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THE OHIO STATE UNIVERSITY, PH.D., 1978

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THE EFFECTS OF LOCUS OF CONTROL AND PROVISION OF OVERVIEWS UPON RESPONSE LATENCY AND ACHIEVEMENT IN A COMPUTER-ASSISTED INSTRUCTIONAL SEQUENCE

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

Janie Ann Campanizzi, B.S., M.A.

* * * * * *

The Ohio State University
1978

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CHAPTER I

INTRODUCTION - PURPOSE AND OVERVIEW

Smallwood (1962) states that in most instructional systems where interaction occurs between the system and the student, both the system and the student are expected to change. The learner changes in terms of acquisition of new behaviors. The system changes by continually gaining new information about the learner and altering instructional strategies based upon information acquired by the learner. The computer-assisted instructional system maintains this capacity for diagnostic decision-making.

Stolurow (1968) suggests that in the behavioral sciences, particularly in the science of teaching, computer systems provide an effective mode for both empirical investigation and analysis of teaching processes. He defends computer-assisted instruction as a viable "laboratory" or "theory machine", as well as being a way of implementing instruction. He alludes
to the nature of the technology, which affords use of a more scientific method than is customarily utilized in an educational setting. Computer-assisted instructional development requires a formalized technique. Events must be defined and time sequences and hierarchies provided. Controls are more easily provided, and learning objectives and performance requirements must be established.

Computer-assisted instruction then presents a medium for analysis of the teaching-learning process as well as a means for instruction. If educators make wise use of this medium, then decisions with regard to instruction could rely on empirical evidence, rather than current trends or a "haphazard discard of old theory" (Stolurow, 1968, p. 68)

I. A PERSPECTIVE ON CAI

Stolurow (1968) has presented a well-developed overview of the potentialities of computer-assisted instruction. CAI is distinct from other modes of presentation in that it is potentially capable of making instruction a truly individualized process. It accomplishes this individualism through the use of a variety of media in a system of instruction.
In a computer-assisted instructional system, the computer integrates sensory and motor devices into a learner-dependent, or cybernetic instructional system. A multi-media environment can be provided for learning, using complex decision-making algorithms to adjust a learning environment to the cumulative trend of the student's responses.

In the behavioral sciences, particularly in the psychology of teaching, the use of a computer for instruction is a significant development. This is not necessarily because of any financial savings, but because of its contribution to the clarification of teaching as a set of dynamic processes. Teaching needs explanation as well as efficient implementation. A CAI system, with its capacity for more rigorous control, can be employed both as a "theory machine" or "laboratory" for evaluating instruction and as an instrument or tool for presentation. Thus, a computer employed in teaching may be used to explain theory and define effective practice.

In computer-assisted instruction the learner's interaction with the system may be registered to provide a complete record of instructional interaction. These protocols are raw data for either immediate or
later analysis, and can serve as a data base for both determining the nature of the learning process and diagnosing difficulties within the teaching strategies.

Stolurow reports that in the computer-assisted instructional system it should be possible to use any or all of the following characteristics of the learner in a contingency statement or teaching rule: a) aptitude scores; b) personality test scores; c) reading rate; d) knowledge about prerequisite information; e) immediate and delayed retention span; f) reinforcement; and g) preferences. It should also be possible to base instructional decisions on: a) the response to the last frame; b) the responses to a set of other related frames; and c) the response latencies. This should be of significance for the behavioral sciences, which have recognized that there are substantial differences in individual rates of learning.

II. NEED FOR RESEARCH

Glaser (1976) states that research on instruction should attempt to evaluate the effects of strategies which maximize the outcomes of learning for individuals. Investigators such as Gilbert (1962) relate that some
ways of organizing information may permit better memory retrieval than other ways, and as a result, facilitate the learner's capacity to learn new things on the basis of what he has already learned and to access information readily for thinking and problem solving.

Gagne' (1976) cites as one of the organizational events of instruction: informing the learner of expected outcomes. The learner is given information about the class of responses to be expected when learning is completed. He offers the following example of such an organizational event:

(The learner is beginning a lesson on reproduction.) "There are several different ways in which living organisms reproduce themselves. What you will be learning is how to describe each of these ways and to give some examples of them." (p. 306)

Gagne' suggests that such instructions may provide continuing direction to learning, where the learner establishes a set that is "carried in his head" throughout the period of learning. He then is able to reject extraneous and irrelevant stimuli.

These preinstructional events may occur in the form of pre-tests, behavioral objectives, overviews and advance organizers. The effectiveness of these forms of instructional organization needs to be investigated in a computer-assisted instructional setting, where
cost-effectiveness and efficiency are important considerations for determining instructional arrangement. A CAI environment, where capacity for control of variables is optimum, will also provide more reliable results than less formalized experimental settings.

O'Neal (1973) states that among the effects of our technological society has been the "proliferation of alternatives." This society will reward flexibility and the ability to learn, with efficient and self-directed learning a supreme life skill. As the hardware capabilities of computer technology improve for interactive systems of instruction, it is becoming possible to provide the learner with more manipulative power during the instructional sequence.

Therefore, utilization of computer-assisted instruction involves making decisions regarding the amount of learner control versus amount of program control to allow for optimization of learning. Judd (1975) cites two assumptions regarding learner control:

1) Instruction administered under learner control will be less aversive than if administered under program control.
2) The learner is sufficiently aware of his own learning state to make his own instructional decisions. (p. 2)

However, Judd states that recent research introducing greater control over the learning situation in general and over learner control options in particular has produced mixed results.

III. STATEMENT OF THE PROBLEM

There has been a limited amount of research utilizing computer-assisted instruction to evaluate the impact of instructional strategies upon the teaching-learning process. An important consideration is the identification of relevant strategies which promote optimum learning, while meeting the individual needs of the learner.

This research thus proposes to evaluate the effects of type of control and provision of expected outcomes in the form of overviews (knowledge of learner objectives) in a computer-assisted instructional sequence. The dependent variables utilized in the study will be measures of achievement gain and response latency. An investigation will also be made to determine if a significant correlation exists between response latency and achievement in the instructional sequence.
The major questions of this study are:

1) What are the effects of type of control and provision of overviews on student on-line achievement and response latency?

2) Are there relationships which exist between response latency and achievement?

IV. HYPOTHESES

The objective of this study is to investigate the effects of two independent variables, type of control and provision of overviews, on computer-assisted learning. Two different methods of control, each paired with provision of overviews or no provision of overviews will be investigated.

The treatment conditions developed are the following four computer-assisted instructional sequences:

- LCOB - Learner control with objectives
- LCNOB - Learner control with no objectives
- PCOB - Program control with objectives
- PCNOB - Program control with no objectives

Both a primary and a secondary hypothesis will be tested. The primary hypotheses will use achievement and response latency measures as indicators of the effectiveness of the instructional strategies. The secondary hypothesis will be used to determine if a
relationship exists between the latencies of correct and incorrect responses on a post-test of the instructional sequence.

**Primary Hypotheses**

The primary hypotheses are expressed as null hypotheses and deal with time relationships and measures of learner on-line performance.

Learners experiencing a CAI sequence will perform the same as measured by achievement gain and response latency under four experimental conditions:

1) when the learner has control over taking review sequences and is provided with the objectives of the CAI sequence (LCOB);

2) when the learner has control over taking review sequences but is not provided with objectives (LCNOB);

3) when the program controls whether the learner receives the review sequences and the learner is provided with objectives (PCOB);

4) when the program controls whether the learner receives the review sequences, but the learner is not provided with objectives (PCNOB).
Secondary Hypothesis

There is a negative correlation between the latencies of correct responses and the latencies of incorrect responses on a post-test of the instructional sequence. Correct responses will generally have shorter response latencies than incorrect responses.

V. IMPORTANCE OF THE STUDY

This study will help contribute information toward research on instruction in several areas.

Identification of Important Indicators of Internal Learning States

Dennis (1975) has commented that while computer-assisted instructional programs are presently sensitive to overt responses by the learner, there are limitations as to the basis for making instructional decisions. However, if predictors of internal learning states could be developed and utilized in an effective manner, the immediate needs of the learner could be responded to in a more adaptive response dependent fashion. This study will attempt to investigate variables which are sensitive predictors of internal learning states.
Determination of the Effectiveness of Instructional Strategies

This study will assess the effectiveness of two independent instructional variables. Contributions will be made to current research efforts in providing a cumulative body of information towards developing a science of instruction.

Promotion of Computer Technology as a Workable Medium for Educational Research

The uses of the computer as a laboratory tool in education are becoming more obvious. Table 1 contains a listing of main fields of investigation in education (LPI Report, 1973). Table 2 presents ways of using a computer for educational research. While it can make possible dynamic learning experiences permitted by no other medium, computer technology also allows for controlled scientific experiments to assess instructional systems and methodologies. Thus, it enables promoters and users to form a realistic grasp of the systems' instructional value. This study will attempt to support the functions of computer technology in this research capacity.
TABLE 1

FIELDS OF INVESTIGATION IN EDUCATION

<table>
<thead>
<tr>
<th>Research on learning theory</th>
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<tbody>
<tr>
<td>-- model development</td>
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<td>-- model or theory verification</td>
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<tr>
<td>-- application of models to concrete situations</td>
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<tr>
<th>Research on factors influencing learning</th>
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<tbody>
<tr>
<td>-- influence of social and motivational factors</td>
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<tr>
<td>-- individual characteristics of the learner</td>
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<td>-- environmental factors</td>
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<tr>
<th>Research on organization and teaching techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>-- effectiveness of various media</td>
</tr>
<tr>
<td>-- comparison of media</td>
</tr>
<tr>
<td>-- relation between learning processes and instructional sequences</td>
</tr>
<tr>
<td>-- effects of reinforcement and feedback</td>
</tr>
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**TABLE 2**

WAYS OF USING A COMPUTER
FOR EDUCATIONAL RESEARCH

<table>
<thead>
<tr>
<th>Information banks</th>
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</thead>
<tbody>
<tr>
<td>-- gathering empirical data</td>
</tr>
<tr>
<td>-- storage of information</td>
</tr>
<tr>
<td>-- testing aid</td>
</tr>
<tr>
<td>answer processing</td>
</tr>
<tr>
<td>test generation</td>
</tr>
<tr>
<td>item analysis</td>
</tr>
<tr>
<td>individualized testing</td>
</tr>
</tbody>
</table>

**Instructional management and development**

| -- computer-assisted instruction |
| simulation and gaming |
| drill and practice |
| tutorial |
| problem solving |
| inquiry |

| -- computer-managed instruction |

**Statistical analysis of data**
VI. DEFINITION OF IMPORTANT TERMS

**Response Latency**

The amount of time elapsing from the time a question frame is displayed until the learner makes an overt response to the associated frame by depressing the RETURN key on the computer terminal. Response latency is measured in units of seconds through use of an internal clock of the computer.

**Learner Control**

There is a lack of consensus as to a specific definition of learner control. Within the context of this investigation, the learner control mechanism will provide the learner with decision-making capacities regarding branching options within the instructional sequence.

**Program Control**

Decision-making capacities regarding branching options within the instructional sequence are not
relegated to the learner. Rather, a decision factor is programmed into the sequence itself, with no option given the learner relative to the inception of branching.

**Informing the Learner of Expected Outcomes**

Communication which informs the learner about the type of performance he will demonstrate after he has learned. In this study, informing the learner of expected outcomes occurs by provision of pre-instruction overviews (learning objectives).

**Achievement Score**

Percentage of correct responses by the learner on an on-line test of the given instructional sequence.

**VII. LIMITATIONS OF THE STUDY**

The results of this investigation should not be generalized to types of learner control or program control strategies other than those which are utilized in the experiment. Control of branching is a common provision in development of computer-assisted learning
sequences. However, there are numerous branching options which may be provided within a sequence. This study investigates one of many possible options.

Since there are several ways of developing pre-instruction organizers, no generalizations can be made to advance organizers other than those developed for the subject matter employed in this study.

This study will utilize stimulus materials designed to elicit specific types of learning. The results cannot be generalized to learning types not utilized in this investigation.

VIII. SUMMARY

Development of a science of teaching and provision for the individual differences of learners are important priorities of education today. Computer-assisted instruction presents an excellent medium for realization of optimization of individualization in the instructional process. Computer-based educational technology also presents itself as a viable laboratory for the evaluation of the effectiveness of instructional strategies. Thus, important functions are served by the employment of computer technology in education.
This study will attempt to investigate the effects of two instructional strategies—objectives and type of control—and to determine their effect on student on-line achievement and response latency. This investigation will also focus upon relationships which may contribute to a greater understanding of factors affecting retrieval of information by the learner, and add to the cumulative body of knowledge regarding the teaching-learning process.
CHAPTER II

REVIEW OF THE RELATED LITERATURE

Effective instructional strategies or schema for providing for individual differences of learners should be predicated upon careful scientific educational investigations. The investigator desires to manipulate independent variables to create treatment conditions while controlling for extraneous variables. Computer-assisted instruction, with its attendant capabilities for complex on-line instructional interactions, provides high potential for systematic and controlled educational experiments. The present study is implemented in a computer-assisted instruction (CAI) setting.

In this chapter, research related to topics dealing with variables relevant to this investigation will be reviewed. The chapter is organized into four sections: 1) research on response latency; 2) research on learner control of instruction; 3) research on pre-instructional strategies; and 4) research on educational media and technology.

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I. RESEARCH ON RESPONSE LATENCY

Judd and Glaser (1960) studied response latency as an indicator of associative strength or degree (depth) of learning. They suggested using measures of response latency as a possible basis for instructional decision-making in CAI. Paired-associate learning was the medium of investigation in their study.

Findings suggested that the magnitude and variability of latency measurements were not dependent on training method during the acquisition phase of learning. But both magnitude and variability were reduced by the recall criterion during overlearning. Latency was an increasing function of the number of response alternatives during both the acquisition and overlearning phases.

During acquisition, prior to the trial of last error (TLE) for each item, latency remained relatively constant and did not differ between correct and incorrect responses. However, the study suggests that latency in a rote verbal task may be a sensitive measure of strength of learning during the overlearning phase.

Judd and Glaser suggest that measures of response latency may serve as indicators of performance. They state, however, that the nature of the functions
relating the students' responses to optimal presentation schemes is not well known.

The common behavior measure employed in performance evaluation is frequency of responses. Frequency measures may lose their sensitivity as response probability approaches an asymptote. It is desirable that the student retain what he has learned, and it is known that retention is a function of degree of learning (Judd).

Judd and Glaser further elaborate that response latency may be useful as a supplement to frequency measures, latency being easily measured in computer-assisted instruction. However, conditions contributing to variability in response latency measures need to be identified.

Merrill (1974) studied the effects of the availability of objectives and/or rules on the learning process. Response latency measures were used as a dependent variable. In this study, a comparison of display latency and test-item response latency revealed that objectives either increased or had no effect on display latency, but significantly reduced test-item response latency.

Merrill suggests that the reduced test-item response latency was affected by the presentation of
objectives. These objectives facilitated the efficiency and effectiveness of the subject's information processing and affected his performance on the test items.

In a later study, Judd, et.al. (1973) undertook an examination of the relationships between response latency during paired associate learning and the subsequent retention in a computer-assisted instruction program. It was found that good retention subjects demonstrated substantially longer latencies during acquisition than poor retention subjects.

The results also supported a hypothesis that good retention subjects would demonstrate a sharper decrement in latency during overlearning. The hypothesis that good retention subjects would have a shorter mean latency during overlearning than would poor retention subjects was not supported. The comparative latencies of correct and incorrect items were also examined in this investigation, but no significant differences were found between the two types of items.

Judd poses some questions for future research of response latency:

1) Can the degree of retention be controlled by training to a latency criterion?
2) Do response latencies reach a stable asymptote and if so, does this asymptote have any implications for retention?

3) How does latency change over the course of learning in more complex tasks, such as concept formation?

4) Do latency measures have utility for instructional decisions? (Judd, 1969, p. 29)

II. RESEARCH ON LEARNER CONTROL OF INSTRUCTION

In a paper in 1973, O'Neal defends learner controlled instruction (LCI) as a means for developing the self-directed learners required by modern society. He describes the TICCIT computer-assisted instructional system at Brigham Young University used to field-test an LCI program in which learners control instructional variables. Table 3 provides a partial list of variables which a learner control system may provide the learner. In the TICCIT system, the learner can exercise control over the majority of these variables.

McCann (1973) compared a student option versus program controlled CAI training with Navy trainees. The two instructional strategies employed as training conditions were student selection of training and
<table>
<thead>
<tr>
<th>TABLE 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEARNER CONTROL VARIABLES</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>pacing</td>
</tr>
<tr>
<td>sequencing and organization</td>
</tr>
<tr>
<td>mode (inquiry, tutorial, practice, etc.)</td>
</tr>
<tr>
<td>difficulty level</td>
</tr>
<tr>
<td>depth of instructional interaction</td>
</tr>
<tr>
<td>media selection</td>
</tr>
<tr>
<td>resource selection</td>
</tr>
<tr>
<td>prompting or advice</td>
</tr>
<tr>
<td>evaluation and feedback</td>
</tr>
<tr>
<td>graphics support</td>
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<tr>
<td>memory support</td>
</tr>
</tbody>
</table>
program control of training. No significant differences in post-test performance or training times were found.

Seidel (1975) employed a study designed to test the effects of learner control at the level of instructional sequencing within a self-contained tutorial course, administered by an adaptive computer program. The CAI instruction, a COBOL course, employed the learner control variables of remedial activity, acceleration and sequencing of topics. Results of the study showed significant main effects for sequencing of topics, with post-test achievement scores as the dependent variable.

Seidel noted that:

"the key to optimal allocation of learner controls in the instructional decision process would be for basic research in human learning to a) identify those components of strategy selection and use of which students are capable b) relate these components to individual characteristics and c) determine where program control can or cannot handle the same components." (Seidel, 1975, p. 10)

Student control of sequencing in a computer based electronics training course was investigated by Lahey, Hurlock & McCann (1973). A study was devised to investigate student controlled or program controlled sequencing (branching) and also to test the effects of
remediation using a no-remediation control group. Results showed no significant differences between branching conditions or remediation conditions for training time or final exam performance.

Other studies (Slough, Ellis & Lahey, 1972; Hurlock, 1972) demonstrate that computer based training programs which incorporate adaptive sequencing are superior to fixed sequence programs. In linear or fixed sequence programs, the learner is required to receive exposure to every training frame.

A study was made by Fisher, et.al. (1974) to determine whether children allowed to choose the difficulty levels of their arithmetic problems in a computer-assisted instruction task would show greater engagement in learning than children not given the choice. Although the choice group was significantly higher in engagement, the findings also showed that children chose problems that resulted in poor academic performance.

Judd (1975) posited two assumptions in support of learner-controlled computer-assisted instruction.

1) Learner controlled instruction is less aversive than instruction administered under program control.

2) The student is sufficiently aware of his state of learning to make his own instructional decisions.
Judd exposed subjects to a CAI module in which one group of subjects received an option to view subject material (pictures), while a second group always viewed the material. The subjects receiving the treatment elected to see the pictures at a mean request rate of .98. Performance between the two groups did not differ significantly. It was concluded also that learner control over a facilitating treatment did not reduce state of anxiety. In addition, the subjects' ability to use learner control effectively appeared to be a function of personality traits as well as cognitive skills.

III. RESEARCH ON PREINSTRUCTIONAL STRATEGIES

In a recent article by Hartley and Davies (1976), four preinstructional strategies are reviewed: pre-tests, behavioral objectives, overviews and advance organizers. The concepts are defined, research findings are reviewed, and procedural guidelines are developed to summarize the results.

Sequencing and organization of subject matter tend to affect not only what students learn, but their attitudes toward the importance and beneficaiity of what is presented. Thus, procedures that enhance the
organizational capacities of the learner are likely to facilitate the learning of more meaningful material. Table 4 summarizes the above mentioned four pre-instructive strategies as defined in the Hartley and Davies article.

**Pre-tests**

A number of studies have been carried out investigating the effects of pre-test performance upon post-test performance. In studies by Hartley and Holt (1970), Miller and Krautheim (1970), and Apter and Boorer (1971), pre-test effects have not been discernible. In some studies, pre-test effects have been notable. Hartley, Holt and Swain (1970) observed specific effects — that is, on pre-test items which were the same as post-test items, subjects receiving the treatment scored higher than control subjects, but not on post-test items not previously seen. Lumsdaine (1963) and Warr, et.al. (1970) observed generalized effects for pre-tests. Treatment subjects scored highest on post-test items previously seen on the pre-test, but also higher on other items than did control subjects. Bloomer and Heitzmann (1965) observed that pre-tests have an adverse effect on post-test performance.
### TABLE 4

**PREINSTRUCTIONAL STRATEGIES**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pretest</strong></td>
<td>Any set of related questions, given before instruction, that is directly relevant to the knowledge, attitude or skill domain to be acquired. Items may be the same as, a selection from, or parallel versions of questions to be posed as a post-test.</td>
</tr>
<tr>
<td><strong>Behavioral Objectives</strong></td>
<td>Statements which identify the kind of behavior that will be accepted as evidence that learning has been achieved, define the important conditions under which this behavior is expected to occur, and specify the standard which will be used to determine whether the performance is acceptable. (Mager, 1962)</td>
</tr>
<tr>
<td><strong>Overviews (or Summaries)</strong></td>
<td>Statements which introduce new material by familiarizing the learner with the central argument. They emphasize key concepts, principles and technical terms, as well as prepare the learner for the general structure or gestalt of the material to be presented.</td>
</tr>
<tr>
<td><strong>Advance Organizers</strong></td>
<td>Advance organizers are process oriented. They have &quot;a high level of abstraction, generality and inclusiveness&quot; (Ausubel, 1969), which provide a broad framework rather than a limited, specific outline.</td>
</tr>
</tbody>
</table>


-- Hartley & Davies, 1976, p. 246
Hartley and Holt state that a problem of research dealing with behavioral objectives is the lack of accord as to a precise definition of the term. Some studies utilize objectives which are more specific than others, while other studies fail to define the type of objectives used or compare different types of objectives. Therefore, it is difficult to generalize across studies.

However, Oswald and Fletcher (1970) declare that general objectives may be as effective as specific objectives, while Rothkopf and Kaplan (1972) obtained results which favored specific objectives.

Merrill (1974) studied the effects of behavioral objectives on the learning process using a computer-assisted learning task. Objectives did not significantly affect total or display latency, but significantly reduced test-item response latency and required number of examples. Research also suggests that disclosing objectives to students before traditional types of instruction is more advantageous than presenting them prior to non-traditional teaching programs, such as programmed instruction and computer-assisted instruction (Sink, 1973).
Overviews

There is a limited amount of research on the effectiveness of overviews as facilitators of learning. Exposure to key words before instruction (Weiss & Fine, 1956) and providing learners with "advance perceptual organization of factual material" by method of a map (Reynolds, 1966) suggests that overviews help facilitate retention and achievement. Rosenshine and Furst (1971) observed that the use of structuring comments as an overview yielded significant results. Yet, Norford (1949), using film treatments that included summaries, found significance in only one of three such studies.

Wulff and Kraeling (1961) found that in an assembly task, the group given a mass overview prior to instruction performed less well than a group given a spaced overview prior to each successive instructional step.

Hartley and Davies state that although it appears that overviews are successful as preinstructional strategies, much more must be known about their effects. Inquiries as to the type of task most benefiting from their use, length of overviews, and best position within the instructional presentation need to be answered.
**Advance Organizers**

Hartley and Davies report that results over the previous fifteen years of inquiry into the effects of advance organizers is quite inconclusive. In the majority of studies, advance organizers appear to facilitate learning and retention (Ausubel, 1960; Ausubel & Fitzgerald, 1961; Groteluescher & Sjorgren, 1968). In other studies, advance organizers have not demonstrated significant effects (Clawson & Barnes, 1973; Thelen, 1971; Jerrolds, 1967).

The reader is referred to a thorough synopsis of research in advance organizers as facilitators of learning by Barnes and Clawson (1975). The concept of "advance organizer" is well presented, along with an analysis of 32 studies employing advance organizers. The studies are classified according to selected variables to see if patterns of results appear. Inconsistencies are discussed and conjectures made as to their causes. A critique of this article is presented by Lawton and Wanska (1977).
IV. RESEARCH ON EDUCATIONAL MEDIA AND TECHNOLOGY

In a paper by Salomon and Clark (1977) the methodology of research on media and technology in education is examined. The authors identify three common research objectives which guide this research and permit classification of studies. The first is the attainment of knowledge about the instructional effectiveness of a technology. Researchers using this objective attempt to answer the question raised by Gagne' (1974) "How can various media best be used for instruction?"

The second objective is to foster an understanding of the psychological effects media and technology have on learners. The third objective is to improve the practice of education through evaluating and producing better media, materials, procedures and technologies, in a developmental sense.

Trends in media research in the recent past focused on finding the best technology for instruction. Research was therefore centered upon intermedia comparisons. Investigators such as Knowlton (1964) and Miellke (1971) have demonstrated that comparing the superiority of one medium over another leads to uninterpretable results.
There is a distinction offered between research with and research on media in the following quote:

"Research with media usually deals with existing, often typical media devices and products. Research on media, on the other hand, need not be concerned with any available given. It can create the most creative potentialities of media, and study how they affect learning, even if they are not typical of any existing instructional package."

(Salomon & Clark, 1977, p. 102)

Research with media is then more static research. It deals with simply a delivery system and allows only gross comparisons. Research on media is more dynamic and adaptive to the nuances and specifics of an investigation.

Educational research utilizing the medium of computer-assisted instruction can be thought of as an example of research on media. A main focus of the investigation lies in the inherent attributes of the medium for producing useful conceptualizations of the teaching-learning process. Information gathering capabilities of the medium such as obtaining response latencies can be combined with manipulation of instructional variables. Data may then be obtained regarding on-going information processing activities of the learner as well as the effectiveness of certain instructional strategies.
Salomon emphasizes that educational media research should be representative of the real world of education. He argues that research needs to be conducted in natural settings with real materials and stimuli. Shulman (1970) and Snow (1974) have addressed this issue.

Briefly, there is the need to assign a particular effect to a certain variable. This requires carefully arranged experiments where only the desired variables are allowed to vary according to the researcher's rationale (emphasis upon internal validity). Yet, there is also the need to generalize the findings to real life settings (emphasis on external validity). Therefore, there is a constant competition between the control of variables and providing natural settings so that generalizability may be obtained.

V. SUMMARY

This chapter has focused upon research related to the variables investigated in this study. Four sections comprised the chapter: 1) research on response latency; 2) research on learner control of instruction; 3) research on pre-instructional strategies; and 4) research on educational media and technology.
Response latency has been suggested by some researchers as possibly being a sensitive indicator of internal learning states. Measures of response latency coupled with measures of performance, such as frequency measures, may provide supplemental information to the researcher about the learner.

Research on learner control of instruction is reviewed in the following section. It has been suggested that learner controlled instruction may be less aversive than instruction which is program controlled. It has also been posited that the student is sufficiently aware of his learning state to make his own decisions regarding instruction.

Four pre-instructional strategies were reviewed: pre-tests, behavioral objectives, overviews and advance organizers. Research results have been somewhat inconclusive due to lack of accord as to precise definition of terminology or differential usage of testing instruments.

Research on educational media focused upon computer-assisted instruction as a medium for analysis of the teaching-learning process. It was emphasized that the media research should be pragmatic in nature while providing for experimental control of variables.
CHAPTER III

EXPERIMENTAL DESIGN AND METHODOLOGY

This chapter will delineate the design of the experiment and provide information regarding the subjects, experimental apparatus and procedure.

I. EXPERIMENTAL DESIGN AND DATA ANALYSIS

The experiment uses a pre-test post-test, 2x2 factorial design in which subjects are randomly assigned to one of four treatment cells. Independent variables are: a) Locus of Control: Learner control or program control and b) Overview (learning objectives) or no overview.

The treatment conditions developed are the following four computer-assisted instructional sequences:

   LCOB— Learner control with objectives
   LCNOB— Learner control with no objectives
   PCOB— Program control with objectives
   PCNOB— Program control with no objectives
Dependent variable measures taken in this study are: a) measures of achievement change from pre-test to post-test and b) measures of response latency.

Data is subjected to analysis of variance using the Statistical Package for the Social Sciences (SPSS) Version H, on an IBM 360/370 computer at The Ohio State University's Instruction & Research Computer Center.

Pilot Study

A study of similar design was conducted during the spring of 1977 using volunteer participants. The pilot study was conducted in the terminal room, Room 124, in the College of Pharmacy. Digital Equipment Corporation DECwriter hardcopy terminals were used for presentation of material.

The sample size was small (n = 5). The pilot study was used: a) to discover problems in the experimental materials for purposes of revision of the materials and b) to test the computer programs developed for data management and analysis.

It was determined in the study that subjects did not take longer than sixty (60) minutes to complete the experimental materials.
II. SUBJECTS

Subjects for this study consisted of sixty (60) college students enrolled in Health Education classes at The Ohio State University during the summer quarter, 1977. Table 5 displays demographic data relating the distribution of the subject population according to sex, age, year in school and previous experience with CAI. Figure 1 displays this data graphically. Appendix E lists subjects' home cities and states, and Appendix F presents subjects' college majors.

All subjects were randomly assigned to one of four treatment groups, with a total of fifteen subjects per treatment. Of the sixty students, seventeen (28.3 percent) were male and forty-three (71.7 percent) were female.

Seniors accounted for the majority of the participants (n = 27, 45 percent). Juniors and graduate students each accounted for 23.3 percent (n = 14). Sophomores constituted 5 percent (n = 3) of the participants, while freshmen made up the remaining 3.3 percent (n = 2).

The age group of the majority of the participants was 22-25 (n = 21, 35 percent). Eighteen participants (30 percent) were in the 20-21 year age group, with the
<table>
<thead>
<tr>
<th>CLASS</th>
<th>TOTAL</th>
<th>PERCENT</th>
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<tbody>
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<tr>
<td>Sophomore</td>
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<td>5.0</td>
</tr>
<tr>
<td>Junior</td>
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<td>23.3</td>
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<tr>
<td>Senior</td>
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</tr>
<tr>
<td>Graduate</td>
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</tr>
<tr>
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<td>17</td>
<td>28.3</td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>71.7</td>
</tr>
<tr>
<td>AGE</td>
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<tr>
<td>18-19</td>
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<td>20-21</td>
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<tr>
<td>22-25</td>
<td>21</td>
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<tr>
<td>Over 25</td>
<td>18</td>
<td>30.0</td>
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<tr>
<td>PREVIOUS</td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15</td>
<td>25.0</td>
</tr>
<tr>
<td>No</td>
<td>45</td>
<td>75.0</td>
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</table>

| TABLE 5 |
| DEMOGRAPHIC DATA SUMMARY |

<table>
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<tr>
<th>TOTAL</th>
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<tr>
<td>5.0</td>
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<td>71.7</td>
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<td>35.0</td>
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<tr>
<td>30.0</td>
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<tr>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td>75.0</td>
<td></td>
</tr>
</tbody>
</table>
fig. 1

GRAPH OF DEMOGRAPHIC DATA
same percentage over 25 years of age. Three participants (5 percent) were in the 18-19 year age group.

Fifteen participants (25 percent) had previous experience with computer-assisted instruction. The majority of participants (n = 45, 75 percent) had no previous CAI experience.

Due to human error during the data reduction of the demographic data, information was unable to be extracted regarding randomization of demographic categories within the four treatments. However, since subjects were randomly assigned to treatment conditions, the assumption is that the demographic categories were randomized within treatments.

III. EXPERIMENTAL APPARATUS

Instructional Sequence

An instructional sequence was created by the investigator on the subject of venereal disease utilizing the Instructional Dialogue Authoring Facility (IDAF), a Hewlett-Packard computer-assisted instruction authoring language. In this sequence, a detailed
comparison between gonorrhea and syphilis is presented. Characteristics of the infecting agent, pathogenesis of the infection, stages of the disease, clinical signs and usual course, complications, epidemiology, prophylaxis, treatment and residual immunity are discussed.

The sequence was originally developed for use in an introductory pathology course by Pharmacy students at The College of Pharmacy, The Ohio State University. However, this subject population became unavailable to the investigator when a hardware malfunction occurred on the HP2000F computer facility which held the treatment files. This malfunction resulted in a loss of some of the files which had been created, and the situation was unable to be rectified in time to enable this population to receive the computer-assisted instructional (CAI) sequence.

The material presented in this instructional sequence was developed primarily from a text on concepts in human disease by Dr. Harmon C. Bickley, with permission (see Appendix G). This text had been used as part of the Introductory Pathology course previously
mentioned. The course typically utilized computer-managed instruction (CMI), with off-line presentation of material and on-line testing.

The four instructional sequences consist of 69 sections with adaptive branching employed. Therefore, the sequences are non-linear in nature. Figures 2 through 5 describe the instructional flow of the four treatment sequences.

The learner is first presented with an on-line 9 item pre-test. After the pre-test, the treatments LCOB (learner control with objectives) and PCOB (program control with objectives) are presented with an overview consisting of learning objectives adapted from Bickley (1974). These objectives consist of short statements informing the learner of what principal concepts will be presented in the following instructional set. The objectives are presented before each of six instructional sets of the sequence. LCNOB (learner control with no objectives) and PCNOB (program control with no objectives) treatments do not receive the objectives.

After each instructional set, the learner receives a formative evaluation instrument consisting of two or three multiple choice questions over the previous
FIGURE 2
INSTRUCTIONAL FLOW OF TREATMENT LCOS
FIGURE 3

INSTRUCTIONAL FLOW OF TREATMENT LCNOB
FIGURE 4

INSTRUCTIONAL FLOW OF TREATMENT PCOB
FIGURE 5

INSTRUCTIONAL FLOW OF TREATMENT PCNOB
instruction. Subjects responded by typing the letter (A,B,C,D or E) of the correct item and depressing the RETURN key. One trial is allowed for an unanticipated response, that is, a response other than A,B,C,D or E, and one trial for an anticipated response. Feedback is given as to the correctness or incorrectness of the response.

A criterion was established for passing each formative evaluation instrument. If the criterion is not met, the subjects in the learner control treatments (LCOB and LCNOB) are advised that they have not met the criterion of acceptable performance, and given an option to branch to a set consisting of a recapitualization of the previous instruction. This method is similar to the ADVISOR feature of the TICCIT system. Subjects not achieving criterion in the program control treatments (PCOB and PCNOB) are automatically branched to the recap set by the program, without receiving an option to branch.

These procedures are repeated throughout the six instruction sets. Upon completion of these sets, the learner is presented with an on-line 9 item post-test which ends the sequence.
Validation. Ideally, the instruction sets would be reviewed by at least three subject matter specialists. However, these sets have not been formally validated for content for the specific population for which they were used.

Hardware Facilities

The treatment files were held on an HP2000F computer in the College of Pharmacy, The Ohio State University. Digital Equipment Corporation DECwriter hardcopy terminals, printing at 30 characters per second, served as the medium of presentation of the sequence. These terminals print both upper and lower case characters, use unlined paper, and produce black letters. A cardboard restraint was placed on top of the terminal to restrict subject access to previously printed copy when answering test items. Figure 6 displays the terminal as configured for the experiment.

Pre-Test and Post-Test

Pre-test and post-test items were taken from three parallel forms of tests accompanying the section on
FIGURE 6

THE EXPERIMENTAL STATION
venereal disease of Dr. Bickley's text. The tests were developed in the Department of Pathology, at the University of Iowa College of Medicine.

A statistical analysis of the test items was performed by the Office of Educational Development, College of Pharmacy, The Ohio State University in Spring, 1975. The analysis was completed utilizing MSEP (A Modularized Statistical Evaluation Package) developed by Carlson and Dennis (1975). Frequency counts, item statistics and summary statistics were computed, allowing an assessment of the test items.

Mean item difficulty of the items was .114. Item difficulty indicates the proportion of the group who do not answer the items correctly. Mean item discrimination index was .282. This statistic indicates the difference between good and poor students in proportion of correct response on the items.

The pre-test and post-test are of multiple choice format, with five responses to each test item. The learner responds to the test item by selecting the letter A, B, C, D or E for the correct response, then depressing the RETURN key.
Printed Forms

Three types of printed forms were used by each subject in this study:

1) A demographic data sheet containing information regarding: a) sex, b) age, c) year in school, d) major, e) home city and state, and f) previous experience with CAI was completed by every individual (see Appendix D).

2) A consent form, required by the Human Subjects Committee, The Ohio State University, was signed by each participant.

3) A printed paragraph explaining the procedure for correcting a typing error was read by each student, seated at the terminal, prior to starting the sequence (see Appendix C).

Data Collection

Response latency data is measured and collected for every section of the sequence by the internal timer of the Hewlett-Packard 2000F computer system. The latency of each subject's response is written onto a disc file. Also, the total time required by the
subject to complete the sequence is obtained from the starting and stopping times printed on the subject's hard copy listing. Thirdly, response data for each subject is collected from the listing.

IV. EXPERIMENTAL PROCEDURE

The study was carried out employing students in Health Education classes at The Ohio State University during summer quarter, 1977. The computer-assisted instructional sequence was required by the course instructors as a supplemental course activity.

The experiment was begun in Room 124, the terminal room, in the College of Pharmacy. However, construction on this room necessitated the experiment moved to Room 220 of the same building. A minimum of one terminal and a maximum of four were activated during experimental sessions. Sessions were scheduled in one hour blocks of time. No session lasted more than sixty minutes. Appendix B provides a summary of experimental sessions.

Sequence of Events

Upon entering the room, subjects were instructed to complete the demographic data form and the consent form.
A card containing the name of the treatment and a subject number was drawn from a shuffled deck to determine the treatment assignment.

Subjects were then instructed to be seated at the terminal, and given the form containing the printed paragraph to read. The investigator then signed each participant on to the computer terminal for the instructional session. After completion of the session, the subject listing was saved for data collection purposes, and subject response latency data was transferred to a permanent holding file.

V. SUMMARY

This chapter has presented the design of the experiment and provided information regarding the subjects, experimental apparatus and procedure.

The experiment utilized a pre-test post-test 2x2 factorial design with subjects randomly assigned to one of four treatment cells: 1) LCOB (learner control with objectives); 2) LCNOB (learner control with no objectives; 3) PCOB (program control with objectives; and 4) PCNOB (program control with no objectives). Dependent variable measures are:
a) measures of achievement gain and b) measures of response latency.

Demographic data for the experimental sample population were presented in this chapter. Data were collected on subjects' sex, age, year in school, and previous experience with computer-assisted instruction.

Experimental apparatus was explained concerning: a) the instructional sequence; b) hardware facilities; c) pre-test and post-test; d) printed forms; and e) data collection. Finally, the experimental procedure was discussed.
CHAPTER IV

DATA ANALYSIS AND RESULTS

During the summer quarter, 1977, the experiment to investigate the effects of locus of control and provision of objectives in a computer-assisted instructional sequence was conducted. This investigation utilized as subjects Health Education students at The Ohio State University. Each participant was randomly assigned to a 69 frame CAI sequence consisting of one of four treatment conditions: LCOB (learner control with objectives), LCNOB (learner control with no objectives), PCOB (program control with objectives), and PCNOB (program control with no objectives). Both performance and response latency data were collected. The analysis of this data is presented in this chapter.

The chapter is divided into eight parts. The first seven parts present data analysis for the various dependent variables under investigation as guided by the primary hypotheses stated below.
Learners experiencing a computer-assisted instructional sequence (CAI) will perform the same as measured by achievement gain and response latency under four experimental conditions:

1) when the learner has control over taking review sequences and is provided with the objectives of the CAI sequence (LCOB);

2) when the learner has control over taking review sequences but is not provided with objectives (LCNOB);

3) when the program controls whether the learner receives the review sequences and the learner is provided with objectives (PCOB);

4) when the program controls whether the learner receives the review sequences, but the learner is not provided with objectives (PCNOB).

In each section the hypothesis will be presented symbolically with the dependent variable specifically defined. The symbols for the experimental treatments are defined above and are used consistently throughout.

The final part of this chapter is a summary of the results of the data analysis. Descriptive statistics (group means, standard deviations and variances) appear in Appendix A. Raw data are also listed in Appendix A.
I. ACHIEVEMENT GAIN

An achievement score is the number of correct responses on a nine item test of the instructional sequence. An achievement score for each subject was collected from an on-line pre-test and post-test of the material.

Achievement gain is the difference between the achievement scores of the pre-test and post-test. This statistic was computed by subtracting the achievement score of the pre-test from the achievement score of the post-test, and is expressed by:

\[ A_g = A_{t2} - A_{t1} \]

where \( A_g \) is the achievement gain statistic, \( A_{t2} \) is the achievement score on the post-test, and \( A_{t1} \) is the achievement score on the pre-test.

The null hypothesis is:

\[ A_{g\text{COB}} = A_{g\text{CNOB}} = A_{g\text{PCOB}} = A_{g\text{PCNOB}} \]

where \( A_g \) is the achievement gain statistic.

Data were subjected to a two-way analysis of variance. The results indicate a significant effect for type of control (\( F = 4.31, p < .05, [df 1, 56] \)).
TABLE 6

TWO-WAY ANALYSIS OF VARIANCE -
TYPE OF CONTROL BY OBJECTIVES

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>SIGNIF OF F</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN EFFECTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE OF CONTROL</td>
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<td>1</td>
<td>14.017</td>
<td>4.310</td>
<td>0.040</td>
</tr>
<tr>
<td>OBJECTIVES</td>
<td>7.350</td>
<td>1</td>
<td>7.350</td>
<td>2.260</td>
<td>0.134</td>
</tr>
<tr>
<td>INTERACTIONS</td>
<td>3.750</td>
<td>1</td>
<td>3.750</td>
<td>1.153</td>
<td>0.288</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>182.133</td>
<td>56</td>
<td>3.252</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>207.250</td>
<td>59</td>
<td>3.513</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The learner control treatment group produced a mean gain of 4.73 as opposed to a gain of 3.77 for the program control group. The learner control group demonstrated an average achievement gain of 10.7 percent more than the program control group (see Appendix A).

II. AVERAGE TEST RESPONSE LATENCY CHANGE

Response latency is the amount of time measured from the end of the presentation of an item to the point the subject enters an answer and depresses the RETURN key. Average test response latency is the sum
of the response latencies on a test divided by the number of items on the test.

Average test response latency is computed by the following formula:

\[
ATRL = \frac{1}{n} \sum_{i=1}^{n} x_i
\]

where ATRL is the average test response latency, \( x_i \) is the response latency for an item on the test, and \( n \) is the number of items on the test pertaining to the specific analysis.

Average test response latency change is obtained by subtracting the average test response latency on the pre-test from the average test response latency on the post-test, and is expressed by

\[
ATRLC = ATRL_{post} - ATRL_{pre}
\]

where ATRL is the average test response latency change, ATRL\(_{pre}\) is the average test response latency on the pre-test, and ATRL\(_{post}\) is the average test response latency on the post-test.

The null hypothesis is:

\[
ATRLC_{LCOB} = ATRLC_{LCNOB} = ATRLC_{PCOB} = ATRLC_{PCNOB}
\]

where ATRLC is the average test response latency change from pre-test to post-test.
Correct and Incorrect Items

In this analysis, results were obtained for average test response latency change (ATRLC) by using both correct and incorrect test items. Therefore, $n = 9$ when computing ATRL (average test response latency).

Hence,

$$\text{ATRLC}_{c+i} = \text{ATRL}_{\text{post}_{c+i}} - \text{ATRL}_{\text{pre}_{c+i}}$$

where $c+i$ represents the use of correct and incorrect items in the computations.

The results of the two-way analysis indicate a significant interaction effect which was graphed (Figure 7) and found to be disordinal with cell means as a function of both independent variables.

TABLE 7

TWO-WAY ANALYSIS OF VARIANCE - TYPE OF CONTROL BY OBJECTIVES

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>SIGNIF OF F</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN EFFECTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE OF CONTROL</td>
<td>28.972</td>
<td>1</td>
<td>28.972</td>
<td>0.325</td>
<td>0.999</td>
</tr>
<tr>
<td>OBJECTIVES</td>
<td>115.960</td>
<td>1</td>
<td>115.960</td>
<td>1.303</td>
<td>0.258</td>
</tr>
<tr>
<td>INTERACTIONS</td>
<td>477.418</td>
<td>1</td>
<td>477.418</td>
<td>5.364</td>
<td>0.023</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>4984.617</td>
<td>56</td>
<td>89.011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>5606.969</td>
<td>57</td>
<td>95.033</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FIGURE 7

GRAPH OF INTERACTION - ATRLC
(CORRECT AND INCORRECT ITEMS)
**Correct Items**

In this analysis, average test response latency change (ATRLC) was computed using only correct test items. Therefore, \( n = \) the number of correct items on the test when computing ATRL (average test response latency). If a subject made no correct responses on a pre-test, the ATRLC data were considered missing values in the analysis.

Then

\[
\text{ATRLC}_c = \text{ATRL}_{\text{post}_c} - \text{ATRL}_{\text{pre}_c}
\]

where \( c \) is the use of correct items in the computations.

A two-way analysis of variance produced no significant effects for type of control or objectives. The null hypothesis was not rejected.

**TABLE 8**

**TWO-WAY ANALYSIS OF VARIANCE - TYPE OF CONTROL BY OBJECTIVES**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>SIGNIF OF F</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN EFFECTS</td>
<td>319.601</td>
<td>1</td>
<td>319.601</td>
<td>2.296</td>
<td>0.132</td>
</tr>
<tr>
<td></td>
<td>27.714</td>
<td>1</td>
<td>27.714</td>
<td>0.199</td>
<td>0.999</td>
</tr>
<tr>
<td>INTERACTIONS</td>
<td>4.933</td>
<td>1</td>
<td>4.933</td>
<td>0.035</td>
<td>0.999</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>6960.832</td>
<td>50</td>
<td>139.217</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>7312.566</td>
<td>53</td>
<td>137.973</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
III. AVERAGE TEST RESPONSE LATENCY ON POST-TEST ONLY

Average test response latency (ATRL) was computed for the post-test only, using latencies on correct test items.

The null hypothesis is:

$$\text{ATRL}_{\text{PC-LCOB}} = \text{ATRL}_{\text{PC-LCNOB}} = \text{ATRL}_{\text{PC-PCOB}} = \text{ATRL}_{\text{PC-PCNOB}}$$

where ATRL$_{\text{PC}}$ is the average test response latency on the post-test, using correct test items only.

A two-way analysis of variance indicated no significant effects for type of control or objectives. The null hypothesis was not rejected.

TABLE 9

TWO-WAY ANALYSIS OF VARIANCE - TYPE OF CONTROL BY OBJECTIVES

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>SIGNIF OF F</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN EFFECTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE OF CONTROL</td>
<td>93.229</td>
<td>1</td>
<td>93.229</td>
<td>1.580</td>
<td>0.211</td>
</tr>
<tr>
<td>OBJECTIVES</td>
<td>37.086</td>
<td>1</td>
<td>37.086</td>
<td>0.629</td>
<td>0.999</td>
</tr>
<tr>
<td>INTERACTIONS</td>
<td>9.931</td>
<td>1</td>
<td>9.931</td>
<td>0.168</td>
<td>0.999</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>3303.620</td>
<td>56</td>
<td>58.993</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>3443.867</td>
<td>59</td>
<td>58.371</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IV. AVERAGE TEST RESPONSE LATENCY ON PRE-TEST VS. POST-TEST

Average test response latency (ATRL) data was collected for all subjects in all treatments both on pre-tests and post-tests. Data was analyzed using type of test as an independent variable, without regard to the treatment groups.

The null hypothesis is:

\[ \text{ATRL}_{\text{post}} = \text{ATRL}_{\text{pre}} \]

where ATRL\text{pre} is the average response latency on the pre-test, and ATRL\text{post} is the average response latency on the post-test.

The primary hypothesis is:

\[ \text{ATRL}_{\text{post}} < \text{ATRL}_{\text{pre}} \]

that is, average test response latency on the post-test is significantly less than average test response latency on the pre-test.

Correct and Incorrect Items
(Total Average)

In this analysis, ATRL was calculated using both correct and incorrect items on the pre-test and post-test.
A one-way analysis of variance showed highly significant effects for the type of test \( (F = 37.76, p < .001, [df \ 1, 118]) \). Thus, the null hypothesis was rejected.

### TABLE 10

**ONE-WAY ANALYSIS OF VARIANCE**

**PRE- VS. POST-TEST LATENCY (TOTAL AVERAGE)**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SUM OF SQUARES</th>
<th>MEAN SQUARES</th>
<th>F</th>
<th>F PROB</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETWEEN</td>
<td>1</td>
<td>4348.2148</td>
<td>4348.2148</td>
<td>37.759</td>
<td>.001</td>
</tr>
<tr>
<td>WITHIN</td>
<td>118</td>
<td>13588.6406</td>
<td>115.1580</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>119</td>
<td>17936.8555</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Descriptive statistics indicate a mean pre-test latency of 26.36 seconds, and a mean post-test latency of 14.32 seconds. Average pre-test latency was 1.84 times greater than the post-test latency (see Appendix A).

**Correct Items**

Average test response latency (ATRL) was computed for each subject on the pre-test and post-test, using only correct test items. If a subject made no correct
responses on the pre-test, the data was considered a missing value on both pre-test and post-test ATRL.

A one-way analysis of variance again resulted in significance for the type of test \((F = 52.72, p < .001, [df 1,106])\). The null hypothesis was rejected.

**TABLE 11**

ONE-WAY ANALYSIS OF VARIANCE
PRE- VS. POST-TEST LATENCY (CORRECT ITEMS)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SUM OF SQUARES</th>
<th>MEAN SQUARES</th>
<th>F</th>
<th>F PROB</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETWEEN</td>
<td>1</td>
<td>5855.4844</td>
<td>5855.4844</td>
<td>52.717</td>
<td>0.001</td>
</tr>
<tr>
<td>WITHIN</td>
<td>106</td>
<td>11773.8437</td>
<td>111.0740</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>107</td>
<td>17629.3281</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The pre-test had a mean average latency of 27.41 seconds as opposed to 12.69 seconds for the post-test. Average pre-test latency was 2.16 times greater than the post-test (see Appendix A).

**Incorrect Items**

Average test response latency (ATRL) was calculated on the pre-test and post-test, using only incorrect test items. Data from subjects who made no incorrect
responses on the post-test were considered as missing
values on both pre-test and post-test ATRL.

A one-way analysis of variance indicated no signifi-
cant effects for the type of test. The null hypothesis was not rejected.

**TABLE 12**

**ONE-WAY ANALYSIS OF VARIANCE**
**PRE- VS. POST-TEST LATENCY (INCORRECT ITEMS)**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SUM OF SQUARES</th>
<th>MEAN SQUARES</th>
<th>F</th>
<th>F PROB</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETWEEN</td>
<td>1</td>
<td>301.2539</td>
<td>301.2539</td>
<td>1.321</td>
<td>0.252</td>
</tr>
<tr>
<td>WITHIN</td>
<td>102</td>
<td>23254.4375</td>
<td>227.9847</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>103</td>
<td>23555.6914</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**V. AVERAGE TEST RESPONSE LATENCY - CORRECT VS. INCORRECT ITEMS**

Average test response latency data was collected for all subjects in all treatments, first for correct responses only, then for incorrect responses only. Treatment groups were disregarded.

The null hypothesis is:

\[ \text{ATRL}_c = \text{ATRL}_i \]
where $ATRL_c$ is average test response latency for correct items on a test, and $ATRL_i$ is average test response latency for incorrect items on the same test.

The primary hypothesis is:

$$ATRL_c < ATRL_i$$

that is, average test response latency of correct responses is significantly less than that for incorrect responses.

Post-Test

One-way analysis of variance was computed using average test response latencies on the post-test. Subjects with no incorrect responses on the post-test received missing value indicators in the analysis.

Highly significant effects were indicated for type of item ($F = 16.27$, $p < .001$, [df 1,102]). The null hypothesis was rejected.
Correct responses had a mean ATRL of 12.43 seconds, with mean ATRL of 22.31 seconds for incorrect responses. Incorrect responses had an average latency 1.79 times longer than correct responses (see Appendix A).

**Pre-Test**

One-way analysis of variance was performed using average test response latencies on the pre-test. Subjects with no correct responses on the pre-test received missing value indicators.

No significant effects for type of item were indicated for the pre-test. Hence, the null hypothesis was not rejected.
TABLE 14

ONE-WAY ANALYSIS OF VARIANCE
CORRECT VS. INCORRECT ITEM LATENCY (PRE-TEST)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SUM OF SQUARES</th>
<th>MEAN SQUARES</th>
<th>F</th>
<th>PROB</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETWEEN</td>
<td>1</td>
<td>46.3125</td>
<td>45.3125</td>
<td>0.245</td>
<td>0.627</td>
</tr>
<tr>
<td>WITHIN</td>
<td>106</td>
<td>20037.6875</td>
<td>189.0348</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>107</td>
<td>20084.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VI. ANALYSES RELATED TO THE BRANCHING CONDITION

Evaluation Criteria Not Met

For each subject in each treatment group, the number of times the criterion was not met on the six sequence formative evaluation instruments was calculated. This sum also reflects the number of times the recap was given to each subject in the program control group, and the number of times the option to review was encountered by each subject in the learner control group.

The null hypothesis is:

$$RC_1^{LCOB} = RC_1^{LCNOB} = RC_1^{PCOB} = RC_1^{PCNOB}$$
where $R C_1$ is the number of times the criterion is not met. This statistic also reveals the number of times the recap is given to each subject in the program control group, and the number of times the recap option is presented to each subject in the learner control group.

The data was subjected to a two-way analysis of variance. No significant effects were found for type of control or objectives. The null hypothesis was not rejected.

**TABLE 15**

**TWO-WAY ANALYSIS OF VARIANCE**  
**TYPE OF CONTROL BY OBJECTIVES**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>SIGNIF OF F</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN EFFECTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TYPE OF CONTROL</td>
<td>0.417</td>
<td>1</td>
<td>0.417</td>
<td>0.175</td>
<td>0.999</td>
</tr>
<tr>
<td>OBJECTIVES</td>
<td>6.017</td>
<td>1</td>
<td>6.017</td>
<td>2.530</td>
<td>0.113</td>
</tr>
<tr>
<td>INTERACTIONS</td>
<td>0.017</td>
<td>1</td>
<td>0.017</td>
<td>0.007</td>
<td>0.999</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>133.200</td>
<td>56</td>
<td>2.379</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>139.650</td>
<td>59</td>
<td>2.367</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Frequency Recap Given

For each subject in each treatment group, the number of times that the recap was actually given was computed. For the learner control group, this statistic represented the number of times the option to review was actually taken by the subject. For the program control group, this sum reflected the number of times the review was given, and is the same value as $RC_1$ above.

The null hypothesis is:

$$RC_2^{LCOB} = RC_2^{LCNOB} = RC_2^{PCOB} = RC_2^{PCNOB}$$

where $RC_2$ is the number of times the recap is given.

Significant effects were found for type of control ($F = 6.4$, $p < .05$, [df 1,56]). The null hypothesis was rejected.

The learner control treatment group received the recap an average of 2.04 times, while the program control treatment group received it an average of 3.07 times (see Appendix A).
TABLE 16

TWO-WAY ANALYSIS OF VARIANCE
TYPE OF CONTROL BY OBJECTIVES

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUM OF SQUARES</th>
<th>DF</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>SIGNIF OF F</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN EFFECTS</td>
<td>16.017</td>
<td>1</td>
<td>16.017</td>
<td>6.413</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>8.817</td>
<td>1</td>
<td>8.817</td>
<td>3.530</td>
<td>0.062</td>
</tr>
<tr>
<td>INTERACTIONS</td>
<td>0.150</td>
<td>1</td>
<td>0.150</td>
<td>0.060</td>
<td>0.999</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>139.866</td>
<td>56</td>
<td>2.498</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>164.850</td>
<td>59</td>
<td>2.794</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Percent Option Taken - Learner Control Group

The percentage the recap option was actually taken was computed for each subject receiving the learner control treatment. This percentage was derived as follows:

\[ \%_{lc} = \frac{\text{Tot}_{opt}}{\text{Tot}_{opp}} \times 100 \]

where \( \%_{lc} \) is the percentage the recap option was taken by a subject in the learner control group, \( \text{Tot}_{opp} \) is the number of times the option was presented, and \( \text{Tot}_{opt} \) is the number of times the option was taken.
The null hypothesis is:

$$\%_{1c}^{OB} = \%_{1c}^{NOB}$$

where $$\%_{1c}^{OB}$$ is the percentage the option is taken in the objectives group, and $$\%_{1c}^{NOB}$$ is the percentage the option is taken in the group without objectives.

A one-way analysis of variance resulted in no significant effects for objectives. The null hypothesis was not rejected.

**TABLE 17**

**ONE-WAY ANALYSIS OF VARIANCE**

**PERCENT OPTION TAKEN - LEARNER CONTROL GROUP**

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>DF</th>
<th>SUM OF SQUARES</th>
<th>MEAN SQUARES</th>
<th>F</th>
<th>PROB</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETWEEN</td>
<td>1</td>
<td>0.5246</td>
<td>0.5246</td>
<td>3.557</td>
<td>0.067</td>
</tr>
<tr>
<td>WITHIN</td>
<td>28</td>
<td>4.1289</td>
<td>0.1475</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>29</td>
<td>4.6535</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**VII. PERCENTAGE OF CORRECT ITEMS VS. RESPONSE LATENCY ON POST-TEST**

Response latencies were collected for each of the nine post-test items of each subject in the study. Therefore, latencies were obtained for:

$$I = n \times 9 \text{ items}$$
where \( n = 60 \) subjects and \( I = 540 \).

Each item was assigned to one of eight time slots. These time slots reflected the subject's response latency to a post-test item. Items within each time slot were then evaluated as to correctness or incorrectness of response.

The percentage of correct items within a given time slot was then calculated. This percentage is derived as follows:

\[
\%\text{CI} = \frac{\text{Tot}_{ci}}{\text{Tot}_{ti}} \times 100
\]

where \( \%\text{CI} \) is the percentage of correct items, \( \text{Tot}_{ci} \) is the number of correct items within the time slot and \( \text{Tot}_{ti} \) is the number of total items within the time slot.

Figure 8 provides a plot of the relationship between the variables \( x \) (response latency—number of seconds to respond on post-test items) and \( y \) (percentage of correct items). Results show a high negative correlation of \(-0.95844\) (Pearson's \( r \)) at the 0.00009 significance level.

**VIII. SUMMARY**

The results of the study will now be summarized. The synopses presented will be for seven types of analyses.
Graph of response latency.

% Correct

Response Latency (seconds)
Achievement Gain

Achievement gain showed a significant effect for type of control. The learner control group made a higher gain in achievement than the program control group.

Average Test Response Latency Change

Average test response latency change (ATRLC) computed from correct and incorrect items on the tests showed no significant main effects for type of control or objectives. ATRLC computed from correct items only again resulted in no significant effects for treatment groups.

Average Test Response Latency on Post-test Only

Average test response latency (ATRL) was calculated on the post-test from correct items only. No significant effects were found for type of control or objectives.
Average Test Response Latency (ATRL) on Pre-Test vs. Post-Test

One-way analysis of variance was utilized with type of test as the independent variable. For ATRL derived from correct and incorrect responses, latencies were longer on the pre-test than on the post-test.

For ATRL obtained from correct responses only, group latencies also were longer on the pre-test than on the post-test.

Data were also analyzed obtaining ATRL from incorrect items. No significant effects were observed. Figure 9 presents a graphic representation of group means.

Average Test Response Latency - Correct vs. Incorrect Items

On the pre-test, no significant effects were found comparing items responded to correctly and items responded to incorrectly. On the post-test, correct items had a shorter mean response latency than incorrect items. Group means are presented graphically in Figure 10.
TEST RESPONSE LATENCY sec.

- total
- correct
- incorrect

ITEMS

GRAPH OF TEST RESPONSE LATENCY BY ITEMS

fig. 9
Graph of test response latency by test.

- Pre-test: 30 seconds
- Post-test: 25 seconds

Correct items
Incorrect items
Analysis Related to the Branching Condition

No significant differences were found between treatment groups using the number of times the evaluation criteria were not met. However, significant effects were observed for the learner control group using the number of times the recap was actually given. The recap was presented fewer times to the learner control group than to the program control group.

An analysis was performed on the two learner control groups (LCOB and LCNOB) using the percentage the option was actually taken when presented as the dependent variable. No significant objectives effect was observed.

Percent of Correct Items vs. Response Latency on Post-Test

On the post-test, a significant negative correlation was observed between the time taken to respond on post-test items and the percentage of correct items within the time period. As response latency to test items rose, the percentage of correct items went down.
IX. GENERAL SUMMARY OF RESULTS

Table 18 presents the results related to the main effects of the primary hypotheses. The only significant finding was that achievement gain was greater when the learner had control over taking review sequences.

<table>
<thead>
<tr>
<th>DEPENDENT VARIABLE</th>
<th>LOCUS OF CONTROL (LC, PC)</th>
<th>OBJECTIVES (OB, NOB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACHIEVEMENT GAIN</td>
<td>LC &gt; PC</td>
<td>NS</td>
</tr>
<tr>
<td>ATRL*PC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct Items</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Incorrect Items</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>ATRL*POST-TEST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct Items</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

ATRLC
average test response latency change
ATRL * POST-TEST
average test response latency * post-test
LC learner control
PC program control
OB objectives
NOB no objectives
NS not significant
Regardless of whether latencies in responding both to correct and incorrect items were combined or latencies in responding to correct items only were analyzed, latencies were greater on the pre-test Table 19).

**TABLE 19**

**SUMMARY OF RESULTS**

<table>
<thead>
<tr>
<th>DEPENDENT VARIABLE</th>
<th>TYPE OF TEST (Pre-test, Post-test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATRL</td>
<td></td>
</tr>
<tr>
<td>Correct/Incorrect Items</td>
<td>pre-test &gt; post-test</td>
</tr>
<tr>
<td>Correct Items</td>
<td>pre-test &gt; post-test</td>
</tr>
<tr>
<td>Incorrect Items</td>
<td>NS</td>
</tr>
<tr>
<td>ATRL</td>
<td>average test response latency</td>
</tr>
<tr>
<td>NS</td>
<td>not significant</td>
</tr>
</tbody>
</table>

Table 20 presents the results related to the secondary hypothesis. When response latency is used as the dependent variable, response latencies on post-test items were greater for incorrect items than for correct items.
<table>
<thead>
<tr>
<th>DEPENDENT VARIABLE</th>
<th>TYPE OF ITEMS (Correct, Incorrect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATRL</td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>correct &lt; incorrect</td>
</tr>
<tr>
<td>Pre-test</td>
<td>NS</td>
</tr>
<tr>
<td>ATRL</td>
<td>average test response latency</td>
</tr>
<tr>
<td>NS</td>
<td>not significant</td>
</tr>
</tbody>
</table>

After establishing that there was no measurable difference between the number of times the recap could have been presented to learner control or program control groups, the learner control group elected to receive the review sequences significantly fewer times than the program presented these sequences to the program control group (Table 21). Within the learner control group, the provision of objectives did not measurably affect the number of times the review option was taken.
### TABLE 21

**SUMMARY OF RESULTS**

<table>
<thead>
<tr>
<th>DEPENDENT VARIABLE</th>
<th>LOCUS OF CONTROL (LC, PC)</th>
<th>OBJECTIVES (OB, NOB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC₁</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>RC₂</td>
<td>LC &lt; PC</td>
<td>NS</td>
</tr>
</tbody>
</table>

- **RC₁**: number of times criterion not met
- **RC₂**: number of times recap given
- **LC**: learner control
- **PC**: program control
- **OB**: provision of objectives
- **NOB**: no provision of objectives
- **NS**: not significant
CHAPTER V

SUMMARY, DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

This study has attempted to investigate the effects of two types of instructional strategies in a computer-assisted instructional sequence. Locus of control (learner control vs. program control) and provision of overviews (learning objectives) were evaluated. Both independent variables under investigation are instructional variables which are important considerations in CAI development for meeting the educational needs of the learner. Determining the type and amount of control of instructional events is a decision which must be addressed by developers of computer-assisted instruction. Effective organization of the instructional sequence to promote maximum learning is also important.

This chapter will explore assumptions related to the data discussed in Chapter IV, and present a discussion of the implications for the learner, the instructional developer, and the educational
researcher. This section will provide useful information upon which decisions can be made regarding instructional strategies.

I. SUMMARY

A computer-assisted instructional sequence on venereal disease was specially developed for this study. Four lesson files were created, one for each treatment under investigation. These files were kept on an HP 2000F computer in the College of Pharmacy, The Ohio State University.

Each instructional sequence consisted of 69 sections and was non-linear in nature. The sequence essentially consisted of a nine-item on-line pre-test, the instructional treatment phase with adaptive branching, and a nine-item post-test. The four different instructional phases reflected the four experimental treatments: LCOB (learner control with objectives), LCNOB (learner control with no objectives), PCOB (program control with objectives) and PCNOB (program control with no objectives).

The experimental apparatus consisted of Digital Equipment Corporation LA36 DECwriter terminals. These
are hardcopy terminals, printing at 30 characters per second. A paper restraint was placed on the top of each terminal.

During the summer quarter, 1977, sixty Health Education students at The Ohio State University were exposed to the treatment conditions. The students received the computer-assisted instructional sequence as a required supplemental activity to their class work. Students were randomly assigned to the experimental materials, which were located in the College of Pharmacy.

Both performance and response latency data were collected. Response latencies were measured by the internal clock of the HP2000F computer. Performance data was collected manually. The data were subjected to one-way and two-way analyses of variance, utilizing the Statistical Package for the Social Sciences (SPSS).

II. DISCUSSION

The learner control option, which provided control over branching to a recap sequence, appears to have influenced achievement gain. Achievement gain was significantly greater under learner control than under
program control. No similar effect was observed for provision of overviews (learning objectives).

One is led to speculate as to the reasons for this gain under learner control as opposed to program control. Judd (1975) suggested two reasons for his support of learner controlled CAI. He implied that instructional control provided the learner is less aversive to the individual than instruction administered under program control. Secondly, Judd optimistically states that the student is "sufficiently aware of his state of learning to make his own instructional decisions."

It is interesting to note that there was no significant difference in the amount of times the evaluation criteria were not met by the subjects in the learner control and program control groups. That is, both of these treatment groups potentially could receive the recap a relatively equal number of times. However, the learner control group actually received the recap significantly fewer times than the program control group.

This observation may indicate that the learner is quite aware of his learning state during instruction. Given the opportunity to actively participate in decision-making, the individual may not always follow
the advice, but will choose paths which will ultimately result in achievement. These results were obtained even with the built-in facility advising the learner to take the recap sequence when the criterion was not attained.

One may suggest that corrective feedback presented during the formative evaluations provided the learner with enough information regarding his acquisition errors; the learner, then realizing his mistakes, did not feel the need to review.

The outcomes of this investigation would then support Judd's second contention. It may also be argued that being given an active role in the instructional activity contributes toward making the material more meaningful for the learner, hence less aversive than material in which the individual maintains a more passive role. However, more accurate measures of state of anxiety would need to be employed to obtain a clear indication of the validity of this argument.

The one-way and two-way analyses of variance resulted in no significant effects for objectives. The overviews presented in the sequence were not of highly specific nature, but served as general organizational indicators of forthcoming material. This type
of overview did not appear to contribute to significant achievement gain. Pre-tests may have had a pre-organizational effect which made the additional effect of overviews indiscernible.

This investigation also explored suggestions in Glaser and Judd (1969) that response latency may be a sensitive measure of strength of learning. The findings seem to require an in-depth study of this variable.

Merrill (1974) found that while objectives had no effect on achievement, they did significantly effect test-item response latency. Hence, Merrill postulated that response latency may be a more sensitive indicator of the internal state of the learner than performance measures. The results of this study do not support his argument. No significant effects for treatments were found by using either response latency on the post-test as the dependent variable or response latency change as the indicator.

As this study indicates, however, it is important to look at response latency when it is related to the correctness or incorrectness of test items.

Results of this investigation demonstrate that after the acquisition phase of learning, as indicated
on the response latencies of the post-test, there is a significant difference between response latencies of correct and incorrect items. Average response latencies of correct items are significantly shorter than response latencies of incorrect items. The response latencies measured on the pre-test do not support this statement.

In his paired-associate learning investigations, Judd (1973) found no significant differences in comparative latencies of correct and incorrect items. This study, which involves verbal learning tasks, would tend to refute this claim. Response latency measures may indeed reflect internal states of the learner and serve as an indicator of how well information is being stored and retrieved by the learner.

The negative correlation between percentage of correct responses to items and response latency needs to be addressed. As response latency rose, percentage of correct responses decreased. If one examines the plot of this correlation, an observable change appears to occur around four seconds. Before four seconds percentage of correct items appears quite high, becoming much lower after four seconds.
With regard to average test response latency, average latencies on the pre-test appear to be significantly greater than average latencies on the post-test. This observation seems to indicate two things. It tends to provide affirmative support to Judd’s (1973) suggestion in paired-associate studies that latency changes over the course of learning. It also suggests that the learner, by spending more time on the pre-test, has demonstrated willingness to approach the instructional environment with a concern for performing well. No external performance incentives such as grades, monetary payoffs, etc. were provided in this study. Acquisition of information may have been an internalized incentive.

Although no formal survey of subjects' attitudes toward CAI was taken, the investigator informally made observations of the subjects, and participant comments were made to class instructors after the study. The investigator observed subjects to be always involved in purposive activity during the computer-assisted instructional sequence. Comments about the sequence included reactions such as "fun", "challenging" and "stimulating" with no negative comments given.
III. IMPLICATIONS

For the Learner

This study has demonstrated that providing the learner with active participation in the decision-making strategies during instruction tends to result in achievement gain. Provision of overviews do not appear to contribute to significant gain when used with pre-tests.

However, provision of overviews does not appear to have a deleterious effect upon learning, and may aid the learner in facilitating organization of material in a small sense.

The results of this investigation have found the learner with a positive attitude towards acquisition of information. The subjects' willingness to attempt to perform well, reflected in the relatively long latencies on the pre-test, promotes an optimistic view of the learner in the instructional setting.

For the Instructional Developer

An important demonstration provided in this study for the instructional developer is the capacity of
computer-assisted instruction for individualization. Use of implementations such as branching options, pre-determined decision rules, and active participation by the student exemplify the potential of this medium for meeting individual needs during the learning process.

This investigation has also stressed the need for providing the learner with opportunity to achieve a role of active decision-making during instruction. Provision of overviews did not have a significant effect upon achievement. The instructional developer should be aware of this when decisions are made regarding the organization of the instructional sequence. Courseware development cost is a function of the development time. From a cost-benefit standpoint, the developer may wish to delete from instruction organizational strategies which are not significantly effective in contributing to achievement.

For the Educational Researcher

This study has demonstrated the potentialities of computer-assisted instruction as a laboratory tool to aid in educational research. In CAI, the researcher
has the capacity to optimally provide control over strategies under investigation, and to better ensure equality in presentation of treatment conditions.

On-line data gathering is optimized during computer-assisted instruction. Response latency data is much more reliably obtained by the internal clock of the computer than by the usual utilization of observers to obtain latency measurements.

Dennis (1975) has remarked, however, that "any algorithm which computes internal learning states from latencies must take into account the display hardware...the nature of the display device must be known." This means that the printing display rate of the specific terminals used must be constant so that word rate presentation is equal, and the latency data more reliable.

Attention should be given when reporting response latency data on test items as to whether the data was computed on correct responses, incorrect responses, or the combination of both. Also, separating latency components into such areas as pre-test, instruction section (acquisition phase), and post-test may allow for more subtle implications to be made.
IV. RECOMMENDATIONS FOR FUTURE RESEARCH

This experiment has provided results from a limited set of instructional conditions. It would be desirable to expand learner control to other branching strategies such as decisions on sequencing, pacing, difficulty level and media selection. Measures of state of anxiety might also aid in determining factors such as learner aversiveness to the material.

In further research of the effects of pre-instructional strategies, more specific levels of strategies might be compared with less specific levels. For example, specific provision of behavioral objectives, spaced vs. massed summaries or overviews, and advanced organizers may be investigated. These pre-instructional strategies should also be paired with pre-tests/no pre-tests to observe effects. Inquiries should be made as to the type of learning task that would most benefit from their use.

This study dealt with short-term learning. Retention of the content of the CAI course was only required for an hour or less. No attempt was made to investigate the effects of the variables on long-term
Further research should evaluate the effects of these experimental manipulations upon long-term memory.

Finally, this investigation has presented the need for further research on response latency as an indicator of learning. Latency measures would seem to have utility for instructional decision-making. Judd poses these questions regarding future research of response latency:

1) Can the degree of retention be controlled by training to a latency criterion?

2) Do response latencies reach a stable asymptote which may have implications for retention?

3) How does latency change over the course of learning in more complex tasks?

Also, future research should focus upon the relationships between latency and test item correctness in evaluation of learning. The types of internal learning states that are reflected in latency measures should be explored. Latency should be examined over the course of learning to determine changes and relationships.
APPENDIX A

RAW DATA AND DESCRIPTIVE STATISTICS
<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>LCOB</th>
<th>LCNOB</th>
<th>PCOB</th>
<th>PCNOB</th>
</tr>
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<tbody>
<tr>
<td>4</td>
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<td>2</td>
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<td>7</td>
<td>4</td>
<td>8</td>
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</tr>
</tbody>
</table>
TABLE 23

DESCRIPTIVE STATISTICS OF TREATMENTS USING ACHIEVEMENT GAIN

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>Sum</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Variance</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>POPULATION</td>
<td></td>
<td>255.0000</td>
<td>4.2500</td>
<td>1.8742</td>
<td>3.5127</td>
<td>60</td>
</tr>
<tr>
<td>TYPCON LC</td>
<td>LC</td>
<td>142.000</td>
<td>4.733</td>
<td>1.760</td>
<td>3.099</td>
<td>30</td>
</tr>
<tr>
<td>OBJECT OB</td>
<td>OB</td>
<td>80.000</td>
<td>5.333</td>
<td>1.877</td>
<td>3.524</td>
<td>15</td>
</tr>
<tr>
<td>OBJECT NOB</td>
<td>NOB</td>
<td>62.000</td>
<td>4.133</td>
<td>1.457</td>
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<td>15</td>
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<tr>
<td>TYPCON PC</td>
<td>PC</td>
<td>113.000</td>
<td>3.767</td>
<td>1.888</td>
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<td>OBJECT PC58</td>
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<td>58.000</td>
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<td>OBJECT PC55</td>
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<td>3.667</td>
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</tr>
</tbody>
</table>

TOTAL CASES = 60
**TABLE 24**

 RAW DATA, ATRLC * CORRECT & INCORRECT ITEMS

<table>
<thead>
<tr>
<th>TREATMENT (seconds)</th>
<th>LCOB</th>
<th>LCNOB</th>
<th>PCOB</th>
<th>PCNOB</th>
</tr>
</thead>
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</tr>
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<tr>
<td>-12.56</td>
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</tr>
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</tbody>
</table>
## Table 25

**Descriptive Statistics Using Latency Change * Correct & Incorrect**

<table>
<thead>
<tr>
<th>CRITERION VARIABLE BROKEN DOWN BY</th>
<th>LATENCY TYPE CON</th>
<th>LATENCY CHANGE PRE-POST TEST * CORRECT &amp; INCORRECT TYPE OF CONTROL OBJECT</th>
<th>PROVISION OF OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Label</td>
<td>Sum</td>
<td>Mean</td>
</tr>
<tr>
<td>-----------------------------------</td>
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<td>NOB</td>
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</table>
## TABLE 26

**RAW DATA, ATRLC * CORRECT ITEMS**

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<th>PCOb</th>
<th>PCNOB</th>
</tr>
</thead>
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- **Mean**: 27.4125
- **S.D.**: 12.9249

**Post-test**

- **Mean**: 12.6859
- **S.D.**: 7.4226
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RAW DATA, ATRL * CORRECT VS. INCORRECT ITEMS  
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S.D. 7.8638

**INCORRECT ITEMS**  
Mean 22.3107  
S.D. 15.8186
TABLE 33

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**Raw Data, Times Criterion Not Met**

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<th>PCOB</th>
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**MEANS:**

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S.D.: .4321  

No Objectives  
Mean: .7811  
S.D.: .3290
TABLE 37

RAW DATA, PERCENT OF CORRECT ITEMS WITHIN TIME SLOTS * POST-TEST

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APPENDIX B

SUMMARY OF
EXPERIMENTAL SESSIONS

117
## TREATMENT SCHEDULE FOR JULY 11 - JULY 15, 1977

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<tr>
<th>TIME</th>
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<td></td>
<td>S</td>
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<tr>
<td></td>
<td>*</td>
<td>U</td>
<td>S</td>
<td>*</td>
<td>A</td>
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</tbody>
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**KEY:**

- **A** Subject Absent
- **U** Unsuccessful Session
- **S** Successful Session
- **** Session Cancelled by Experimenter
TREATMENT SCHEDULE FOR AUGUST 1 - AUGUST 5, 1977

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</tr>
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<td>S</td>
<td>S</td>
<td></td>
<td>S</td>
<td>*</td>
</tr>
</tbody>
</table>

KEY:  
A  Subject Absent  
U  Unsuccessful Session  
S  Successful Session  
*  Session Cancelled by Experimenter
APPENDIX C

DIRECTIONS FOR CORRECTING TYPING ERROR
You may find it necessary to correct a typing error. If you discover that you have made a typing error, do not depress the RETURN key; instead, depress the control key labeled CTRL and depress the letter X simultaneously. This completely erases your answer and you may then type in your new answer and depress the RETURN key.

For example, let us suppose you incorrectly typed the letter B and wish to change your answer to A. First, depress the CTRL key and the X key simultaneously, then press the letter A and hit the carriage return.

If you have any problems with the computer terminal, ask the room monitor to assist you. Do not ask the monitor to assist you with content questions.
APPENDIX D

DEMOGRAPHIC DATA SHEET
SURVEY INVENTORY

DO NOT PLACE YOUR NAME ON THIS SHEET!

Please supply the following information:

1) Class Standing:       F   S   Jr   Sr   Grd
2) SEX:               M   F
3) Major:               _____________
4) Age:            18-19   20-21   22-25   >  25
5) Home City:           _______________
6) Home State:           _______________
7) Have you ever had a computer-assisted learning experience?

                     Yes             No
APPENDIX E

SUBJECTS' HOME CITIES AND STATES
HOME CITIES AND STATES

Akron, Ohio
Bellefontaine, Ohio
Bowling Green, Ohio
Canton, Ohio
Centerburg, Ohio
Chagrin Falls, Ohio
Chardon, Ohio
Columbus, Ohio (19)
Cuyahoga Falls, Ohio
Dayville, Ohio
Dayton, Ohio
Doylestown, Ohio
Granville, Ohio
Grove City, Ohio
Hilliard, Ohio
Hudson, Ohio
Huron, Ohio
Kettering, Ohio
Lakewood, Ohio
Lancaster, Ohio
Lima, Ohio
London, Ohio
Marion, Ohio
Middletown, Ohio
Millersburg, Ohio
New Vienna, Ohio
Perrysville, Ohio
Plain City, Ohio
Portsmouth, Ohio
Reynoldsburg, Ohio
Springfield, Ohio
St. Clairsville, Ohio
Tiffin, Ohio
Toledo, Ohio
Waynesville, Ohio
Willard, Ohio
Wooster, Ohio
West Hartford, Connecticut
Clifton, New Jersey
Eatontown, New Jersey
Tulsa, Oklahoma
Lehighton, Pennsylvania
APPENDIX F

SUBJECTS' MAJORS
MAJORS

Medical Technology
Spanish (2)
Industrial Technology (3)
French (2)
Vocational Education
Physical Education (11)
Special Education (2)
Professional Education (6)
Health Education (12)
Dental Hygiene (8)
Business Education (4)
Veterinary Medicine
Family Relations (3)
Pharmacy
Recreation
Child Development
Dietetics
APPENDIX G

LETTERS REGARDING
PERMISSION TO USE TEXT
April 26, 1977

Janie A. Campanizzi  
49 E. 14th Avenue  
Columbus, Ohio 43201  

Dear Ms. Campanizzi:  

Thank you for your interest in my book. I have no objection to your reproducing pages 275-219, however you should obtain clearance from the publisher since they actually own the copyright. (The Williams and Wilkins Co., 428 E. Preston St., Baltimore, Maryland 21202).

I would appreciate hearing of your results and the best of luck in your project.

Cordially,

Harmon C. Bickley  
Professor of Pathology
MAY 6 1977

Dear Sir:

I am a Ph.D. candidate in Education at The Ohio State University, currently completing dissertation requirements. I should like to request permission to reproduce portions of the text Practical Concepts In Human Disease (1974), by Harmon C. Bickley, for use in a computer-assisted instructional sequence in which I will investigate the effects of a learner control option and provision of learning objectives. I should like permission to reproduce material from pp. 275-279 on venereal disease, which occurs in Chapter 17 entitled "Male & Female Genital Systems."

I am developing the CAI instructional sequence in consultation with Dr. Daniel Krauthaus, Director of Educational Development, College of Pharmacy, The Ohio State University. The book Practical Concepts in Human Disease is currently being used in the College of Pharmacy as the text for the course Pathology 475, "Introduction to Disease."

Dr. Harmon Bickley, in a letter of April 26, 1977, has expressed no objection to my reproducing the above mentioned pages of his book. I will be happy to provide you with more information if it is required.

Thank you.

Cordially,

Janie A. Campanizzi

Janie A. Campanizzi

JAC:smk

Permission granted by the copyright owner, contingent upon the consent of the author, provided complete credit is given to the original source and in the form of: The Williams & Wilkins Co., Baltimore

per: S.R. Smoot

4/3/77
APPENDIX H

CAI COURSE LISTING
1. This CAI course consists of an instructional sequence on venereal disease. First you will take a 9 item pre-test. Try to answer the items the best you can. Then you will receive the instructional sequence,
and lastly a 9 item post-test. In order to do well on the post-test, it is important that you answer all questions presented within the instructional sequence to the best of your ability.

2. If you have any problems with the computer terminal, ask the assistant in the room to aid you. Please do not ask the assistant to help you with any of the questions.

3. Before we get started, it is necessary for you to be able to communicate with the computer effectively. You will be asked to respond in various ways. Sometimes you will type your answer and press the RETURN key; at other times you will be directed only to press the RETURN key. Find the RETURN KEY and press it now.

SECTION 2

SECTION OPTIONS:
1 TRIALS = 1

QUESTION:
2 VERY GOOD! You found it. You must remember to press the RETURN key after each response.
3 (Please press the RETURN key to continue.)
SECTION 3

SECTION OPTIONS:
1 TRIALS = 1

QUESTION:
2 We will begin with the 9 item pre-test. Try to answer the
3 questions as best you are able. (Hit the RETURN key please)

SECTION 4

SECTION OPTIONS:
1 COUNTER = 3
2 TRIALS = 1

KEYWORD

QUESTION:
3 1) With regard to the agent that causes gonorrhea
4 it might be said that it
5
6 A) also infects several species of lower animals
7 B) is a virus.
8 C) is a gram-positive diplococcus.
9 D) is a pyogenic pathogen.
10 E) is insensitive to antibiotics.
11
12 (Please type ONLY the letter A,B,C,D or E.)

CORRECT ANSWER GROUP
13 #D#
SECTION # 5

SECTION OPTIONS:
1 TRIALS = 1
2 COUNTER = 3
KEYWORD

QUESTION:
3 2) Which of the following statements is FALSE?
4
5 A) Gonorrhea is the most common venereal disease reported in the United States.
6 B) The causative agent of gonorrhea is a gram-negative bacterium.
7 C) The causative agent of gonorrhea is a pyogenic diplococcus.
8 D) Although primarily a human disease, gonorrhea is found among certain species of lower animals.
9 E) In recent years the agent of gonorrhea has manifested a slowly developing penicillin resistance.

CORRECT ANSWER GROUP
17 #D#

SECTION # 6

SECTION OPTIONS:
1 TRIALS = 1
2 COUNTER = 3
KEYWORD
QUESTION:
3 3) Common complications of ascending gonococcal
infection in the female include all of the
following EXCEPT
6
7 A) pyosalpinx
8 B) predisposition ot tubal pregnancy
9 C) scarring and tubal stricture
10 D) amenorrhea
11 E) acute peritonitis

CORRECT ANSWER GROUP
13 #D#

SECTION # 7

SECTION OPTIONS:
1 TRIALS = 1
2 COUNTER = 3

QUESTION:
3 4) Complications of gonorrhea in the male OFTEN include
infection of all the following EXCEPT
5
6 A) urethra
7 B) prostate
8 C) seminal vesicles
9 D) epididymes
10 E) testicles
11
QUESTION: 3 5) All of the following are general characteristics of spirochetosis EXCEPT

6 A) difficulty in isolating, culturing and staining the infecting organism.
7 B) infections of long duration.
8 C) widespread dissemination of the organism within the infected individual.
9 D) extremely high fever, leukocytosis and prostration during the acute phase.
10 E) ready communicability of the infection.
QUESTION:

Which of the following does NOT belong to a category common to the rest?

A) chancre
B) thoracic aortic aneurysm
C) gumma
D) hepar lobatum
E) spirochete

CORRECT ANSWER GROUP

#E#
B) swarming with spirochetes and highly infectious.
C) not clinically detectable.
D) confined to the aorta.
E) almost never found on mucous membranes.

CORRECT ANSWER GROUP
13  #B#

SECTION # 11

SECTION OPTIONS:
1  TRIALS = 1
2  COUNTER = 3
KEYWORD

QUESTION:
3  8) Acquired (not congenital) syphilis can be spread by
4
5  A) sexual contact only.
6  B) any contact with a gumma.
7  C) contact with dried exudate from any syphilitic lesion.
8  D) direct contact with fresh material from a primary or secondary lesion.
9  E) direct contact with fresh material from a tertiary lesion.

CORRECT ANSWER GROUP
14  #D#
SECTION # 12

SECTION OPTIONS
1  TRIALS = 1
2  COUNTER = 3
KEYWORD

QUESTION:
3  9) All of the following are true of the SECONDARY
4  stage of syphilis EXCEPT
5
6  A) The lesions heal spontaneously.
7  B) The infectious agent is distributed widely
8  throughout the body.
9  C) Direct contact with lesions may transmit the
10  disease.
11  D) The lesions are varied and often confused with those
12  of other diseases
13  E) There is no lymphadenopathy.
14

CORRECT ANSWER GROUP
15  #E#

SECTION # 13

SECTION OPTIONS:
1  TRIALS = 1

QUESTION:
2  ***BEGINNING OF THE INSTRUCTIONAL SEQUENCE***
3
4  (Please press the RETURN key to continue.)
5
SECTION # 14

SECTION OPTIONS:
1 TRIALS = 1

QUESTION:
2 In this instructional sequence, you will learn
3 about venereal disease. You will develop a detailed
4 comparison between gonorrhea and syphilis as examples
5 of venereal disease.
6
7 Mentioned (where applicable) will be:
8
9 a) characteristics of the infecting agent
10 b) pathogenesis (development) of the disease
11 c) stages of the disease
12 d) clinical signs and usual course
13 e) possible complications
14 f) epidemiology (prevalence and spreading),
15 prophylaxis (prevention),
16 treatment and residual immunity
17
18 (Please press the RETURN key to continue.)
19
20

SECTION # 15

SECTION OPTIONS:
1 TRIALS = 1

QUESTION:
2 In this section of the instructional sequence,
a general overview of venereal disease will be
presented to you.

(Please press the RETURN key to continue.)

SECTION # 16

SECTION OPTIONS:
1 TRIALS = 1

QUESTION:
A venereal disease is one that is spread principally
by sexual contact.

These following 5 diseases, listed in order of decreasing
(highest to lowest) incidence in the United States are
all venereal:

1) Gonorrhea
2) Syphilis
3) Chancroid
4) Lymphogranuloma Venereum
5) Granuloma Inguinale

Only the first two, however, are of any public health
significance in the United States and most of Europe. In
the United States these two diseases, gonorrhea and syphilis,
account for more than 99 per cent of all reported cases
of venereal disease.
Because of their comparatively overwhelming importance, the prime focus of this discussion of venereal disease will be limited to these two diseases. (Please press the RETURN key to continue.)
Which of the following best expresses the percentage of reported cases of venereal disease in the United States other than gonorrhea and syphilis?

A) 1  
B) 5  
C) 7  
D) 25  
E) 99

CORRECT ANSWER GROUP

REPLY FOR THIS GROUP:
Correct you are. Chancroid, Lymphogranuloma Venereum, and Granuloma Inguinale account for 1% of reported cases of venereal disease.

WRONG ANSWER GROUP:

REPLY FOR THIS GROUP:
No. The question asked for the percentage of cases NOT attributed to gonorrhea and syphilis. The answer is A) 1.

$$BRANCH- 19$$
Question:

Which venereal disease has the highest incidence in the United States?

A) Syphilis
B) Chancroid
C) Gonorrhea

CORRECT ANSWER GROUP
#C#

REPLY FOR THIS GROUP:
Correct. Gonorrhea is the venereal disease which has the highest incidence.

WRONG ANSWER GROUP:
#A#

REPLY FOR THIS GROUP:
Wrong! Syphilis is the venereal disease with the second highest incidence. Gonorrhea is the correct response.

WRONG ANSWER GROUP:
#B#

REPLY FOR THIS GROUP:
Wrong! Chancroid is the venereal disease with the third highest incidence. Gonorrhea is the correct response.

REPLY TO UNEXPECTED ANSWER:
Please select A, B or C.
SECTION # 19

SECTION OPTIONS:
  KEYWORD
  1   TRIALS = 3

QUESTION:
  2   Which venereal has the highest incidence in
  3   the United States?
  4
  5   A) Syphilis
  6   B) Chancroid
  7   C) Gonorrhea

CORRECT ANSWER GROUP:
  9   #C#

REPLY FOR THIS GROUP:
  10  Correct. Gonorrhea is the venereal disease which has
  11   the highest incidence.

WRONG ANSWER GROUP:
  12  #A#

REPLY FOR THIS GROUP:
  13  Wrong! Syphilis is the venereal disease with the SECOND
  14   highest incidence. Gonorrhea is the correct response.
  15   $$$BRANCH-  20

WRONG ANSWER GROUP:
  16  #B#

REPLY FOR THIS GROUP:
  17  Wrong! Chancroid is the venereal disease with the
THIRD highest incidence. Gonorrhea is the correct response.

REPLY TO UNEXPECTED ANSWER:
Please selected A, B or C.

FAILURE MESSAGE:
Wow

SECTION # 20

SECTION OPTIONS:

KEYWORD
1 TRIALS = 3

QUESTION:
You have not passed the acceptable criterion on the formative quiz testing your knowledge of the previous material. It is advised that you take a short review of the previous material.

However, the decision is up to you.

Would you like a short review of the previously presented material?

(Press Y if yes; press N if no.)

CORRECT ANSWER GROUP
BILL
Venereal diseases in order of decreasing incidence in the United States:

1) Gonorrhea
2) Syphilis
3) Chancroid
4) Lymphogranuloma Venereum
5) Granuloma Inguinale

Gonorrhea and syphilis account for more than 99% of all venereal disease reported in the U.S.

***END OF REVIEW***
SECTION # 21

SECTION OPTIONS:
1  TRIALS = 1

QUESTION:
2  In this section, gonorrhea will be discussed.
3  You will learn the characteristics of the infecting agent.
4  and the pathogenesis (development) of the disease.
5
6  (Please press the RETURN key to continue.)

SECTION # 22

SECTION OPTIONS:
1  TRIALS = 1

QUESTION:
2  Gonorrhea is the most prevalent of all venereal diseases.
3  The ratio of gonorrhea to syphilis reported today in the
4  United States is about 20:1. An estimated 2 million new
5  cases of gonorrhea occurred in America in 1970, placing the
6  dynamics of this disease within the limits of an epidemic.
7
8  Failure to control gonorrhea is based on factors such as
9  the rapid collapse of traditional value systems. However,
10  no small part is due to the highly infectious nature of
11  Neisseria gonorrhoeae, the causative organism.
12
13  Neisseria gonorrhoeae was discovered by Albert Neisser
14  in 1879. It is a gram negative diplococcus. The organism
15  is an exclusively human pathogen, and is pyogenic (pus
16  forming)
Gonorrhea exhibits a very short incubation period. It ranges from 2 to 6 days. It does NOT leave its victim immune to future infection. There is reason to believe that a large reservoir of asymptomatic (without symptoms) female carriers exists, particularly in areas of high prevalence. Young adults rank first in incidence.

(Please press the RETURN key to continue.)

SECTION # 23

SECTION OPTIONS:

KEYWORDS

1 TRIALS = 3

QUESTION:

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17
With regard to Neisseria gonorrhoea, it is true that it

A) also infects lower animals.
B) is a virus.
C) is a gram-positive diplococcus
D) is a pyogenic pathogen.
E) is not sensitive to antibiotics.

CORRECT ANSWER GROUP
#D#

REPLY FOR THIS GROUP:
You are right. Neisseria gonorrhoeae is a pyogenic (pus
forming) pathogen.

WRONG ANSWER GROUP:
#A#

REPLY FOR THIS GROUP:
No. The causative agent (Neisseria gonorrhoeae) only infects humans. The correct response is D. (It is pyogenic.)
Which ratio correctly expresses reported gonorrhea to syphilis in the United States?

A) 3/1  
B) 7/1  
C) 20/1  
D) 40/1  
E) 60/1

CORRECT ANSWER GROUP
#C#

REPLY FOR THIS GROUP:
Right you are.

WRONG ANSWER GROUP:
#A#  
#B#  
#D#  
#E#

REPLY FOR THIS GROUP:
This is incorrect. The correct answer is C. Reported gonorrhea to syphilis has a ratio of 20/1.
REPLY TO UNEXPECTED ANSWER:
   Please select A,B,C,D or E.

FAILURE MESSAGE:
   wow

SECTION # 25

SECTION OPTIONS:
   KEYWORD
   TRIALS = 3

QUESTION:
   Which ratio correctly expresses reported gonorrhea to syphilis in the United States?

A) 3/1
B) 7/1
C) 20/1
D) 40/1
E) 60/1

CORRECT ANSWER GROUP
   #C#

REPLY FOR THIS GROUP:
   Right you are.

WRONG ANSWER GROUP:
   #A# #B# #D#
REPLY FOR THIS GROUP:
17 This is incorrect. The correct answer is C. Reported gonorrhea to syphilis has a ratio of 20/1.
19 $$BRANCH-26$$

REPLY TO UNEXPECTED ANSWER:
20 Please select A,B,C,D or E.

FAILURE MESSAGE:
21 wow

SECTION # 26

SECTION OPTIONS:
1 TRIALS = 3

KEYWORD

QUESTION:
2 Your responses on the formative quiz of the previous material indicate that it would be advisable for you to take a short review.
5 But this decision is up to you.
7 Would you like a short review of the previous material?
9 (Press Y if yes; press N if no.)

CORRECT ANSWER GROUP

12 BILL
The ratio of reported gonorrhea to syphilis in the U.S. is about 20:1.

Neisseria gonorrhoeae (the causative organism):

1) was discovered by Albert Neisser in 1879.
2) is a gram negative diplococcus.
3) is an exclusively human pathogen.
4) is pyogenic (pus forming).
5) is penicillin sensitive (although a slowly developing penicillin resistance has been noticed.)
FAILURE MESSAGE:
    35  wow

SECTION # 27

SECTION OPTIONS:
    1  TRIALS = 1

QUESTION:
    2  In this section you will learn the disease characteristics
    3  of gonorrhea when present in both the male and female.
    4
    5  (Please press the RETURN key to continue.)

SECTION # 28

SECTION OPTIONS:
    1  TRIALS = 1

QUESTION:
    2  In the male, gonorrhea is usually localized to urothelial
    3  surfaces, and begins as a purulent (pus containing) urethritis.
    4  There is pain on urination (dysuria), but no other complications
    5  in early mild infections. Repeated or persistent infections
    6  may spread up the genital tract involving prostate, seminal
    7  vesicles and epididymes, but rarely involving testicles.
    8  Complications may include sterility and urethral stricture.
    9
    10  In the female, gonorrhea is a quite different disease from
    11  that in the male. The woman may harbor the organism, but be
essentially asymptomatic for long periods.

However, in time, the organism in the female may traverse the urethra and spread up the birth canal to involve the fallopian tubes, ovaries and peritoneal cavity. These developments give rise to severe pelvic inflammatory disease (PID) or life-threatening peritonitis. Other complications include pyosalpinx (fallopian tube sealed and distended with pus), and sterility.

(Please press the RETURN key to continue.)

SECTION # 29

SECTION OPTIONS:
1 TRIALS = 3

KEYWORD

QUESTION:
Common complications of ascending gonococcal infection in the female include all of the following EXCEPT

A) sterility  
B) pelvic inflammatory disease (PID)  
C) tubal stricture  
D) amenorrhea  
E) peritonitis

CORRECT ANSWER GROUP:

#D#

REPLY FOR THIS GROUP:

Very good! Amenorrhea is NOT a common complication of gonococcal infection in the female.
Your response is incorrect. This IS a common complication of gonococcal infection in the female. The correct response is D) amenorrhea.
CORRECT ANSWER GROUP
13  #D#

REPLY FOR THIS GROUP:
14  Yes! You are right.
15  Untreated male carriers may NOT be aware of their infection.
16  $$BRANCH- 33$

WRONG ANSWER GROUP:
17  #A#
18  #B#
19  #C#
20  #E#

REPLY FOR THIS GROUP:
21  No. This is a true statement. The false statement is
22  D) Untreated male carriers of gonorrhea are aware of their
23  infection.
24  $$BRANCH- 32$

REPLY TO UNEXPECTED ANSWER:
25  Please select A,B,C,D or E.

FAILURE MESSAGE:
26  wow

SECTION # 31

SECTION OPTIONS:
1  TRIALS = 3
  KEYWORD

QUESTION:
2  Which of the following statements is FALSE?
A) Untreated female carriers of gonorrhea may not be aware of their own infection.
B) Gonorrhea may cause sterility in the male.
C) Gonorrhea may cause sterility in the female.
D) Untreated male carriers of gonorrhea are aware of their own infection.
E) Salpingitis is a complication of gonorrhea in the female.

CORRECT ANSWER GROUP

13 $D$

REPLY FOR THIS GROUP:
14 Yes! You are right.
15 Untreated male carrier may NOT be aware of their infection.
16 $$BRANCH- 32$$

WRONG ANSWER GROUP:

17 $A$
18 $B$
19 $C$
20 $E$

REPLY FOR THIS GROUP:
21 No. This is a true statement. The false statement is
22 D) Untreated male carriers of gonorrhea are aware of their infection.
23 $$BRANCH- 32$$

REPLY TO UNEXPECTED ANSWER:
25 Please select A,B,C,D or E.
FAILURE MESSAGE:
  26  wow

SECTION # 32

SECTION OPTIONS:
  1  TRIALS = 3
  KEYWORD

QUESTION:
  2   Your performance on the formative quiz in this section
  3   indicates that it is advisable that you take a short review
  4   of the previous material.
  5
  6   (However, the decision is up to you.
  7
  8   Would you like a short review of the previously presented
  9   material?
 10
 11   (Press Y if yes; press N if no.)
 12

CORRECT ANSWER GROUP:
  13  BILL

REPLY FOR THIS GROUP:
  14

WRONG ANSWER GROUP:
  15  #Y#

REPLY FOR THIS GROUP:
  16   *** REVIEW ***
COMPLICATIONS OF GONORRHEA

1) In the male:

a) purulent (pus forming) urethritis (may be asymptomatic)
b) retrograde spread may involve prostate, seminal vesicles, epididymes (but rarely testicles)
c) sterility and urethral stricture may result.

2) In the female:

a) purulent urethritis (may be asymptomatic)
b) retrograde spread may cause salpingitis, pyosalpinx (fallopian tube sealed), PID, and
c) sterility may result.

*** END OF REVIEW ***

WRONG ANSWER GROUP:

#N#

REPLY FOR THIS GROUP:

O.K. We will then continue to the next presentation.

REPLY TO UNEXPECTED ANSWER:

Press Y if you want to review, press N if you do not want a review.

FAILURE MESSAGE

wow
SECTION # 33

SECTION OPTIONS:
1 TRIALS = 1

QUESTION:
2 In this section syphilis will be discussed. You will learn
3 the characteristics of the infecting agent and the development
4 of the disease.
5
6 (Please press the RETURN key to continue.)

SECTION # 34

SECTION OPTIONS:
1 TRIALS = 1

QUESTION:
2 Syphilis is an infectious disease characterized by long
3 duration, widespread systematic involvement and a confusing
4 variety of signs and symptoms.
5
6 There are 3 genera of spirochetes which cause human
disease: Treponema, Borrelia, and Leptospira. The general
7 features of spirochetosis are: widespread dissemination of the
8 organism within the body, a relatively mild reaction, difficulty
9 in isolating, culturing and staining the organism, and
10 the persistence of infection.
11
12 The causative agent of syphilis belongs to the spirochete
13 (genus) Treponema. Specifically, it is Treponema pallidum,
14 an exquisitely delicate organism that has proven to be
unfailingly sensitive to a variety of antibiotics. Treponema pallidum is a single-host human pathogen.

Like gonorrhea, syphilis is most prevalent among the young (62% of cases occur between the ages of 15 and 25). Unlike gonorrhea, which is usually localized to the urethra, syphilis is always a generalized, systemic infection. It is seen as either an acquired or congenital disease.

(Please press the RETURN key to continue.)
All of the following are characteristics of spirochetosis EXCEPT

A) communicability of the infection
B) usual absence of necrosis
C) widespread dissemination of the organism within the infected individual
D) extremely high fever and leukocytosis during the acute phase
E) difficulty in isolating and staining the infecting organism.

CORRECT ANSWER GROUP

#D#

REPLY FOR THIS GROUP:

Correct! Let's try the next question.

WRONG ANSWER GROUP:
Of the following, which is the genus of spirochetes that the causative organism of syphilis belongs?

A) Leptospira
B) Granuloma
C) Treponema
D) Lymphonoma
E) Borrelia
CORRECT ANSWER GROUP
11  #C#

REPLY FOR THIS GROUP:
12  Yes, this is right. On to the next question.
13  $$$BRANCH- 39

WRONG ANSWER GROUP:
14  #B#
15  &&&
15  #D#
16  &&&

REPLY FOR THIS GROUP:
18  This is an incorrect response. The correct answer is C.
19  $$$BRANCH- 38

WRONG ANSWER GROUP:
20  #A#
21  #E#
22  &&&
23  &&&
24  &&&

REPLY FOR THIS GROUP:
25  This is an incorrect response. This is a genus of
26  spirochetes, but the correct genus is C.
27  $$$BRANCH- 38

REPLY TO UNEXPECTED ANSWER:
28  Please select A,B,C,D or E.

FAILURE MESSAGE:
29  wow
SECTION # 37

SECTION OPTIONS:
   KEYWORD
   1 TRIALS = 3

QUESTION:
   Of the following, which is the genus of spirochetes that the causative organism of syphilis belongs?

   A) Leptospira
   B) Granumloma
   C) Treponema
   D) Lymphonoma
   E) Borrelia

CORRECT ANSWER GROUP
   #C#

REPLY FOR THIS GROUP:
   Yes, this is right.

WRONG ANSWER GROUP:
   #B#
   #D#

REPLY FOR THIS GROUP:
   This is an incorrect response. The correct answer is C.

WRONG ANSWER GROUP:
   #A#
   #E#
REPLY FOR THIS GROUP:
19 This is an incorrect response. This is a genus of spirochetes, but the correct genus is C.
20 $$\text{BRANCH- 38}$$

REPLY TO UNEXPECTED ANSWER:
22 Please select A,B,C,D or E.

FAILURE MESSAGE:
23 wow

SECTION # 38

SECTION OPTIONS:
1 TRIALS = 3
KEYWORD

QUESTION:
2 Your performance on the quiz of this section indicates that you should be advised to take a short review of the previous material.
3 However, this decision is yours.
4 Would you like a short review of the previously presented material?
5 (Press Y if yes; press N if no.)
11

CORRECT ANSWER GROUP
13 BILL
173

WRONG ANSWER GROUP:

14 #Y#

REPLY FOR THIS GROUP:

15 ***REVIEW***
16
17 1) There are 3 genera of spirochetes which cause human
disease:
18
20 Treponema
21 Borrelia
22 Leptospira
23
24 2) General features of spirochetosis:
25
26 a) widespread dissemination of the organism within
the body
27 b) relatively mild reaction
28 c) usual absence of necrosis (death of tissue)
29 d) difficulty in isolating, culturing and staining
the organism
30 e) persistence of infection
31
32 3) T. Pallidum is a single-host human pathogen.
33
34 4) T. Pallidum is sensitive to a number of antibiotics.
35
36 *** END OF REVIEW ***
37 $$$BRANCH- 39$$$

WRONG ANSWER GROUP:

40 #N#
41
All right, On to the next question.

Press Y if you want a review; press N if you do not.

wow

In this section you will learn how acquired syphilis is transmitted and spread.

You will also learn the clinical course of syphilis, which follows 3 major stages - primary, secondary and tertiary.

(Please press the RETURN key to continue.)

Most acquired syphilis (about 95%) is transmitted sexually. Wherever a living spirochete comes in contact with
a body surface, there is the potential for its penetrating and initiating an infection.

Thus accidental direct inoculation may occur in any contact (sexual or nonsexual) with the moist effusion of a primary or secondary lesion. However, tertiary lesions are not infective. Acquired syphilis can also be spread by blood transfusion. although this is rare today.

(Please press the RETURN key to continue.)
The clinical course of syphilis follows 3 major stages. The primary stage begins after an incubation period of 1 to 10 weeks with the appearance of a chancre (lesion) at the point of inoculation. The chancre is the primary lesion of syphilis and is the hallmark of the primary stage.

The secondary stage usually becomes manifest in the appearance of one or a combination of a variety of skin and mucous lesions 1 to 3 months after the chancre is noticed. In most instances the chancre will have healed before the appearance of secondary signs. Some of these signs are rash, lymphadenopathy, and mucous patch.

(Please press the RETURN key to continue.)
With the resolution of secondary lesions, the infected individual appears to be cured; however, in many cases the disease has merely entered a more concealed phase, known as the latent state. Persons within the latent state are not infectious, but harbor the organism within their body for varying lengths of time.

About 1/3 of all untreated cases progress to the tertiary stage, where permanent damage to the cardiovascular and nervous systems may occur. Tertiary lesions may appear at any time 1 to 30 years following early stages of the disease. Signs of tertiary syphilis are cardiovascular lesions, such as aortic...
aneurysm (thoracic), gumma (a soft, rubbery tumor), and hepatic lobatum.

(Please press the RETURN key to continue.)

SECTION § 43

SECTION OPTIONS:
  KEYWORD
  1  TRIALS = 3

QUESTION:
  2
  3
  4
  5
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  9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
Which of the following does NOT belong to a category common to the rest?

A) chancre  
B) thoracic aortic aneurysm  
C) gumma  
D) hepar lobatum  
E) spirochete

CORRECT ANSWER GROUP

#E#

REPLY FOR THIS GROUP:

Yes! The other responses are signs of syphilis, while E) spirochete is the causative agent.

WRONG ANSWER GROUP:

#A#  
#B#  
#C#  
#D#
REPLY FOR THIS GROUP:
50 No. Responses A,B,C and D are signs of syphilis, while
51 the correct answer, spirochete, is the causative agent.
52 $$BRANCH- 46$$

REPLY TO UNEXPECTED ANSWER:
53 Please select A,B,C,D or E.

FAILURE MESSAGE:
54 wow

SECTION # 44

SECTION OPTIONS:
1 TRIALS = 3
KEYWORD

QUESTION:
2 A focal area of non-suppurative granuloma inflammatory
3 destruction seen in a person also manifesting tertiary
4 syphilis will probably prove to be a
5
6 A) tubercle
7 B) Aschoff nodule
8 C) condyloma
9 D) gumma
10 E) papule
11

CORRECT ANSWER GROUP
12 #D#
13
REPLY FOR THIS GROUP:
14 Right you are! Let's try the next question.
15

WRONG ANSWER GROUP:
16 #A#
17 #B#
18 #C#
19 #E#

REPLY FOR THIS GROUP:
20 This is an incorrect response. Tertiary syphilis is
21 associated with gumma.
22 $$$BRANCH- 47

REPLY TO UNEXPECTED ANSWER:
23 Please select A,B,C,D or E.

FAILURE MESSAGE:
24 wow

SECTION # 45

SECTION OPTIONS:
1 TRIALS = 3
   KEYWORD

QUESTION:
2 The lesions of secondary syphilis are
3
4 A) chronic and scar forming
5 B) swarming with spirochetes and highly infective
6 C) only in the aorta
7 D) not detectable clinically
8 E) hardly found on mucous membranes

CORRECT ANSWER GROUP
10 #B#
11

REPLY FOR THIS GROUP:
12 Correct! Good for you. We'll now proceed to the final section.
13
14 $$BRANCH- 52$$

WRONG ANSWER GROUP:
15 #A#

REPLY FOR THIS GROUP:
16 No. Remember, we are talking about SECONDARY syphilis. The correct response is B.
17
18
19 $$BRANCH- 48$$

WRONG ANSWER GROUP:
20 #C#
21 #D#
22 #E#

REPLY FOR THIS GROUP:
23 No. The correct response is B.
24
25 $$BRANCH- 48$$
REPLY TO UNEXPECTED ANSWER:
26 Please select A,B,C,D or E.

SECTION 1 46

SECTION OPTIONS:
1 TRIALS = 3

KEYWORD

QUESTION:
2 A focal area of non-suppurative granuloma inflammatory destruction seen in a person also manifesting tertiary syphilis will probably prove to be a
3
4
5
6 A) tubercle
7 B) Aschoff nodule
8 C) condyloma
9 D) gumma
10 E) papule

CORRECT ANSWER GROUP
12 #D#

REPLY FOR THIS GROUP:
13 Right you are! Let's try the next question.

WRONG ANSWER GROUP:
15 #A#
REPLY FOR THIS GROUP:
19 This is an incorrect response. Tertiary syphilis is
20 associated with gumma.
21
22 $$BRANCH- 47$$

REPLY TO UNEXPECTED ANSWER:
23 Please select A,B,C,D or E.

FAILURE MESSAGE:
24 wow

SECTION # 47

SECTION OPTIONS
1 TRIALS = 3

QUESTION:
2 The lesions of secondary syphilis are
3
4 A) chronic and scar forming
5 B) swarming with spirochetes and highly infective
6 C) only in the aorta
7 D) not detectable clinically
8 E) hardly found on mucous membranes
CORRECT ANSWER GROUP
10 #B#

REPLY FOR THIS GROUP:
11 Correct!
12
13 $$BRANCH-48$

WRONG ANSWER GROUP:
14 #A#

REPLY FOR THIS GROUP:
15 No. Remember, we are talking about SECONDARY syphilis.
16 The correct response is B.
17
18 $$BRANCH-48$

REPLY TO UNEXPECTED ANSWER:
19 Please select A, B, C, D or E.

FAILURE MESSAGE:
20 wow

SECTION # 28

SECTION OPTIONS:

KEYWORD
1 TRIALS = 3

QUESTION:
2 Your performance on the quiz of the previous material
3 indicates that it is advisable for you to take a short review.
But this decision is up to you.

Would you like a short review of the previously presented material?

(Press Y if yes; press N if no.)

CORRECT ANSWER GROUP

BILL

WRONG ANSWER GROUP:

#Y#

REPLY FOR THIS GROUP:

*** REVIEW ***

How acquired syphilis is spread:

1) Sexual exposure (about 95% is transmitted sexually)
   Contact with moist effusion of a primary or secondary lesion is usually required.

2) Accidental direct inoculation -
   Any contact (sexual or nonsexual) with moist effusion of any primary or secondary lesion is potentially infective. Tertiary lesions are NOT infective.
30  3) Blood transfusion (rare today) -
31
32  Spirochetes die in banked blood.
33
34
35
36  $$$BRANCH- 49

WRONG ANSWER GROUP:

37  #N#

REPLY FOR THIS GROUP:

38  All right. We will then go to the last section.
39  $$$BRANCH- 52

REPLY TO UNEXPECTED ANSWER:

40  Press Y if you want a review; press N if you do not want
41  a review.

FAILURE MESSAGE:

42  wow

SECTION # 49

SECTION OPTIONS:
1  TRIALS = 1

QUESTION:
2  (Please press the RETURN key to continue.)
3

FAILURE MESSAGE:
4
SECTION # 50

SECTION OPTIONS:
   1  TRIALS = 1

QUESTION:
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  29  Clinical stages of syphilis:
  30
1) **Primary** - appearance of a chancre 1 to 10 weeks after exposure

2) **Secondary** - appearance of any one or combination of a variety of skin and mucosal eruptions 1 to 3 months after the chancre is noticed.

**Latent** - interpretation varies, but usually is taken to mean the stage following disappearance of secondary lesions and preceding the appearance of tertiary.

3) **Tertiary** (1/3 of untreated cases) - irreversible lesions primarily affecting cardiovascular and nervous systems appearing 1 to 30 years following early stages.

(Please press the RETURN key to continue.)

**SECTION # 51**

**SECTION OPTIONS:**

1  TRIALS = 1

**QUESTION:**

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Signs of Syphilis:

1) Primary stage
   chancre

2) Secondary stage
   rash
   alopecia
   lymphadenopathy
   annular skin lesions
   split papule
45 mucous patch
46
47 3) Tertiary stage
48
49 cardiovascular lesions
50
51 aortic aneurysm (thoracic)
52 syphilitic aortitis
53
54 central nervous system deficit
55
56 tabes dorsalis
57
58 gumma
59
60 miscellaneous
61
62 hepar lobatum
63
64 *** END OF REVIEW ***
65
66
67 (Please press the RETURN key to continue.)

SECTION # 52

SECTION OPTIONS:
1 TRIALS = 1

QUESTION:
2 In this last section of material, you will learn how
3 congenital syphilis is transmitted and spread.

191
SECTION # 53

SECTION OPTIONS:
1  TRIALS = 1

QUESTION:
2 Congenital syphilis is a form in which the developing fetus
3 is involved as a complication of maternal infection. For reasons
4 yet unexplained, spirochetes infecting the mother cannot invade
5 the fetus until approximately 4 1/2 to 5 months of gestation.
6 Treatment of the infected mother at some time prior to the
7 5th month will usually prevent fetal infection.
8
9 Untreated congenital syphilis results in a variety of
10 diseases ranging from fetal wastage and perinatal death to a
11 series of stigmatizing lesions which include: depression of
12 the bridge of the nose (saddle nose), a tibial deformity
13 (saber shin), and three pathognomonic lesions first described
14 by Hutchinson. These include notched, screw-driver shaped
15 incisors, interstitial keratitis and eighth nerve deafness.
16
17 The newborn with congenital syphilis manifests the secondary
18 stage seen in the acquired form.
19
20 (Please press the RETURN key to continue.)
21
SECTION # 54

SECTION OPTIONS:
  1 TRIALS = 3
  KEYWORD

QUESTION:
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31 Which of the following is a form of syphilis spread by intrauterine infection?

32
33 A) Primary
34 B) Acquired
35 C) Latent
36 D) Congenital
37 E) Permanent

CORRECT ANSWER GROUP
40 #D#

REPLY FOR THIS GROUP:
41 Yes! Congenital syphilis is spread by intrauterine infection.

WRONG ANSWER GROUP:
43 #A#
44 #C#
45 #E#

REPLY FOR THIS GROUP:
46 Incorrect! The correct answer is D.
47
48 $$BRANCH- 56$$

WRONG ANSWER GROUP:
49 #B#

REPLY FOR THIS GROUP:
50 Incorrect! Acquired syphilis is spread during extrauterine life. The correct answer is D.
51
52 $$BRANCH- 56$$
REPLY TO UNEXPECTED ANSWER:

53 Please select A, B, C, D or E.

FAILURE MESSAGE:

54 wow

SECTION # 55

SECTION OPTIONS:

1 TRIALS = 3
KEYWORD

QUESTION:

2 Which of the following is FALSE?

3

4 A) The infected child is born manifesting the secondary stage of infection.

5 B) In recent years there has been a rise in congenital cases.

6 C) Spirochetes can invade the fetus before 4 1/2 to 5 months of gestation.

7 D) Fetal infection causes late abortion, stillbirth, perinatal death or lesions.

8 E) Congenital syphilis is contracted in utero through maternal infection.

CORRECT ANSWER GROUP

15 #C#
REPLY FOR THIS GROUP:
16   Right! Spirochetes can NOT invade the fetus before this time.
17
18   $$BRANCH- 59$$

WRONG ANSWER GROUP:
19 #A#
20 #B#
21 #D#
22 #E#

REPLY FOR THIS GROUP:
23   Wrong! This is a true statement. The false statement is C.
24
25   $$BRANCH- 57$$

REPLY TO UNEXPECTED ANSWER:
26   Please select A,B,C,D or E.

FAILURE MESSAGE:
27   wow

SECTION # 56

SECTION OPTIONS:
1   TRIALS = 3
KEYWORD

QUESTION:
2   Which of the following is FALSE?
3
A) The infected child is born manifesting the secondary stage of infection.

B) In recent years, there has been a rise in congenital cases.

C) Spirochetes can invade the fetus before 4 1/2 to 5 months of gestation.

D) Fetal infection causes late abortion, stillbirth, perinatal death or lesions.

E) Congenital syphilis is contracted in utero through maternal infection.

CORRECT ANSWER GROUP
15  #C#

REPLY FOR THIS GROUP:
16    Right! Spirochetes can NOT invade the fetus before this time.

WRONG ANSWER GROUP:
18    #A#
19    #B#
20    #D#
21    #E#

REPLY FOR THIS GROUP:
22    Wrong! This is a true statement. The false statement is C.
23 $$BRANCH- 57$$

REPLY TO UNEXPECTED ANSWER:
25    Please selected A,B,C,D or E.

FAILURE MESSAGE:
26    wow
SECTION # 57

SECTION OPTIONS:
  KEYWORD
  1 TRIALS = 3

QUESTION:
  2  Your performance on the formative quiz of the previous
  3  material indicates that it is advisable to take a short review
  4  of this section.
  5
  6  The decision rests with you.
  7
  8  Would you like a short review of the previous material?
  9
 10  (Press Y if yes; press N if no.)

CORRECT ANSWER GROUP
  12  BILL

WRONG ANSWER GROUP:
  13  #Y#

REPLY FOR THIS GROUP:
  14  *** REVIEW ***
  15
  16  Congenital Syphilis:
  17
  18  1) Maternal disease causes fetal infection.
2) Spirochetes cannot invade the fetus until approximately 4 1/2 to 5 months. Treatment of the mother before the 5th month prevents fetal infection.

3) Fetal infection causes late abortion, stillbirth, perinatal death, or stigmatizing lesions:
   - saddle nose
   - saber shin, notched incisors, keratitis
   - 8th nerve deafness

4) Infected child is born manifesting the secondary stage of infection.

*** END OF REVIEW ***

WRONG ANSWER GROUP:

#N#

REPLY FOR THIS GROUP:

O.K.

REPLY TO UNEXPECTED ANSWER:

Press Y if you want a review, N if you do not.

FAILURE MESSAGE:

wow
SECTION # 58

SECTION OPTIONS:

1 TRIALS = 1

QUESTION:

3 *** END OF THE INSTRUCTIONAL SEQUENCE ***

4 You will now take a post-test over the instructional sequence. Please answer the questions to the best of your ability.

5 (Please press the RETURN key to continue.)

SECTION # 60

SECTION OPTIONS:

1 COUNTER = 5
2 TRIALS = 1
3 KEYWORD

QUESTION:

3 1) Which of the following MOST accurately expresses the PERCENTAGE of reported venereal disease in the United States represented by syphilis and gonorrhea TOGETHER?

4 A) 40

5 B) 50
Which of the following is the correct expression of the ratio of reported syphilis to gonorrhea in the U.S.?

A) 1/2
B) 1/5
C) 1/10
D) 1/20
E) 1/50

CORRECT ANSWER GROUP

#D#
QUESTION:
3 3) Which of the following statements regarding Neisseria gonorrhoeae is/are FALSE?

A) It is a gram-negative, pyogenic diplococcus.
B) It is an exclusively human pathogen.
C) both A and B
D) neither A nor B

CORRECT ANSWER GROUP
11 $D$

SECTION # 63

QUESTION:
3 4) Complications of gonorrhea in the male may include

A) urethral stricture
Which of the following statements is FALSE?

A) Treponema pallidum is the only example of a pathogenic spirochete in the human

B) The agent of syphilis is difficult to isolate and culture.

C) Widespread dissemination of the spirochete of syphilis is characteristic of the early stages of this infection.

D) Treponema pallidum is a single-host human pathogen

E) Treponema pallidum is sensitive to a number of antibiotics.

CORRECT ANSWER GROUP:

#A#
QUESTION:

3 6) A clinician develops a chancre on his finger as the result of treating a patient with unsuspected secondary syphilis. His subsequent action should be governed by the knowledge that

8 A) the chancre will heal spontaneously, but the disease may not.
9 B) both the chancre and the disease will heal spontaneously.
10 C) no treatment should be instituted until signs of the next clinical stage appear
11 D) if the chancre heals, the disease is arrested.
12 E) the disease can be treated at this stage by vigorous, local treatment of the chancre.

CORRECT ANSWER GROUP

18 #A#
8) Any of the following may be seen in congenital syphilis EXCEPT

A) 8th nerve deafness
B) interstitial keratitis
C) notching of the central incisor
D) saddle deformity of the nose
E) pulmonary hyaline membrane formation

CORRECT ANSWER GROUP
#E#

SECTION # 68

QUESTION:
9) What is the latest time during pregnancy that one can treat the mother and prevent signs of congenital syphilis in the offspring?

A) third month
B) fourth month
C) sixth month
D) seventh month
E) eighth month
This completes the course. Thank you for your participation. It is hoped that you found the sequence fun as well as informative. Please do not discuss your experience with your classmates. Your cooperation will be deeply appreciated.
BIBLIOGRAPHY


