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**Saidi, Houshmand**

THE IMPACT OF ADVANCE ORGANIZERS UPON STUDENTS' ACHIEVEMENT  
IN COMPUTER-ASSISTED VIDEO INSTRUCTION

*The University of Oklahoma*

PH.D. 1985

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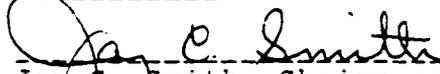
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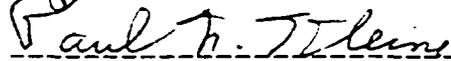
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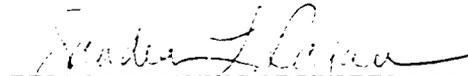
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## ACKNOWLEDGMENTS

After all the hard work that has gone into my doctoral dissertation, I sit among pleasant thoughts and write these words to pay just tribute to those who have helped prepare it.

I wish to express my sincere appreciation to Dr. Jay C. Smith, chairman of the doctoral committee, for his guidance, help, and encouragement during the process of preparation of this dissertation as well as throughout my entire graduate work. I also wish to extend my appreciation to my committee members: Dr. Paul F. Kleine, Dr. Sandra Ragan, Dr. Gary Green, and Dr. Loy Prickett for their advice, encouragement, and valuable suggestions.

I am grateful to my fellow graduate students Steve Zlotolow, Catherine Coulter, Landra Rezabek, and Judith Wakefield for their support, understanding, and for reading the script and making valuable suggestions for its improvement.

My appreciation goes to the entire Instructional Service Center staff and technicians who helped in the preparation of the videotape and the program and also to the students who participated in the experiment.

A special feeling of appreciation goes to my friend Ravi Melkote' and his mother who helped me reach this goal.

For wonderful moral support and warm friendship, I happily acknowledge my debt to the Hashemi family.

I gratefully acknowledge my debt to all these people without whose help I would not have achieved this goal. But over and above all these acknowledgments I offer this work to my dear parents as a token of my love for them. Throughout these years I never lacked inspiration because I could constantly feel the love of Minou, Said, and Mitra reaching out to me from thousands of miles away.

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## ABSTRACT

One of the newer tools for instruction today is Computer-Assisted Video Instruction (CAVI). The focus of this study was the impact of advance organizers as an instructional strategy upon students' achievement in CAVI. Specifically, this research examined the increase of students' rule-learning when exposed to advance organizers presented in a CAVI mediated lesson.

It was hypothesized that subjects who receive the advance organizer treatment in a CAVI mediated lesson would achieve higher mean rule-learning test scores than those who do not receive the advance organizer treatment. To test the hypotheses, a sample of 70 college students were subjected to one of two treatment conditions. The instructional material dealing with rule-learning in basic computer programming for the CAVI lesson was developed on the basis of the Principles of Instructional Design suggested by Gagne' and Briggs (1979). The advance organizer for the CAVI mediated lesson was developed based on Ausubel et al.'s conceptual definition of the term (1978). Translated into operational terms, Mayer's (1979) checklist of attributes for advance organizers provided the basis for the advance organizer developed.

The results-obtained by a 2X2 factorial posttest-showed that the visual-spoken advance organizer did not significantly influence rule-learning in the CAVI situation.

# THE IMPACT OF ADVANCE ORGANIZERS UPON STUDENTS' ACHIEVEMENT IN COMPUTER-ASSISTED VIDEO INSTRUCTION

## CHAPTER 1

### INTRODUCTION

With the industrialization of society has come a larger and more vital role for technology in our world. Continuous innovation is an accepted fact of post-industrial society. In education, as elsewhere, technology is playing an important part. Educational goals may now be reached by technologically-assisted means. Computer Assisted Instruction (CAI) is fact. This study involves the use of the relatively new procedure of Computer-Assisted Video Instruction (CAVI) in an investigation of the impact of advance organizers on learning. The hardware and equipment exist in relatively sophisticated form both for CAI and CAVI. Current efforts are focused more on how to utilize the full potential of these powerful tools.

As Taylor (1980) stated that the computer functions in three modes in learning. It functions as 1) tutor, 2) tool and

3) tutee. When we use a computer to analyze data we are using it in its function as tool. When we program a computer, the part played by the computer is that of tutee. The tutor mode is called Computer-Assisted Instruction (CAI). This facet or mode of computers ideally embodies many of the features of the best individualized learning systems. The limitation is, obviously, a lack of good software. Yet, the use of the computer in this mode is growing. By March 1981, half the nation's school districts were providing students access to at least one microcomputer or computer terminal. An extension of CAI is CAVI. CAVI has two distinctive components: a) computer, and b) video, with the video component being used to illustrate or reinforce the material presented by the computer.

As stated above, one aspect of CAVI is Instructional Television (ITV). Since 1953, ITV has been used in education. By 1978, a third of all school-aged children in the country were using it. Television has delivered most of the characteristics of a live lecture and has, often, stimulated and motivated learning (Maftoon, 1982).

CAVI combines the best of CAI and ITV into a potentially useful instructional tool. The greatest challenge to the use of these systems seems to be the design and development of appropriate materials for delivery to the learner. In the mix of CAVI, which includes the interactive qualities of microcomputers and visual impact of videotape, instructional

material is presented primarily through the videotape and the computer handles such interactive uses as pacing, review, evaluation, and reinforcement (Dillingham, Roe, and Roe, 1982).

Another aspect of instruction that this study dealt with is advance organizers. Research by Ausubel (1960) and others in the area of meaningful verbal learning has shown that advance organizers do facilitate learning under certain conditions. With the increase in the utilization of CAVI in the future, it is important to know whether advance organizers are beneficial in CAVI. The impact of advance organizers on CAVI has not been established, and that is the focus of this study.

Advance organizers are preliminary passages which are designed to expedite the learning of focused information. The concept of advance organizer was evolved by David P. Ausubel (1960), and is based on Ausubel's subsumption theory which states that "cognitive structure is hierarchically organized in terms of highly inclusive concepts under which are subsumed less inclusive sub-concepts and informational data" (Ausubel, 1969, P.99).

Advance organizers are among the most important of the instructional techniques that Ausubel and others investigated, explained and used as pre-instructional strategies. The use of advance organizers as an instructional strategy is for anchoring new material to existing knowledge (cognitive structure) and to promote subsumptive learning 1) by providing

"ideational scaffolding" or anchorage for the learning task and/or 2) by increasing "discriminability" between the new ideas to be learned and related ideas or concepts in cognitive structure (Ausubel, Novak, and Hanesian, 1978).

Most of the conclusions of research by Ausubel and others on subsumption theory involved the immediate retention and transfer of one kind of learning, called substantive learning (Ausubel et al., 1978); which is actually a sub-category of verbal information called substance learning or organized information (Briggs, 1977). Generally research findings support subsumption theory, but Ausubel believed that subsumption theory applies to all types of learning outcomes; however, there has not been enough research yet to support this generalization. Also, a literature search has failed to locate any studies which investigated the impact of advance organizers upon students' learning in a Computer-Assisted Video Instruction mediated lesson which is systematically designed. Even the review of literature, "Voting Technique" by Barnes and Clawson (1975); and "A Meta-Analysis Technique" by Luiten, Ames, and Ackerson, (1979, 1980); Kozlow (1978); Mayer (1979) has not projected any generalization on the effects of advance organizers relative to specific media.

Gagne' and Briggs, (1979) accepted the position of Ausubel which is that meaningful context, in the form of an advance organizer, should come first when verbal information is

expected as an outcome of instruction. They do not agree that an advance organizer is an essential prerequisite for all types of learning outcomes. They believe the psychological organization of intellectual skills may be represented as a learning hierarchy, that the higher levels of learning depend on the lower levels (prerequisites). Based on this assumption, Gagne' classified intellectual skills into the sub-categories of discriminations, concrete concepts, defined concepts, rules and problem solving.

#### Statement of the Problem

This study was concerned with the impact of advance organizers as an instructional strategy upon students' achievement in Computer-Assisted Video Instruction (CAVI). Specifically, this study examined the increase of students' rule-learning when exposed to advance organizers presented in a CAVI mediated lesson.

#### Hypotheses

H1 : Subjects who receive the advance organizer treatment in a CAVI mediated lesson will achieve higher mean rule-learning test scores than those who do not receive the advance organizer treatment.

H2 : Subjects with higher mathematical ability level will

achieve higher mean scores than those with lower mathematical ability level in a systematically designed, CAVI mediated lesson to teach rule-learning.

H3 : Subjects with lower mathematical ability level will show a greater improvement on test scores with advance organizer treatment than will those with higher mathematical ability level in a CAVI-mediated lesson to teach rule-learning.

#### Theoretical Framework

"A Model of Information-Processing Theory of Learning and Memory" by Gagne' and Briggs (1979) (which originated from the work of Gagne' (1977) "The Conditions of Learning") was used as the theoretical basis for designing the instructional events in this study. According to Gagne' and Briggs (1979), "a learning event involves several internal processes, each of which may be influenced by the external factors of instruction" (p.10).

While different learning outcomes should be attempted by means of different instructional strategies, all outcomes come about through the same stages of processing in the learner's mind. The initial stimulation that comes to the senses of the learner becomes transformed first into neural impulses. The initial registration of the stimulation affects what is called sensory registers through the process of attending (which is known as selective perception) and relies upon the learner's

capability to attend to certain features of the contents of the sensory register, and is a very brief kind of registration. Next, information gets recorded in short-term memory, which has limitations in terms of time (20 to 30 seconds) and also in terms of amount (usually between four and seven units of information). After that, the most critical transformation occurs when the held information enters long-term memory for storage. This process is called semantic encoding. As the term implies, in this type of transformation, information is stored according to its meaning. Such information has a general definition which involves the five types of learning outcomes. Learned capabilities are differentiated in Gagne's taxonomy (1977).

In order to confirm learning, the stored information must be sought for in and retrieved from long-term memory. This process requires certain cues which should be provided by external conditions or the learner's memory. The retrieved information enters short-term memory (or working memory) and may be combined with other inputs to form new learned capabilities, and to be transformed into observable action, by way of a response generator which is brought into play to generate a suitable response organization. After this transformation takes place, learner performance can be activated by external feedback which includes the process of reinforcement.

In addition to the learning sequence the theory proposes the existence of executive control processes which are known as cognitive strategies; and they influence attention, selective perception, semantic encoding and retrieval of information, as well as the kind of response organization chosen for the learner's performance. Gagne' and Briggs (1979) summarized the kinds of processing that are presumed to occur during any single act of learning.

1. Attention - determines the external and nature of reception of incoming stimulation
2. Selective perception - transforms this stimulation into the form of object-features, for storage in short-term memory
3. Rehearsal - maintains and renews the items stored in short-term memory
4. Semantic encoding - the process which prepares information for long-term storage
5. Retrieval, including search - returns stored information to the working memory, or to a response generator mechanism
6. Response organization - selects and organizes performance
7. Feedback - an external event which sets in motion the process of reinforcement
8. Executive control processes - select and activate cognitive strategies; these modify any or all of the previously listed internal processes (P.154).

The information-processing model of learning and memory implies that stimulating conditions (external conditions) support several different kinds of ongoing internal processes which are involving in learning, remembering and performing. The effect of the external events on the internal processes is summarized by Gagne' (1977, P.68).

Table 1.1

Internal processes of learning, and the effects which can be exerted upon them by external events.

Internal Process	External Events and Their Effects
Attention (Reception)	Stimulus change produces arousal (attention)
Selective Perception	Enhancement and differentiation of object features facilitates selective perception
Semantic encoding	Verbal instruction, pictures, diagrams, suggest encoding schemes
Retrieval	Suggestion or display of cues such as diagrams, tabular arrays, rhymes, aids retrieval
Response organization	Verbal instructions about the objective of learning inform the learner about the class of performance expected
Control processes	Instructions establish sets which activate and select appropriate strategies
Expectancies	Informing the learner of the objective establishes a specific expectancy for performance

While the internal events of learning come about through the same stages of processing in the learner's mind, different learning outcomes should be attempted by means of different instructional strategies. Gagne proposes a taxonomy of learning outcomes. He classifies human learned capabilities into five major domains: intellectual skills, verbal information, attitudes, motor skills, and cognitive strategies. These five domains represent outcomes of the learning process. Intellectual skills are involved in acquiring and processing information, and the other four domains relate more to content than to process. Intellectual skills and verbal information are

divided into sub-categories. Intellectual skills include: discriminations, concrete concepts, defined concepts, rules and problem solving. Verbal information is divided into name-labels, information facts, and organized knowledge (substance learning). The sub-category of verbal information called organized knowledge or substantive learning (discussed earlier in this chapter) and the sub-category of intellectual skills called rule learning were the main concern of this investigation.

Rules are relationships between two or more concepts. A rule is defined by Gagne' as a chain of two or more concepts. It is a chain that enables the learner to respond to various situations in similar, rule-regulated ways.

The internal processes of learning are activated or influenced by external conditions and this is what makes instruction possible. These conditions should be incorporated into the planning and designing of instruction to bring about any type of learning outcome, and in this study acquisition of rule has been promoted by systematically designed instruction. Techniques for accomplishing instructional design, based upon these principles, have been described by Gagne' and Briggs (1979).

#### Limitations of the Study

The results of the study may not be generalized beyond the

population from which subjects for the study were drawn. However, by carefully choosing the sample groups, both for the experiment and for control, we have obtained results that are more indicative of the behavior of the universe i.e. all students being taught by CAVI. Careful choice of instructional materials and testing techniques, as well as careful adherence to the procedures outlined further helped validate the result. Care was taken to establish content validity for both instruments and materials. Finally, this research used "comparative" advance organizers; hence the results may not be generalized to include the other type of advance organizers ("expository" organizers).

#### Definitions

The following definitions were used in this research:

Advance organizer: refers to an introductory passage written at a higher level of abstraction, generality and inclusiveness than the learning material it precedes.

Cognitive structure : the total content and organization of a given individual's ideas, the content and organization of his or her ideas in a particular area of knowledge.

Computer-Assisted Video Instruction (CAVI) : involves the interaction of computers and videotape. Instruction is primarily through videotape presentation while pacing, review, reinforcement, evaluation, note-taking is handled by computer.

Posttest :refers to a 20 item multiple choice test based on the learning passage, which was administered immediately after the learning passage was read.

Subsumers : refers to hierarchically ordered with very general and inclusive principles.

### Significance of The Study

There are two very important aspects of advance organizer utilization investigated by this study. First, this study was concerned with the impact of advance organizers on rule-learning (a sub-category of intellectual skills) as an outcome of instruction in the Gagne' taxonomy. Second, the medium of instruction is relatively new. We studied the impact of advance organizers in a systematically designed, CAVI mediated lesson. With the growing utilization of CAVI in education, it is very important to have the instructional strategies for the optimal use of this medium. If it had been demonstrated that advance organizers were beneficial to rule-learning in CAVI mediated lessons, their use would be a powerful strategy.

CHAPTER II  
REVIEW OF RELATED LITERATURE

This chapter is centered around Computer-Assisted Video Instruction (CAVI), subsumption theory, and advance organizers. The first section deals with instruction-delivery systems, leading up to CAVI and its attributes. The second section is concerned with Ausubel's subsumption theory. The third section is a review of advance organizer research. Finally, at the end is a discussion of two studies, very closely related to this one.

The Computer's Roles in Education

Taylor (1980), in his book, The Computer in the School: Tutor, Tool, Tutee, divided the educational role of the computer into three categories: tool, tutee, tutor.

The Computer as Tool

According to Taylor (1980) the computer as tool is used primarily for statistical analysis, calculation, and word processing. It functions as a typewriter and a calculator. Computers are beginning to be used in schools, not only for scoring multiple choice tests, but also for gathering and synthesizing diagnostic and statistical information. At the classroom level, instructors may use computers to score their classroom tests, to keep grades, and to compute grades.

### The Computer as Tutee

According to Taylor (1980), to use the computer as tutee is to tutor the computer. For that, students or teachers learn to teach the computer to do interesting things. This is done through programming, which has several advantages. First, the student can not teach what he does not understand; he will learn what he is trying to teach the computer. Second, the student tutor of the computer will learn something about how the computer works and about how his own thinking works.

### The Computer as Tutor

The computer, in its role as a tutor, presents subject material. The student responds and the computer evaluates the responses. Based on this evaluation, the computer decides what to present next. The tutor mode may be described in different ways, but the term Computer Aided Learning (CAL) is often used to refer to the tutorial role. CAL can be divided into two categories: Computer-Managed Instruction (CMI) and Computer-Assisted Instruction (CAI).

CMI has been developed as a management information system to enable teachers to manage the record-keeping demands of individualized instruction. It does not involve the computer in the actual teaching of material. Typically, a teacher may use a microcomputer to tabulate grades, to compute averages, etc. (Willis, Johnson, and Dixon, 1983).

In CAI, the learner interacts directly with the computer

which stores the instructional materials and controls the sequence of instruction. The computer serves as the primary vehicle for the delivery of instruction. CAI is actually a general category that includes three forms of instruction: 1) Drill and Practice; 2) Simulation; and 3) Tutorial (Willis et al., 1983).

Drill and Practice is an elementary form of CAI and implies providing computer exercises for previously-learned skills, e.g. computational rules (Willis et al., 1983).

Simulations: Students learn by taking part in simulated situations. CAI offers a safe and relatively inexpensive method of learning when the real experience is too dangerous, too expensive, too slow, too rapid, and/or simply an experience impossible to go through (Orwing, 1983).

Tutorial: The third category of CAI is tutorial, and perhaps the most familiar form of CAI to most educators. Tutorial CAI systems are designed to teach new concepts, rules, and/or discriminations, as well as to exercise previously available knowledge. Scandura (1983) explained that "tutorial systems can be envisaged in almost every conceivable area, ranging from teaching basic concepts and principles (e.g., rules) to teaching complex, highly interrelated bodies of content" (p.16). Tutorial CAI introduces information in relatively small sections, gives the learner a chance to deal with or manipulate the material, and then tests the learner's mastery of the

material being taught. The computer either repeats or moves on to the next segment based on the result of the test given to the learner.

To summarize, the educational roles of the computer fall into three categories: Tutor, Tool, Tutee. The term Computer-Aided Learning (CAL) is used to describe the tutorial role which includes two categories: Computer-Managed Instruction and Computer-Assisted Instruction, with (CAI) generally including drill and practice, simulation and tutorial.

#### Instructional Television (ITV)

Wittich and Schuller (1973) define ITV as a multimedia learning resource with several functions. It is demonstration, lecture, radio, filmstrip, phonograph, field trip etc. ITV can be each of these singly and it can be a composite of them all. The use of ITV has now been increased through the appearance of Videotape Recording (VTR) and Videodisk. VTR makes it possible to overcome some of the difficulties of ITV and to develop great flexibility in terms of time and place usefulness.

During the early years of research, investigations of ITV reported that there is "...no significant difference in the use of ITV versus traditional instruction in the communication of factual information" (Wittich & Schuller, 1973, p.547). These authors also generalize that research results show that ITV can be employed efficiently to teach any subject where one-way

communication contributes to learning. From a learning point of view, Maftoon (1982) states "...television has delivered most of the characteristics of a live lecture and has proved itself to be more effective in the process of learning. It can stimulate and motivate learning,...increase listening and observational skills, and promote inservice education" (p.25).

The usefulness of ITV is no longer in doubt. What researchers need to be more concerned with is methods by which it's potential may be more fully realized.

The conjunction of CAI with ITV prepares an inviting new educational medium that educational technologists are enthusiastic about. CAVI has distinct potential because it brings together a useful expository medium (ITV) with a useful interactive medium (CAI).

#### Attributes of CAVI

CAVI combines the attributes of CAL and ITV, resulting in a very effective delivery system. Specifically, the attributes combined are:

##### (1) Attributes of CAL

- (a) Involving the individual actively in the process of learning.
- (b) Allowing variations of pace to suit individual needs.
- (c) Immediately and systematically reinforcing what has been learned.
- (d) Motivating learners by offering a novel and

interesting way to learn.

- (e) Providing feedback on what has been learned and what needs to be repeated.

(2) Attributes of ITV:

- (a) ITV is a teaching device highly effective in explaining and demonstrating cognitive information.
- (b) ITV can stimulate and motivate learning.
- (c) ITV can increase listening and observational skills.
- (d) ITV can reinforce classroom experience.

As discussed earlier in this chapter, CAI and ITV are individually effective delivery systems. CAVI is the integration of CAI and ITV into a powerful delivery system that exploits the attributes of both not only to enrich but to enhance the learning process. Undoubtedly, this delivery system will be very effective. The question now is—what should be done to make the use of this medium more effective? What kind of instructional strategies should be used to exploit this medium more effectively? The instructional strategy of advance organizers, which is the focus of this study, is discussed next.

#### Theoretical Basis of Advance Organizers

One of the pioneer cognitive psychologists in the field of information processing is David P. Ausubel. His basic assumption is that cognitive structure is hierarchically

organized in terms of highly inclusive concepts under which are subsumed less inclusive sub-concepts and detailed information. If Ausubel's assumption is true, then it is reasonable to suppose that new meaningful material becomes incorporated into cognitive structure as far as it is subsumable under existing relevant concepts (Ausubel et al., 1978).

Ausubel believes that students learn large bodies of subject matter mostly through reception learning (expository teaching). Such reception learning, he theorizes, is facilitated by appropriately designed expository teaching and instructional materials. In two independent dimensions, Ausubel identifies four learning types. The first dimension relates to the way material is learned by the student (or reception learning vs. discovery learning). The second dimension relates to the manner in which learners can incorporate the material into existing cognitive structure (or meaningful learning vs. rote learning (Ausubel et al., 1978).

Ausubel speaks of two stages of learning. First, the stimulus situation may be created by expository teaching (which involves reception learning) that presents the information in final form; or by the discovery approach to teaching (which implies discovery learning) that requires the student to independently discover information. Second, the learner acts upon the information in his/her own way (rote or meaningful). If the new information is memorized without incorporation into

existing cognitive structure, then rote learning occurs. If the information is related to what is already present in existing cognitive structure, meaningful learning occurs. Ausubel makes these distinctions between: (a) the rote vs. meaningful dimension of learning; (b) the reception vs. discovery dimension. He further theorizes that when meaningful verbal learning occurs, the learner reaches a higher level of abstract understanding in terms of generality, clarity, precision, and explicitness.

#### Subsumption Theory

Cognitive structure refers to "...an individual's organization, stability, and clarity of knowledge in a particular subject field at any given time" (Ausubel, 1963, p.26). This "organization", Ausubel assumed to be hierarchical; with the most inclusive concept at the top, and increasingly specific concepts and detailed information towards the base. Logically, then, instruction should start at the most general and inclusive level and proceed towards specifics and detailed instances. Ausubel has used the term subsumer in describing cognitive structure. A subsumer is a concept, or an idea; but the word implies that the subsumer includes other concepts or ideas. Such concepts (term subsumers) arranged hierarchically make up cognitive structure. The processes of learning and forgetting can now be described in terms of subsumption.

Remembering depends upon whether or not newly learned material can be dissociated from existing concepts in cognitive structure. After learning (subsumption) occurs the new material begins increasingly to resemble the existing material or concepts in cognitive structure. When the point is reached where dissociability no longer exists, the new material can no longer be recalled. This is forgetting. Learning occurs due to derivative or correlative subsumption, forgetting involves oblitative subsumption (Ausubel et al., 1978).

#### Derivative or Correlative Subsumption

According to Ausubel et al. (1978), "subsumption learning occurs when a 'logically' meaningful proposition....is related meaningfully to specific superordinate propositions in the pupil's cognitive structure" (P.39). Derivative subsumption occurs when the new material is so similar to existing cognitive structure that it could have been logically derived directly from existing ideas. If, however, the new material is entirely new and hence, an addition to cognitive structure, we have what is termed correlative subsumption (Ausubel et al., 1978).

Based on the organizational similarity between subject matter and the learner's cognitive structure. Ausubel suggests the principle of "progressive differentiation" as a sound way of introducing learners to subject matter. Starting with the

most general, broad concepts the learner is taken through a logically patterned process of more and more specific information (Ausubel et al., 1978).

#### The Concept of Advance Organizers

The advance organizer was developed by David P. Ausubel (1960) as a method of dignifying "meaningful" rather than rote learning of verbal information. The advance organizer is actually an introduction presented to learners before the information to be taught.

Ausubel (1964) defines advance organizers as being "maximally stable and discriminable from related conceptual systems in the learner's cognitive structure. These organizers are introduced in advance of the learning material itself, and are also presented at a higher level of abstraction, generality, and inclusiveness" (P.81). Thus, advance organizers provide the learner the advantages of a subsumer in an important way: They function to give a student a preview of the subject or content area to be learned, but in a more general or preliminary way than by just presenting the material itself (Ausubel, 1969).

#### Function of Advance Organizers

Ausubel notes that there are two principal kinds of advance organizers corresponding to two distinct functions

performed. The one presents ideational anchorage when the learner's cognitive structure does not have in it any related concepts. This kind of organizer is expository in nature and is called an expository organizer by Ausubel. The second kind deals with material in a situation where there already exist, in the learner's cognitive structure, similar and related concepts and ideas. This kind he terms "comparative" organizers. Such an organizer "delineates clearly, precisely, and explicitly the principal similarities and differences between the new learning passage...and existing, related concepts in cognitive structure" (Ausubel, 1961, p.109).

A review of experimental studies dealing with advance organizers reveals contradictory results. The information generated by researchers has been both positive and negative. Alvarman (1981) pointed out that "the controversy surrounding the effectiveness of information which uses advance organizers of various kinds continues to appear in the literature" (p.2). These contradictory results were dependent upon the procedure, topic, subject, materials, location, student characteristics, and possibly other variables which impacted the result of the experiments.

#### Early Research on Advance Organizers

Ausubel (1960) studied the effectiveness of advance organizers of the expository type in the learning and retention

of meaningful verbal material: An experimental group was matched and divided on the basis of scores obtained on material similar to the experimental material in terms of being equally unfamiliar to the students, but different in terms of being totally unrelated in content. The matched groups were then given introductory passages to read—the experimental group getting the expository advance organizers, and the control group getting historically relevant background material that contained no information helpful on the test. A third group was administered the test after reading only the background information in order to confirm that the historical information actually did not contain helpful material. The results were related to the sex and major field of the students and were inconclusive. Ausubel then rematched the groups posttest to hold these factors constant and concluded that the hypothesis was indeed valid. However the process of rematching, (instead of randomised sampling) makes the findings of this study questionable.

#### Comparative vs Expository advance Organizers

The second study differentiates between two types of organizers - comparative and expository based on the assumption that only discriminable categorical variants of previously learned concepts have long-term retention potentialities.

The value of a comparative organizer was tested by

contrasting its effects on the retention of a Buddhism learning passage with the effects of a non-ideational (historical) introduction and those of a simple expository organizer.

Two hypotheses were tested : first, the organizer facilitates the learning and retention of the new Buddhist ideas to the extent that it increases their discriminability from related (Christian) concepts established in cognitive structure. Second, the discriminability of the Buddhism passage varies as a function of the learners existing knowledge of Christianity. Six sections of an educational psychology course at the University of Illinois were administered the test. The learning material was a 2500 word passage on Buddhist concepts. The subject was completely unfamiliar to the students and also dealt with variants of previously learned concepts.

To confirm the unfamiliarity of the Buddhism material, a group of students was administered the test without being given the learning passage. They did only slightly better than chance-confirming that the material was indeed, unfamiliar.

Three types of introductory passages were administered—a comparative organizer, an expository organizer, and a historical introduction. The first explicitly pointed out the similarities and differences between Buddhist and Christian doctrines. The second (expository organizer) presented only Buddhist doctrine—at higher levels of abstraction, generality, and inclusiveness than the learning passage. The historical

information contained no material on Buddhist or Christian doctrine.

A 36 item multiple-choice test measured variation in the stability and clarity of existing (Christian) concepts among the students. All students took this test and each of the three groups studied a different kind of introduction for eight minutes (the groups were randomly constituted and stratified by sex).

Two days after taking the Christianity test and reading the different introductions, all three groups studied the learning passage for 35 minutes. Three days after that, one form of the Buddhism test was administered to all the students. One week after that an equivalent form of the same test was given to all the students.

Comparison of corresponding 3 and 10 day means of the total treatment groups showed relatively slight retention loss in that time period. Only the comparative organizer was effective in facilitating retention on the 3 days test. The 10 day test showed that retention was significantly higher in the comparative and expository groups. Also the difference in retention between the comparative and expository organizer groups was negligible at this point.

In both the 3 day and 10 day tests, the below-median subgroups (on the basis of the Christianity test) derived substantial benefit from both the types of organizers. Verbal

ability was positively correlated both with knowledge of Christianity and retention of the Buddhism material and this correlation was not reduced by organizer effects.

It must be noted that the hypotheses used apply only to meaningful learning material that can be related to established and relatively stable concepts in cognitive structure. They do not apply to rote learning, or unfamiliar material that either can not be related to existing concepts in cognitive structure or can be related only to unstable or recently learned concepts.

The organizers were concluded to have exerted a leveling influence on the positive relationship between endogeneously determined discriminability and meaningful learning and retention. The above- median subgroups were not substantially helped and discriminability was not really facilitated by the organizers. On the 3 and 10 day tests, the above median subgroups (students with a clearer and more stable knowledge of Christian concepts) did better on retaining the newly learned (Buddhism) concepts (Ausubel & Fitzgerald, 1961).

#### Advance Organizer in sequential learning

Most learning is sequential in nature. In many cases, the new information is sequentially organized and related to existing concepts in cognitive structure. In other instances, the new information may be just sequentially organized-but

without anchoring concepts in existing cognitive structure.

Ausubel and Fitzgerald (1962), used essentially senior undergraduate students in six sections of an educational psychology class and the same methodology to investigate sequential learning in these situations. This study compared the effectiveness of an expository organizer and an introductory passage on the endocrinology of pubescence. The reason for selection of the topic was the unfamiliarity of students with the subject matter. Two passages (sequentially related) dealing with the endocrinology of pubescence were prepared. In addition an expository organizer passage and a control introduction were constructed.

Membership in a treatment group (expository, introduction) was determined by random assignment, and the population of each treatment group was stratified by sex. Both treatment groups studied their respective introductory passage for six minutes, then studied the first pubescence passage for 25 minutes. The test was given 48 hours later. Three days after the first test, the second pubescence learning passage was administered in 27 minutes. The second test was given four days later. Students with lower verbal ability achieved significantly better scores with the organizer than with the control introduction; otherwise the organizer did not significantly affect learning and retention. By contrast, the 1961 study showed that students with higher verbal ability benefitted more. Ausubel related

this to the fact that the organizer material in this pubescence study was too unfamiliar to relate to existing cognitive structure.

#### Review of Advance Organizer Research

As a result of contradictory findings, Barnes & Clawson (1975) reviewed 32 studies of advance organizers and classified them into those finding statistically significant results and those finding nonsignificant results. They also organized them by other variables such as organizer-type and learning-ability-level. Twelve reported statistical significance in favor of advance organizers facilitating learning; and 20 reported that they did not. "Nonsignificant" studies outnumbered "significant" ones. Barnes & Clawson concluded that "advance organizers, as presently constructed, generally do not facilitate learning" (P.651). They also note a significant weakness in Ausubel's construction of an advance organizer—he provides no operational distinction between organizers and overviews (P.653). They stress the importance of working by the conditions necessary for experimental research.

Introducing students to new knowledge or unusual situations is a very important part of designing and using teaching material. This is usually done by means of an introductory statement of the kind that Hartley & Davies (1976) call "preinstructional strategies." They reviewed the

research on four preinstructional strategies: pretest, behavioral objectives, overviews, and advance organizers. Although these introductions all serve a preinstructional role, there are essential differences between them in both form and function, therefore, each of them suggests a different theoretical position rather than variations in style (Hartley & Davies, 1976). They briefly reviewed twenty-five studies on advance organizers. They agree that previous results were confusing. They conclude, however, that there was a trend in research indicating that advance organizers favor higher grade university students and students with higher verbal ability than students with lower grade levels and students with low verbal ability.

Lawton and Wanska (1977) in their article "Advance Organizers as a Teaching Strategy: a Reply to Barnes & Clawson", pointed out several inaccuracies in the latter's interpretation of advance organizers as well as inconsistencies in their classification. Lawton & Wanska note, "inconsistencies in the presentation of studies contribute to a somewhat inaccurate picture of the status of advance organizers" (p.236). Lawton and Wanska (1977) specifically cite several important limitations of the Barnes and Clawson (1975) review. First, by not defining the word "study" clearly, the results tended to be distorted and presented an inaccurate picture. Three parts of one study are made to appear as three

independent studies. Second, studies that can not actually be compared, get compared, because Barnes and Clawson (1975) organized the studies by selected variables. The overall effect of this is to present a picture that is more negative than it ought to be (Lawton and Wanska, 1977).

Mayer (1979a) tends to support the Lawton and Wanska (1977) view of the Barnes and Clawson (1975) review. Other important disqualifications of Barnes and Clawson (1975) include inadequate analysis of learning outcomes, and the lack of proper experimental control. Ausubel et al., (1978) answer advance organizer critics by citing disagreements related to this theory and propose that misinterpretation and methodological difficulties lead to wrong conclusions on the subject.

Luiten, Ames, and Ackerson, (1980) used Meta-Analysis Techniques to study the effects of advance organizers on learning and retention. These authors examined 135 published and unpublished studies on the facilitative effects of advance organizers, including the Barnes and Clawson (1975) critique. Luiten et al., (1980) concluded that "the average advance organizer study shows a small, but facilitative effect on learning and retention. The small effect is a function of the short duration of treatment of the typical study....moreover, the findings indicate that advance organizers facilitate learning in all content areas examined, and with individuals of

all ability level" (p.217). However, citing the short duration of the typical study, they concluded that the small positive effect could be a far from conclusive outcome of the study. Such opposing and confusing indications are really the result of the different research designs used by different reviews. For instance, Barnes and Clawson (1975) used a simple "voting technique" procedure to classify advance organizer studies into those finding statistically significant and those finding non-significant results. On the other hand, Luiten et al., (1980) used a different technique (proposed by (Glass, 1978) that accounts for any positive treatment effects in different studies. As a result, their conclusions are less affected by statistical error.

A Meta-Analysis of advance organizers by Stone (1980) found that "The results of the study indicated, that advance organizers were associated with an increase in the learning and retention of the material to be learned. This was consistent with Ausubel's prediction. However, other variables associated with high 'effect size' (ES) were not consistent with predictions by Ausubel's model" (p.2).

Mayer (1979a) reviewed 44 published research studies in the broader context of assimilation theory, comparing the results with predictions from assimilation theory. Of the 44 studies, twenty-seven studies compared advance organizer results with control groups results, and the rest compared

advance organizer results with post organizer results. Mayer (1979a) concluded:

1. Advance organizers have a positive but small effect on learning and retention.

2. Post organizers are less effective than advance organizers.

3. Advance organizers are more effective when the learning material seems (to be learn) not to be very well organized or is unfamiliar.

4. Advance organizers are more effective when the material is relatively new.

5. Advance organizers are more effective in transfer of learning than in specific retention of details.

All these findings are well in line with predictions from assimilation theory.

Next, we turn to two studies of particular interest that have similarities with this one:

Noel (1983) studied the influence of advance organizers on transfer of rule learning to problem-solving situations. He hypothesized that, students receiving advance organizer treatment would perform better than those not receiving advance organizer treatment. The instruction was systematically designed to teach rule-using behavior to spell words with cie and cei letter sequences. The study used 77 fifth and sixth grade elementary school students. Noel concluded that the study

indicates that," while students benefit from systematically designed instruction to teach rules, advance organizers incorporated in that instruction do not necessarily enhance learning transfer."

There are significant differences between this study and the one just described.

1. Noel studied far-transfer of rule-learning where this study is concerned with near-transfer.

2. The instruction delivery mode in this study is CAVI, a spoken-visual presentation. Noel used a written presentation mode.

3. Noel studied elementary school students. This study uses college students.

Chang (1982) studied the effects of filmic advance organizers on acquisition of facts and concepts learned from a sound film by regular and educable mentally retarded learners. "Filmic advance organizer" refers to a set of tape narrated slides presented in advance of a sound film from which the slides were made to give brief general overview of the film. Chang concluded that "FAOs prepared for this study appeared to provide facilitative effect for the regular subjects in acquisition and retention of facts and concepts presented in a consumer education film, and ability levels did not differentially affect the learning outcomes.

Again, there are significant differences:

1. A systematic lesson design procedure-suggested by Gagne' and Briggs (1979) is used in this study. Chang used a ready-made sound film.

2. Chang studied acquisition and retention of facts and concepts. This study studies acquisition of rule-learning.

3. Chang used mentally retarded and normal middle school students. This study uses only normal, college students.

## CHAPTER III

### METHODOLOGY

This study is an investigation of the impact of advance organizers upon students' achievement in Computer-Assisted Video Instruction. This chapter outlines the methodology which was used to conduct the investigation. Students' achievement was the dependent variable measured, and the advance organizer was the independent variable. An experimental methodology was employed to test the hypotheses.

#### Subjects for the Study

The subjects for the study were from a population of college students at the University of Oklahoma-four sections of undergraduate students in a course of media technology. The subjects had no prior experience with computers or computer programming. All students from these four sections were randomly assigned to one of two treatment conditions. One treatment condition was an advance organizer as the first event of instruction in systematically designed instruction (computer programming). The other treatment condition was systematically designed instruction without the advance organizer.

Conditions For The Correct Construction And Use of  
Advance Organizers

Advance organizers are based on subsumptive learning. Guidelines for the correct construction of advance organizers have been developed over a twenty-year period that spanned the development of subsumption theory. Ausubel et al. (1978); and Mayer (1979a) have clarified the subject by indicating that there are three classes of conditions that need to be met in designing and using advance organizers: one, attributes of learning material; two, attributes of the learner; and three, attributes of advance organizers.

(1) Attributes Of Learning Material

The most important material attribute comes from Ausubelian theory which indicates that learning must proceed from the most general and inclusive concepts toward specifics and detailed instances.

(2) Attributes Of Learner

The most important attribute of the learner, since we are using a comparative advance organizer, is that the learner must already have, in his cognitive structure, a set of subsuming concepts. These concepts will serve to anchor new information.

(3) Attributes Of Advance Organizers

Although there has been much criticism and rebutting on the subject of specificity in the definition of advance organizers, most researchers have relied upon Ausubel's

definitive statement (concerning the nature of advance organizers) to build their organizers. Ausubel et al. (1978) defined organizers as:

Introductory material presented in advance of and at a higher level of generality, inclusiveness, and abstraction than the learning task itself, and explicitly related both to existing relevant ideas in cognitive structure and to the learning task itself; designed to promote subsumptive learning by providing ideational scaffolding or anchorage for the learning task and/or by increasing the discriminability between the new ideas to be learned and related ideas in cognitive structure, i.e., bridging the gap between what he needs to know to learn the learning material more expeditiously (p.628).

The main criticism of this definition comes from the fact that it does not provide an operational starting point from which to construct advance organizers (Barnes & Clawson, 1975).

Ausubel et al. (1978) in defense of advance organizers, argue that "one can not be more specific; for the construction of a given organizer always depends on the nature of the learning material, the age of the learner, and his degree of prior familiarity with the learning passage" (p.175). They also cite the fact that precise and operational definition has been provided and effectively used in various specific instances.

Mayer (1979b) provides a very useful list of attributes of advance organizers from which to design one. According to him an advance organizer has the following attributes:

1. Short set of verbal or visual information,
2. Presented prior to learning a larger body of to-be-learned information,
3. Containing no specific context from the

- to-be-learned information,
4. Providing a means of generating the logical relationship among the elements in the to-be-learned information,
  5. Influencing the learner's encoding process" (Mayer, 1979b, p.382).

### Materials For The Study

A model of information-processing theory of learning and memory by Gagne' and Briggs (1979) was used as the theoretical basis for designing the instructional events of the study. According to Gagne' and Briggs (1979) "a learning event involves several internal processes, each of which may be influenced by the external factors of instruction" (p.10). For reaching this goal they advocate systemtically designed instruction.

Although the development of material in this study follows the model, the researcher did not use all the stages in the Gagne' and Briggs model. Taking needs, resources, scope etc as known, we start at the lesson level.

### Lesson Level

1. Definition of performance objectives
2. Preparing lesson plans
3. Developing, selecting material, media
4. Assessing student performance
5. Formative evaluation
6. Field testing-revision.

According to Gagne' and Briggs the best way to design instruction is to work backwards from its expected outcomes. The outcome sought is rule learning, which is a sub-domain of a major outcome-intellectual skill. (The other four domains being cognitive strategies, verbal information, attitudes, and motor skills).

### Rule\_learning

Given the definition of rule as the relationship between two or more concepts, we see that it is essential to first know the concepts to which the rule refers. If this knowledge of the concepts is lacking, the learner must acquire it before or during the process of the learning the rule. This knowledge of the concepts linked by the rule already exists in cognitive structure. Mathematics, for instance, consists of concepts logically linked by rules; for that matter any field of knowledge consists of rules that express the relationships between concepts and combine them. Rules give the learner the ability to respond to situations in a regulated manner. The conditions for rule learning thus lead us into developing a specific sequence of instructional events (Gagne', 1977).

- Step 1: Inform the learner about the form of the performance to be expected when learning is completed.
- Step 2: Question the learner in a way that requires the reinstatement (recall) of the previously learned concepts that make up the rule.
- Step 3: Use verbal statements as cues that will lead the

learner to put the rule together, as a chain of concepts, in the proper order.

Step 4: By means of a question, ask the learner to demonstrate one or more concrete instances of the rule, and provide feedback as to correctness in each case.

Step 5: (Optional, but useful for later instruction): by a suitable question, require the learner to make a verbal statement of the rule" (P.142).

In systematically designed instruction the greatest clarity in conception of the outcomes of instruction was achieved when human performances are described. The initial question is "what will students be doing after they have learned?" The instructional objective was the first consideration. Instructional objectives were defined clearly, and they were also analyzed. This process was based on the "Analysis of the Learning Task" described by Gagne' and Briggs (1979). Two different kinds of analysis were performed on the target objective of instruction. Each of these was undertaken for a different purpose:

1. Information Processing Analysis was involved in identifying the sequence of decisions and actions (needed to perform a target objective) in the form of a flow chart, (see flow chart in appendix A).

2. Task Classification was involved in classifying target objectives in terms of the five different kinds of learning: intellectual skills, cognitive strategy, verbal information, attitude, and motor skills.

Instructional Objectives

Target Objective . When given a series of computer programming commands from a CAVI mediated lesson program titled Basic Programming, the Student Will Be Able To (SWBAT) \* demonstrate his/her knowledge of the proper commands by typing the correct responses.

Enabling Objectives

1. When given the Print command in text operation, the SWBAT demonstrate usage of the print command in text operation by typing the correct response.

2. When given the Print command in math operation (multiplication, division, addition, subtraction), the SWBAT demonstrate the operation of the function problem by typing the correct response

3. When given the sign for math operation (\*, /, +, -), the SWBAT identify these signs in computer programming by typing the correct response.

4. When given the parentheses for math operation, the SWBAT identify the order of operation in computer programming by typing the correct response.

5. When given the Run command, the SWBAT demonstrate the proper operation in computer programming by typing the correct response.

6. When given the List command, the SWBAT demonstrate the proper operation by typing the correct response.

7. When given the New command, the SWBAT demonstrate the proper operation by typing the correct response.

8. When given the Stop command, the SWBAT demonstrate the proper operation by typing the correct response.

9. When given the End command, the SWBAT demonstrate the proper operation by typing the correct response.

10. When given the statement of the program, the SWBAT identify the line statement of the program by typing the correct response.

11. When given the statements of the program, the SWBAT identify the line order statements of the program by typing the correct response.

12. The SWBAT type the correct spelling word command.

With the completion of the task of analyzing and classifying the learning task, we may now move on to the remaining stages of Gagne' and Briggs model. In practical terms, these stages are serving the events of instruction. The following is a very logical correlation between instructional events and the conditions of learning for the learned capability we are targeting (ie., rule learning-which is a sub-domain of intellectual skills) suggested by Gagne' and Briggs in "Principles of Instructional Design" (1979, P.166):

\* Throughout the text the acronym SWBAT will be used to designate. "the student will be able to".

**Table 3.1**  
**Adapting condition of learning to instructional events for**  
**intellectual skill (rule learning).**

<b>Instructional Event</b>	<b>Intellectual Skill</b>
1. Gaining Attention	
2. Informing learner of objective	Provide description and example of the performance to be expected
3. Stimulating recall of prerequisites	Stimulate recall of subordinate concepts and rules
4. Presenting the stimulus material	Present examples of concepts and rule
5. Providing learning guidance	Provide verbal cues to proper combining sequence
6. Eliciting the performance	Ask learner to apply rule or concept to new examples
7. Providing feedback	Confirm correctness of rule or concept application
8. Assessing performance	Learner demonstrates application of concept or rule
9. Enhancing retention and transfer	Provide spaced review including a variety of examples

#### Formative Evaluation of Script

A panel of colleagues knowledgeable in content and instructional design was consulted, first in a group discussion and later individually:

(1) To confirm that the enabling objectives have been met for the target objective of rule-learning.

(2) To confirm that the instructional strategies applied in instruction is appropriate for rule-learning.

(3) To confirm that the material fits appropriately to class schedules.

(4) To confirm that the students have the necessary

prerequisites.

(5) To confirm that the post-test will measure rule-learning.

Although no major changes were suggested, some very valuable suggestions were made which have been incorporated. These had to do with: (a) length of instruction, (b) wording of script and test, (c) minor variations in instructional format. The important variation suggested was that the lesson be divided into four sections and that the student get a chance to practice with the computer after each section. In fact the students were provided with the handbook that contains exercises for students. These recommendations have been adapted for instruction. These experts were also asked to fill out the Mayer (1979) checklist to confirm that the advance organizer had been correctly constructed.

Finally, a field test was conducted on 37 undergraduate students of the University of Oklahoma College of Education to make sure that the advance organizer did not contain information that would provide a direct advantage in answering any of the questions on the test. This was done by randomly assigning students to one of two groups. The first group viewed the advance organizer and then took the test. The second group simply took the test without viewing the advance organizer. Subsequent analysis showed that the advance organizer did not contain any information that would provide a

direct advantage in answering the test questions.

### Testing Instrument

Based upon the order of their scores on the American College Test-Mathematics (ACT-M), subjects were divided into high and low mathematical ability groups by the median score. Within ability level, subjects were randomly assigned to each of the two treatment conditions (experimental group or control group). Every student participated in the experiment independent of every other student.

The test instrument was a 20 question, multiple choice, true-false, and completion type items posttest based on information presented in the CAVI program. It was developed based on the learning objective. The scores were calculated by a computer.

Generally the test items are designed to measure a student's rule learning. Items on this test were designed to test one type of transfer, near transfer, where the stimulus is very similar to that during learning.

### Design

A posttest, 2X2 factorial design was used to study the research hypotheses. The independent variable manipulated was instruction-with and without visual advance organizer. The attribute variable was the mathematical ability of the students-higher than median ACT-M scores and lower than median

ACT-M scores. Data generated were the students' scores on performance measures for both the experimental group and the control group.

### Instructional Procedure

Subjects participated in one hour of instruction independently. Instructional material was presented on the computer screen. The computer controlled the videotape presentation by selecting exact frame segments on the videotape which presented information, demonstrated procedures, and illustrated concepts. The computer segment was used to generate questions, problems and explanations, elicit learner responses, provide exercises and evaluate competency.

Before presenting the instructional material, there were four frames of typed information on the computer screen regarding the direction of the study. During this section of the instructional event, the administrator of the materials was available to answer questions regarding the operation of the computer.

The subjects in the experimental group received the advance organizer as the first instructional information, followed by the main body of instructional material. The control group received only the main body of instructional material, followed by the twenty-item questionnaire.

## CHAPTER IV

### RESULTS

This study considered the impact of advance organizers as an instructional strategy upon students' achievement in Computer-Assisted Video Instruction (CAVI). Specifically, this study examined the increase of students' rule-learning when exposed to advance organizers presented in a CAVI mediated lesson. It was hypothesized that subjects who received the advance organizer treatment in a CAVI mediated lesson would achieve higher mean rule-learning test scores than those who do not receive the advance organizer treatment.

The independent variable manipulated was instruction-with and without a visual-spoken comparative advance organizer. The attribute variable was the mathematical ability of the students-higher than median ACT-M scores and lower than median ACT-M scores. Data generated were students' scores on performance measures for both the experimental group and the control group.

Of seventy subjects who completed the experiment, ACT-M or SAT-M scores were not available for ten. These were deleted from the computer analysis of the data. Of the remaining sixty, two reported SAT-M scores instead of ACT-M scores. Assuming no significant difference between the mean mathematical ability of

students taking the SAT and those taking the ACT, both of these were classified as higher mathematical ability subjects because they both reported higher-than mean SAT scores.

The next step in the preliminary classification process was to form two groups of relatively equal mathematical ability and then assign these groups (one each) to the experimental and the control procedures. This was very simply achieved through random assignment of subjects to groups, and subsequent testing for equality of ability as measured by the mean scores and standard deviation of both the experimental and the control groups so formed. The mathematical median of ability measure was 19. Subjects with scores of 19 and under were considered low ability subjects. Those with scores of 20 and over were considered high ability subjects.

Mathematical ability scores were analysed using a T-test and this analysis confirmed there was, indeed, no significant difference between the two groups in terms of mathematical ability (Table 4.1).

Table 4.1

Means and Standard deviation for Mathematical Ability

<u>Group</u>	<u>N</u>	<u>Mean</u>	<u>S.D.</u>	<u>T</u>	<u>P(T)</u>
Control	29	17.68	5.16	-0.141	0.888
Experimental	29	19.37	6.74		

The overall mean of the scores of all subjects that participated in the experiment was calculated along with the standard deviation. The overall mean score on the posttest measure of rule-learning was 15.95 with a standard deviation of 2.52.

A two by two factorial analysis of variance (ANOVA) was used to analyze achievement measures of transfer of rule-learning with and without an advance organizer. This procedure is of great importance because it provides a statistical model for evaluating the outcome of the two-group investigation, while at the same time allowing us to search for any possible ability effect. The results are presented below.

#### Test of Hypotheses

H1: It was hypothesized that subjects viewing the visual-spoken, comparative CAVI advance organizer would score higher on a post-test measure of transfer of rule-learning than those who did not view the advance organizer. The results of the ANOVA indicated that when instruction is systematically designed and mediated by CAVI, the visual-spoken comparative advance organizer does not result in a significant difference in posttest scores, ( $\alpha = 0.05$ ) as shown in Tables 4.2 and 4.3.

Table 4.2

## Factorial Analysis of Variance on Transfer Post-test

Variable	SS	DF	MS	F	P(F)
Model	44.83	3	14.94	2.32	0.083
Treatment	0.016	1	0.016	0.00	0.959
Ability	42.88	1	42.88	6.66	0.012
Treat*ability	1.94	1	1.94	0.30	0.585
Error	360.81	56	6.44		
Total	405.65	59			

Table 4.3

## Mean scores and Standard Deviation for treatment groups

Group	N	Mean_scores	S.D
Experimental	30	15.86	2.80
Control	30	15.83	2.47

H2 : It was hypothesized that subjects with higher mathematical ability levels would achieve higher mean scores than those with lower mathematical ability levels in a systematically designed, CAVI mediated lesson to teach rule-learning. As anticipated, subjects with higher mathematical ability scored significantly

higher ( $\bar{X}_H=16.72$ ) than subjects with lower mathematical ability ( $\bar{X}_L=15.03$ ). The ability effect means are shown in Table 4.4.

Table 4.4

Mean Scores and Standard Deviation for Mathematical Ability

<u>Math_Ability</u>	<u>N</u>	<u>Mean_scores</u>	<u>S.D.</u>
High	29	16.72	2.28
Low	31	15.03	2.69

H3 : It was hypothesized that subjects with lower mathematical ability level would show a greater improvement on test scores with advance organizer treatment than would those with higher mathematical ability level in a CAVI-mediated lesson to teach rule-learning. As indicated in table 4.2, there was no significant interaction between treatment and mathematical ability. The cell means are reported in Table 4.5.

Table 4.5

Mean scores and Standard Deviation (Ability, Treatment)

<u>Group</u>	<u>Ability</u>	<u>N</u>	<u>Mean_Score</u>	<u>S.D</u>
Control	High	13	17.07	1.89
Control	Low	17	14.87	2.57
Experimental	High	15	16.53	2.64
Experimental	Low	15	15.20	2.88

At the conclusion of this study we calculate the cell means, the row means and the column means, shown at the margins of the table below from the individual performance scores on the learning task. The results of this study are thus briefly summarized in Table 4.6.

Table 4.6

Two-Factor Analysis of Variance				
-----				
Instructions				
-----				
		Experimental Group	Control Group	
		With Advance Organizer	No Advance Organizer	
-----				
Types of	High Ability	$\bar{X}=16.53$	$\bar{X}=17.07$	$\bar{X}=16.72$
Subjects	Low Ability	$\bar{X}=15.20$	$\bar{X}=14.87$	$\bar{X}=15.03$
		$\bar{X}_E=15.86$	$\bar{X}_C=15.83$	

In conclusion, there was no significant difference between the mean scores of the two treatment groups-whereas there was a significant difference between the mean scores of the two ability-level groups. Interaction between ability level and treatment was insignificant although subjects with a higher level of mathematical ability did perform significantly better than those with a lower level of mathematical ability.

## CHAPTER V

### SUMMARY, DISCUSSION, RECOMMENDATIONS AND CONCLUSION

#### SUMMARY

The impact of science in our post-industrial society is largely in the area of computerization. The advantages of computers should not only be taught and learned, but used in the instructional process as well (CAI). That is exactly what has happened. One of the newer tools of instruction today is CAVI. This study is concerned with trying to utilize this potent tool to its full potential.

The focus of this study was the impact of advance organizers as instructional strategy upon students' achievement in CAVI. Specifically, this research examined the increase of students' rule-learning when exposed to advance organizers presented in a CAVI mediated lesson.

It was hypothesized that subjects who receive the advance organizer treatment in a CAVI mediated lesson will achieve higher mean rule-learning test scores than those who do not receive the advance organizer treatment.

To test the hypotheses of this study, a sample of 70 college students participated, and were subjected to, one of two treatment conditions: (experimental vs. control).

The instructional material (dealing with rule-learning in basic computer programming) for the CAVI lesson was developed on the basis of the Principles of Instructional Design suggested by Gagne' and Briggs (1979). The advance organizer for the CAVI mediated lesson was developed based on Ausubel et al's conceptual definition of the term (1978). Translated into operational terms, Mayer's checklist of attributes of advance organizers provided the basis for the advance organizer developed.

The hypotheses were tested using a 2X2 factorial design posttest of transfer of rule-learning to generate data consisting of students' scores on measures of performance.

### Discussion

The results obtained through this investigation suggest that visual-spoken advance organizers do not significantly influence transfer of rule-learning in a systematically designed program presented by CAVI. Subjects who viewed the visual-spoken advance organizer in a CAVI program did not perform significantly better on the post-test than those who did not view the advance organizer.

In view of the evidence from previous research on the usefulness of advance organizers in enhancing transfer of rule-learning, this result is not entirely unexpected. Ausubel (1963) indicated that the facilitating effects of advance

organizers are felt most in cases where the instructional material is not well organized.

The instructional material for this study was carefully and systematically prepared using the model set forth by Gagne' and Briggs (1979). First, the target objective of the CAVI-mediated lesson was carefully analyzed and classified as rule-learning. Next came the process of systematically breaking down the target objective in an orderly manner to get to the enabling objectives (Appendix A). With these in hand, the lesson was then prepared to conform to Gagne' and Briggs' model. The script so obtained was then turned over to a group of educational experts in content and instructional design for a formative evaluation and corrections/recomendations. By definition, an "advance organizer" helps organize material in a student's mind. In fact it helps the learning process by providing a super-organization to the subject matter. The main body of subject matter used in this study was very carefully prepared, following instructional design procedures which are very precise, and further inspected by experts for correctness of organization and process. This efficiency in the preparation of the text could well have had an impact on the result.

Another very interesting factor with a possible effect on the results of this study is the delivery system itself. CAVI, of all the possible modes of instruction, offers the most interactive potential. This unique quality of the delivery

system used in this study made the subject matter far more absorbing and easily assimilable. This, in conjunction with the high organization level of the text and the use of the advance organizer, enhanced rule-learning in the low ability students of the experimental group. The same factors worked (per the prediction of Mayer-1979) in reverse with the high ability students of the experimental group.

### Recommendations

The purpose of such research efforts as this is to aid in the development of instructional material for use in instruction at different levels. However, an important factor in such efforts that has not received sufficient attention, is the meaningfulness of communication in CAI and CAVI. This is an area that invites further research efforts. The entire processes of CAI and CAVI would undoubtedly benefit in great measure, too, from research aimed at identifying and classifying specific cognitive structures that apply in different topics and with various types of learning.

A third area of potential research possibilities is the effectiveness of near vs. far transfer of learning in various types of learning situations, subjects, and for various types of learning. This study concerned itself with only near-transfer.

This study, further, did not concern itself with

measurement of the time element. Such a consideration would demand further inquiry into the effectiveness of advance organizers in a new area altogether—in terms of their time-saving potential in the actual instruction period itself. If advance organizers, by providing a firm anchoring base for further materials to be consumed and digested (ie., subsumed into existing cognitive structure—including modifications or strengthening thereof by such advance organizers), save time in the instructional process—then they are effective and worth using, at least to that extent. Again, this would have to be researched vis-a-vis different subjects, types of learning, and learning environments/situations.

### Conclusion

To summarily dismiss the idea of using advance organizers in CAVI situations would be analogous to the Old World's dismissal of the theory of a spherical planet earth. More fruitful it would be, to examine possible reasons for the results obtained in this specific instance and then generalize to other subject areas that can be taught using CAVI.

A consideration of the interactive quality of microcomputers will reveal that the main body of the instructional process itself requires a degree of mastery by the student being taught before he/she can be taught the next unit. This facet of CAVI/CAI, in conjunction with the added

visual stimulus and impact of videotape (which altogether ensure more attention being paid to the subject matter at hand-and hence, better transfer at least a in near-transfer situation), seems to have contributed to the seeming lack of effectiveness of the advance organizer in this study. Finally the high degree of organization of the subject matter itself would have seemed to contribute to the results obtained.

What may be concluded is that under the conditions of this study it was found that advance organizers do not facilitate near-transfer of rule-learning in CAVI.

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## Appendix A

Outcome of instruction measured by near transfer test

Target Objective . When given a series of computer programming commands from a CAVI mediated lesson program titled Basic Programming, the Student Will Be Able To (SWBAT) demonstrate his/her knowledge of the proper commands by typing the correct responses.

1            2            3            4            5

Enabling Objectives

When given the Print command

When given the PRINT comand in text operation, the SWBAT demonstrate usage of the print command in text operation by typing the correct response.

The SWBAT state the correct spelling word of the commands

When given the Print command in math operation (multiplication, division, addition, subtraction), the SWBAT demonstrate the operation of the function problem by typing the correct response.

When given the sign for math operation (\*, /, +, -), the SWBAT identify these signs in computer programming by typing the correct response.

A

When given the parentheses for math operation, the SWBAT identify the order of operation in computer programming by typing the correct response.

1

When given the Run command, the SWBAT demonstrate the proper operation in computer programming by typing the correct response.

2

When given the List command, the SWBAT demonstrate the proper operation by typing the correct response.

3

When given the New command, the SWBAT demonstrate the proper operation by typing the correct response.

4

when given the Stop command, the SWBAT demonstrate the proper operation by typing the correct response.

5

when given the End command, the SWBAT demonstrate the proper operation by typing the correct response.

The SWBAT type the correct spelling word command.

B

B

: When given the statement of the program, the SWBAT :  
: identify the line statement of the program by :  
: typing the correct response. :

: When given the statements of the program, :  
: the SWBAT identify the line order statements :  
: of the program by typing the correct response. :

: The SWBAT type the correct spelling word command. :

Key: SWBAT = student will be able to

## APPENDIX B

## Visual-spoken advance organizer script

<u>Visuals</u>	<u>Video</u>	<u>Narration</u>
1.  Narrator at computer	Knowledge has existed ever since people have existed. Some where along the line language was developed in order to communicate knowledge. Further down the line printing was developed. Now knowledge could be communicated through print.	
2.	Print appears in the form of books and magazines and newspapers. Similarly it was obvious that six men together could attack a beast and kill it-where as one person could not.	
3.	As this difference became clearer and clearer people began to understand math. As math progressed different instruments were invented to enable people to perform math operations more easily.	
4.	They started with the Abacus, then the slide rule, then the adding machine, and	

then pocket calculator and now we have computers.

5. Just as knowledge has always existed, forms of communicating it have evolved over time; so the concept of math has always existed in the mind, but the tools used to perform math operations have evolved.

6. Commanding officer and marching soldiers The computer is only a machine to start with. By putting a hundred army privates together, we get only a collection of men; to make them an army you must teach them commands and specific meanings of terms such as "attention", "line up", "stand at ease", "march" etc.

7. Load and close up of person aiming firing a rifle A computer program works like soldiers on parade, one gives them commands to turn right, left, march etc. However, when a soldier is commanded to shoot at the target, several steps must be performed in order to do so. The soldier must first load the rifle, then close it, and aim the rifle, and finally fire.



## APPENDIX C

This appendix contains the script of instruction used in this study. After certain sections of the text information within dashed lines appears repeatedly at the top of the screen with each follow up interactive question or comment. The test instrument and the content of this script have been adapted for CAVI by permission from Program Design, Inc.

Objective: The purpose of this program is to teach you a series of commands in computer programming. After the instruction, you should be able to demonstrate your knowledge of the proper commands by typing the correct responses.

<u>Visuals</u>	<u>Video</u>	<u>Narration</u>
1. Computer Memory 0f00 2100 45 4d 11 ,, ,, ,, ,,	If you looked in the memory you would see a code something like this. This is the only code the machine can understand. So this kind of code is called machine language.	
2. Machine Language Program ff 00 D8 ff 01 58 ,, ,, ,,	This is the set of instructions that the machine follows to do a certain task. While this is the only code that the machine can understand, it means little to most people. To make communication with the computer easier an interpreter was invented.	
3. 10 PRINT 2+3 20 GOTO 10	The interpreter is placed in the computer's memory. It translates words to machine code the computer can understand. The interpreter in this computer translates the machine code to a machine language known as BASIC.	

4. BASIC As you can see in this visual, BASIC  
 B stands for Beginner's All-purpose Symbolic  
 A Instruction Code. BASIC was the first  
 S computer language for all beginner computer  
 I programmers. But now it is the most common  
 C language found for small computers.

5. The Apple II computer is supplied with two  
 Applesoft Basic BASIC interpreters. One speaks applesoft  
 Integer Basic BASIC and the other one speaks integer  
 BASIC. The one used to interpret this  
 program is applesoft BASIC and this lesson  
 teaches you the code used to program your  
 computer in applesoft.

- - - - - Interactive

:6. BASIC WORDS : Now, let's look at the some of the

:LIST RUN END : comman BASIC words.

:IF THEN STOP :

:PRINT NEXT FOR :

: - - - - - :

7. BASIC words look more like: (Student input required)

A. English words (Correct answer is A)

B. Machine code

8. Which of these instructions does the computer need an interpreter to understand?

- A. PRINT (Correct answer is A)
- b. c2 12 18

9. The first thing you should notice about BASIC instructions is that they are all in:

- A. Small letters
- b. Capitals (Correct answer is B)

video

10. PRINT "HELLO THERE" HELLO THERE

The first BASIC instruction we will cover is PRINT. PRINT will put symbols and numbers on the computer screen. First you will type PRINT, then you type the quotation mark, then you would type the text to appear on the screen. Finally you close the quotation. Now you have to press the 'RETURN' key. As you see the text you typed in the quotation is printed on the screen for you.

Interactive

11. Which of these instructions will print a sentence on

the screen?

a. PRINT I AM A COMPUTER

b. PRINT "I AM A COMPUTER" (Correct answer is B)

### Video

12. In the first part of this lesson you learn to use the PRINT command to display strings of letters or other characters. In this lesson you are going to learn to use the PRINT command to do arithmetic.

DOING ARITHMETIC

13. The computer will do any math operation and show you results, if you use the print instruction. First, the instruction is typed, and then the RETURN key is pressed, and the answer appears.

PRINT 5+6

11

14. The computer will not, however, do arithmetic inside quotation mark. Anything inside quotation marks is treated just as letters and printed exactly as it is entered.

PRINT "10-5"

10-5

15. Although the computer uses the same symbols for addition and subtraction,

\*=MUL : 2\*5 = 10

`/=DIV` :  $10/2 = 5$       an asterisk or a star is the computer  
`+=ADD` :  $3+3 = 6$       symbol for multiplication and slash  
`-=sub` :  $10-4 = 6$       for division.

Interactive

```

-----
16.      : * = MULTIPLICATION : 2*5 = 10 :
          : / = DIVISION : 10/2 = 5      :
          : + = ADDITION : 3+3 = 6      :
          : - = SUBTRACTION : 10-6 = 4   :
          : ----- :
  
```

What will the computer show when you enter this:

`PRINT 15+6`                      (Correct answer is 21)

17. What will the computer show when you enter this:

`PRINT 17-3+6`                      (Correct answer is 20)

18. Which of these two will the computer print  
after you enter:

`PRINT "5-5"`

A. 0

B. 5-5                      (Correct answer is B)

19. What is the computer symbol for multiplication?

(Correct answer is \*)

20. What is the computer symbol for division?

(Correct answer is /)

21. Which will print the answer to three times six?

A. PRINT 3\*6 (correct answer is A)

B. PRINT "3\*6"

22. Which of these will print the answer to 25 divided by 5?

A. PRINT 25>5

B. PRINT 25/5 (Correct answer is B)

Video

23. 3+8 \* 2/8

! !

! !

16

16/ 8

! !

! !

2

3+ 2

5

Some math problems involve addition, division, subtraction and multiplication together. You need to know how the computer will handle this. All multiplications and divisions are done first. In this example the multiplication is done, 8\*2 replaced by 16, then division is done, the 16 divided by 8 being replaced by that result too. Finally addition and subtraction are done, giving the final answer-5.

24. (26+8-32)/(9-8) When parentheses are used in a problem,

! ! !            the operation inside the parentheses will  
 2            !    always be done first. Here, the  $26+8-32$   
              1    is computed and replaced by its result 2.  
 2/           1    Then  $9-8$  is done and replaced by that  
              2           result 1. Then two divided by one is  
                          computed leading to 2.

### Interactive

25. What will the computer print when you enter this statement?

PRINT  $15-6/3+2$             (Correct answer is 15)

26. What will the computer respond to this:

$(3+8-2)/3*(8-7)$             (Correct answer is 3)

### Video

27.                    Let's look at a more complex example. We

STEPS THAT COMPUTER will take the first parentheses first.

FOLLOWES:            Multiplication and addition are mixed in this

MUL & DIV INSIDE ( ) parentheses, so the  $3*4$  is done first and

ADD & SUB INSIDE ( ) replaced by 12, then the addition is done,

MUL & DIV OUTSIDE ( ) the  $12+1$  being replaced by the result 13.

ADD & SUB OUTSIDE ( ) This result can now be replaced by the

entire group of first parentheses. Now the

$(1+3*4)+2*(3+3)$             second parentheses:  $3+3$  are replaced by the

! !            ! !            result 6. Now we are outside of parentheses,

1 12        6            the 2\*6 is replaced by 12 and finally 12  
 13        12            and 13 are added given 25. This can be  
 25                        complex.

### Interactive

```

-----
:        STEPS THAT COMPUTER FOLLOWS:        :
: (1) MULTIPLY AND DIVIDE INSIDE ( )        :
: (2) ADD AND SUBTRACT INSIDE ( )        :
: (3) MULTIPLY AND DIVIDE OUTSIDE( )        :
: (4) ADD AND SUBTRACT OUTSIDE ( )        :
: ----- :

```

28. What will the computer respond to this:

```
PRINT (8*5+2)/(3+3)-6    (Correct answer is 1)
```

29. How would the computer solve this problem?

```
PRINT 2*(5+2)/(4+3-6)    (Correct answer is 14)
```

### Video

30.                        By the end of this lesson you will know what  
 COMPUTER PROGRAM        a computer program is. In the first lesson  
                           you learn to use the print command. A command  
 1 PRINT "BEGINNING"      is a single step. However, most computer jobs  
 2 PRINT                    require several steps. Now you are seeing  
 3 PRINT "END"             a sample program. a program consisting of

several steps- each of which is called a statement, and each statement gets a line number.

31.                   The immediate commands you used before are  
 PRINT "BEGINNING"       executed as soon as you press the return  
 10 PRINT "BEGINNG"     key. A program statement is executed only  
 20 PRINT               when the whole program is executed.  
 30 PRINT "END"

32.                   Look at this program. To get this program to  
 10 PRINT "2+2="       run we simply type the word RUN, and then  
 20 PRINT 2+2           press RETURN, and all the statements in the  
                       program are performed one after another.

RUN                   In this example of two print statements, when  
 2+2=                 you type RUN and press RETURN the BASIC  
 4                     interpreter sends the computer to the lowest  
                       line number, and starts the program there.  
                       It does the statements in numerical order  
                       regardless of what order they are typed in.

33.                   In this program you will see that the program  
 5 PRINT "GOOD BYE"     is typed backwards, that is last line first,  
 4 PRINT               nevertheless when RUN is typed, and RETURN is  
 3 PRINT "HELLO"       pressed, the computer still will execute line

HELLO

3 and then 4 and then line 5. Notice the  
print statement with nothing after it will  
print a blank line.

GOOD BYE

Interactive

34. Which of the following is part of a program?
- A. PRINT "2+2"
  - B. 3 PRINT 3+4 (correct answer is B)
35. Which of these is executed immediately when you press return?
- A. 5 PRINT 2+2
  - B. PRINT 2+2 (Correct answer is B)
36. What word would you enter to execute this program?
- ```
12 PRINT "THIS IS REALLY THE MIDDLE"  
35 PRINT "THIS IS REALLY THE END"  
5 PRINT "THIS IS THE BEGINNING"
```
- (Correct word is RUN)
37. In what number order will the lines be executed?  
(separate each of your line number with a space)  
(Correct answer is 5 12 35)

video

38. Here is the similar program you saw a moment

```
5 PRINT
10 PRINT "8+5"
15 PRINT 8+5
RUN
8+5
13
```

ago, listed in proper number order with altered numbers, you should notice that you can type the line numbers in steps of 1, 10, 100 and etc. The numbers do not have to be at equal intervals. But, each line number must be below 64000.

39.

To repeat, whatever order you type the line numbers in, the interpreter puts the numbers in order and executes them.

40.

```
RUN
8+5
13
```

Let's run this program. Type RUN and press return for result. If we want to run the same program, we again type RUN then press return, and we see the same result again.

41.

We can run the same thing over and over again, because, the program stays in memory, no matter how many times we run it. But, suppose the program is no longer on the screen.

42.

```
LIST
5 PRINT
```

In order to see the program on the screen again, we will use the LIST command. We just type LIST and press RETURN, and there is the

```
10 PRINT "8+5"
15 PRINT 8+5
```

same program we just ran.

43.

```
10 PRINT "8+5"
5 PRINT
15 PRINT 8+5
LIST
5 PRINT
10 PRINT "8+5"
15 PRINT 8+5
```

This example shows a program typed out of order; the LIST command can come in handy, when we want to see it in proper order. Again, we can type LIST, and press RETURN and we will see our program in the order it will be RUN.

44.

```
10.....
500.....
10000.....
30000.....
```

The word LIST was just typed in. Let's press RETURN and see what happens. Now you see the program that teaches you lesson 2 right now. Obviously, it is too long to fit entirely on the screen. LIST can be used to show you a portion of a program or one statement only.

45.

```
LIST 15
15 PRINT 10+2
```

If you want to see line 15 of this program, you type list 15. Press return, and there is line 15.

46.

```
LIST 10-15
10 PRINT "10*2="
```

Let us say that we want to see all the lines between 10 and 15. You would then type LIST 10-15. Press RETURN and there are our

15 PRINT 10\*2            lines. We will cover more about this later.  
Now let's review some practice questions.

Interactive

47. What command is used to show an entire program?

(Correct answer is LIST)

48. Enter the command to show line number five.

(Correct answer is LIST5)

49.

5 PRINT

10 PRINT "10+2"

15 PRINT 10+2

Which command will show the first two lines of the above program?

A. LIST10

B. LIST5-10            (Correct answer is B)

50. Which word must you enter to make this program execute?

(Correct answer is RUN)

Video

51.            In the last lesson you learned how to write  
CORRECTING PROGRAM a program. In this part you will learn to  
ERRORS            fix program ERRORS and END the program, and  
how to erase a program from memory.

52. Let's say you just typed in a program like

```
10 PRINT "BEGINNING"
20 PRINT
30 PIRNT
40 PRINT "END"
```

this one, and you did not notice that you misspelled PRINT wrong in line 30, and you typed RUN and pressed RETURN. Lines 10 and 20 executed. But the program could not continue, because, the machine does not know what the WORD PIRNT means, instead you got A SYNTAX ERROR message with the line number.

53. Here is one way to correct this, just type

```
30
```

in the line number; press RETURN, and line 30 will disappear from the program. To prove it is gone, just type LIST and press RETURN and as you can see there is no line 30 in the new version. Now suppose line 30 was a necessary line in the program, and we did not want it discarded.

54. Another way to correct the error in line 30 is: just retype line 30 the way it should be

```
30 PRINT
```

and press RETURN, and line 30 is replaced.

```
LIST
```

If we want to list it, we just type LIST and press RETURN and we see THE NEW line 30

```
10 PRINT "BEGINNING"
```

replace the defective one. To see it run

20 PRINT                    type RUN and press RETURN and there are  
30 PRINT                    our results. Let's go over some of these  
40 PRINT"END"                again with some questions.  
RUN  
BEGINNING

END

Interactive

55. If you typed the number 30, and pressed the RETURN key.

- A. The number 30 will be printed
- B. Line 30 will be executed
- c. Line 30 will be ERASED from memory

(Correct answer is C)

56. To make this program work:

- A. Enter the number 30
- B. Retype line 30 with no ERROR
- c. Either of the above.

(Correct answer is C)

57. NOTE Remember that you may also correct an error using the BACKSPACE key as long as you haven't pressed the RETURN key yet. The backspace key (arrow left) can be used to correct ERRORS.

- A. Before pressing RETURN

## B. After pressing RETURN

(Correct answer is B)

Video

58. We have seen that we can remove a line by typing in with empty line numbers. Suppose we want to get rid of an entire program, we may want to do this to prevent any new problem we want to enter from containing lines new from old. To kill the program type NEW and press and the program will be gone from memory. To prove that it is gone type LIST and press RETURN, and you see nothing listed because, there is no program in memory to list.
- ```

10 PRINT "BEGINNING"
20 PRINT
30 PRINT
40 PRINT "END"
NEW
LIST

```
59. All programs must end somewhere. It is a good idea to tell the computer where the end is; you see that line 40 consists of END statements. This program will stop running at line 40.
- ```

10 PRINT "MATH PROB"
20 PRINT "2+2="
30 PRINT 2+2
40 END

```
60. If your program is long and complex, you may want to see what line number the computer will stop at. This is why a STOP statement would be used.

61. Look at this program with the STOP statement. How execute and compare it with the one program with the END statement instead. Notice that only line 30 of each program has been changed. When RUN is entered, each program was executed but note that STOP statement generated a line number message for you, where the END statement in the program on the right did not. Let's review some questions.

```

10 PRINT "1"
20 PRINT "2"
30 STOP
RUN
1
2
BREAK AT 30

10 PRINT "1"
20 PRINT "2"
30 END
RUN
1
2

```

### Interactive

62.

```

- - - - -
: 10 PRINT "BEGINNING" :
: 20 PRINT              :
: 30 PRINT              :
: 40 PRINT "ENDING"    :
: 50 PRINT "END"       :
: - - - - -           :

```

Type the word you would use in a statement to halt a program without a line number.

(Correct answer is END)

63. Type the command that will clear a program from memory.

(Correct answer is NEW)

**APPENDIX D**  
**TEST INSTRUMENTS**

Name.....Date.....

1. In BASIC computer programming, which of these will print a word?
  1. print hello
  2. print "hello"
2. Which of these can the computer understand without a BASIC interpreter?
  1. print "my name"
  2. ff o0 d8
  3. neither of these
3. Type the command that will cause the computer to add 20 plus 8.
4. What is the multiplication sign on the computer?
5. Which of these is the command to divide 100 by 25?
  1. PRINT 100\*25
  2. PRINT 25/100
  3. PRINT 100/25
  4. any of these
6. What will the computer print if given this command:  
PRINT 55-8/2+5\*10
7. What will the computer print if given this command:  
PRINT 8/2-55+10/5
8. A microcomputer program is:
  1. a command
  2. a series of statements
  3. a series of statement with line numbers
9. Type a command that will show you statements you have in your program.
10. If you enter a program in this order: line 20, line 30, line 10, what happens when the program is RUN?
  1. the computer does line 10 first
  2. the computer can't run the program because it's in the wrong order
  3. line 20 is first

11. You can get rid of a line in a program by typing the line number and pressing the return key.
  1. true
  2. false
12. What statement will correct this error in line 30?  
30 PRNT "ok"
  1. correct 30
  2. NEW
  3. 30 PRINT "ok"
13. Type a word that will end a program and show you the line number in which it ended.
14. Type another statement that will end the program.
15. Type a command that will remove the program from memory.
16. The command to use to cause the computer to print a word in the screen is:
  1. TYPE
  2. WRITE
  3. PRINT
17. When given the command "PRINT 50+5/2" the computer will respond:
  1. 52.5
  2. 27.5
  3. 53.2
  4. 51.5
18. If you have a program in memory and type the command NEW,
  1. the program is hidden from view but still there
  2. will be written on the disk
  3. will be gone from the computer's memory
19. For the computer the sign for division is:
  1. \*
  2. %
  3. /
  4. &
20. 12 PRINT "this is really the middle"  
35 PRINT "this is actually the end"  
5 PRINT "this is the beginning"  
What word would you enter to execute this program?