriented learning

c) reception learning

d) objectivity and observation

Part d) of question # 5, was changed as follows:

BEFORE:

d) all of the above

AFTER:

d) a teaching/learning pattern designed to provide reliable and effective instruction through the application of principles of human learning.

Questions # 6, 10 and 18 were eliminated from the post-test.

In the TRUE/FALSE section, a new question concerning humanism was added. Three open questions were added, concerning instruction in instructional simulations and the three theoretical approaches to

learning.

A question was also added in which students were asked to identify the parts of an algorithm.

Concerning the attitude questionnaire, all of the questions (10) were rewritten.

A resource section giving references on the topics covered was included.

Changes concerning writing style, spelling and format were also made.

All of these changes can be found in precise form in Appendix 3.

3.2.3 RESULTS

1) From the two subjects involved in the one-to-one evaluation, only one completed the post-test, obtaining a result of 8/19. Incorrect answers were taken in consideration for the module and post-test revision, as explained before.

2) The attitudes collected from this stage of evaluation were favorable attitudes towards the use of

the module. The subjects pointed out those parts which they had problems with, and suggested possible solutions which were all taken in consideration.

3.3 FORMATIVE EVALUATION PROCEDURE: Group Evaluation

3.3.1 DESCRIPTION

Once the one-to-one evaluation was done and the pertinent changes made, a small group evaluation was carried out. Twenty-seven subjects from the target population were given the instructional module. The designer had no interaction with this group. The main purpose of this evaluation was to assist in identifying problems in the implementation of the instructional materials, and verifying the appropriateness of the improvements made earlier.

3.3.2 PROCEDURE

This part of the evaluation is based on three measures: the post-test, the attitude questionnaire, and the class assignment. The group evaluation was conducted with students who were at the time enrolled in the Diploma Program in Instructional Technology, and were also registered in the course Ed. Tech. 504 "Fundamentals of Educational Technology".

Twenty-seven subjects received the module, and were asked to go through it, answering all of the embedded

tests, as well as the attitude questionnaire in one week's time. A week later, when the class was scheduled to meet again, they answered the post-test, followed by a discussion during which they pointed out all the problems they had with it, as well as suggestions for its improvement. The objective of this discussion was to outline all the problems concerning the module itself, not to explain whatever doubts they had on the content of instruction. A second discussion followed, with the objective of clarifying and giving further explanation on the content of the module. Both discussions were conducted by the instructor of the course, while the designer had no participation, except to take notes of all the comments made.

Finally, all the subjects were given the following assignment:

ETEC 504

TECHNOLOGIES OF INSTRUCTION (2-3 pages)

1. Select a specific educational/training problem (any area or subject matter).

2. Express your problem in terms of outcome, i.e., objective.

3. Select a technology of instruction that you consider appropriate to solve this problem, and briefly describe how you would implement it.

4. Justify your selection in terms of learners, content, objective & practicality.

5. Consider any other appropriate technology of instruction that could also be implemented. For example, if the objective, is "The child will be able to solve 2 digit subtractions", you may consider a game, an algorithm, PI, etc.

3.3.3 RESULTS

a) ATTITUDE QUESTIONNAIRE

All the subjects answered an attitude questionnaire, the results of which can be found in Figure 3.1. (refer to Appendix 2).

b) POST-TEST

The purpose of the post-test which can be found in Appendix 4, is to locate those areas in which the module appeared to be unclear. To this end items were included that would somehow represent the general objectives stated on pages 11, 12 & 13. Problem areas would certainly lead to wrong answers identification of areas needing revision would then be achieved by examining those questions which were answered incorrectly.

c) CLASS ASSIGNMENT

This assignment represents general objective 14. However, this objective integrates all of the other objectives it is therefore interesting to examine the correlation between the grade obtained in this exercise and the score obtained from the post-test. Twenty-three subjects submitted the class assignment, obtaining a

score between 4 and 10, with a mean of 8.46 and a standard deviation of 2.07. For these twenty-three subjects the correlation between the score obtained in the class assignment and score obtained in the post-test was of +.30 ($p < .05$).

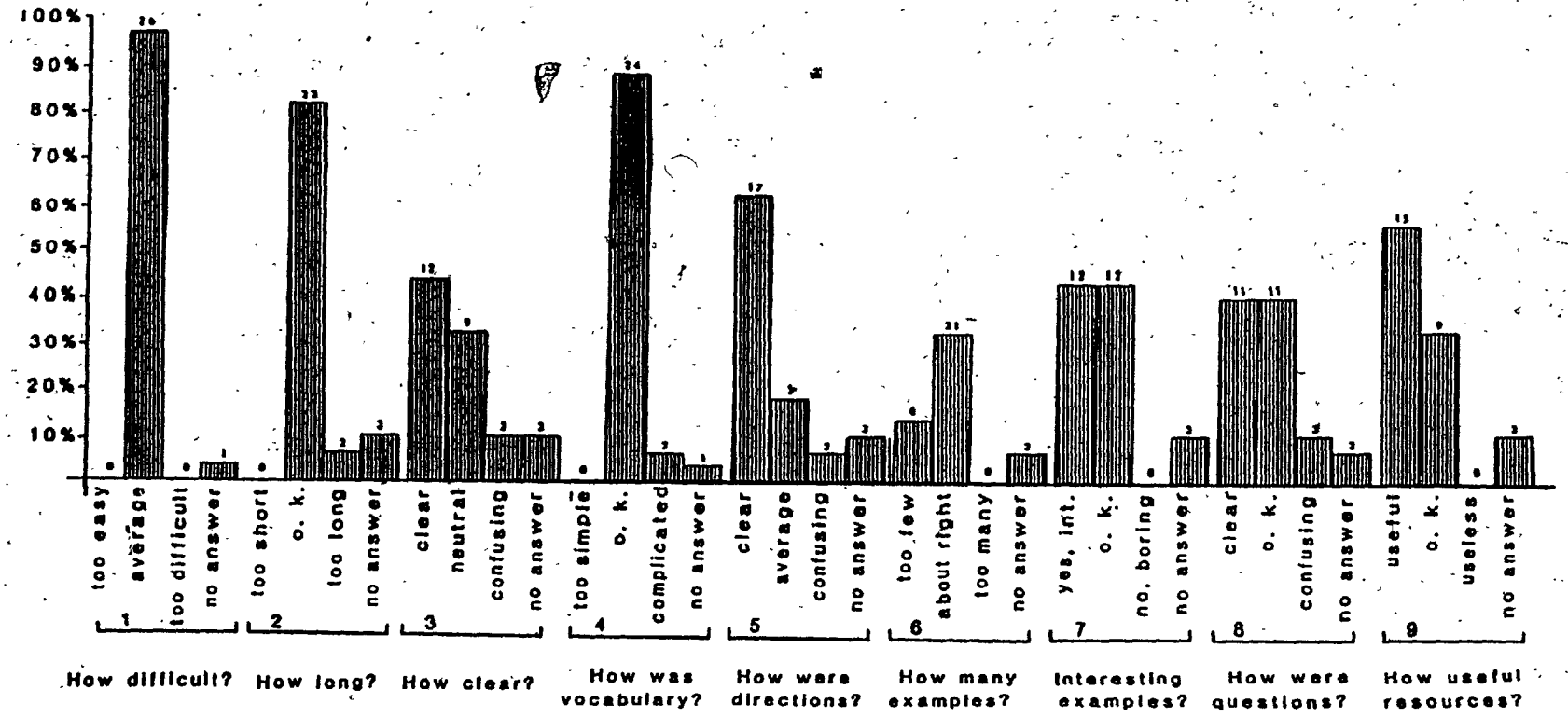
d) RELATIONSHIP BETWEEN STUDY BEHAVIOUR AND MARK.

In order to find out if the scores obtained in the post-test were in any way dependent on the behaviour and attitude of students when reading the module, a series of correlations were calculated. Attitudes were examined to determine if the students took notes at the different parts of the module, if they provided any written comments, and if the embedded tests were answered.

Spearman Rank Order correlations were calculated for all of them, as were the results from each of the post-test questions, with the conclusion that none of them were significant at $\alpha = .05$.

Figure 3.1

Attitude Questionnaire



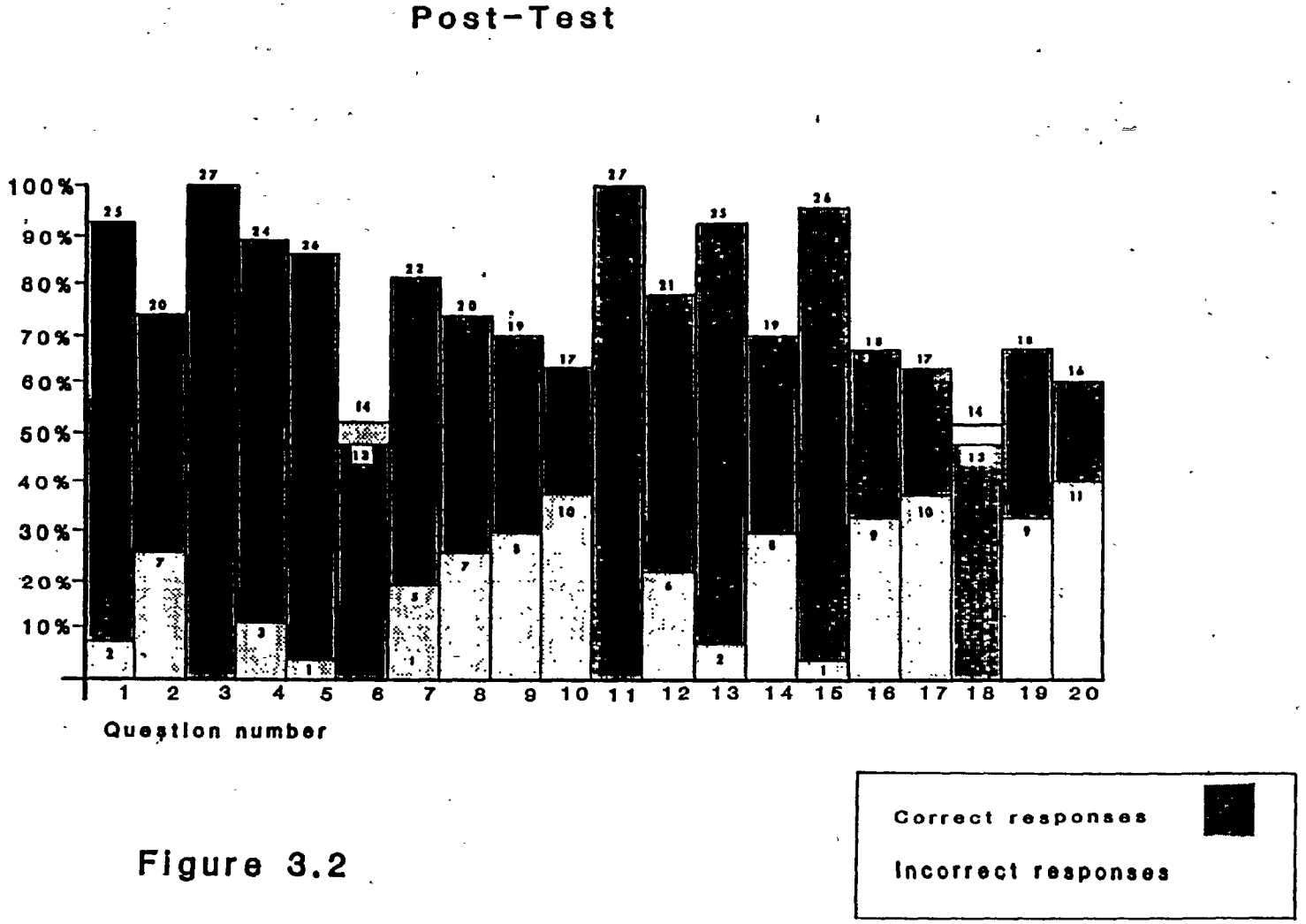

Post-Test
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Question number
Correct responses
Incorrect responses

Figure 3.2

3.3.4 DISCUSSION

From the previous data it was determined that, in general, students' performance was very high in the post-test as well as in the class assignment. It can be noted in Figure 3.2 that the only areas that presented any major problems concerned questions 6, 14 and 18 of the post-test. This will be taken under consideration for the modifications to the module proposed later on.

The attitudes towards the module, all of them very positive, indicate the students' high degree of satisfaction with this kind of instruction. As demonstrated by the absence of significant correlations, neither the attitudes nor the observed behaviour at the time of studying the module had any influence in the scores obtained.

A factor that deserves attention is the low correlation between the score in the class assignment and the post-test score. Despite this, the two scores were generally very high. Thus, the low correlation suggests the possible need for both measurements in order to determine the total achievement of the objectives. The positive sign of the correlation indicates, as expected, that the knowledge required to complete the class assignment is closely based in the

knowledge required to succesfully complete the post-test, and that the first is a summary of the second.

4. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this thesis was the design and evaluation of a self-instructional module to be used as enrichment material for the course ED.TECH. 504 "Fundamentals of Educational Technology" in the Diploma Programme in Instructional Technology at Concordia University. Formative evaluation was carried out, the results of which show that the module could be helpful to students.

Based on these results, the following is a list of proposed changes to the module in order to improve its efficiency. These changes, which can be found in Appendix 5, have been classified according to:

1. Instruction
2. Embedded Tests
3. Post-Test
4. Methodology
5. Examples

1. Instruction

- The last two paragraphs on page 12 appeared to be contradictory. The concept of Negative Reinforcement needs to be clarified.

- Concerning the section on algorithms, the concept

"syntactic structure" needs further explanation.

- The section on Quasi-Algorithms seems to be unclear.

- The diagram on "Intrinsic Programming" (p. 12) needs explanatory titles.

- The amount of instruction in the section on Algorithms was considered too lengthy. (However, as all the information presented is considered to be essential, no changes in the length of the section are presently recommended).

2. Embedded Tests

- In the self-evaluation section for linear and intrinsic programming (p. 16), the students found Question # 1 confusing, specifically the use of the word 'contrasting'.

- On p. 29 instructions are needed on where to go for the answer-key for that section.

3. Post-Test

- In Question # 20, explain that it is enough to indicate one of each.

4. Methodology

- Make clear separations of sections.

5. Examples

- The part on the "Humanist Point of View" needs examples.

- Concerning the example on Linear Programming on p.64, indicate that the answers must be covered.

As results indicated, only 48.14% of the students correctly answered post-test Question #6. This question is related to Question #7, which was answered correctly by 81.48% of the subjects. This suggests that instruction on Simulations and Games should be reinforced and that other related questions should be included.

A similar problem is found with post-test Question #14 which was answered correctly by only 29.62% of the students. In order to achieve a higher incidence of correct responses to this question and therefore a better knowledge of the related content, it is recommended to add instruction on Montessori's theory, add at least one more question related to it in the post-test and, as mentioned above, include an example.

After these modifications, the module is ready for use. Future evaluations should be continued in order to assure that it fulfills the needs and expectations of students using it.

6. BIBLIOGRAPHY

Biggs, L. Morris. Learning Theories for Teachers. Harper and Row Publishers, N.Y. 1964.

Bower, H. Gordon and Hilgard, R. Ernest. Theories of Learning. Prentice Hall, Inc., Englewood Cliffs, N. J. 1981.

Briggs, J. Leslie and Wager, W. Walter. Handbook of Procedures for the Design of Instruction. Educational Technology Publications, 1981.

Dick, Walter and Carey, Lou. The Systematic Design of Instruction. Scott, Foresman and Company, 1978.

Gagne, M. Robert. The Conditions of Learning. Holt, Rinehart and Winston, 1977.

Hartley, James and Davies K. Ivor. Contributions to an Educational Technology vol. 2. Kogan Page Limited, London 1978.

Heinich, Robert, Molenda, Michael, and Russell, D. James. Instructional Media. John Wiley and Sons, Inc. 1982.

Hess, H. John. Large-Scale Individualized Instructional Systems: A comparison of Three Working Models. Educational Technology/September, 1977.

Moore, M. David. Self-Instruction and Technology: A Review. Journal of Educational Technology Systems, vol.5 (1), 1976-1977.

Romiszowski, A.J. Designing Instructional Systems. Kogan Page Ltd., London 1981.

Ruskin, S. Robert and Ruskin, L. Rebecca. Personalized Instruction and its Relation to Other Instructional Systems. Educational Technology Publications, 1978.

Russell, D. James. The Audio-Tutorial System. The Instructional Design Library, vol.3 Educational Technology Publications, 1978.

Sahakian, S. William. Learning: Systems, Models and Theories. Rand Mc Nally College Publishing Company, Chicago 1976.

Stake, R. The Countenance of Educational Evaluation. In Worthen, R. Blaine and Sanders, R. James Educational Evaluation: Theory and Practice. Wadsworth Publishing Company, Inc., 1973.

Vazquez-Abad, Jesus and Larocque Gabriel. La Algoritmizacion en la Ensenanza. Reflexiones Hacia un Posible Desarrollo. Revista de Tecnologia Educativa vol. 7 - no. 2, 1981.

Winer, R. Laura and Vazquez-Abad, Jesus. Towards a Theoretical Framework for Educational Simulations. Simulations/Games for Learning, vol. 11 no. 3 Autumn 1981.

APPENDIX 1

QUESTIONNAIRES

STUDENTS QUESTIONNAIRE

As you know, ED. TECH 504 "Fundamentals of Educational Technology", is a required and very important course within the Diploma program. An attempt to improve the course content to meet the needs of all students, is now under study. To achieve this, your input is needed. Please answer the following questions:

1. Circle the number that best describes your opinion towards the corresponding topic. Take into consideration that these are topics to be taught as part of the course.

1. NOT IMPORTANT (NI) 2. NEUTRAL (N)
3. IMPORTANT (I) 4. VERY IMPORTANT (VI)

	NI	N	I	VI
COMMUNICATIONS THEORY	1	2	3	4
SIMULATIONS AND GAMES	1	2	3	4
PERCEPTION PRINCIPLES FOR MESSAGE DESIGN	1	2	3	4
PROJECTED VISUALS	1	2	3	4
TECHNOLOGIES OF INSTRUCTION	1	2	3	4
COMPUTERS IN EDUCATION	1	2	3	4
TECHNOLOGIES OF INSTRUCTION	1	2	3	4

	NI	N	I	VI
COMPUTERS IN EDUCATION	1	2	3	4
LEARNING PRINCIPLES FOR MESSAGE DESIGN	1	2	3	4
NONPROJECTED VISUALS	1	2	3	4
LEARNING THEORIES	1	2	3	4
AUDIO-MEDIA	1	2	3	4
ATTITUDE CHANGE PRINCIPLES FOR MESSAGE DESIGN	1	2	3	4
MULTIMEDIA SYSTEMS	1	2	3	4
EVALUATION OF INSTRUCTIONAL MEDIA	1	2	3	4
THE ROLE OF THE EDUCATIONAL TECHNOLOGIST	1	2	3	4
FILM	1	2	3	4
BASIC MODELS OF INSTRUCTIONAL DESIGN	1	2	3	4
TELEVISION	1	2	3	4
VISUAL LITERACY	1	2	3	4
INTRODUCTION TO SYSTEMS ANALYSIS	1	2	3	4
MEDIA AND THE CHILD	1	2	3	4

2. Write three topics you consider essential for this course. You may add others not included in the previous list.

3. Would you like to have had instructional materials (audio-tapes, self-instructional modules, etc.) to deliver or reinforce certain aspects of the content of the course?

If YES:

What type of materials and for what topics?

4. If you had the chance to organize the course content, how would you distribute the course load, considering there are 13 classes? You may add others not included in the previous list.

CLASS 1:

CLASS 2:

CLASS 3:

CLASS 4:

CLASS 5:

CLASS 6:

CLASS 7:

CLASS 8:

CLASS 9:

CLASS 10:

CLASS 11:

CLASS 12:

CLASS 13:

How many courses have you taken in the program so far?

Are you:

FULL TIME STUDENT _____

PART TIME STUDENT_____

INDEPENDENT STUDENT_____

MAILING ADDRESS:

NAME:

THANK YOU!!!!!!

QUESTIONNAIRES FOR SUBJECT MATTER EXPERTS

The planning of an overview course in "Educational Technology, is now under study. Your opinion concerning what topics should be included as part of this course, would be more appreciated. Please answer the following questions:

1. Circle the number that best describes your opinion towards the corresponding topic, if it was to be part of an introductory course in Educational Technology. Bear in mind this is a course for the Diploma Program.

1. NOT IMPORTANT (NI) 2. NEUTRAL (N)
3. IMPORTANT (I) 4. VERY IMPORTANT (VI)

	NI	N	I	VI
COMMUNICATIONS THEORY	1	2	3	4
SIMULATIONS AND GAMES	1	2	3	4
PERCEPTION PRINCIPLES FOR MESSAGE DESIGN	1	2	3	4
PROJECTED VISUALS	1	2	3	4
TECHNOLOGIES OF INSTRUCTION	1	2	3	4
COMPUTERS IN EDUCATION	1	2	3	4
TECHNOLOGIES OF INSTRUCTION	1	2	3	4

	NI	N	I	VI
COMPUTERS IN EDUCATION	1	2	3	4
LEARNING PRINCIPLES FOR MESSAGE DESIGN	1	2	3	4
NONPROJECTED VISUALS	1	2	3	4
LEARNING THEORIES	1	2	3	4
AUDIO-MEDIA	1	2	3	4
ATTITUDE CHANGE PRINCIPLES FOR MESSAGE DESIGN	1	2	3	4
MULTIMEDIA SYSTEMS	1	2	3	4
EVALUATION OF INSTRUCTIONAL MEDIA	1	2	3	4
THE ROLE OF THE EDUCATIONAL TECHNOLOGIST	1	2	3	4
FILM	1	2	3	4
BASIC MODELS OF INSTRUCTIONAL DESIGN	1	2	3	4
TELEVISION	1	2	3	4
VISUAL LITERACY	1	2	3	4
INTRODUCTION TO SYSTEMS ANALYSIS	1	2	3	4
MEDIA AND THE CHILD	1	2	3	4

2. List five topics you consider essential for this course. You may add others not included in the previous list.

3. If you had the chance to organize the course content, how would you distribute the course load, considering there are 13 classes?

CLASS 1:

CLASS 2:

CLASS 3:

CLASS 4:

CLASS 5:

CLASS 6:

CLASS 7:

CLASS 8:

CLASS 9:

CLASS 10:

CLASS 11:

CLASS 12:

CLASS 13:

NAME:

THANK YOU!!!

APPENDIX 2

SELF-INSTRUCTIONAL MODULE "TECHNOLOGIES OF INSTRUCTION"

(BEFORE ONE-TO-ONE EVALUATION)

INTRODUCTION

target audience

The target audience for this module are graduate students enrolled in the Diploma Program in Instructional Technology at Concordia University. If you are among this group, you have the right materials on your hands: let's get started.

how to go through this module

This module provides you with an introduction to the application of learning theories into educational practice. This application is accomplished through different "Technologies of Instruction". As you go through this self-instructional module you will find several exercises and tests that will help you master the topic, as well as some selected readings. Please do not skip these parts since they are an essential part of the module, as well as a way of giving you immediate feedback.

Four different learning theories have been selected, and the instruction you are about to start will focus on how these theories form the basis of some of the technologies that are and have been used for instruction. At the end of each section you will find a self-test that will help you evaluate your mastery of the topic. You will find as well selected readings relevant to the topic that will provide further information on the subject. Well, now you are ready to start instruction.....

G O O D L U C K !!!!!

THE ROLE OF TECHNOLOGY IN EDUCATION

Technology is a term that has had numerous interpretations. It will be useful for our purposes to start by analysing the meaning of TECHNOLOGY and its place in education.

Romiszowski (1981) defines technology in the following way:

> TECHNOLOGY: the creative application of science to industrial (or any practical) purposes.
>
> SCIENCE: any body of tested knowledge, which may be expressed in the form of a set of general principles.

a process and a product

He goes on to explain how technnology has acquired a 'process' and a 'product' meaning. The above definition, is a process definition since it is something done by people, creatively applying what they know. The 'product' meaning of technology, is that of something you can see, touch, count: a product.

From the product point of view, technology in education would come to be things like overhead projectors, blackboards, computers,etc. That is essentially hardware, still under the control of the teacher. Technology in education, from the process point of view is concerned with the development of learning experiences through the application of science of learning.

Education has made use of many recent technological changes. Traditional education has changed, as well as the tools for educating. Many have been the benefits education has received from the new technology, but technology by itself will not produce these benefits. The latter will be subject to the effective use made by those adopting the new technology. For many years Instructional Television has been widely critiziced as being a promising technology capable of solving many educational problems, and which failed to do so. Presently similar criticisms are being placed upon Computer Assisted Learning. What is happening? Are these technological advancements inefficient?

No matter how well designed a piece of computer software may be, its use is no guarantee of effectiveness in education. It is up to the educational institutions and

educators to integrate this technology into their teaching and learning processes, in such a way that the new technology will help improve learning.

At this point it could be helpful to ask other questions such as: How are these technologies being used? Is the social context congruent with the innovation?

resistance to innovation

Gilbert (1982), outlines some factors which may help to provide some pragmatic explanations. He points out that the available criteria for comparing technologies or comparing a specific technology with traditional techniques are unsatisfactory; that there is an unexplained discrepancy between the favourable attitudes towards technology which potential users declare, and actual acceptance and use. Teachers need to have full appreciation, not simply an awareness, of the innovations which may help them solve their actual problems. There may be resistance to the introduction of any new technology into a context where there exists a customary and accepted network of interpersonal relationships and communications.

Thus, the resistance in adopting technological innovations may very well be due to one or more of the reasons given by Gilbert. It could also be due to the belief that technology is going to replace the teacher. But more than replacing the teacher, technology has redefined the teacher's role. With the use of new technology the teacher is free for other activities; as Knirk and Childs (1968) put it, "technological changes in the school should free the teacher to make the learning environment one of human interaction."

technologies of instruction

Among many of the changes brought about by technological innovation has been the individualization of instruction. There are many computer programs, instructional modules, etc. that allow the students to go through instruction at their own pace, at the place and time of his/her choice, etc. These technological innovations developed, following a specific model on program design, have been called "Technologies of Instruction", "Instructional Strategies", and many other names. Throughout this module we will be using the term "Technologies of Instruction" to refer to the application of learning theories to the teaching/learning processes; or as it has been defined by Heinich, Molenda and Russell (1983):

> A "Technology of Instruction" is a teaching/learning pattern designed to provide reliable, effective instruction to each learner through application of scientific principles of human learning.

It should be emphasized, however, that for Heinich a "Technology of Instruction" must have the capability to take over the initiative and the main burden of the instructional task; not those technologies that are being used as complement of instruction, as can be television, computers, etc. However, he accepts the fact that in many cases different "Technologies of Instruction" have and are being used as complements of instruction rather than for mainline instruction.

According to Heinich, adopting these technologies as the mainline of instruction implies the creation of an environment where the products of technology become both useful and desirable. Without that environment the products of educational technology will remain the objects of luxury in a system that can no longer afford luxuries.

This might be an extreme view, since these technologies have found place in educational systems, sometimes as mainline instruction, others as complements to it, but nevertheless accepted and implemented in a field that calls for, and needs of these technologies.

In the following units, we will go through some of the early learning theories that in one way or another have been the basis or the source of some Technologies of Instruction and that have also affected the educational system. The technologies of instruction to be covered are: "Simulation and Games", "Programmed Instruction", and "Instructional Algorithms".

LEARNING THEORIES AND TECHNOLOGIES OF INSTRUCTION

As mentioned earlier, this module deals with the following Technologies of Instruction: "Programmed Instruction", "Simulation and Games", and "Instructional Algorithms". Although being recent developments, these technologies have their roots on well established learning theories.

Most psychologists since the early 1900's have been greatly concerned with the study and understanding of the learning process. This has led to the formulation of three main approaches to learning, broadly identified as:

1) The Behavioristic Approach to Learning

2) The Cognitive Approach to Learning

3) The Humanist Approach to Learning

According to Lefrancois (1979), these approaches are characterized as follows:

behaviorism Behaviorist theoreticians are concerned with the explanation, prediction, and control of behavior. They assume that behavior is subject to certain rules; that it is affected in predictable ways by experience; that it is not subject to erratic, random forces; that it is, at least to some degree, lawful.

cognitivism Refers to the work of those psychologists who have abandoned the earlier concern with the external, observable behavioral components. They have, instead, become preoccupied with the organization of knowledge, information processing, and decision-making behavior.

humanism The term humanism is employed in psychology to describe an orientation that is primarily concerned with the humanity of people, that is with characteristics of a person that are assumed to make us more human. Humanists deal largely with the affective (emotional) aspects of human behavior. They are interested in explaining our relationship to the world and to other people and in learning how an individual feels about things.

learning theories

This section will outline the following learning theories like:

- Reinforcement Theory
- Bruner's Cognitive Developmental Theory
- Landa's Theory of Instruction
- The Humanist View: Montessori

Among the three theoretical approaches to learning, the just mentioned theories can be located in the following way:

BEHAVIORISM	COGNITIVISM	HUMANISM
Reinforcement theory	Bruner's cognitive developmental theory. Landa's theory of instruction	Montessori

And related to the Technologies of Instruction of our concern, in the following way:

Programmed Instruction:

Learning Theory: Reinforcement Theory

Theoretical Approach: Behaviorism

Simulations and Games:

Learning Theory: Bruner's Cognitive Developmental Theory

Theoretical Approach: Cognitivism

Instructional Algorithms:

Learning Theory: Landa's Theory of Instruction

Theoretical Approach: Cognitivism

This classification does not imply, by any means, that no other learning theory might be reflected in some way in the technologies covered.

REINFORCEMENT THEORY AND PROGRAMMED INSTRUCTION

One of the principal concepts of Programmed Instruction, is that of reinforcement in learning. Edward Thorndike (1963), introduced the notion of reinforcement with his "law of effect". This law states that responses which are followed by a satisfying event, are fixated (learned), while those followed by unsatisfying events are eliminated. In other words, those responses that are rewarded, will be learned.

Along this same line of thought, we find B.F. Skinner. For him learning is an observable change in behavior, and reinforcement a key element in learning. Skinner developed a technique called operant conditioning. This consists of strengthening certain behavior by presenting a special class of events called reinforcers. A reinforcer is any stimulus that increases the probability that a response will occur. He defines reinforcement of behavior as the supplying of a reinforcer in order to increase the probability of a given response.

Skinner points out two kinds of reinforcers:

positive reinforcement

1) Positive Reinforcement.- a stimulus which when added to a situation, strengthens the probability of a response.

Lahey and Johnson (1978), give an example of positive reinforcement, that appeared in a report from the University of Washington, about a four year old girl who spent little time playing with other children. Her teachers designed a program to change her behavior. They encouraged peer play by systematically praising (positive reinforcement) the child whenever she played with other children. Before the reinforcement program started, the child spent approximately fifteen percent of her time interacting with children and forty percent of her time with teachers. After the staff began praising her for playing with other children, the amount of time spent with children rose to about sixty percent.

negative reinforcement

2) Negative Reinforcement.- is a stimulus which when removed from a situation, strengthens the probability of a response, like could be, a loud noise, a very bright light, extreme cold or heat. Closing a window or a door to avoid hearing loud noises is an example of negative reinforcement, in which the loud noises are the negative reinforcers, which strengthens the probability of behaviors that will remove them, such as closing the

window or the door and the procedure of closing the window or door the negative reinforcement. Another example of a negative reinforcement would be turning off television commercials or leaving the room to avoid hearing them. The commercials are the negative reinforcers, and the various means of avoiding them negative reinforcement. So, a negative reinforcement is the procedure of eliminating certain stimuli. The stimuli which we try to eliminate (noise, commercials, ugly sights, bright lights, etc.) are the negative reinforcers.

Notice that the effect of reinforcement is always to increase the probability of response. In the case of positive reinforcement the behavior increases in order to maintain the positive consequences. In the case of negative reinforcement the behavior <u>also increases</u> in order to eliminate the adverse stimulus. According to Bower and Hilgard (1981), Skinner distinguished two types of punishment:

punishment

1) the presentation of an aversive or unpleasant stimulus, like a shock, and
2) the removal of a positive reinforcer, like when an enjoyable privilege is taken away, or penalties, detention, etc.

Punishment is something different than negative reinforcement. Skinner pointed out that punishment is not a very reliable way of preventing responses from occurring. Punishment is both an unreliable technique for controlling behavior, and a technique that is likely to have unfortunate side effects.

shaping

Another technique developed by Skinner, relevant to learning, is that called <u>shaping</u>. By presenting a reinforcer only after a desired response is emitted, behavior can be shaped. Skinner demonstrated shaping in his experiments with pigeons, in which he instructed a pigeon to move in a clockwise direction by reinforcing aproximations of this kind of movement only, and not those counterclockwise. Those movements followed by reinforcement increased their appearance ending with the desired movement. According to Skinner this principle can be applied in the same way to a student learning a new instructional process. By dividing the process into small steps, and reinforcing the desired ones, students can go through a new instructional process in a succesful way.

In his 1954 article "The Science of Learning and the Art of Teaching", Skinner pointed out the importance of reinforcement in learning: "...Reinforcements continues

to be important of course, long after an organism has learned how to do something, long after it has acquired behavior. They are necessary to maintain the behavior in strength."

feedback

In an educational context, reinforcers such as 'praise' or 'tokens' have been widely used, but perhaps one of the most useful reinforcers in education has been feedback, which consists of information given to the student about his/her performance in learning. In programmed instruction, as well as in instructional algorithms and within simulations and games, feedback is the most common (if not the only) reinforcement used.

According to Skinner, good teaching is the ability to arrange proper sequences of reinforcement for the student, and then to be certain that the presentation of these reinforcers is contingent on the student emitting the correct response.

contiguity

An important point in Skinner's theory, is that of the delay between response and reinforcement. According to Skinner, the longer the delay between response and reinforcer, the less the reinforcing effect. This is of special importance since as we will see later, feedback in the early teaching machines and programmed instruction was immediate.

programmed instruction

One such application of Skinner's research is Programmed Instruction designed to help students meet behavioral objectives of a particular instructional unit in a specified order.

During the early stages of Programmed Instruction a great deal of effort was devoted to the creation of teaching machines. These machines present the learner a series of frames of information followed by questions on the content just presented, and immediate reinforcement (feedback) is given after the student gives an answer.

Teaching machines, however, were not all that succesful; they were criticized as being mechanical page-turners, and very soon its contents were put in books.

In any case, the importance of this movement does not rely in whether a book or a machine was used, but rather on the method of arranging, ("programming") the content of instruction.

Reinforcement is not the only element in Skinner's

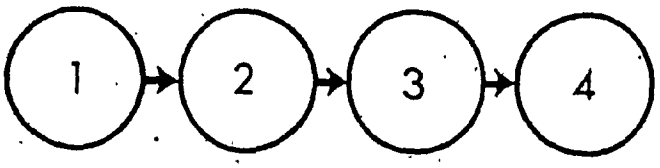
theory of learning. Both repetition and variation are important to guarantee understanding and every frame included a prompt related to the question to follow. A prompt is a supplementary stimulus added to a frame in order to make an item easier for a student to answer correctly.

According to Deterline (1962), some characteristics of a Skinner-type program are:

1. The program consists of small steps; (shaping)
2. The student writes his/her own answers, rather than selecting them from a limited set of answers as in multiple-choice responding;
3. Continual active responding is required on the part of the student after every small amounts of information are given;
4. Reinforcement is immediate; (contiguity)
5. Breath of understanding, not rote memorization, is the main objective;
6. Every effort is made to eliminate errors, the assumption being that a student most efficiently learns by being correct, not by being told that he/she is wrong after making an error; and
7. The program is capable of providing for a wide range of student ability and allows each student to proceed at his/her own pace.

A result of Skinner's Theory and techniques, is the format called "Linear Programming". In linear programming every learner regardless of his/her response goes through a fixed sequence of instruction, exactly in the same way, and in the same order.

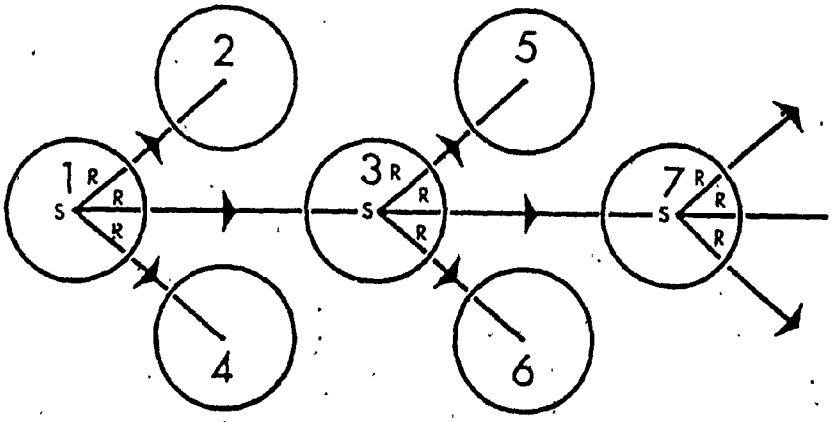
a linear program



Another approach to skinnerian programming is the one developed by Norman Crowder ( ), called Branching or Intrinsic programming. In this format, the content of instruction depends upon the response made by the student to a multiple choice question, and it may be different for every learner.

By providing a multiple choice question, Crowder is asking the student to recognize the correct answer rather than to produce it, and the student takes a route through the program which is determined by his/her own response. Branches are employed as a method of diagnosing if the student is going through any kind of problems during instruction. If a question is answered incorrectly, the student is provided with corrective feedback.

the branching program



The major difference between linear and intrinsic or branching programs, is that linear programs simply inform the students whether their responses were right or wrong (and can not continue until the correct response is given), while intrinsic programming makes use of these responses to guide the student through the program.

According to linear programming, the best learning situation is the one in which no errors occur, and the design of the program will ensure a high probability of producing correct responses. If the student makes an error, he/she is informed about it and continues on to the next frame. Errors are treated in a completely different way in intrinsic programming. Students cannot

go on to the new information until they have demonstrated that they "learned" by answering correctly at the different questions. Every time the student makes a mistake, he/she is reinstructed.

criticisms

Both approaches to programming (linear and intrinsic) have had numerous criticisms. It has been said about linear programming that too much prompting gives the student the correct answer. With intrinsic programs, on the other hand, criticism has centered around the use of multiple choice questions, saying that selected rather than constructed answers may have a serious drawback in terms of the transfer of learning from this situation to situations in which no choice is offered, for example in an essay test. However these programs have defended their position by requiring active problem solving behavior by the student.

Programmed Instruction has been related (maybe in excess) to teaching machines. As we have seen, Programmed Instruction refers to the arrangement of instruction, rather than to the means by which it is presented. Presently, with Computer Assisted Learning new and completely different alternatives are offered (cf. Coburn et al, Rushby).

when to use P.I.?

Now that the fundamental features of reinforcement theory and programmed instruction have been covered, you must feel like saying... well, fine, but when do I use Programmed Instruction?, How efficient is it? For what kind of audience is it best suited?, and many other questions alike. Unfortunately, there is not a fixed answer for those questions. It all depends on the kind of program, the environment in which it is going to be used, the content of instruction, etc. You may not want to produce a linear or an intrinsic program in the strict sense of the word, but make use of some of their features. The responsibility lies in you as designer, instructor or trainer. However, we could highlight some advantages of programmed instruction which may prove useful when looking at a program.

The following points, and Appraisal Checklist, might be helpful when evaluating programmed instructional materials.

1. Each student should advance at his/her own pace, the fast learner moving ahead rapidly while the slower learner moves at a speed convenient for him/her.

2. The student should move on to advanced material only after he/she has thoroughly mastered earlier stages.

3. There should be a certain amount of autonomy, since in Programmed Instruction students on their own decide time and duration of instruction, among other things.

4. There should be a measurable outcome: programmed instruction is supposed to accomplish something, and that something (learning) is supposed to be measurable in terms of change.

5. The student is expected to respond actively.

6. There should be immediate feedback.

7. There should be a planned structure: programmed instruction is carefully sequenced, or logically organized.

8. A record of students responses should be kept to furnishe the programmer with valuable information for future revisions.

9. The program must be tried out and evaluated before its implementation.

The following checklist, will assist you in a later exercise, in which you will evaluate a piece of programmed instruction.

APPRAISAL CHECKLIST

PROGRAMMED MATERIALS

- LIKELY TO AROUSE STUDENT INTEREST
- CONTENT ACCURATE
- STRUCTURE IS "LEAN"
- CRITERION FRAMES (TEST ITEMS) PARALLELL TO OBJECTIVES
- RELEVANT PRACTICE
- LEARNER RESPONSES REQUIRE THOUGHT
- FEEDBACK WELL DELIVERED
- FEEDBACK PROVIDES REMEDIATION
- VALIDATION DATA

If you want to read an example of linear and intrinsic programming, turn to the "example" section at the end of this module.

SELF - EVALUATION.

In a separate piece of paper, select the correct response for each question in the following questionnaire.

Please do not write in this manual, use the answer sheet provided.

1. Fill in the list below with the contrasting attributes of the two programming styles.

	LINEAR	INTRINSIC
a) Size of step, or amount of material..		
b) "Events" following a correct response		
c) "Events" following an incorrect response		

Select the most appropriate answer:

2. Programmed Instruction is considered a "Technology of Instruction" because:

   a) electronic devices are often used to display information.

   b) it puts into practice scientific knowledge of human learning.

   c) it has been used most succesfully in teaching technical subjects.

   d) Visual media are usually integrated into the software.

3. TRUE FALSE The essence (defining characteristic) of any technology of Instruction is the application of Skinner's principles of operant conditioning.

4. TRUE FALSE Intrinsic programming is synonymous of linear programming.

5. TRUE FALSE Branching programs allow more advanced students to skip through material without tedious repetition.

6. A reinforcer is an event or thing that:

   a) is pleasant to most people
   b) inhibits the formation of a habit
   c) precedes the display of a desired response
   d) all of the above
   e) none of the above

7. Compared to linear programming, branching programming:

   a) comes from pragmatic rather that theoretical bases
   b) allows more able students to work through more efficiently
   c) uses larger steps
   d) all of the above
   e) none of the above

8. Intrinsic or branching programs differ from linear programs in that they:

   a) employ smaller frames
   b) require " fill-in-the-blank " responses
   c) entail more frames
   d) all of the above
   e) none of the above

9. In your own words define:

   a) prompt

   b) reinforcer

10. List at least four qualities that would be important appraisal criteria for programmed materials.

   _____

   _____

   _____

   _____

After completing this self-test, turn to the "answer section", page 43 in your manual. Compare your answers with the ones provided.

THE COGNITIVE APPROACH TO LEARNING

Behavioral theorists emphasized the importance of observable behavior, stimuli, and response. Biehler (1971)points out that cognitive theorists start out with the assumption that psychologists should be concerned not only with overt behavior but also with the mental processes which cause behavior. In the late 50's and early 60's some educational psychologists considered there were many important variables involved in the explanation and understanding of human learning, other than those emphasized by behaviorists. Among these variables we find memory, imagery, attention, motivation, verbal and imaginal encoding, and other cognitive processes.

Wittrock and Lumsdaine (1977) summarized the cognitive perspective in the following way:

"A cognitive perspective implies that a behavioral analysis of instruction is often inadequate to explain the effects of instruction upon learning. From a cognitive perspective, to understand the effects of instruction upon learning and memory one must comprehend how learners use their cognitive processes, knowledge, abilities, aptitudes, and interests to transform the nominal stimuli of instruction into functional ones. These cognitive processes include attention, motivation, verbal and imaginal encoding, storage and retrieval".

bruner's cognitive theory

This new approach to learning was undertaken by theorists like Jerome Bruner, who is primarily concerned with the organization of cognitive material. He points out that the learner should organize material if he/she have been provided with the opportunity to discover the relationships inherent in the materials. He is interested in the development of mental abilities, and the kinds of processes learned by the student.

One aspect of Bruner's theory that seem to fit quite well in the area of simulations and games, is that of discovery learning.

discovery learning

Learning by discovery takes place when students organize materials by themselves, rather that receive it already in an organized way, <u>discovering</u> relationships among the information.

modes of representation

The way in which a learner process information has been a key aspect of the cognitive approach, and specifically of Bruner. According to him, there are three modes of representation of material in a developmental sequence. representation here refers to the cognitive behaviors that occurs when people process and remember information. (Lahey and Johnson, 1978). The three modes of representation are: enactive, iconic and symbolic.

enactive

The enactive mode is learning through action, as in learning to ride a bicycle. In this kind of learning, the actions 'represent' the object.

iconic

The iconic mode refers to the ability of forming visual images, and retaining them in the absence of the real object.

symbolic

The symbolic mode, in this kind of representation, thought becomes more abstract, and is not tied to concrete images.

According to Bruner, the best learning sequence would be that in which the learner when presented to a subject, can first experience it, then react to a concrete presentation of it, and finally symbolize it. If learning occurs through these three modes, it becomes more meaningful to the learner.

simulations and games

Simulations and Games offer learners the chance of manipulating materials (enactive mode), of having a visual representation of them in many cases (iconic mode), and of symbolizing the material just learned in the debriefing session, as will be later explained.

instructional algorithms

Instructional Algorithms can also provide the learner with these representation modes.

Both simulations and games and instructional algorithms represent "Technologies of Instruction" since they are both examples of the creative applications of bodies of knowledge to practical purposes.

SIMULATION AND GAMES

what are they?

A simulation is a working representation of reality. It implies the use of abstracted, simplified or accelerated model of a process. It allows students to explore systems where the real thing cannot be used for teaching purposes because it involves other people, or is too expensive, complex, dangerous, fast or slow. Simulations may be tightly or loosely structured but will always be dynamic as opposed to a model which is static.

A game is played when one or more players compete or co-operate for pay-offs, according to an agreed set of rules. It is designed so that success is achieved by the use of the materials to be learnt. The rules will usually include a scoring system and an indication of the objectives to be achieved. The competition may be against nature, the players' previous best score, or other players. It is normally highly structured. Usually implied in the notion of a game is that of being entertaining.

A simulation-game combines the features of a game (competition, co-operation, rules, players) with those of simulation (incorporation of critical features of reality). It is particularly valuable where the real life situation is competitive.

It should be noticed that in practice, the terms are often used interchangeably. There is also a fuzzy area between these and case studies on the one hand, and experiential exercises on the other.

their role in educatio.

In an educational or training environment, simulations can be used as an ice-breaker, as a motivator, as an elicitor of personal relations, decision making, role playing, etc. Educators and trainers have shown interest in simulations because of its adequacy for teaching and practicing complex psychomotor skills like flying, driving, as well as its potential in situations requiring a laboratory setting. Added to the low cost of simulations for practicing these skills, they also offer a high safety element. If you crash your airplane, or spill acids while doing a simulation, no personal or economic damages will be done, instead, you will receive feedback and/or reinforcement. Simulations are also widely used in social studies and human relations, teaching people how to cope with their social environment, or to a new one. In many cases the outcome of the simulation is completely unknown since simulations are more open-ended than games are. Bearing

in mind this 'openness' characteristic of simulations, a mediator, referee or guide should always be present observing the development of the exercise and intervening when needed.

In the same way that simulations can bring about learning through role playing or discussion, games too are useful in the teaching/learning process. Intrinsic to games is the element of competition. That is something not always found in a simulation, where the element of co-operation is in most cases fundamental. Now, when taking part in a game, be this instructional or not, participants look after a common goal: to win the game and have fun. However, attaining the goal in some games may not involve competition. There are games whose goal is to establish communication among participants, not having then either a winner or a looser. Depending on the type of game, an individual or a team can be the winner, and of course there will be a looser; or, in some cases, neither a winner nor a looser but a draw.

As mentioned earlier, games are structured, so rules and instructions must be given to the players, and the elements of chance and competition predominate. In a simulation-game, a representation of reality mixed with chance and competition would be present. Simulations can help develop decision making skills, by providing the learners a complete view of a situation, thus enabling them to realize how their decision can in many ways affect a problem. Simulations can also give the learner a feeling that he/she can cope and interact with the real world.

a didactic game includes..

For Mitchell and Schmid (1980), an instructional game includes:

1.- A set of intended learning outcomes (a curriculum);
2.- A set of two or more players, one of whom may be a computer program;
3.- A set of possible stimulus presentations available to players;
4.- A set of procedural rules and behavioral constraints governing game play;
5.- A set of possible courses of action that might be followed by a player;
6.- A set of possible outcomes that may follow a player's actions (i.e. payoffs, goals, etc);
7.- An event control system that determines the possibility that a specific outcome or stimulus will

occur, given a player's antecedent action and current status;
8.- A conflict of interest among players that is specific to the game; and
9.- Various indeterminate, though often predictable and sometimes planned, social stimuli.

elements in a simulation.

According to Kersh ( ), the essential elements in a simulation are:

1.- That a suitable stimulus situation be presented to the learner.
2.- That there should be a strong element of reality in the presented situation.
3.- The necessity of the student being required to act out the response under supervision just as he would in a role-play situation.

Simulation-Games can take many forms, they can include one or two participants, or they can include a whole group. They can be played over a fixed period of time, or they can take weeks; it all depends on the instructor's idea and goal. However we should always bear in mind that even when they can be very helpful to some students, they can also be threatening to some people and in many cases irrelevant to the subject matter. The use of such technologies in the teaching/learning process must follow a careful planning and evaluation.

There are many resources available to which we can ressort when looking for simulations and games for a particular situation, some of these being already made materials developed by different educational institutions, and ready to be used. A videotaped simulation can have incredible! results when afterwards seen and discussed with the participants. It is all a matter of creativity since simulations and games can be used in almost all of the teaching/learning processes.

computers and simulation and games

Another kind of media widely used with simulations and games is the computer. Countries like the United States and Canada count with a very high index of computer literacy among young children. Those children born in the late 60's are now teenagers who have lived through a computerized era. There is not much special in the computer for these kids. They know how to handle a computer, they have played with it, and are now learning

from it. But even for us old guys over 18, computers offer good use alternatives. Computers are an excellent medium for individualized instruction, they are patient, and allow students go at their own pace. They can give the user immediate feedback and make all kinds of calculations in just a few seconds, allowing a high degree of complexity that cannot be found in a non-computer simulation. A computer allows an individual to play against the machine, so simulations and games, can be used informally, as well as part of a distance education package. The computer can act as the expert to produce information on demand.

One of the disadvantages of running a simulation in a computer is the relatively difficulty to alter the rules. Unless it is a sophisticated program, this normally involves altering the program. The intimidation that machines offer to some people can also be a problem, as well as those technical problems like a power failure.

Whatever kind of simulation-game we want to use we should keep in mind several constraints when planning its use. It should be taken into account how much time is available, how many players can participate, their ability to undertake with the simulation or game, and their age, among other things. Any simulation or game should always be tried out first, the rules evaluated, check for reality performed and if the group or person are not used to such activities a preparation may be required.

debriefing After a simulation or game a debriefing session is a must. During this, the participants will discuss their thoughts, actions, feelings or decisions and will be able to discuss as a group the intent of going through the simulation or game. This session follows right after the simulation or game is completed, while the ideas and reactions to the activity are still warm in the participants.

Simulations and games, as other Technologies of Instruction, attempt to make the educational process an effective and active one. Introducing fun into education can make students actively involved in the instruction, and fully motivate which in turn will facilitate learning. We have seen some of the advantages and disadvantages of simulations and games, however adequate preparation and planning has to be incorporated to the instruction, to bring about the advantages this technology offers.

If would you like to read an example of a Simulation Game, turn to the "example" section at the end of this module, and you will find one called GLOBAL CAKE.

SELF - EVALUATION.

Select the correct response for each of the following questions. Please use your answer sheet, do not write in this manual.

1. A simulation and a game differ in that a game:

   a) is based upon a model of reality.

   b) requires the active participation of the learner.

   c) involves competition against other players or a standard.

   d) none of the above.

2. List the three modes of representation of material present in Bruner's theory.

   _____

   _____

   _____

3. The development of empathy for other people's motivations would best be achieved through:

   a) lecture/discussion.

   b) games of drill and practice.

   c) role-playing simulations.

   d) psychomotor simulations.

4. The first step in group debriefing is:

   a) describing the symbolic meaning of the game activities.

   b) releasing emotions built up during play.

   c) comparing the simulated experience to real life.

   d) explaining the conclusions that should be drawn from the experience.

5. Simulations and simulation/games facilitate:

   a) drill and practice exercises.

   b) individualized instruction.

   c) discovery learning.

   d) all of the above.

6. According to Bruner, when a child is manipulating an object, he/she is in:

   a) the iconic mode.

   b) the enactive mode.

   c) the symbolic mode.

   d) a & b.

   e) a & c.

7. List two skills which are widely taught with the use of simulators, and give one reason for each which might explain why simulations are so popular in teaching these skills.

   _____
   _____
   _____

8. List at least three cognitive processes emphasized by cognitive theoreticians.

   _____ _____ _____

The following descriptors belong to some materials commercially available, read the description of each item carefully. According to the following classification decide which fits best with the description

Instructional Simulation	IS
Instructional Game	IG
Instructional Simulation/Game	ISG
Game	G

Write down on your separate answer sheet whether the description fits an IS, an IG, an ISG or a G.

1. High school students learn anthropological concepts and archeological techniques by playing DIG. The class is divided into two teams. In phase I, each team creates its own civilization with specific details of government, religion, and economy. In phase II, members of the team create artifacts to reflect their culture and bury them. In phase III, teams "excavate" each other's sites using standard archeological procedures and simulated museum forms. In the final phase, both teams explain their findings to each other and see how accurately they reconstructed the "past". At the conclusion, students cooperatively evaluate their performance and the project.

2. To play ELEMENTS one should have some previous knowledge of chemical elements. This activity gives you practice in ordering the elements by means of a board and different tokens with chemical symbols on them. Players begin with equal number of tokens. Through a series of moves, they attempt to order all the elements. The first player to do so is the winner.

3. TEACHING PROBLEMS LABORATORY is an elaborate activity package for preservice and inservice teacher training. It consists of 11 sound films and other materials to create a hypothetical school setting. The trainee receives student record folders, faculty handbook, curriculum handbook, sociograms, and other documents to create a strong feel for the imaginary school. The trainee is presented with a problem he has to solve within the role of a fifth grade teacher. There is no planned interaction among different players during these activities.

4. In GHETTO, materials include a game board, various chance cards, role profiles for four male and six female ghetto residents, and a coordinator's manual. The activity is tightly structured with the rules reflecting the realities of ghetto life. Each round consists of each player receiving and distributing "hour chips" on a variety of activities including hustling. The object is to get as many reward points as possible during the round and also to improve the chances of succeeding in future rounds.

5. In TWIXT, the object is to place plastic pegs in holes and link them in such a way that they form an unbroken connection between two edges of the game board. At the same time, each player blocks his opponent from doing the same thing on his side.

6. ACTIONALYSIS "facilitates the development of perceptual and behavioral repertories of the participants, particularly in verbal interaction". It includes a series of structured interactions which aproximate real-life situations (for example, an encounter between a teacher and a student). In each round two players role-play for three minutes. During the three next minutes observers discuss their observations. This is followed by a longer discussion by all participants to determine how well each participant played.

TURN TO THE ANSWER SECTION OF THIS MANUAL, PAGE # 47.

LANDA'S THEORY OF INSTRUCTION

The predominant idea in the work of L.N. Landa concerning instruction, is that of the control of the cognitive activity of the student during the instructional process. In an interview given by Landa to Educational Technology Journal (1982), he stated that both the acquisition and application of knowledge involve cognitive actions or operations with knowledge; its breaking down into components, its transformation, synthesizing, generalizing, etc. His theory analyzes and explains the mental processes wich underlie expert performance, learning and decision making.

Landa (1982) points out that his theory is a system of techniques for:

1.- Penetrating the unobservable, unconscious, and intuitive mental processes underlying expert performance and decision-making for any given type of problem, task, or decision.

2.- Breaking those processes down into relatively elementary component operations.

3.- Describing those operations, both manual and cognitive, explicitly (i.e. building descriptive models of such processes).

4.- Composing algorithmic prescriptions based on such descriptions of what a non-expert should do in his mind in order to perform at an expert level (i.e. building prescriptive models of such processes).

5.- Creating specific training programs on the basis of algorithmic prescriptions to guide and effectively develop the expert-level processes within the non-experts.

What Landa tries to do through these prescriptive and descriptive programs, is to create expert performers and learners in a given area without spending all the years of experience and study that takes to be one. Landa's theory of instruction fits under the cognitive movement. His theory emphasizes the total learning system where inputs, processes and outputs are considered equally (Romiszowski, 1981).

algorithms and relevant terms.

Trakhtenbrodt (1963) defines an algorithm as a single list of instructions specifying a sequence of operations which will give the answer to any problem of a given type. In other words an algorithm tells how to solve not just one particular problem, but a whole class of similar problems.

Vazquez-Abad and Larocque (1981) point out that the use of algorithms with educational purposes is a relatively new area; they were first used for technical training in industrial and militar areas. However, educators are increasing the use of algorithms in the teaching/learning process.

Algorithms have different attributes, descriptors and elements, and are represented in various ways, as we will see later. There are some terms that need to be defined at this point; these terms are: prescription, procedure, and rule.

rule

Scandura (1973) defines a rule as an ordered triple (D,O,R) where D refers to a *domain* of stimuli, O refers to an *operation*, and R refers to a *range* of response.

procedure

A procedure is an ordered list of instructions or rules.

prescription

A prescription can be seen as a method.

algorithmic prescription

According to Landa there are classes of problems for which we can design a prescription (method) that would specifically and unequivocally determine what one should do manually and/or cognitively in one's mind in order to solve any problem belonging to a certain class or type. For example, what operations are to be performed in order to find a common denominator of two numbers. Prescriptions of this type are *algorithmic*, because they fully determine the operations to be performed in order to solve any problem belonging to a particular class.

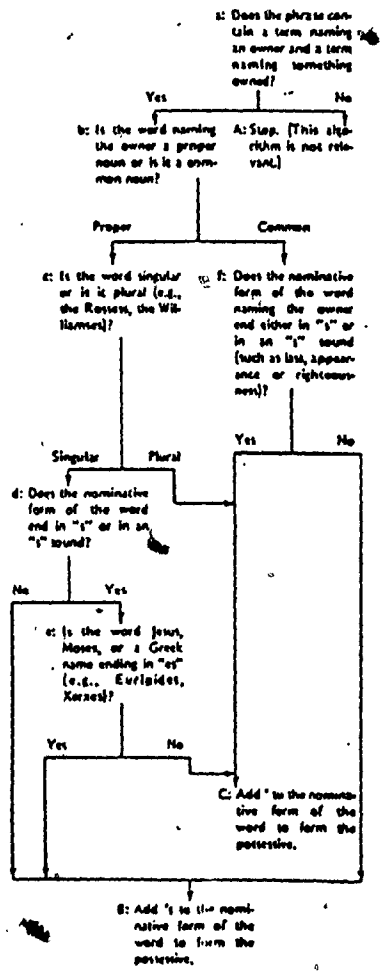
To illustrate what is meant by an algorithm, see fig.1

From this example, you can see in what way information is given to the user, taking him/her to a correct solution through a sequence of preplanned questions by which the user is told exactly what to do. The arrival to a correct solution can be achieved by any user that has the required entry skills. One advantage in the use of algorithms is that of `time saving` since the user is lead to information that is relevant to what he/she is doing.

(Gerlach et al., 1977)

Algorithm for Forming the Possessive of English Nouns

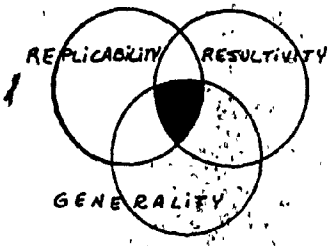
Domain: Vocal or subvocal expressions including a possessive noun and the object of the possession.
Range: Written possessives.
Entry skill. Ability to write the nominative form of a noun after hearing or saying the possessive form.



Before getting into the use of algorithms in an educational context, let's see which are the components of an algorithm.' These components are divided into: attributes, descriptors and elements, as follows:

attributes: The first attribute of an algorithm, is that of generality, which means that an algorithm must be applicable to a class of problems and not only to a single problem. The second attribute of an algorithm is that of replicability: it must specify an unambiguous procedure. Finally, an algorithm must always lead to a correct result: this is called resultivity. If a procedure has these three attributes, it can be called an algorithm.

In the following figure, the shaded area represents those procedures which are algorithms.



descriptors It has been said that an algorithm must apply to a class of problems and not only to a specific problem. The domain of an algorithm describes this class or, as Bung (1971) says, the domain of an algorithm is the entire class of problems for which it will work. The range of an algorithm is the set of possible correct results. And the user, as the name implies, refers to the system for which an algorithm is intended. This descriptor must specify as well the necessary entry skills any user must posses in order to succesfully go through the algorithm. This descriptor must seccesfully answer: "What must the user know or be able to do in order to use this algorithm?"
An example of domain, range and user (entry skills), was given in the algorithm in figure 1. The following is an example of descriptors from an algorithm for adding fractions (Gerlach et.al., 1975).

DOMAIN: Any set of two fractions with whole number denominators
RANGE: Sum of any set of the domain
ENTRY SKILL: Factoring of natural numbers

elements

Gerlach et.al. (1975), describe three elements in an algorithm. These are: operators, discriminators and syntactic structure. An operator is the statement that will tell you to perform an operation. The following statement is an operator of an algorithm for adding fractions: "multiply the numerator and denominator of the other fraction by this fraction". This operator, is telling the user to perform a specific operation. A discriminator is a statement which requires the user to make a decision. Faced with a discriminator, the user has to discriminate between two conditions, as in a yes/no question, or between the presence or absence of a specific condition. From the same algorithm for adding fractions, (figure 1) here is one of the discriminators used:

> "Are the denominators multiples of a common factor other than 1?"

The discrimination is between yes or no. From an algorithm for forming the possesive of English nouns (Gerlach et.al., 1977) we have the following discriminator:

> "Is the word singular, or is it plural (e.g., the Rossess, the Williamses)?"

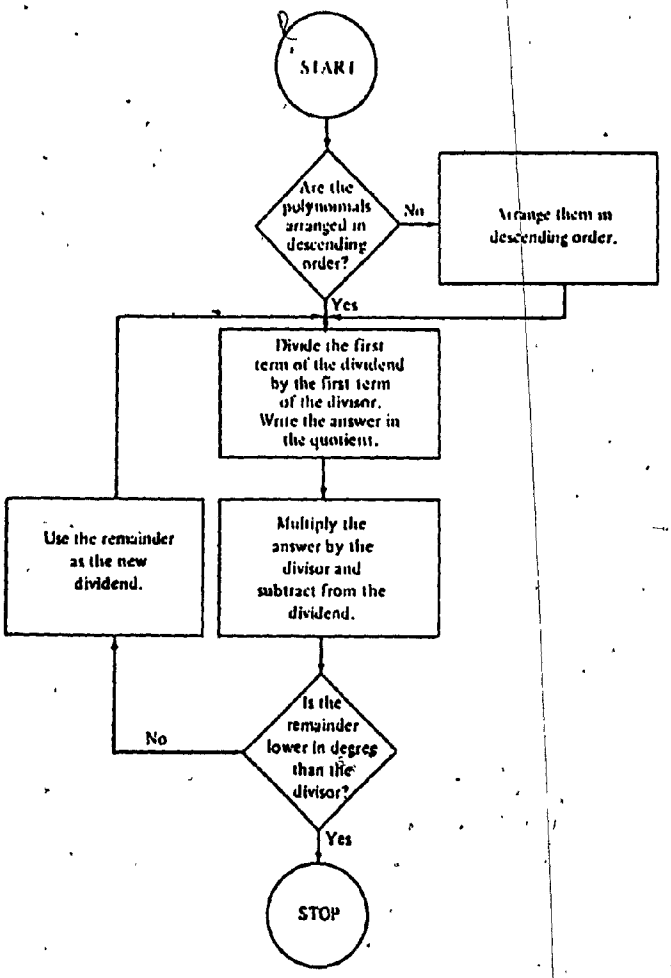
In this case, the answer to this discriminator will be between singular or plural.

representing algorithms

Algorithms may be represented in different ways. The most common way of representing an algorithm, is in flowchart form. The following algorithm for polynomial division, is an example of flowchart form:

insert algorithm

POLYNOMIAL DIVISION



The popularity of representing algorithms in flowchart form is due to their advantages in terms of readability and clarity. Coscarelli (1978) points out that as instructional designers we are often faced with the problem of representing many types of information. The use of flowcharts is often selected to represent complex procedural operations when accuracy and speed are of prime consideration. However, flowcharts are not the only way of representing algorithms; they can also be represented also as Coded Graphs, in List Form, Prose Form, using a Linear Representation or a Decision Table Form. (cf. Gerlach, Reiser and Brecke 1975).

'standard prose and flowcharts

Bung and Sanchez Carrasco (1977), suggest the use of algorithms as a more efficient way of communicating information than prose. In many cases, when using prose, the learner has to go through information that is not applicable for his/her problem in order to acquire the needed information.
Gerlach et.al. (1977), give a prose representation for an algorithm, noting the level of difficulty this one implies, and the flowchart form of the same algorithm. Notice the difference in both:

example of prose form

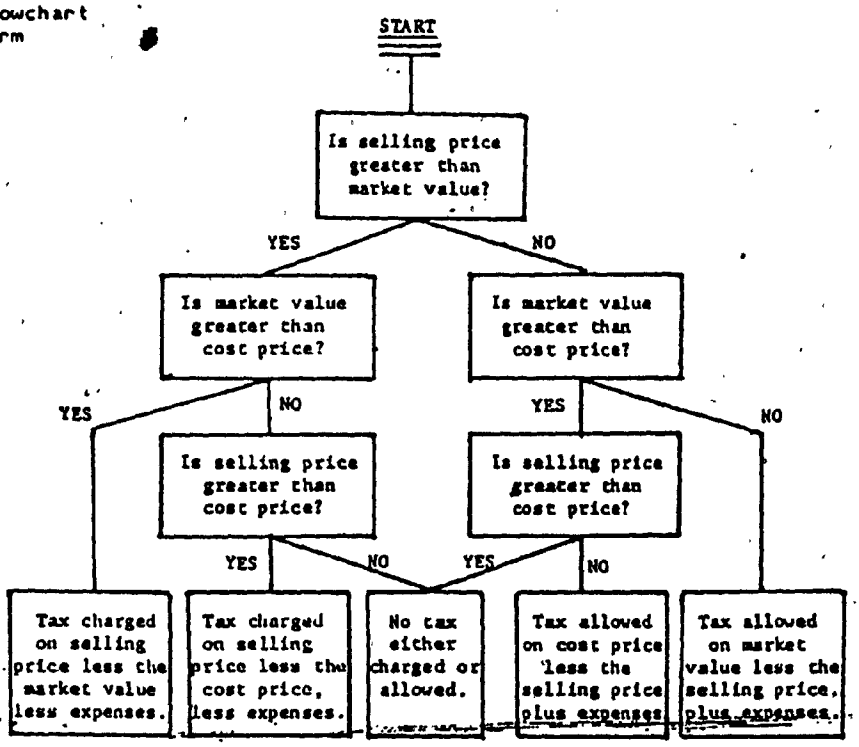
Domain: Price, transaction expenses, and date of purchase of shares of stock; market value on 6 April 1965.
Range: Base for tax allowance or charge.
Entry skill: 7th grade reading ability.

If the asset consists of stocks or shares which have values quoted on a stock exchange or unit trust units whose values are regularly quoted, the amount of tax chargeable or allowable depends upon the relative sizes of the cost price of the asset, its market value on 6 April 1965, and the selling price of the asset.

If the selling price is greater than the market value, and the market value is greater than the cost price, tax is charged on the selling price less the market value (less allowable expenses). If the selling price is greater than the market value, and the market value is less than the cost price, in which case tax is charged on selling price (less expenses). Or the selling price is less than the cost price, in which case no tax is either charged or allowed.

If the selling price is less than the market value, and the market value is less than the cost price, tax is allowed on the market value less the selling price (plus allowable expenses). If the selling price is less than the market value, and the market value is greater than the cost price, two possibilities arise. Either the selling price is less than the cost price, in which case tax is allowed on the selling price (plus expenses). Or the selling price is greater than the cost price, in which case no tax is either allowed or charged. (Horabin and Lewis, 1974, p.6)

example of flowchart form



As you can notice, there is a great difference between reading this algorithm in the prose form, and in the flowchart form. As it was pointed out earlier, the flowchart form allows the user to read only the required information for his/her case, not wasting time with irrelevant information, and having an obvious gain in clarity and readability)

advantages

Clarity and readability is one advantage of the use of algorithms in education. Another use of this technology is in self-instruction, providing a variety of ways of achieving the same goal; in turn, an algorithm can be applied for different learning styles. As well the design of an algorithm leads the instructor and/or designer to clearly specify the required entry skills necessary for an specific objective, as well as a planned sequence of instruction.

algorithms and objectives

Gerlach et.al., (1975), points out a relationship between algorithms and objectives. They state that both algorithms and objectives represent descriptions of terminal behavior. Algorithms are explicit unambiguous descriptions or prescriptions, while objectives are summarized descriptions which, ideally, are also unambiguous.

algorithms as a technology of instruction

As a technology of instruction, algorithms take the form of an identifiable pattern of teaching/learning. Its procedures provide replicable, effective instruction on an individualized basis.
Some of the principles of human learning discussed in the learning theories covered, and found in algorithms are:

- self-pacing,
- discovery learning (some types of algorithms according to Landa (1974) enable the user to discover which sequence of operations leads to the goal), and
- prompting (algorithms are highly amenable to the gradual withdrawal of a prompt).

quasi-algorithms

Landa (1966) differentiates between prescriptions called quasi-algorithms from proper algorithms in the following way:

1.- The attributes of replicability, generality and resultivity are only approximately fulfilled by quasi-algorithmic prescriptions.

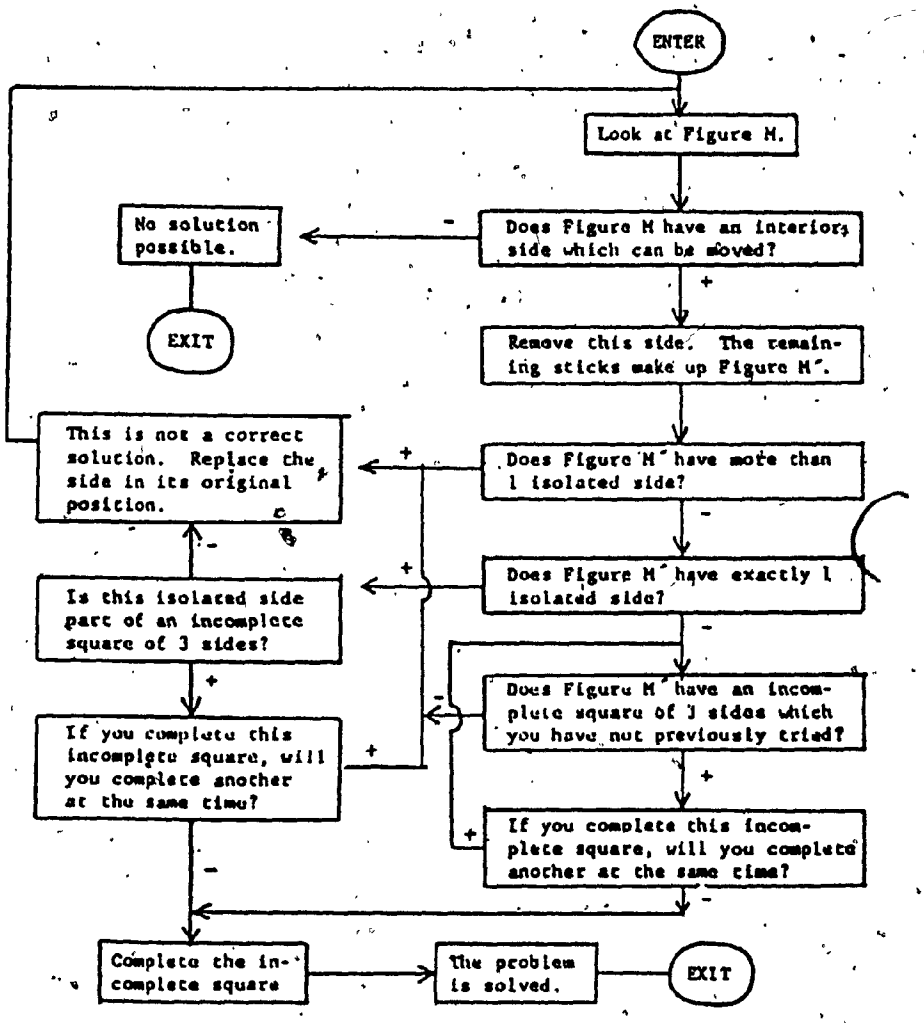
2.- It is generally not possible to unambiguously delimit the domain for quasi-algorithmic prescriptions.

3.- It may not be possible to specify a finite number of operations for quasi-algorithmic prescriptions.

SELF - EVALUATION.

In your answer sheet, write down the responses for the following questions.

1. In the following algorithm identify at least two operators and discriminators.



2. In order for a procedure to be considered an "algorithmic procedure", it has to posess certain attributes. Name and briefly explain them.

---

3. The difference between an algorithmic procedure in standard prose form and in flowchart form has been highlighted earlier. For the following algorithmic procedure, build its equivalent flowchart form.

RANGE: "Leaving; feeding and watering; taking to a veterinarian; burying"

DOMAIN: "Any instance of a person finding a bird lying on the ground"

ENTRY SKILL: "Recognizes birds; knows what a veterinarian is."

This is the algorithm:

"You find a bird lying on the ground. Check if it is still alive, give 50 ml. of water, and 30 g. of birdseed per day. If it gets better, let it fly. If it doesn't get better and is still alive, take it to a veterinarian and follow his instructions. If it dies, bury him".

4. Explain the importance of determinig entry skills for an algorithm.

5. Write the main advantage for using an algorithmic procedure in education.

Now, turn to page 51 in the Answer Section.

THE HUMANIST POINT OF VIEW

A third approach to human learning is the position of psychologists and educators who follow the principles underlying humanist psychology. This approach operates under principles such as free schools, open classrooms, open and effective communication, empathy and warmth. But it can be said that the keystone of humanist education is the belief in the importance of the right of all students to be treated as human beings and to be allowed to develop in such a way as to enhance their human qualities (Lefrancois, 1979). Humanists are concerned with the content of instruction and, most important, the way students are taught.

montessori

One representative of this approach to education is Maria Montessori, who argued in favor of observation and liberty as basic aspects of her approach to teaching. According to Montessori the spontaneous behavior of a child should be observed and then used as a basis for creating teaching methods. Concerning objectivity and observation, stressed in Montessori's method, De Cecco and Crawford (1974) explain that by objectivity is meant that the focus of the child's attention should be on the objects he/she seeks to understand and not on the personality of the teacher. And by observation, that the focus of the teacher's attention should be on the changing level of the child's interest rather than on pressing the child beyond the limits of spontaneous interest.

influence in education

The respect and freedom for the child's individuality that Montessori sought in her method determined drastic changes in the classroom, as well as in the relation between teacher and student. These changes have influenced all sorts of educational methods, even in those who are not advocates of the humanistic approach. Not only Montessori's theory has favored changes in the classroom, also the theories of other humanists such as Rogers have had a great influence in the way teaching is conducted nowadays.

In order to stimulate the child's interest and curiosity Montessori developed various instructional materials. These materials are a fundamental element in the classroom. The role of the teacher would at first be active, explaining the child the different materials while the child would have a passive role; however, this situation would soon be reversed and the child would then select the materials he/she wanted to work with and then proceed in their own way and pace. According to Saetler (1968), the development of these instructional materials anticipated concepts of programmed instruction.

ANSWER SECTION

REINFORCEMENT THEORY AND PROGRAMMED INSTRUCTION

Compare your answers with the following:

1.- Contrasting attributes of the two programming styles:

a) size of step, or amount of material:

LINEAR: very small amounts of information are representative of Linear programming; one or two sentences are presentes before a response is required.

INTRINSIC: the amount of material given in an Intrinsic program is increased; a paragraph or even a page of information is given before a response is required.

b) "Events" following a correct response:

LINEAR: Reinforcement (feedback) is given to the student and new information presented.

INTRINSIC: Reinforcement (feedback) is given to the student and new information presented.

c) "Events" following an incorrect response:

LINEAR: the same material is presented again, to the student, until the correct response is given.

INTRINSIC: remedial material and feedback is given to the student.

2.- b

3.- FALSE

4.- FALSE

5.- TRUE

6.- e

7.- d

8.- e

Compare your answer for question #9 with the following. Key words are underlined. Either these words, or an equivalent should be present in your response.

9.- prompt: is a supplementary stimulus added to a frame in order to make an item easier for a student to answer correctly.

reinforcer: any stimulus that increases the probability that a response will occur.

10.- You should have at least four of the following:

-likely to arouse student interest

-content accurate

-structure is "lean"

-criterion frames (test items) parallel to objectives

-relevant practice

-learner responses require thought

-feedback well delivered

-feedback provides remediation

- validation data

turn to next page...

Count your correct answers.

If you have 10 correct answers, CONGRATULATIONS!!! you are doing fine. Keep on with instruction, turn to page 20 on the Instruction Section and continue the good work.

If you have 9 or 8 correct answers, you are doing a pretty good job, you can go back to instruction on page 20 on the Instruction Section. However, it would be better for you if you checked the question number you answered incorrect (in the following page), and revise the section indicated.

If you have less than 8 correct answers, check the question number you answered incorrect (in the following page), and revise the indicated sections. When you are finished take the self-test again, and compare your answers.

If you had questions # 1, 4, 5, 7 or 8 incorrect, go to page #10 to 13 and revise instruction entitled programmed instruction, a linear program and the branching program.

If you had question # 2 incorrect, go to page #1 to 4 and revise instruction entitled THE ROLE OF TECHNOLOGY IN EDUCATION; that includes: a process and a product, resistance to innovation and technologies of instruction.

If you had question # 3 incorrect, go to page #1 to 4 and revise instruction entitled THE ROLE OF TECHNOLOGY IN EDUCATION; that includes: a process and a product, resistance to innovation, and technologies of instruction. And to page #8 to 10 and revise instruction entitled REINFORCEMENT THEORY AND PROGRAMMED INSTRUCTION; that includes: positive reinforcement, negative reinforcement, punishment, shaping, feedback and contiguity.

If you had question # 6 incorrect, go to page #8 to 10 and revise instruction entitled REINFORCEMENT THEORY AND PROGRAMMED INSTRUCTION; that includes: positive reinforcement, negative reinforcement, punishment, shaping, feedback and contiguity.

If you had question # 9 incorrect, go to page #8 to 13 and revise instruction entitled REINFORCEMENT THEORY AND PROGRAMMED INSTRUCTION; that includes: positive reinforcement, negative reinforcement, pubnishment, shaping, feedback, contiguity and programmed instruction.

If you had question # 10 incorrect, go to page #15 and revise instruction entitled the APPRAISAL CHECKLIST FOR PROGRAMMED MATERIALS.

THE COGNITIVE APPROACH TO LEARNING AND SIMULATIONS AND GAMES

Compare your answers with the following:

1.- c

2.- enactive
iconic
symbolic

3.- c

4.- b

5.- c

6.- b

7.- flying, driving -- reduction of expense and danger

8.- you should have answered at least three of the following:
memory
imagery
attention
motivation
verbal and imaginal encoding

turn to the next page...

Count your correct answers.

If you have 8 correct answers, you are doing really well. Keep on with instruction, turn back to page M-32 on the Instruction Section and continue with the good work.

If you have 7 correct answers, every thing is going well, you can go back to instruction on page M-30 on the Instruction Section. However it would be better for you if you checked the question number you answered incorrect (in the following page), and revise the section indicated.

If you have less than 7 correct answers, check the question number you answered incorrect (in the following page), and revise the indicated sections.

If you had questions # 1, 3 or 7 incorrect, go to page #22 to 24 and revise instruction entitled SIMULATIONS AND GAMES; including: what are they? their role in education, a didactic game includes..., and elements in a simulation.

If you had questions # 2, 6 or 8 incorrect, go to page #20 to 21 and revise instruction entitled THE COGNITIVE APPROACH TO LEARNING;including: bruner's cognitive theory, discovery learning, modes of representation, enactive, iconic and symbolic.

If you had questions # 4 or 5 incorrect, go to page #22 to 25 and revise instruction entitled SIMULATIONS AND GAMES, that includes: what are they? their role in education, a didactic game includes..., elements in a simulation, computers and simulation and games, and debriefing.

Descriptors of Instructional Simulations, Instructional Simulations and Games, Instructional Games and Games:

1.- IS DIG: clearly a scaed-down representation of the real-life work of archeologists; no apparent game aspects.

2.- IG ELEMENTS: players do not adopt roles or participate in some model of activity.

3.- IS

4.- ISG

5.- G TWIXT: a pastime only, no instructional goals.

6.- IS ACTIONALYSIS: no competition toward some set goal.

Count your correct answers, if you have more than one incorrect answer in this part, go to page #22 and revise instruction entitled: SIMULATIONS AND GAMES; that includes: what are they? their role in education, a didactic game includes..., elements in a simulation, computers and simulations and games, and debriefing.

LANDA'S THEORY OF INSTRUCTION AND INSTRUCTIONAL ALGORITHMS

Compare your answers with the following:

1.- From the given algorithm, the following statements constituteoperators:

- Look at figure M.
- Remove this side. The remaining sticks make up figure M.
- Replace the side in its original position.
- Complete the incomplete square.

The following statements constitute discriminators:

- Does figure M have an interior side which can be moved?
- Does figure M have more than 1 isolated side?
- Does figure M have exactly 1 isolated side?
- Does figure M have an incomplete square of 3 sides which you have not previously tried?
- If you complete this incomplete square, will you complete another at the same time?
- Is this isolated side part of an incomplete square of 3 sides?

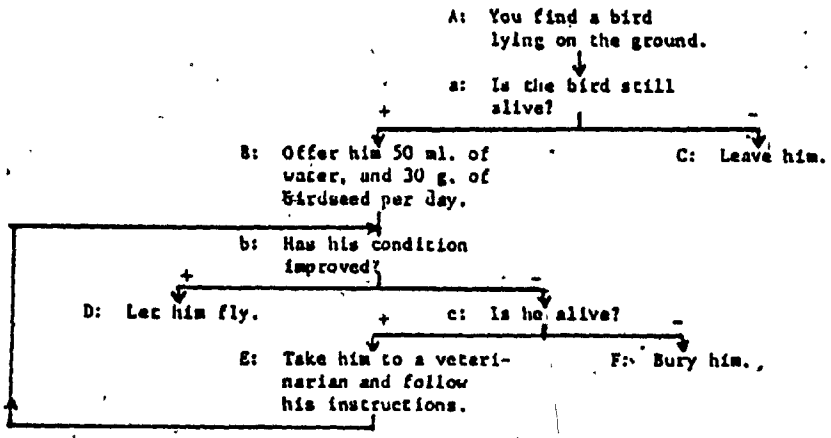
2.- ATTRIBUTES:

GENERALITY: the algorithm must be applicable to a class of problems and not only to a single problem.

REPLICABILITY: must specify an unambiguous procedure.

RESULTIVITY: an algorithm must always lead to a correct result.

3.- The algorithm you built must look something like this:



4.- From the following response, check if yours has the same idea:

Since the goal of an algorithm is to produce a correct result, the user of the algorithm must have the required knowledge and/or skills to perform it. Determining entry skills for an algorithm is essential in order to achieve this goal (resultivity).

5.- clarity and speed.

turn to next page....

Count your correct answers.

If you have 5 correct answers, GREAT JOB !!! you have done very good. Keep on with instruction, turn to page #_42_ on the Instruction Section for the final part of this module.

If you have less than 5 correct answers, check the question number you answered incorrect (in the following page), and revise the indicated sectiond. When you are finished take the self-test again, and compare your answers.

If you had questions # 1, 2 or 4 incorrect, go to page #33 to 34 and revise instruction entitled: attributes, descriptors and elements.

If you has question # 3 incorrect, go to page #24 to 28 and revise instruction entitled: representing algorithms, standard prose and flowcharts, example of prose form and example of flowchart form.

If you had question # 5 incorrect, go to page #39 and revise instruction entitled: advantages, algorithms and objectives, and algorithms as a technology of instruction.

POST - TEST

Select the most appropriate answer, from the following questionnaire. For this test, please write your answers in this form.

1.- Which of the learning theories accept the principle that human behavior is subject to certain rules, and that can be predicted and controlled?

a) Humanism

b) Behaviorism

c) Cognitivism and Humanism

d) Behaviorism and Humanism

2.- A program in which information is sequentially arranged in small steps, each of which requires the learner to make a response, followed by immediate feedback would be an example of:

a) intrinsic programming

b) linear programming

c) a & b

d) none of the above

3.- One of the fundamental concepts in Skinner's theory of human learning is that of:

a) social imitation

b) discrimination learning

c) reinforcement

d) none of the above

4.- Bruner's developmental theory argues for:

a) expository teaching

b) discovery-oriented learning

c) verbal learning

5.- Which of the following would be a brief but sufficient definition of "technology" in relation to instruction?

a) any method involving human/machine interaction.

b) mechanical and electronic devices which promote a more effective classroom communication.

c) print and non-print media and materials which support the teacher in conveying instruction.

d) all of the above

e) none of the above

6.- Norman Crowder is most closely associated with:

a) audio-tutorial systems

b) simulation/gaming

c) branching programming

d) all of the above

e) none of the above

7.- Instructional Simulations is particularly appropriate for use in:

a) helping learners to apply new skills to real-life use

b) teaching new terms and concepts

c) introducing a new topic

d) all of the above

e) none of the above

8.- The technology of instruction that offers the least individualization is:

a) programmed instruction

b) instructional algorithms

c) computer-assisted instruction

d) simulation/gaming

9.- Describe a specific instructional situation where the use of instructional algorithms would be most appropriate.

(answer this question in a separate piece of paper)

10.- In preparing learners for a simulation game, it is desirable to:

a) give an introduction on the purpose of the activity, and its characteristics.

b) give hints about winning strategies

c) restrain the group from starting play until everyone is sure of all the rules and the relevance of the content has been thoroughly discussed.

d) keep the instructional objectives hidden.

11.- Landa's theory of instruction is mostly concerned with

a) self-actualization

b) expert performance

c) clarification of values

d) insight

12.- The theory represented best in programmed instruction is:

a) Bruner's cognitive developmental theory

b) Landa's theory of instruction

c) Reinforcement theory

d) Montessori's theory of human development

13.- TRUE / FALSE — Negative reinforcement would increase the probability of a response.

14.- TRUE FALSE — Feedback is only given after the student gives a correct response.

15.- TRUE FALSE — Discovery learning takes place when students receive materials in an organized way.

16.- TRUE FALSE — A game is played when one or more learners compete or co-operate for pay-offs.

17.- Multiple-Choice questions are related to:

a) shaping

b) algorithms

c) intrinsic programming

d) linear programming

18.- "Ability to write the nominative form of a noun after hearing or saying the possesive form". This statement is an example of:

a) domain

b) discriminator

c) operator

d) entry skill

e) none of the above

19.- When the attributes of replicability, generality and resultivity are partially fulfilled in a prescription,.we are refering to:

a) flowchart form

b) quasi-algorithm

c) descriptor

d) algorithm

ATTITUDE QUESTIONNAIRE

Please answer the following questionnaire, your responses will be most helpful in revising and improving this instructional module.

1.- Do you think that the instruction given was enough to cover the subject areas of this module?

YES_____ NO_____

If NO:

Do you think it was too long, too short? Please expand

2.- Where any of the sections confusing?

YES_____ NO_____

If YES:

which one(s)_____

3.- Did you find sufficient directions to go through the module?

YES_____ NO_____

If NO: what part(s) need better instructions?

_____

_____

4.- Where the examples given relevant to instruction?

YES_____ NO_____

If NO: which one were not:_____

_____

_____

5.- If you were in the situation of going through this module again, would you like more examples?

If YES concerning what:_____

_____

_____

6.- Circle the word that most closely reflects your feelings:

Instruction was:

UNINTERESTING MODERATELY INTERESTING INTERESTING EXTREMELY INTERESTING

7.- Would you like to see as part of this module "enrichment readings" like relevant articles to each of the topics?

YES_____ NO_____

8.- In your opinion what was the weakest aspect of this module?

_____

_____

and the best aspect?_____

_____

9.- Where the self-test helpful? (CIRCLE ONE)

EXTREMELY HELPFUL HELPFUL IRRELEVANT EXTREMELY IRRELEVANT

10.- Would you recommend this module to other students?

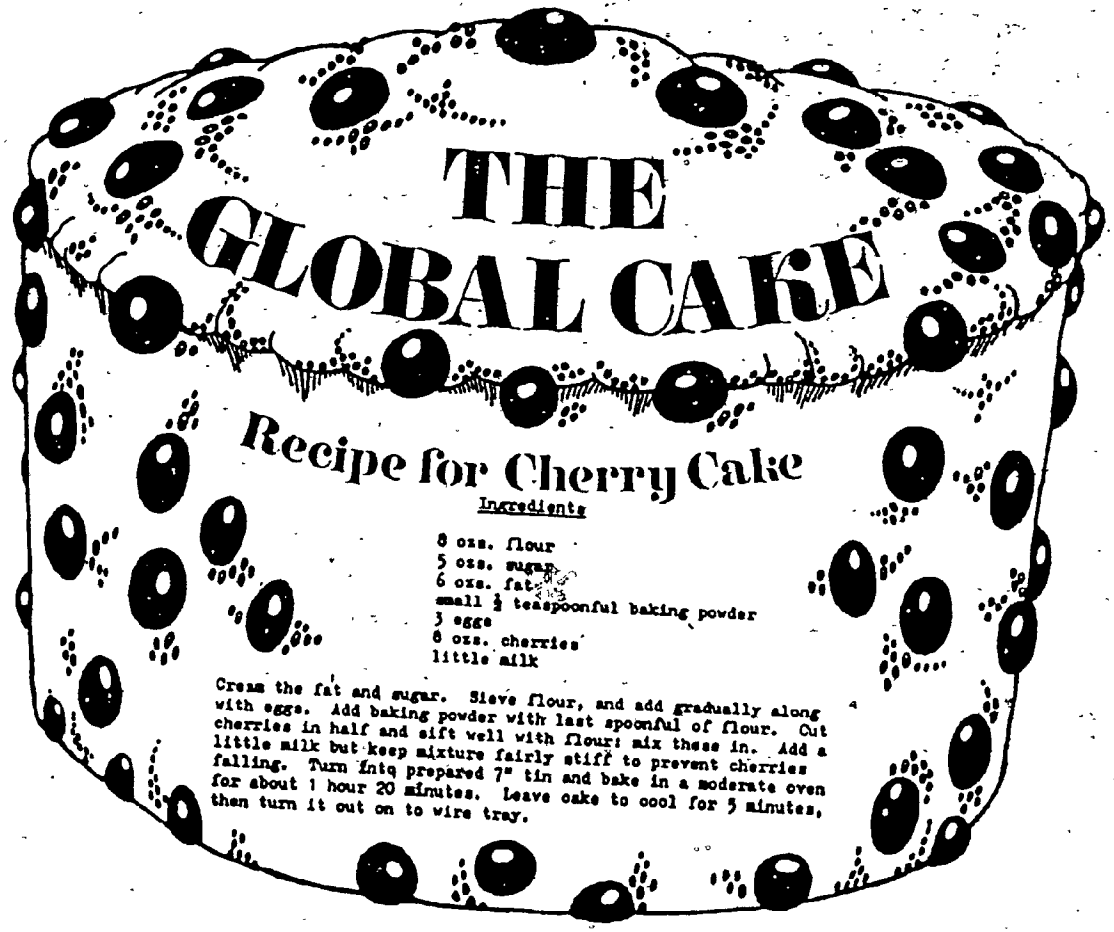
YES_____ NO_____

why?_____

_____

THANK YOU VERY MUCH FOR YOUR COOPERATION

THE GLOBAL CAKE


THE
GLOBAL CAKE
Recipe for Cherry Cake
Ingredients
8 ozs. flour
5 ozs. sugar
6 ozs. fat
small ½ teaspoonful baking powder
3 eggs
8 ozs. cherries
little milk
Cream the fat and sugar. Sieve flour, and add gradually along with eggs. Add baking powder with last spoonful of flour. Cut cherries in half and sift well with flour; mix these in. Add a little milk but keep mixture fairly stiff to prevent cherries falling. Turn into prepared 7" tin and bake in a moderate oven for about 1 hour 20 minutes. Leave cake to cool for 5 minutes, then turn it out on to wire tray.

THE GLOBAL CAKE GAME

A game for 20 - 30 players, lasting 60 - 75 minutes.

The game needs to be played in the context of studies of the world and how its peoples are all inter-dependent on each other for a life of more than mere survival.

The aim of the game is to show by symbols how that inter-action actually changes us all and how it can enrich what life has to offer. It aims also to give an experience of what it may feel like being in a group of people at a different stage of development than other groups of people and having to work harder to receive less.

The teacher will need the following items:-

1. A large sheet of paper mounted on the wall for a proposed mural with the Global Cake illustration and recipe for Cherry Cake stuck in its centre;
2. An actual Cherry Cake (hidden away) already cut into 30 pieces (plus 30 paper plates);
3. One of the seven card sheets of different ingredient templates with barter signs for each of the seven country groups;
4. A recipe of instructions for each of the seven groups;
5. 7 large signs with letters in the relevant group colours saying: CHINA, NORTH AMERICA, ASIA, AFRICA, EUROPE, SOUTH AMERICA and RUSSIA.
6. National Resources for each Country group as follows:
   (a) China: 10 or so sheets of A4 white light card; plus 2 thick card templates of arrows ½" wide, 2¾" broad, and the length of the width of this sheet of paper, so that 4 could be made from a sheet of A4;
   (b) Asia: 7 bottles of glue and some brushes;
   (c) Africa: 7 and more pictures of the blue Globe Map, with atlases available;
   (d) Russia: 7 blue pencils or blue crayons, 7 lead pencils;
   (e) Europe: One or several crayons or pencils of each of the following seven colours: yellow, red, green, brown, orange, black and white;
   (f) S.America: At least 40 sheets of grey A5 paper for making the 'products', (A5 is half the size of this sheet of paper);
   (g) N.America: 7 pairs of scissors.

   It is possible to create a handicap in the game by not having seven bottles of glue or pairs of scissors or blue or lead pencils, so that groups have to barter and borrow more from each other.

Preparation

As well as having obtained all the above items, made the two 'arrow' templates, and mounted the empty mural on the wall, the teacher now needs to arrange the desks and chairs around the room in seven groups, with the relevant signs displayed on them.

CHINA	(yellow)	- 10 chairs, card for arrows and arrow templates on desk;
ASIA	(red)	- 7 chairs, glue and brushes on desk;
AFRICA	(green)	- 5 chairs, world pictures and atlases on desk;
RUSSIA	(brown)	- 5 chairs, blue and lead pencils or crayons on desk;
EUROPE	(orange)	- 5 chairs, coloured crayons or pencils on desk;
SOUTH AMERICA	(black)	- 2 chairs, sheets of 'product' paper on desk;
NORTH AMERICA	(white)	- 2 chairs, scissors on desk.

The children come into the room and teacher lets them work in social groups, sitting in the chairs as they have been prearranged. The figures given above are for a class of thirty children; fewer or greater numbers should be distributed between groups in these proportions.

Beginnings

1. The teacher explains that the class is now going to imagine that they are to make a special kind of cherry cake together.
   The class must tease out what is needed for making a cake, thinking not only of ingredients but also of the oven, utensils, implements etc. The teacher will want to ask what happens when the ingredients are cooked, how they fuse into something new, why it is then that they are eaten and what good does that do and so forth. The purpose here is to establish that a lot of some things and a little of others are equally necessary to make the cake, that great changes occur within the inter-action of the cooking; that something new is made from the creative act of cake-baking; that without food the cooks would not be able to live.

It may be that the class has actually made a cake in an earlier lesson and this may just be a remembering process (or it may be that after this 'symbolic' lesson a cake is made) but it is important that some of those concepts above have been well talked through.

2. Now the teacher explains that our special cherry cake today is going to represent a special kind of World or Global Cake, as if all the resources of the world are like the possible ingredients of some gigantic cake and that all the peoples of the world are like an army of cooks, who not only make the cake but then enjoy eating it. The cake represents in life not only food but all the things necessary to live by, shelter, clothing, toys, machines, facilities. This may need a lot of exampling and elucidation.

3. Finally the teacher explains that if we imagine that all the millions of people in the world, the cooks, were reduced to only 30, then roughly in the proportions that they would find themselves, 10 would be Chinese, 7 would be Asian (that is West Asia, Oceania, South Asia, including India), 3 would be African, 3 would be Russian (that is including all the Russian block and East Europe), 3 would be European (that is western Europe), 2 would be South American and 2 would be North American (that includes Canada and Greenland). Those seven country areas and the colour of the peoples are going to be represented in our cake by the seven ingredients for the cake, the largest amount of ingredients needed, 8oz. flour, being represented by the country with the largest population, China and so on down to the smallest amount, the small teaspoonful of baking powder, being represented by North America.

The Game

The aim of the game is to make a wall chart of the Global Cake within half an hour. Every country has a recipe and that recipe shows what contribution of ingredients the country has to contribute to the cake.
The resources that each country has, its industries, farming, oil, metals, knowledge, facilities and so forth are represented by the scissors, paper, glue, crayons etc.
Some are raw materials (like paper) others are industries (like scissors).

The teacher now needs to go through the Instructions (Recipe) slowly, so that everyone understands. Each country must appreciate what ingredient it is representing and how its symbol, barter units and colour represent this. Countries must keep to the International Trade Agreements for exchanging their commodities/resources for the number of units stated, but 'exchanges' can be set up within that value system. Once a group has sold any of its resources then it can use the money it has gained to buy other resources that it needs to make its ingredients. Countries must decide how they first cut up their barter units. Once the game starts all decisions must come from the Countries, the teacher is not to help, only in the mounting of the 'ingredients' on the mural.

Mounting the Mural

It is suggested that the seven Globe maps, with appropriate areas coloured in, will form an outer widely dispersed ring around the edge. A Country's first arrow will lead from that to the display of the various ingredient symbols as required, then a second arrow will lead from that inner ring into the actual Global Cake itself. The third arrow will lead back from the Cake to the ingredients (because that is how they are sustained) and a fourth arrow back to the Country (because that is how its peoples are fed).

Evaluation

Once the 30 minutes are up, (and the teacher will need to give warnings of this in the last 10 minutes), then all groups must stop, whatever state they are in, and gather round the Mural to see what it looks like. They must account for why some ingredients are better mounted than others, why some may not be complete yet, why others were complete a long while ago and what those people have been doing since.
It is here that the teacher should help the group to gain insights into the different stages of development that some countries are at and how this affects what they can contribute. What was it like having a large number in a group or a small number? How did they make decisions? What organisation or leadership did they set up? What were their feelings when some knew they were handicapped and others had life very easy? The fairness or unfairness of this can be explored and suggestions made why it is so. Leisure activities, the quality of life and tourism can be discussed - what does that all depend on?

Dividing the Cake

Finally, ideally with a real cake, alternatively with a cardboard circle or thirty pieces of chocolate, the cake is ceremoniously produced, already cut into thirty pieces, as if to give one to each child. However, instead the cake is divided between the thirty pupils in the way in which the world's cake of resources is currently distributed among its peoples. This will need to be talked through, explained and reflected upon.
China, 10 players, 4 pieces; Asia, 7 players, 1¾ pieces; Africa, 3 players, ¾ piece;
Russia, 3 players, 5¼ pieces; Europe, 3 players 6¾ pieces;
South America, 2 players, 1½ pieces; North America, 2 players, 6¾ pieces.

RECIPE TO MAKE THE GLOBAL CAKE

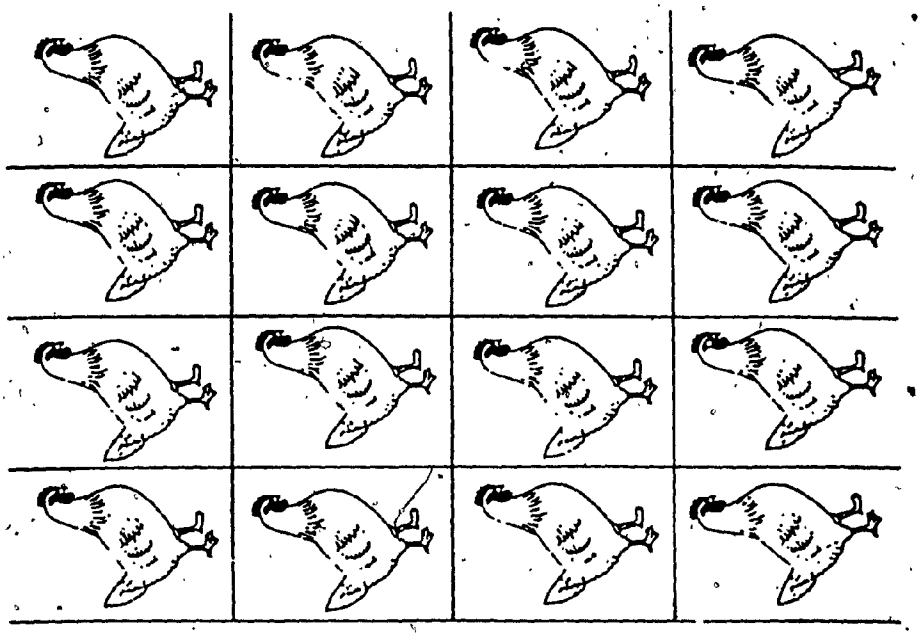
COUNTRY	POPULATION NUMBERS	INGREDIENT REPRESENTING	PRODUCTS FOR CHART	COLOUR	NATIONAL RESOURCES	SELLING PRICE
CHINA	10 players	8 oz flour	8 sheaf of corn symbols	Yellow	Card for arrows & template	4 units each
ASIA	7 players	8 oz flour	8 cherry symbols	Red	Glue and brushes	2 units each
AFRICA	3 players	6 oz fat	6 grass/vegetation symbols	Green	World pictures	2 units each
RUSSIA	3 players	5 oz sugar	5 cane sugar symbols	Brown	Blue & lead pencils	6 units each
EUROPE	3 players	3 eggs	3 chicken symbols	Orange	Coloured crayons	4 units each
SOUTH AMERICA	2 players	little milk	1 cow symbol	Black	Paper for products	2 units each
NORTH AMERICA	2 players	baking powder	1 tin of baking powder symbol	White	Scissors	6 units each

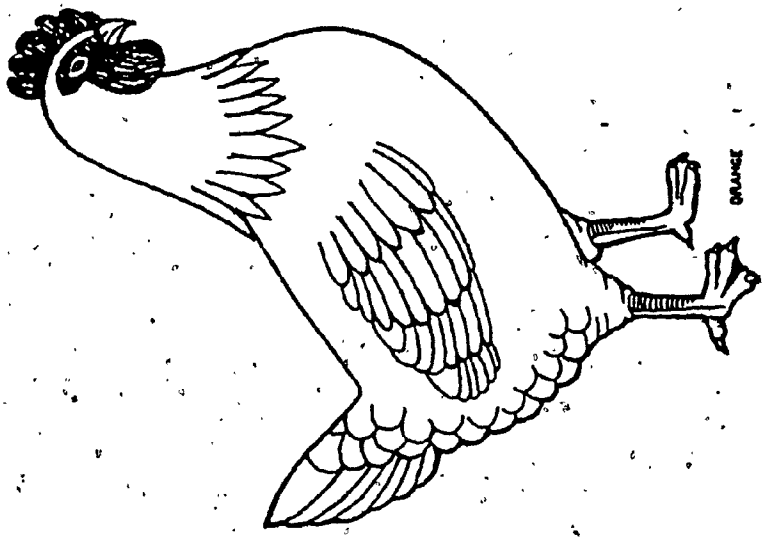
THE MAKING OF THE CAKE - THE MURAL

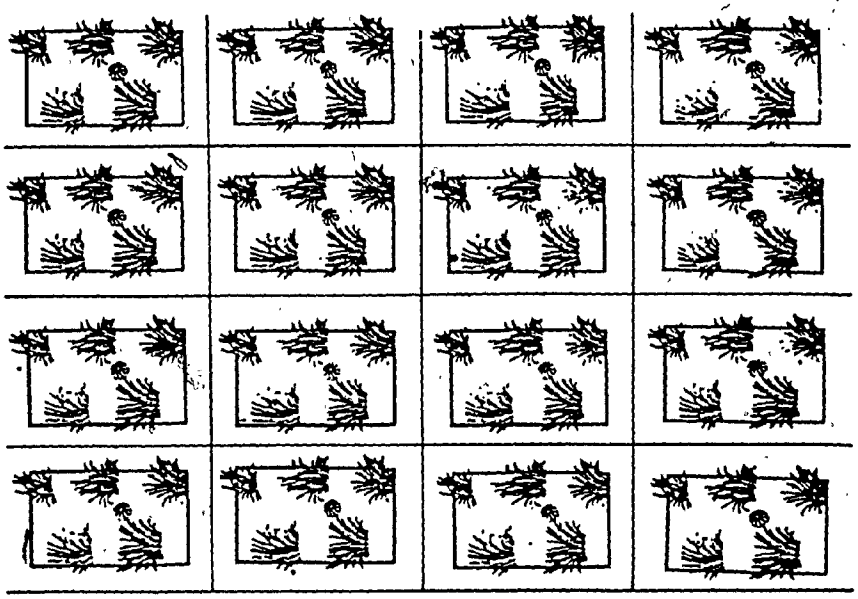
All countries start with a sheet containing one large country symbol and 16 barter units, plus its National Resources within the time limit given, each Country has to:-

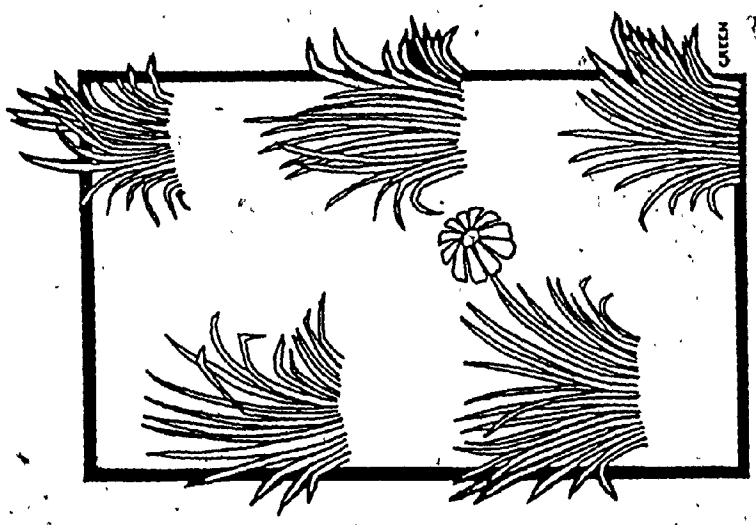
1. Obtain a Globe map and colour in your Country's area with the colour of the country;
2. Obtain sufficient card and using the template, make four arrows which must be coloured blue;
3. Obtain sufficient paper to make the required number of 'products' for the chart (see column 4 above).

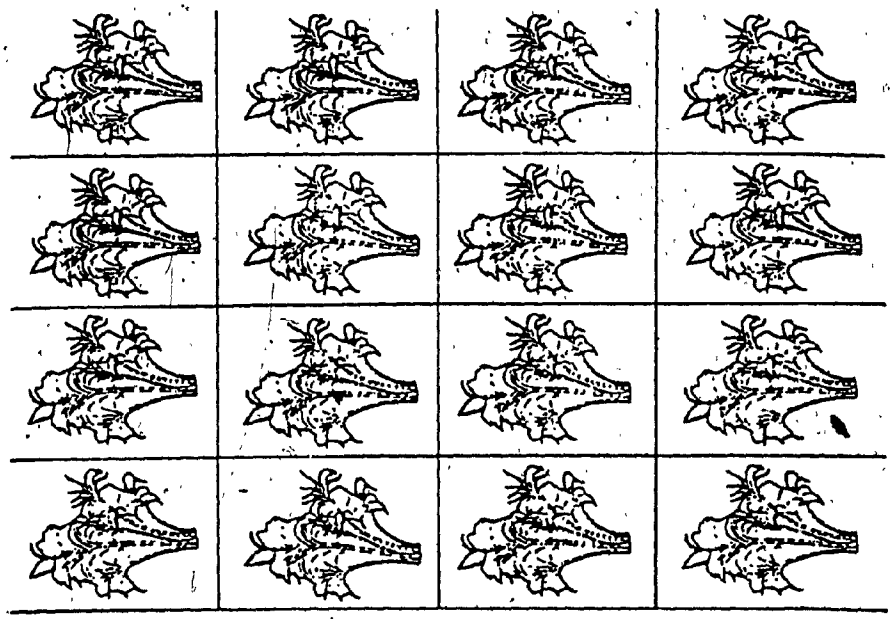
   To make these products you must cut out your symbol to make a template of it, then with a pencil trace around it on the sheets of paper; these must then be cut out. Each 'product' must then be filled in with all the details of the symbol and coloured neatly the country colour. If you have time this should be most carefully undertaken.
4. When all is complete, obtain some glue and under the directions of the teacher all your items must now be stuck attractively onto the Mural. Your contribution to the cake is then complete.
5. Now you have time for leisure. By buying and selling different resources you can try to gain as many barter units (your wealth) as possible. Also, using your resources and buying and selling, you could make other, new products, either for your own use, or to sell to other countries who are enjoying their leisure. Be ingenious.. You can also go visiting and watch other people at work, perhaps making appropriate comments as tourists.

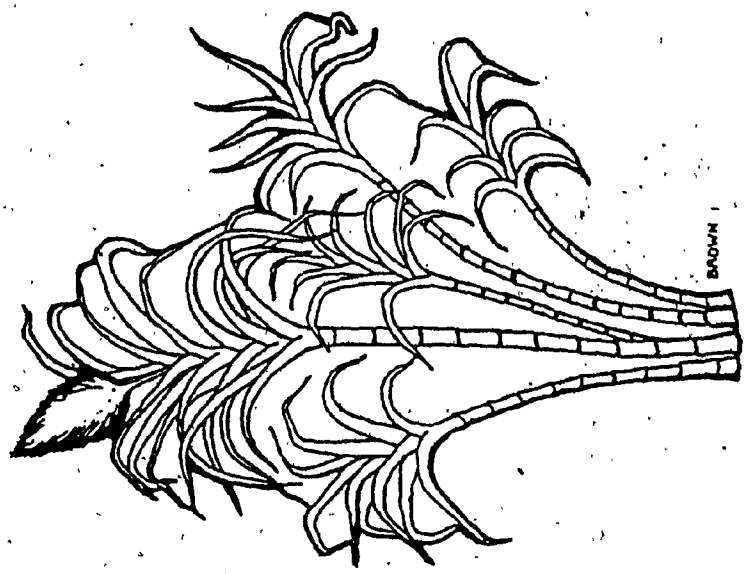


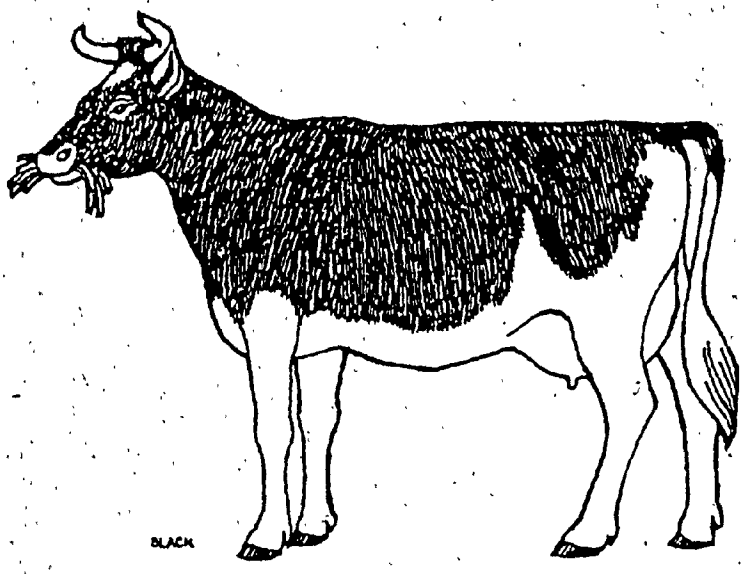

ORANGE



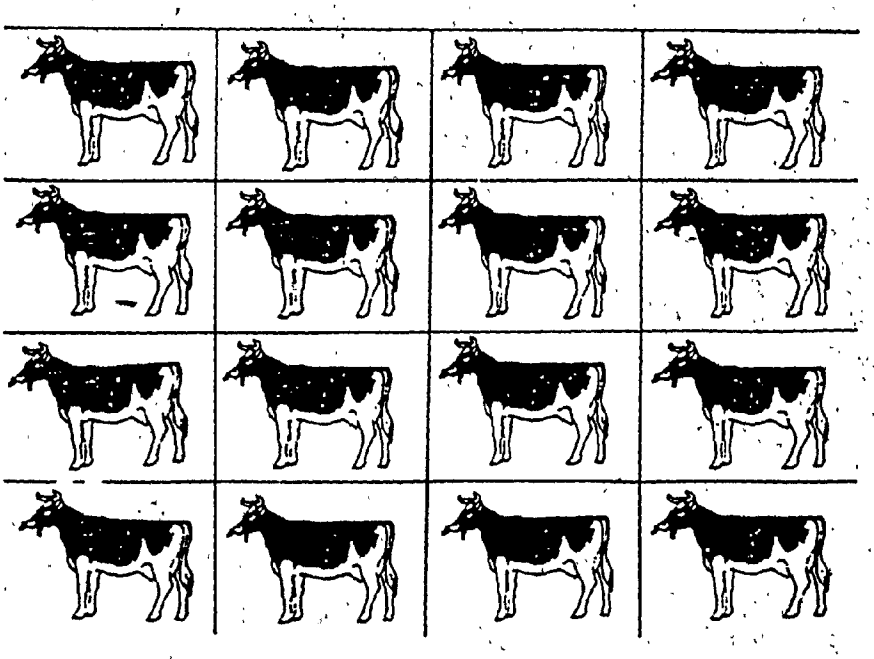

SEEN



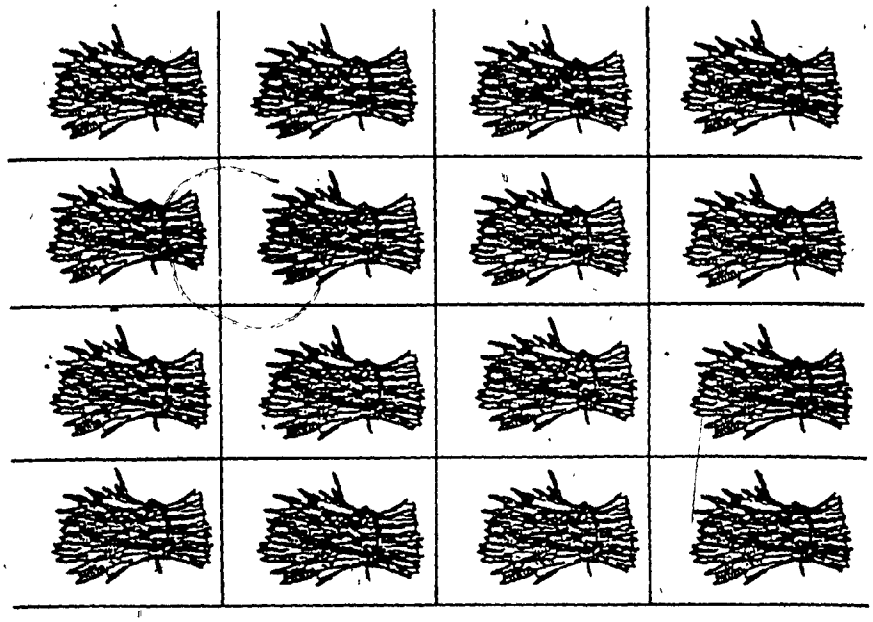

BROWN

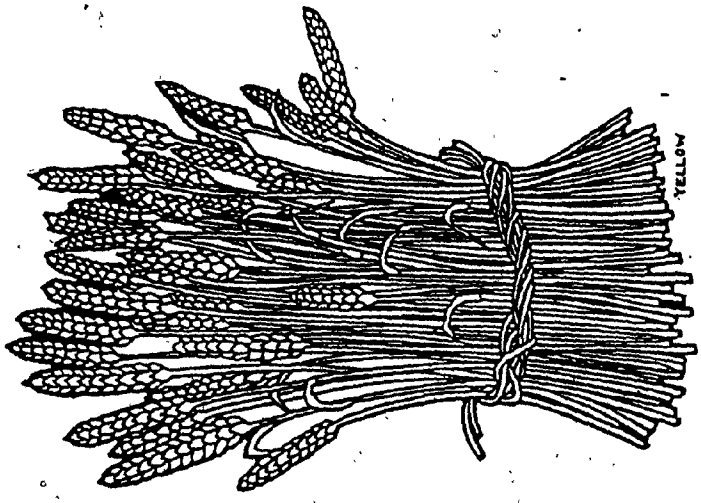


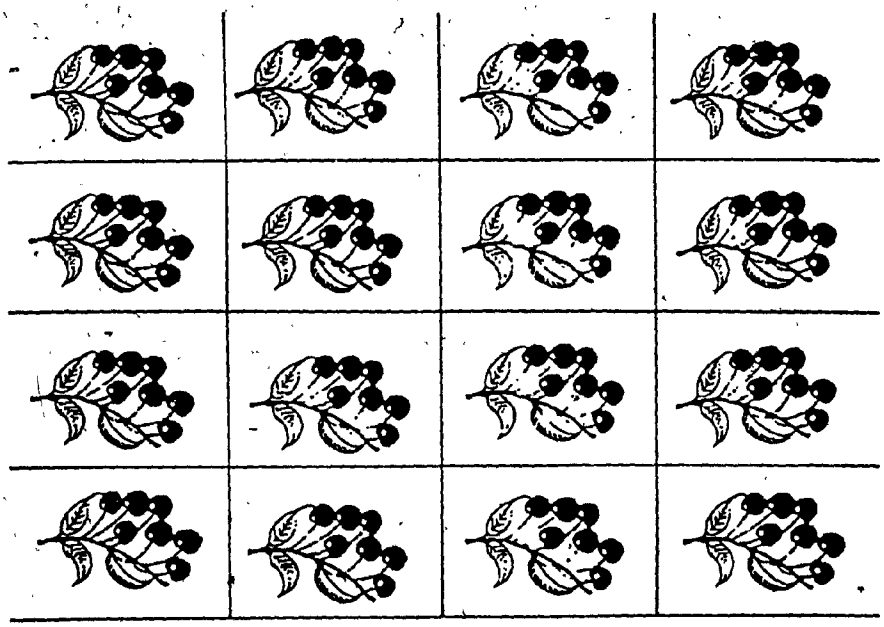
BLACK

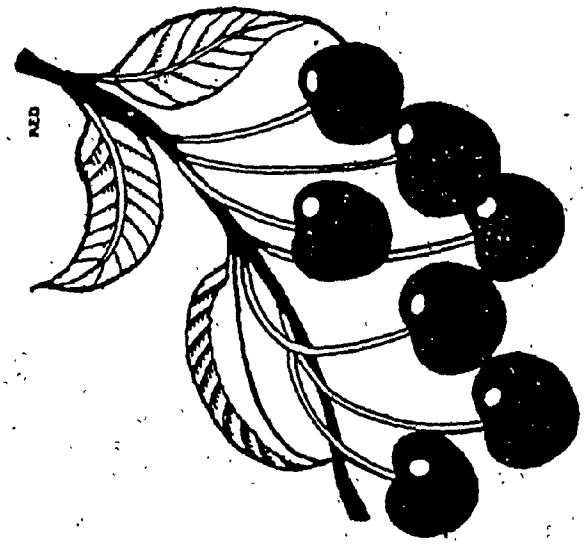



Baking
Powder
WHITE
Baking
Powder




YELLOW





APPENDIX 3

CORRECTIONS TO THE MODULE (FROM ONE-TO-ONE EVALUATION)

SELF - EVALUATION

In a separate piece of paper, select the correct response for each question in the following questionnaire. Please do not write in this manual, use the answer sheet provided.

1. On your answer sheet, write the contrasting attributes of the two programming styles.

a) Size of step, or amount of material:

LINEAR: _____

_____

INTRINSIC: _____

_____

b). "Events" following a correct response:

LINEAR: _____

_____

INTRINSIC: _____

_____

c) "Events" following an incorrect response:

LINEAR: _____

_____

INTRINSIC: _____

_____

The following checklist, will assist you in a later exercise, in which you will evaluate a piece of programmed instruction.

APPRAISAL CHECKLIST

PROGRAMMED MATERIALS

- LIKELY TO AROUSE STUDENT INTEREST
- CONTENT ACCURATE
- STRUCTURE IS "LEAN" *
- CRITERION FRAMES (TEST ITEMS) PARALLEL TO OBJECTIVES
- RELEVANT PRACTICE
- LEARNER RESPONSES REQUIRE THOUGHT
- FEEDBACK WELL DELIVERED
- FEEDBACK PROVIDES REMEDIATION
- VALIDATION DATA

* strictly essential information is given (i.e., the smallest amount of absolutely relevant information.

	BEHAVIORISTIC APPROACH	COGNITIVE APPROACH	HUMANISTIC APPROACH
MAJOR ASSUMPTIONS	explanation, prediction, and control of behavior.	organization of knowledge, information processing, and decision making behavior.	effective, (emotional) aspects of human behavior.
RELATED LEARNING THEORIES	reinforcement theory	Bruner's cognitive developmental theory Lenda's theory of instruction	Montessori's learning theory.
RELATED TECHNOLOGIES OF INSTRUCTION	programmed instruction.	simulations and gaming. instructional algorithms.	Montessori's teaching method.

This classification does not imply, by any means, that no other learning theory might be reflected in some way in the technologies covered.

Below you will find descriptions of six commercially available materials. Read each one carefully and decide wether the item described could be classified as an Instructional Simulation (IS), an Instructional Game (IG), an Instructional Simulation/Game (ISG), or a Game (G). Use only one descriptor (ie., IS, IG, ISG, or G) per material described.

1. High school students learn anthropological concepts and archeological techniques by playing DIG. The class is divided into two teams. In phase I, each team creates its own civilization with specific details of government, religion, and economy. In phase II, members of the team create artifacts to "excavate" each other's sites using standard archeological procedures and simulated museum forms. In the final phase, both teams explain their findings to each other and see how accurately they reconstructed the "past". At the conclusion, students cooperatively evaluate their performance and the project.

2. To play ELEMENTS one should have some previous knowledge of chemical elements. This activity gives you practice in ordering the elements by means of a board and different tokens with chemical symbols on them. Players begin with equal number of tokens. Through a series of moves, they attempt to order all the elements. The first player to do so is the winner.

3. TEACHING PROBLEMS LABORATORY is an elaborate activity package for preservice and inservice teacher training. It consists of 11 sound films and other materials to create a hypothetical school setting. The trainee receives student record folders, faculty handbook, curriculum handbook, sociograms, and other documents to create a strong feel for the imaginary school. The trainee is presented with a problem he has to solve within the role of a fifth grade teacher. There is no planned interaction among different players during these activities.

CONCLUSION

This module has introduced you to the notion of a Technology of Instruction. Through the examples given, we have seen how different learning theories merge with technological innovations in an attempt to mediate and improve the instructional process.

Something we should keep in mind is to look at these technologies and try to fully understand them, looking at their theoretical basis, assumptions and principles, as well as their implications, before trying to implement them. Succesful use of a technology of instruction, and the results we may obtain thereof, are subject to our ability as designers, instructors or trainers to apply them in the appropriate situation and in the appropriate way.

These technologies have sometimes received a distinctive name (like educational simulations or instructional algorithms); some are inherently attached to a particular learning theoretician (like linear programmes are with Skinner's behaviorism, or Montessori's teaching method with the humanist approach to learning); and for some others, their emergence is clearly related to the availability of some technological innovations (like branching programs with computer aided instruction). It is important to realize that neither the first nor the last situation is essential for something to be called a technology of instruction: they may not have received a distinctive name, and they may not be attached to any particular technological application. All of them, however, rely in some way or other in learning principles; all of them, as well, are intended to help in instructional processes.

You are now encouraged to turn to the Resource Section to look for further information on the topics covered in this introductory module.

ANSWER SECTION

REINFORCEMENT THEORY AND PROGRAMMED INSTRUCTION

Compare your answer for question #1 with the following, keywords are underlined. Either these words, or an equivalent should be present in your response.

1.- Contrasting attributes of the two programming styles:

a) Size of step, or amount of material:

LINEAR: very small amounts of information are representative of Linear programming; one or two sentences are presented before a response is required.

INTRINSIC: Larger amounts of information are given in an Intrinsic program; a paragraph or even a page of iformation is given before a response is required.

b) "Events" following a correct response:

LINEAR: Reinforcement (feedback) is given to the student and new information presented.

INTRINSIC: Reinforcement (feedback) is given to the student and new information presented.

c) "Events" following an incorrect response:

LINEAR: the same material is presented again to the student, until the correct response is given.

INTRINSIC: remedial material and feedback is given to the student.

2.- b

3.- FALSE

4.- FALSE

ATTITUDE QUESTIONNAIRE

Please answer the following questionnaire, your responses will be most helpful in revising and improving this instructional module.

Mark your response to each statement with an "X" at the appropriate point on the scale.

1a. How difficult was the instruction?

TOO EASY AVERAGE TOO DIFFICULT

b. Where was it too easy or too difficult?_____

_____

2a. How was the length of the instruction?

TOO SHORT O.K. TOO LONG

b. Where was it too long or too short?_____

_____

3a. Was the information clear or confusing?

CLEAR NEUTRAL CONFUSING

b. Where was it confusing?_____

_____

4. How was the vocabulary in the lesson?

TOO SIMPLE O.K. TOO COMPLICATED

5a. How were the directions?

CLEAR AVERAGE CONFUSING

b. Where were the directions confusing?_____

_____

6. How were the examples given?

TOO FEW ABOUT RIGHT TOO MANY

7. Did the examples hold your interest?

YES, INTERESTING O.K. NO, BORING

8a. How were the test questions?

CLEAR O.K. CONFUSING

b. Where were the test questions confusing?_____

_____

9. How did you find the "Resource Section"?

USEFUL O.K. USELESS

10. Any other general comments? Write them below.

_____

_____

_____

_____

_____

SUGGESTIONS FOR FURTHER READING.

PROGRAMMED INSTRUCTION:

Teaching Machines and Programmed Learning, edited by Arthur A. Lumsdaine and Robert Glaser (Washington, D.C.: National Education Association, Division of Audio-Visual Instruction, 1960). This is a collection of papers, including the famous articles by Skinner of 1954 and 1958, and a generally good introduction to the state of the art at the end of the 1950's.

The Learning Process and Programmed Instruction, by Edward J. Green (New York: Holt, Rinehart, and Winston, 1962) is an easy to read introduction to the Skinnerian approach to programming.

Applied Programed Instruction, edited by Stuart Margulies and Lewis D. Eigen (New York: Wiley, 1962). This is a collection of papers.

A Guide to Programmed Instruction, by Jerome D. Lysaught and Clarence M. Williams (New York: Wiley, 1963). This is a general introduction.

From the three programed introductions to programed instruction mentioned below, the first two are in linear form, the third in intrinsic programming in the style of N.A. Crowder.

A Programed Primer on Programing, by Susan M. Markle, Lewis D. Eigen, and P. Kenneth Komoski (New York: The Center for Programed Instruction, Inc., 1961).

Programed Instruction: A Manual of Programing Techniques, by Dale M. Brethower (Chicago: Educational Methods, Inc., 1963).

Explaining Teaching Machines and Programming, by David Cram (San Francisco:Fearon, 1961).

A useful book on analyzing the objectives of programed instruction- or any other kind of teaching- is Robert F. Mager's book Preparing Objectives for Programmed Instruction (San Francisco: Fearon, 1962).

The 1964 Yearbook of the National Society for the Study of Education is entitled Individualized Instruction, and is edited by Ernest R. Hilgard (Chicago:NSSE). A number of articles in this volume deal with programed learning.

Programs '63, edited for the U.S. Office of Education by the Center for Programed Instruction, Inc., (Washington, D.C.: U.S. Government Printing Office, 1963) contains brief descriptions and page-long samples of all programs known to have been available in the United States by September 1963.

Abstracts of all the research on programed instruction carried out and reported prior to Spring, 1963, are to be found in a small book, The Research on Programmed Instruction, prepared by Wilbur Schramm and published by the U.S. Office of Education (Washington, D.C.: U.S. Government Printing Office, 1964).

The Programmed Instruction Guide, was compiled by the Instructional Technology Information Center, Office of Educational Resources, Northeastern University, Boston, Massachusetts, and published by Entelek, Incorporated, Newburyport, Massachusetts, 1968. Contains an extensive list on commercially available materials.

SOME EXAMPLES OF GAMES AND SIMULATIONS UNDER SUBJECT HEADINGS

CAREERS

Framework, a newspaper format adopted by the Schools Council Careers Education and Guidance Project for its Foundation Course trial materials. Each issue contains two lesson units for thirteen to fourteen-year-olds. Decision making units include Lost Underground (Framework 3) and Thiston By-Pass and Community Election Time in Framework 5. From the project, c/o the Village College, Impington, Cambridge.

Speedcop, is a careers simulation aimed at teaching eigth important aspects of any job.

Deciding, looks at decision-making skills within the curriculum, including those relating to education, careers and leisure, on an individual and group basis. For older secondary pupils. Obtainable from Careers Research and Advisory Centre, Hobsons Press (Cambridge), Bateman St., Cambridge.

ECONOMICS

Bank Loan, sponsored by Loyds Bank, this simulation puts pupils in the position of a bank manager making decisions on loans for five clients. Good background information included. For fourteen-year-olds upwards and lasting about two hours. From Longman Group Resources Unit, 35 Tanner Row, York.

C.T. Standford and M.S. Bradbury et al. Case Studies in Economics: Projects and Role Playing in Teaching Economics Macmillan, 1971. A useful book for teachers, containing fourteen projects and role-playing case studies. Can be adapted to suit different school contexts.

Economic Decision Games, a series of booklets for upper secondary pupils dealing with a number of topics in economics. Easy to use as only paper and pencil is required and booklets can be reused. From Science Research Associates, Maidenhead, Berks.

Esso Service Station Game, large scale game dealing with the siting and operating of service stations in a new town. A whole class can participate but requires a good length of time to play. From Hobsons Press (Cambridge).

Profit and Loss, an economics board game for older secondary pupils with business studies connections. Lasts about four hours and for up to ten players. Available from Economics Association, Hamilton House, Mabledon Place, London WCI.

ENGLISH

Context, a crossword game, involving the use of parts of speech, to form sentences on a nine by nineteen square board. Simulating and amusing. Can be played at two levels, elementary and advanced. Takes under an hour for two to four players: suitable for seven years upwards. By Airfix.

Crack, a board game using coloured tiles and squares. Bonus given for achieving colour words. For eight upwards, playing time variable. By Peter Pan Playthings.

Foil, each player is dealt ten letter cards: the aim basically is to scramble other players words in three minutes. Simple rules. From six years to adult, two to four players and takes between one and two hours. By 3M.

K.R. Krupar Communication Games, Collier Macmillan, 1973. A book consisting of thirty-three English Games, for individual pupils.

My Word, printed grids with column of eleven test-word spaces of unequal letters lengths. Build up to longer words. Scoring in large numbers. Well presented. For two players from ten to adult. Time, one hour. By Gamut of Games, USA.

Storypacks, comprehensive simulation and role play material (ready to cut out) for English teachers. Two packs. One, Cokerheaton, deals with an industrial town and the second, Rushbrook, with a village. Useful for middle school pupils age nine to thirteen. From Evans Bros., Montague House, Russell Square, London WC1.

FOREIGN LANGUAGES

DOMINO QUELLE HEURE EST-IL? practice in french, of telling the time. Illustrations help to make this attractive for primary children. From European School Books, 100 Great Russell St. London WC1.

Spanish Chatter, French Chatter, this games, are a form of rummy, using graded phrase cards illustrations. For young players, eight upwards, as a reinforcement for language learning. Playing time about two hours. By Intellect Games.

GEOGRAPHY

Cities and People, the second of three units of work of the Schools Council Geography for the Young School Leaver Project, directed by R.A. Beddis and T.H. Dalton. Each theme consists of 35 units. The fifth one here involves role playing and the solution of urban problems e.g. to improve the area of Rochdale, Lancashire and plan the future growth of Washington D.C. Published by T. Nelson and Sons, 36 Park St., London W1.

J.P. Cole and N.J. Benyon New Ways in Geography Blackwell, 1969-72. Four books, for primary and lower secondary age students, which pioneered the way in using simulation and games in geography.

J.M. Haigh Geography Games Blackwell, 1975. Contains five new games, with notes for pupils and teachers, on fishing, shipbuilding, tourism, transport and new towns.

High School Geography Project, an American project started in 1961 to reliven the teaching of geography at secondary level. Makes much use of simulations.

Railway Rivals, deals with railway routes in USA, Canada and Britain. It is concerned with construction and competition between companies. For up to eight players. Oil Distribution Game deals with industrial location and is played in pairs. Takes from a half hour to two hours.' Clear instructions and cheap. Both, from D.G. \watts, 32 Eastleigh Drive, Milford Haven, Pembs, Wales.

HISTORY

Destiny, Discovery, Division, three simulations for up to a whole class of upper secondary pupils on various events in the history of the USA. The first lasts up to eight hours, the other two up to fifteen hours. From Interact, PO Box 262, Lakeside, California, USA>

Saga, an historical version of Monopoly. Values are placed on 'events' and participants have to plan their resources and strategy. For children of nine and upwards. By Epic, London.

The Workhouse Game, from the Scholls Council History and Geography and Social Science 8-13 project unit on Poverty. Pupils are divided into groups of five. Four pupils from the group are chosen to be head of a family who lived in the town about a hundred years ago. A family's circumstances are traced, with help of chance cards and the use of a board, over a period of four months. For whole class and takes two periods. Details in the project's Games and Simulations in the Classroom 1975 pp. 16-19.

MATHEMATICS

P. Epps and J. Deans. Mathematical games 1 and 2. Macmillan educational. 1972, 1976. Thirty five well design board games with a developing mathematical content. Well produced, but expensive. For primary and lower secondary age.

Numbers Up, a numerical version of Scrabble. Each player shakes fifteen numbered dice and has three minutes to build up a number sequence on a grid. By Waddington.

Commercial Games suitable for Middle and Secondary School Mathematics. A list by Peter Dean of about one hundred games and their suppliers. In Mathematics in School, March 1976.

SCIENCE

Animal Lotto. Requires primary pupils of five to ten years to match photographs to names: in three languages. Takes up to half an hour and for four players. From Educational Supply Association, PO Box 22, The Pinnacles, Harlow, Essex. CM19 5AY.

Ionics, cards which combine to make ionic formulae or equations. For two to five players aged thirteen upwards. From Science Systems, 173 Southampton Way, London SE5 7EJ and Wff 'n Proof Inc., Box 71, New Haven, Connecticut, USA.

Circuitron, a board game for teaching electric circuits. Different symbols represent cells, switches in the open position, etc. Played in groups of four. For fourteen years upwards. From Griffin and George, 285 Ealing Road. Wembley, Middlesex.

ORGANIZATIONS

Association for the Teaching of the Social Science
This Association disseminates news of teaching materials and advice on teaching methods related to the social sciences. It produces a journal The Social Science Teacher five times a year with some references to simulations. Details from the Secretary, Chris Brown, West Midlands College of Education, Walsall, Staffs.

Community Service Volunteers
237 Pentonville Road, London N1
Produces a number of community simulations games which can be obtained for an annual subscription.

Media Resources Center, Inner London Education Authority
Highbury Station Road, Islington, London N1
Produces a range of material, notably Nine Simulations (1975). These are packs of documentary material covering a variety of situations and take the form of diaries and letters. The simulations are primarily intended to give practice in communication skills.

Oxfam
274 Banbury Road, Oxford
Specialises in materials concerning the Third World e.g. Aid Comitee Game and the Poverty Game.

Shelter
Shelter Youth Education Programme, 86 Strand, London WC2
The best known simulation which has been produced so far is Tenement.

Town and Country Planning Association
17 Carlton House Terrace, London SW1
The Education Unit of the Association issues a monthly magazine with the acronym BEE (Bulletin of Environmental Education). Much relevant information. May 1972 issue was given over to games and simulations.

Youth Service Information Centre
17-23 Albion St., Leicester, Leics.
Loans (only) a number of games and simulations connected with youth service leadership e.g. Mock-Up, Decision Game and Anoton.

BOOKS ON GAMES AND SIMULATIONS

C.C. Abt Serious Games The Viking Press. N.Y., 1970.
Covers a wide field of interests, including games for disadvantaged children, for occupational training and for many areas of the school curriculum.

T. Brennan and J.E. Brown (eds.) Teaching Politics: Problems and Perspectives. BBC, 1975.
The final part of this short book deals with the application of games and simulations to a relatively new area of the curriculum.

M. Chesler and R. Fox Role-Playing methods in the Classroom. Science Research Association Maidenhead, Berks, 1966.

G.I. Gibbs Handbook of Games and Simulation Exercises E. and F. N. Spon, 1974.

P.J. Tansey and D. Unwin. Simulation and Gaming in Education.
Methuen Educational, 1969.
One of the earliest British books on the subject. It gives a good general guide to simulations at both school and teacher training levels.

J.L. Taylor and R. Walford. Simulation in the Classroom. Penguin, 1972.
A good introduction to role play, games and simulations. It contains a detailed account of six games and a useful list of some material for the classroom.

E. Berne Games People Play Penguin 1968.
Deals with the psychology of human relationships in a games context. Amusingly written but with a serious message.

M. Inbar and C.S. Stoll Simulation and Gaming In Social Science Free Press, N.Y. 1972
The majority of the book is devoted to case studies of a number of simulations. Chapter 17 deals with the problem of designing a simulation.

P.J. Tansey (ed) Educational Aspects of Simulation
McGraw-Hill. 1970.
Eleven articles by distinguished workers in the field from Britain and the Usa. Meant as a reference book rather than as a primer.

J.L. Taylor Instructional Planning Systems Cambridge U.P. 1971.
Directed towards instructional simulation in the field of urban studies.

JOURNALS

Games and Puzzles
A monthly magazine dealing with many aspects of games. The evaluation of new commercial games is a useful feature. It also carries advertisements by leading stockists. 11 Tottenham Court Road. London WI.

Programmed Learning and Educational Technology
Includes articles on simulations. Special issues devoted to the topic. Bimonthly, Kogan Page Ltd., 116A Pentonville Road. London N1.

SAGSET Journal
The journal of the Society for Academic Gaming and Simulation in Education and Training includes information on new games and helpful advice in devising them as a good section on book reviews. Published by Kogan Page Ltd., 120 Pentonville Rd., London N1.

Simulations and Games
Its subtitle "An International Journal of Theory, Design and Research" indicates its scope. It is issued quarterly by Sage Publications, 28 Banner Street, London EC1Y 8QE and Beverly Hills, California, USA.

MONTESSORI METHOD.

Montessori, Maria *The Montessori Elementary Material* Robert Bentley, Inc. 1965.

Montessori, Maria *Spontaneous Activity in Education* Robert Bentley, Inc. 1964.

Montessori, Maria *From Childhood to Adolescence* Schocken Books, 1973.

Montessori, Mario *Education for Human Development* Schocken Books, 1976.

Culverwell, E.P. *The Montessori Principles and Practice* G. Bell & Sons Ltd. 1913.

Gitter, Lena L., *The Montessori Approach to Art Education* Bernie Straub Publishing co., inc. & Special Child Publications, 1973.

ALGORITHMS AND INSTRUCTION.

Landa, L.N., Algorithmization in Learning and Instruction Educational Technology Publications, Inc. 1974.

Landa, L.N., Instructional Regulation and Control Educational Technology Pubkications, Inc. 1976.

Horabin, Ivan and Lewis Brian, Algorithms The Instructional Design Library, Educational Technology Publications, Inc., 1978.

APPENDIX 4

POST-TEST

POST - TEST

Answer the following questions by selecting the most appropriate answer. Please write your answers on this form.

1.- Which learning theory accepts the principle that human behavior is subject to certain rules, and that it can be predicted and controlled?

a) Humanism

b) Behaviorism

c) Cognitivism and Humanism

d) Behaviorism and Humanism

2.- A program in which information is sequentially arranged in small steps, each of which requiring the learner to make a response and followed by immediate feedback, would be an example of:

a) intrinsic programming

b) linear programming

c) a & b

d) none of the above

3.- One of the fundamental concepts in Skinner's theory of human learning is that of:

a) social imitation

b) discovery learning

c) reinforcement

d) none of the above

4.- Bruner's instructional theory argues for:

a) expository teaching

b) discovery-oriented learning

c) reception learning

d) objectivity and observation

5.- Which of the following would be a brief but sufficient definition of a Technology of Instruction.

a) any method involving human/machine interaction.

b) mechanical and electronic devices which promote a more effective classroom communication.

c) print and non-print media and materials which support the teacher in conveying instruction.

d) a teaching/learning pattern designed to provide reliable and effective instruction through the application of principles of human learning.

e) none of the above

6.- Instructional Simulations is particularly appropriate for use in:

a) helping learners to apply new skills to real-life use

b) teaching concepts and rules

c) introducing a new topic

d) all of the above

e) none of the above

7.- The technology of instruction that offers the <u>least</u> individualization is:

a) programmed instruction

b) instructional algorithms

c) computer-assisted instruction

d) simulation/gaming

8.- Landa's theory of instruction is mostly concerned with

a) self-actualization

b) expert performance

c) clarification of values

d) insight

9.- The theory best represented in programmed instruction is:

a) Bruner's cognitive developmental theory

b) Landa's theory of instruction

c) Reinforcement theory

d) Montessori's theory of human development

In each of the following questions, indicate whether the statement is TRUE or FALSE.

10.-	TRUE	FALSE	Negative reinforcement increases the probability of a response.
11.-	TRUE	FALSE	Feedback is only given after the student gives a correct response.
12.-	TRUE	FALSE	Discovery learning takes place when students receive materials in an organized way.
13.-	TRUE	FALSE	A game is played when one or more learners compete or co-operate for pay-offs.
14.-	TRUE	FALSE	The main objective in Montessori's method is to use a set of instructional materials specifically intended to promote children's free play.

15.- Branching students according to their responses is related to:

a) shaping

b) algorithms

c) intrinsic programming

d) linear programming

16.- When the attributes of replicability, generality and resultivity are <u>partially</u> fulfilled in a prescription, we are refering to:

a) flowchart form

b) quasi-algorithm

c) descriptor

d) algorithm

17.- Contrast the behaviorist, the cognitive and the humanist approaches using two or three distinctive characteristics.

18.- Describe a specific instructional situation where the use of instructional algorithms would be most appropriate.

19.- List three characteristics of an instructional simulation game.

20.- In the algorithm shown on the following page, identify :

domain (D)

range (R)

discriminators (DIS)

operators (OP)

entry skill (ES)

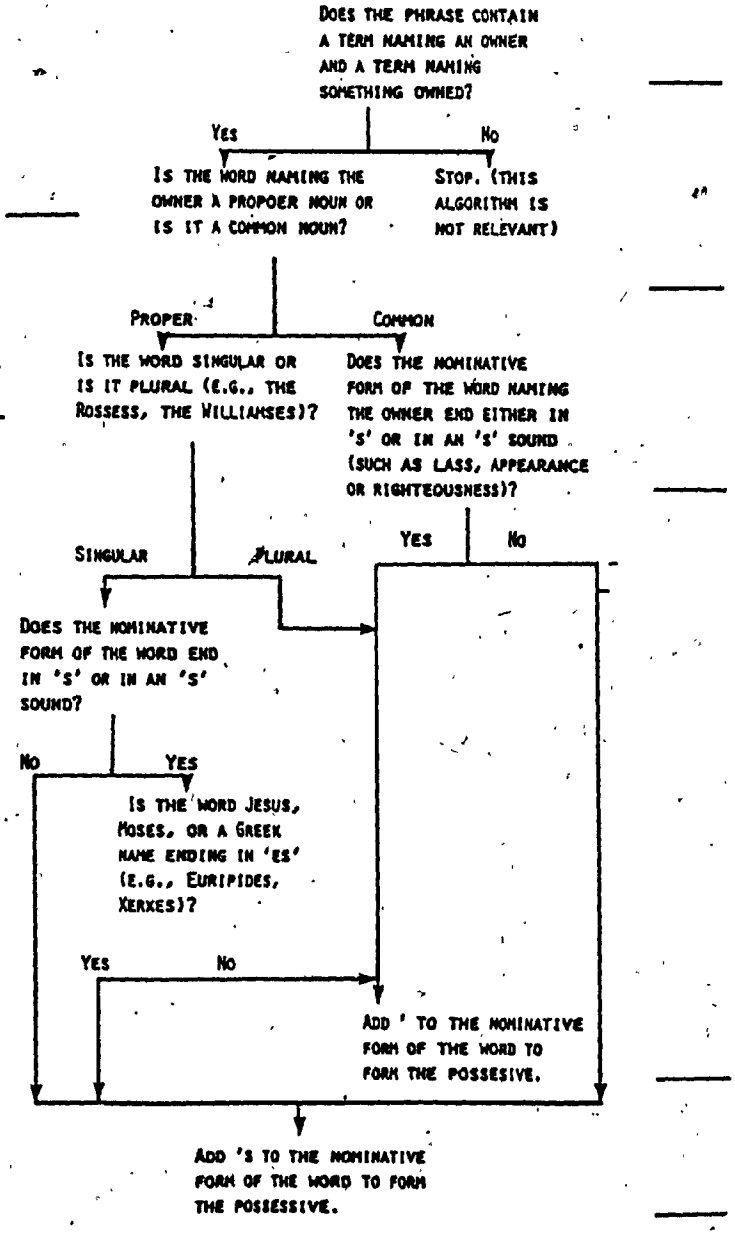
Write the corresponding letters (D, R, DIS, OP, ES) in the space given.

ALGORITHM FOR FORMING THE POSSESIVE OF ENGLISH NOUNS (GERLACH ET AL., 1977)

____ VOCAL OR SUBVOCAL EXPRESSIONS INCLUDING A POSSESIVE NOUN AND THE OBJECT OF THE POSSESION.

____ WRITTEN POSSESIVES.

____ ABILITY TO WRITE THE NOMINATIVE FORM OF A NOUN AFTER HEARING OR SAYING THE POSSESIVE FORM.



APPENDIX 5

CORRECTIONS TO THE MODULE (FROM GROUP EVALUATION)

1. INSTRUCTION.

The following should be inserted at page #9, before the paragraph on punishment.

According to De Cecco and Crawford (1974), negative reinforcement is the procedure of terminating stimuli. The stimuli which we try to terminate (noise, commercials, ugly sights, and so on) are the negative reinforcers. A negative reinforcer is a negative reward, a stimulus which gives us relief from an unpleasant state of affairs.

To be inserted at the end of page # 39:

Read the following three articles on Algorithms and Quasi-Algorithms in Education, which you will find in the library:

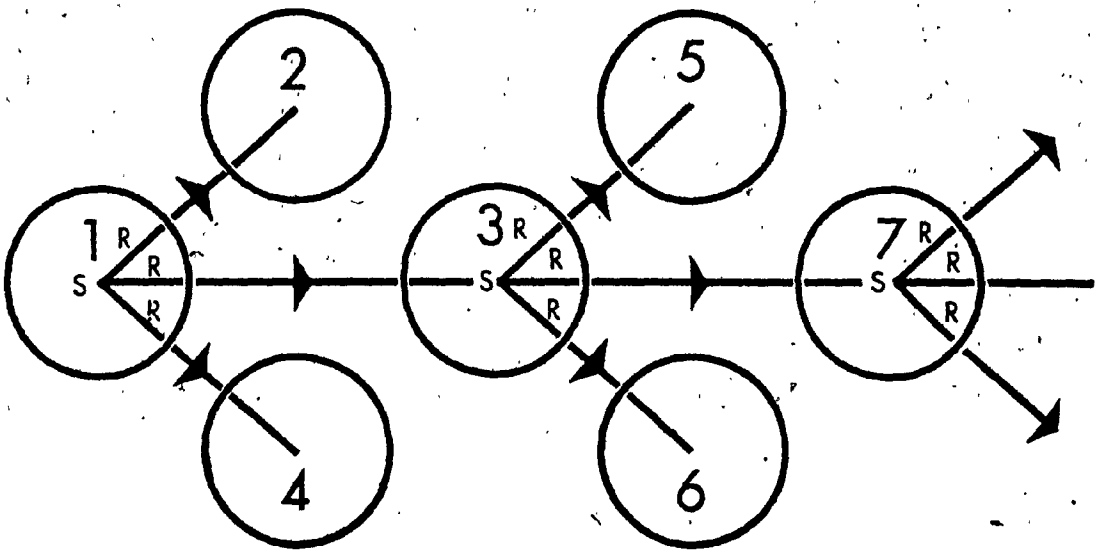
1. Coscarelli C. William, Algorithmization in Instruction. Educational Technology/February, 1978.

2. Bung Klaus and Sanchez Carrasco M.J., "Quasi-Algorithms and the Teaching of Grammar". Educational Technology/October, 1977.

3. Gerlach S. Vernon, Reiser A. Robert and Brecke H. Fritz, "Algorithms in Education". Educational Technology/October, 1977.

After reading these articles, answer the self-test which follows.

The following diagram replaces the one on page # 12:



S = STIMULI

R = RESPONSE

2. EMBEDDED TESTS.

Question #1 on page #16, should read:

On your answer sheet, fill in the blank with the attributes corresponding the two programming styles.

The following instructions should be inserted at page #29:

Turn to the answer section of this module, page #47.

3. POST-TEST.

Question #20 should be:

20. In the algorithm shown on the following page, identify at least one of the following:

- domain (D)
- range (R)
- discriminators (DIS)
- operators (OP)
- entry skill (ES)

Write the corresponding letters (D, R, DIS, OP, ES) on the space given.

4. METHODOLOGY.

In order to separate the different sections of the module, insert dividors in such a way, that the following sections will be separated:

- Introduction
- Instruction
- Answer Section
- Post-Test

5. EXAMPLES.

The following should be inserted at page # 42:

In order to complete instruction on Montessori's Teaching Method, you are required to view the film: " Montessori a Way to Grow ".
For this, you will have to call the Audio-Visual department of Concordia University at the following phone no.: 879-5974 from 9:00 AM to 5:00 PM, and book the film the day and time of your convinience.

The following should be inserted at page # 64:

With a piece of paper, cover the responses under the column "Words to be Supplied".