The Influence of Redundancy, Analogies, and Field Dependency Upon Learning of Scientific Material From Audiotapes.

Ellen Jane Wyllie wydra

Louisiana State University and Agricultural & Mechanical College

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THE INFLUENCE OF REDUNDANCY, ANALOGIES, AND FIELD DEPENDENCY UPON LEARNING OF SCIENTIFIC MATERIAL FROM AUDIOTAPES

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THE INFLUENCE OF REDUNDANCY, ANALOGIES, AND FIELD DEPENDENCY UPON LEARNING OF SCIENTIFIC MATERIAL FROM AUDIOTAPES

A Dissertation
Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy in The Interdepartmental Program in Education

by
Ellen Jane Wyllie Wydra
B.S.N., Louisiana State University Medical Center School of Nursing, 1973
M.S.N., University of Texas Health Science Center, 1977
August 7, 1981
In memory of my father

James J. Wyllie, M.D.
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ABSTRACT

The problems investigated in this study were: 1) Does the use of redundancy and analogies to emphasize the main verbal scientific concepts of an instructional unit facilitate comparable learning for field independent (FI), intermediate cognitive style (ICS), and field dependent (FD) undergraduate college students? 2) Are there differences in the aural, visual, and preferred sense recall of FI, ICS, and FD undergraduate college students?

The population consisted of undergraduate education students at Louisiana State University in Baton Rouge during the Spring Semester, 1981. The sample was all students enrolled in six sections of two media courses.

Instruments used were the Hidden Figures Test (HFT) to measure field dependency, a slide-tape test to identify sense recall and preference, and two multiple choice tests to measure concept acquisition.

The procedure entailed three periods: first, to measure field dependency and aural vs. visual recall and preference; second, to present an audiotape using redundancy and a nine-question test; third, (one week later) to present an audiotape using analogies and a nine-question test.
The design of the study was randomized completely with post-tests only. These hypotheses were tested using one way Analysis of Variance; there are no significant differences in:

1) information acquisition by FI, ICS, and FD subjects when redundancy is used in instruction,
2) information acquisition by FI, ICS, and FD subjects when analogies are used in instruction,
3) aural recall of the FI, ICS, and FD subjects,
4) visual recall of the FI, ICS, and FD subjects,
5) preferred sense recall of the FI, ICS, and FD subjects.

None of the F values of the ANOVAs were significant at the .05 level. All the null hypotheses were accepted. The conclusions were:

1) the amount of information acquired by the FI, ICS, and FD subjects was comparable, 2) there was no trend in the auditory, visual and preferred sense recall for the three groups.

Since the findings failed to demonstrate the variance between FI and FD subjects established by previous research, the results were interpreted as reflecting the effectiveness of redundancy and analogies in assisting all learners in identifying and acquiring the relevant aspects of the material.
CHAPTER 1

INTRODUCTION

All experiences and visual symbols can ultimately be reduced to words whether spoken, written, or thought (Dale, 1969). Considering the importance of words, relatively little research has been conducted on the verbal component of media. Little media research was located which investigated whether the verbal message could be structured to enhance learning. There exists a paucity of research studies which have investigated the influence of the individual's cognitive style on auditory and visual processing of information or on perception of the verbal message.

In the past, media research centered on comparing the effectiveness of media. Generally these studies demonstrated no significant difference in learning when instruction by two media or by one medium and traditional classroom methods were compared (Schramm, 1977). Repeated calls were made (Snow and Salomon, 1968; Herskovitz, 1979; Schramm, 1977; Salomon, 1979) for the study of learner variables, which influenced the perception of and learning from media, and for the study of the content of the media. Research was conducted in both of these areas.
Learner variables have been thought to be responsible for whether or not a learner made progress (Briggs, 1968). A learner variable which received attention in research was that of cognitive style (Witkin et al., 1977; Ausburn, 1976). One factor of cognitive style called field dependency referred to one's ability to perceive an embedded stimulus as separate from the background. Those subjects who were able to extract easily the relevant stimuli were identified as field independent. Those who experienced difficulty or were unable to do the task were identified as field dependent. Field dependency existed across senses and influenced visual perception and auditory perception of music and verbal material (Witkin et al., 1977).

Field dependent subjects demonstrated difficulty extracting pertinent material from the context (Witkin et al., 1977; Greco and McClung, 1979) especially when the material was scientific. A direct relationship between field dependency and scientific performance and achievement was demonstrated in numerous studies (Rosett, Robbins, and Watson, 1968; Dubois and Cohen, 1970; Hunt and Randhawa, 1973; Greenfield, 1970; Williams, 1969). Witkin (1977) and his colleagues concluded, after an extensive review of the large number of studies on the scientific performance of subjects classified by field dependency, that in the majority of the studies with college subjects, field independent subjects performed significantly better than the field dependent subjects. When the findings were not significant, the field independent subjects still performed consistently better than the field dependent subjects.
Field dependent subjects had more difficulty extracting the important aspects of information from the context (Witkin et al., 1977; Greco and McClung, 1979). Research studies attempting to explain why the difference in performance occurred had conflicting conclusions (Berger and Goldberger, 1979; Nahinsky, Morgan, and Oeschger, 1979; Bennink and Spoelstra, 1979; Davis and Frank, 1979).

No pertinent research studies were located that investigated whether the content of the verbal message of the medium could be structured in a way to assist the field dependent subjects in identifying the pertinent material. Studies probed whether attention directing cues could make the essential information salient. Most of these studies used verbal and visual cues to direct attention to the visual aspects of the material (Shapiro, 1970; Greco and McClung, 1979).

Heap (1968) in his research on semantic density wrote that the use of reinforcing statements in the form of redundancy, analogies, similes, and metaphors could emphasize the relevant or nuclear statements and make them more apparent, memorable and easily extracted from the context. No studies were located that investigated the influence of redundancy or analogies on the performance of field dependent and field independent subjects.

Studies which investigated the influence of message redundancy on learning by grade school and high school students had differing results. No studies of this nature were found which used college level subjects. Bucholc (1976) found that there was no significant difference in learning and retention from varying levels of redundancy.
of a slide-tape presentation to eighth grade students. Another study (McArthur, 1967) found that redundancy had both facilitating and inhibiting effects on both the auditory and visual senses. Low levels of redundancy in the visual sense, auditory sense, and in combination had either no effect or facilitating effects. High levels of redundancy were consistently inhibitory. Redundancy was found to aid in the recall of the redundant mode (Baldwin, 1966). Redundancy in both the auditory and visual modes aided recall of both modes.

Only one study that investigated the influence of analogies in the message upon learning was located. Males scored somewhat higher than females when tested in a high school biology class, but the difference between the groups with analogies and without analogies was not significant (Dowell, 1968).

Greco and McClung (1979) used verbal cues to direct attention to the relevant aspects of the visual material in a slide-tape presentation in an attempt to aid the field dependent learner in extracting the pertinent information. The results indicated that the verbal cues did not help the field dependent subjects. The researchers suggested that perhaps these results occurred because the field independent learner processed more information with the auditory mode than the field dependent learner did. DiVesta (1975) demonstrated that college students had a definite sense preference for processing information. He devised the Aural vs. Visual Attendance Test to measure the amount of information processed aurally and visually. He raised the question for further research whether there was a difference in the sense chosen for processing information by field independent and field dependent
subjects. No studies were located that probed this question.

Therefore, this study investigated whether there were any differences in the sense processing and sense preference of field independent (FI), intermediate cognitive style, (ICS), and field dependent (FD) subjects that may be responsible for the performance differences by these subjects. Also investigated was whether redundancy and analogies used to highlight the relevant verbal material would help the more field dependent subjects extract the pertinent information as measured by their performance on objective tests.
Statement of the Problem

The problem investigated by this study was: Does the use of redundancy or analogies to emphasize relevant verbal material assist field independent (FI), intermediate cognitive style (ICS), and field dependent (FD) undergraduate students acquire comparable amounts of information? A sub-problem studied was: Does the cognitive style factor of field dependency influence whether the aural or visual sense is used by undergraduate students in processing information?

The supporting questions of this study were:
1) Does the use of redundancy and analogies to highlight the relevant information make any difference in the acquisition of that information by FI, ICS, and FD subjects?
2) Are there any differences in the aural, visual, and preferred sense recall of aural and visual information by FI, ICS, and FD subjects?

Hypotheses of the Study

The hypotheses tested in this study for significance at the .05 level were:
1) There is no difference in the information acquisition scores ($T_A$) of FI, ICS, and FD subjects when redundancy is used in instruction.
2) There is no difference in the information acquisition scores ($T_B$) of FI, ICS, and FD subjects when analogies are used in instruction.
3) There is no difference in the aural recall ($R_A$) scores of the FI, ICS, and FD subjects.
4) There is no difference in the visual recall ($R_v$) scores of the FI, ICS, and FD subjects.
5) There is no difference in the preferred sense recall ($R_A - R_v$) scores of the FI, ICS, and FD subjects.

**Significance of the Study**

The use of media in education has increased dramatically over the years partially as an attempt to provide individualized instruction. How media presentations can best be structured to maximize the learning of the individual student is not known. How to structure the verbal message to enhance learning for field dependent and intermediate cognitive style learners also is not known. Since field dependent students consistently score lower than field independent students on scientific tests, (Witkin et al., 1977) research is necessary to determine whether redundancy and analogies used to emphasize the relevant material would improve the more field dependent students' performances.
Definition of Terms

Analogies are verbal constructs that show similarities or resemblances in the form of comparisons, metaphors, or similes. Analogies are one form of reinforcing statements.

Attendance, also preferred sense, is the dominance of either the visual or aural sense in processing information. Dominance is determined by which of the two senses produces the greatest recall of different four digit spans presented simultaneously visually and aurally (DiVesta, 1975).

Aural attender is one who prefers the aural sense, that is, is able to recall more information received through hearing than that received visually (DiVesta, 1975).

Cognitive style is a reference to individual differences in perception and in the processing of information. Cognitive style consists of a number of different dimensions that affect cognition (Ausburn and Ausburn, 1978; Witkin et al., 1977).

Field dependence (FD) is one factor of cognitive style that involves one's difficulty in perceiving items as discrete from the background (Witkin et al., 1977). An individual is designated as being field dependent by scoring in the bottom 27 percent on the Hidden Figures Test (HFT) (Maginn, 1975; Greco and McClung, 1979). This percentage corresponds to that used in tests similar to the HFT (Maginn, 1975). Field dependency is a collective term used in this study to refer to both field independence and field dependence.
Field independence (FI) is one factor of cognitive style that involves one's ease in perceiving items as discrete from the background (Witkin et al., 1977). One is designated as being field independent by scoring in the top 27 percent on the Hidden Figures Test. This percentage corresponds to that used in tests similar to the HFT (Maginn, 1975; Greco and McClung, 1979).

Intermediate cognitive style (ICS) is the middle 46 percent of scores on the Hidden Figures Test. These scores are the middle range between the field independent and field dependent scores and represent the ease of perception of items as discrete from the background.

Learning is defined in this study as the acquisition of information measured by the performance score on a multiple choice test.

Nuclear statements are phrases that impart the main idea or the essential point (Heap, 1968). These statements are the concepts derived from the instructional objectives.

Pertinent or relevant aspects of the script are the nuclear or important concepts identified in the instructional objectives.

Reinforcing statements are phrases that increase the saliency of the nuclear statement. Two types of reinforcing statements are: Redundancy which is the reiteration and repetition of phrases, and Analogies which are comparison phrases in the form of examples, metaphors, and similes.

Supporting clauses are phrases used to prepare the learner for the
for the nuclear statement, to supply supplementary information or to strengthen and impress the nuclear statement (Heap, 1968).

**Visual attender** is one who prefers the visual sense, that is, is able to recall more information received visually than that received through hearing (DiVesta, 1975).

**Assumptions of the Study**

Assumptions made in this study were:

1) The Hidden Figures Test which measures flexibility of closure and has been correlated with field dependency is a valid measure of the construct of field dependency as defined in this study.

2) The Aural vs. Visual Attendance Test designed by DiVesta is a valid instrument which measures sense preference.

3) The students randomly enrolled in EDAF 3500 and EDAF 3525 and are representative of the population.

**Limitations of the Study**

The population of this study was limited to undergraduate education students enrolled at Louisiana State University (LSU) during the Spring Semester, 1981. The generalizability of the research findings are accordingly limited to this population. For reasons of logistics the sample was limited to the eighty-six undergraduate students enrolled in EDAF 3500 (Utilization of Instructional Materials) and EDAF 3525 (Selection of Educational Media) enrolled at LSU during the Spring Semester, 1981, with the assumption that these subjects enrolled randomly in these courses. No attempt was made to randomly
select groups from the population.

The subjects in this study experienced both experimental treatments and both post-tests thus serving as the control. Due to the limited number in the sample no attempt was made to form a separate control group.

The research questions delineated the variables for study as field dependency, the two manipulations of the learning material through the use of redundancy and analogies, and aural-visual recall. No other variables were studied in this research. This study did not attempt to quantify the redundancy and analogies used in instruction. This study did not endeavor to define the construct of field dependency. Nor did the study match or control the cognitive style of the researcher as the instructional developer.

The post-tests in this study were administered immediately following the treatments. This testing procedure is not customary at the college level but was necessary to eliminate the effects of history and maturation. In order to maintain a reasonable testing duration no attempt was made to assess the retention of learning.

The order of the experimental treatment was not varied to control multiple treatment interference. However, one week elapsed between the experimental treatments to minimize any interference.
CHAPTER 2

REVIEW OF RELATED LITERATURE

In a state of the art paper in 1967, Chu and Schramm posited that "given favorable conditions, pupils can learn from any instructional media that are now available." In two reviews of research (Holmes, 1959; Schramm, 1977) the majority of studies which compared learning from media with learning from conventional classroom methods indicated no significant difference in learning. In addition, there was generally no significant difference in learning when comparing any two types of media.

Field Dependency

Snow and Salomon (1968:341) criticized past research because "almost all of the research evidence accumulated to date applies to some generalized 'average student', and thus to no one." Recently, research efforts have been directed toward studying the interaction of media with individual deficiencies, learning styles, and the effect of these upon learning (Greco and McClung, 1979; Salomon, 1979; Powers and Russell, 1980). Some of these researchers have used one factor of cognitive style, the dimension of field dependency, to identify the individual's learning style and deficiencies.

The construct of field dependency arose from the work of Witkin
and Asch in 1948 (Witkin, et al., 1977). While trying to discover how people locate the upright direction in space, they made an unexpected discovery about perception. There was a marked difference among people in their abilities to perceive an object as separate from the surroundings. Individuals differed in the extent to which the organization of the field influenced their perception of the components of the field. In short the individuals differed in their abilities to perceive analytically.

Because at one extreme of the performance range perception is strongly dominated by the prevailing field, that mode of perception was designated "field dependent". At the other extreme, where the person experiences items as more or less separate from the surrounding field, the designation "field independent" was used (Witkin, et al., 1977:6-7).

Further research by Witkin's group demonstrated that the extreme field independent person was able to identify an object embedded in a complex structure, to perceive analytically, and to impose a structure on unstructured material. The extreme field dependent person was not able to identify the embedded figure in the time allotment or to impose a structure on unstructured material. The field dependent person depended on an outside source for organization.

In an extensive review of research (Witkin, et al., 1977) field dependency was found to be stable over time and across sense modalities. Field dependency was found to exist with vision, hearing, and touch. Past research (Winn, 1979; Witkin, et al., 1977) indicated that the field dependent person tended to be more attentive to social surroundings and to be better at learning and remembering social material but had difficulty with scientific material.
Contrarily, the field independent person was less socially oriented, more analytical and excelled in scientific and theoretical studies.

The findings of the research comparing sexual difference with field dependency have been inconsistent. Some studies have shown a significant difference in the performance of males and females on field dependency tests (Witkin et al., 1977; Maccoby and Jacklin, 1974; Allen and Cholet, 1978; Cionini et al., 1979). Other studies (Greenfield, 1970; Shapiro, 1970; Small et al., 1979; deLisi and Smith, 1979) have reported no significant difference by males and females on field dependence tests. Other studies demonstrated that the field dependence performance difference of the sexes could be reduced or eliminated by controlling other variables such as socioeconomic factors (Cionini et al., 1979), spatial ability (Maccoby and Jacklin, 1974; Small et al., 1979) culture and sex role training (Witkin et al., 1977).

Scientific Performance

The relationship between field dependency and scientific performance has been well documented. A direct relationship between field dependency, achievement, and performance in the sciences, including general sciences, biology, physics, chemistry, engineering, computational sciences, and mathematics, has been shown (Rosett, Robbins, Watson, 1968; Dubois and Cohen, 1970; Hunt and Randhawa, 1973; Greenfield, 1970). Williams (1969) was able to support that perceptual disembedding test performance, measured by the Thurstone Gottschaldt
Test (which is a precursor of the HFT used in this study) could predict analytical intellectual skill as measured by the performance on the Science and Math ACT exam.

Witkin, et al. (1977:45) in a review of the research on scientific performance of subjects classified by field dependency concluded:

In a good majority of the large number of studies with college populations, relatively field-independent students were found to perform significantly better in the mathematics, sciences, engineering, and architecture domains than field-dependent students...In studies where a significant relation was not found, the results were invariably in the expected direction.

**Performance Differences**

Researchers have attempted to explain why the differences existed in the performances of FI and FD learners on tests and especially on scientific tests. Some suggested that FI subjects were able to selectively focus on and attend to stimuli (Witkin, et al., 1977; Berger and Goldberger, 1979).

Other studies have suggested that FD subjects were unable to tune out irrelevant stimuli and were processing such large loads of information that the short-term memory (STM) was crowded and testing of further information was prevented (Case, 1975; Nahinsky, Morgan, and Oeschger, 1979; Bennink and Spoelstra, 1979).

Some researchers suggested that the differences in performance were due to the FD subject's low capacity for cognitive processing. Pascual-Leone (1970) concluded that FI and FD subjects differed in the amount of central computing space called M-space. FD subjects were
habitually low M-processors and FI were high M-processors. Case (1975) attributed the differences in performance to the "working memory" capacity. The working memory was a general executive system for information processing. The capacity of this system was depleted by short-term storage and immediate processing and thus limited the amount of processing capacity.

Others claimed that the FI learner was better able to organize the material and to use the working memory more efficiently (Robinson and Bennick, 1978; Davis and Frank, 1979). Davis and Frank (1979) suggested two alternate explanations for the performance differences. First, FI subjects were able to generate more possibilities for hypothesis testing which may enable them to assimilate more information. Second, FD subjects had less efficient memory processes or were using their processing capacity to process information superficially which resulted in poorer performances.

The ability of FI subjects to resist interference better has been demonstrated (Davis and Frank, 1979; Berger and Goldberger, 1979). Further findings in the research by Berger and Goldberger, which may account for the differences in performance, were that FD subjects reported a greater curiosity about peripheral stimuli and more mind wandering than FI subjects reported. FI subjects described themselves as more involved and interested in the tasks than FD subjects described themselves. FI students also demonstrated more rehearsal of stimuli especially when involved in other tasks.
Another explanation for the performance differences of FI and FD subjects was that performance was related to the ability for abstract thought and to the attainment of Piaget's formal operational level (Rubenstein, 1980; Nahinsky, Morgan, and Oeschger, 1979).

The research of Zoccolotti and Oltman (1978) showed a neural activity in FI subjects, observed by differences in right visual field discrimination, not found in FD subjects. This finding suggested that the differences in performance could be due to a differences in the hemispheric processing in the brain.

In 1970 a study correlated the test for determining field dependence with five achievement tests and with a university admissions examination consisting of verbal and quantitative components and found a significant correlation among all the tests (Dubois and Cohen, 1970). These researchers suggested that field independence may be a "'semi-specific' factor of ability or intelligence". and that "the dimension [FI], which is certainly not very clearly explained at this point, may yet hold unexpected significance as a broader explanatory construct in human perception and behavior. On the other hand, field independence may someday be thought of simply as one factor of intelligence (1970:414-415)."

The literature contained many suggestions as to why the differences exist in the performance of FI and FD subjects. To date, the reason for the differences in performance is still not known.
Aural vs. Visual Attendance

The existence of field dependency across the senses has been established (Axelrod and Cohen, 1961; Witkin, et al., 1968). DiVesta (1975) demonstrated that college students had strong preferences for either the aural or visual sense. The question of whether field dependency was related to sense preference was raised for further study (Ingersoll and DiVesta, 1972).

Greco and McClung (1979) demonstrated that field dependent persons had more difficulty extracting pertinent verbal information from the context. Verbal cues which directed attention to the relevant aspects of the visual presentation did not aid the field dependent learner. The researchers suggested that perhaps this occurred because the field independent person learned more from the auditory mode than the field dependent person learned. This question, however, has not been addressed in the literature.

Reinforcing Statements

Different results were obtained from attempts to make the relevant material salient so that this material was more easily recognized by those having difficulty extracting the pertinent information from the context. Stripping verbal material down to only the relevant or nuclear statements (Heap, 1968) decreased learning. "Diluting" the relevant material with prepatory, supplementary or reinforcing clauses improved learning by college subjects. However, the impact of each type of clause was not determined. Heap posited
that two types of reinforcing clauses, restatement (reiteration) and comparison clauses (analogies, metaphors, and similes) would make the nuclear clauses more salient, easier to extract, and more memorable. Studies investigating whether either of these two types of reinforcing clauses would be more effective were not located.

**Media Adaptation**

Salomon and Snow (1968) criticized media research because most of the research had compared learning between mediums. These researchers argued that research of this kind was simply a study of whether the medium, in and of itself, could improve learning; instead, research should be directed toward the study of the attributes of media. An attribute is "...any structural component which has an influence on the kind [italics in the original] of material one can present, the arrangement [italics in the original] of the material with relation to other material, or the way [italics in the original] the material is presented is an attribute of the medium (1968:230)."

Currently, the most effective way to structure materials to match the individual learning style or to compensate for the learner's deficiencies is not known. Several adaptations have been studied to determine if they could be used to enhance learning, for example, attention directing cues, advance organizers, post organizers, redundancy, and analogies. Generally, these studies were directed toward compensating for the deficiencies of some students. Allen (1975) suggested that some procedures could make up for the
"attentional, discriminational, analytical and mental processing deficiencies (1975:159)" within some students.

**Attention Directing Cues**

Witkin et al. (1977) demonstrated that field dependent students had difficulty extracting pertinent information from the context. Attention directing cues have been used to study whether relevant material can be made salient in order to compensate for the discrimination deficiency of the field dependent learner.

Field independent learners seemed to benefit from any type of media or format (Allen, 1975; Greco and McClung, 1979). The use of cues to identify the relevant material was suggested as possibly benefiting field dependent learners (Witkin et al., 1977). Generally, attention directing cues seemed to benefit all learners (Allen, 1975). However, in one study (Greco and McClung, 1979) attention directing cues benefited the field independent learners more than the other learners were benefited.

The use of cues to emphasize relevant aspects of verbal material had inconsistent effects on learning. Snow and Salomon (1968) found that cues improved learning for low ability learners but not for the high ability learners. Cronbach and Snow (1977) supported this finding and suggested that attention directing cues helped the low ability learner compensate for discrimination deficiencies. However, learning was decreased for high ability subjects because unnecessary emphasis was placed on details. Increasing the number of irrelevant to
relevant visual cues resulted in a significant increase in the recall of audio information in one study (Schlater, 1966).

The use of color cues to direct attention also had inconsistent effects. A study of 446 field independent and field dependent subjects (Shapiro, 1970) demonstrated no significant difference in the learning of the field dependent male subjects. Field dependent females significantly improved in the recall of the surrounding items but recalled fewer of the color cued items. Field independent females declined significantly in the recall of both the color cued and surrounding items. Field independent males recalled fewer of the surrounding items and improved in the recall of the color cued items. No pattern was apparent to explain the findings.

In a test of sixth grade students, classified as field dependent or field independent, (Greco and McClung, 1979) two slide-tape presentations dealing with oceanography were used for instruction. The presentations were identical with the exception of verbal attention directing cues in the audio portion of one presentation. The verbal cues were directing attention to the important aspects of the visual material. The cues were found to be effective with both groups. However, they benefited the field independent students more.

The attention directing cues discussed were verbal cues that directed attention to the visual elements. Verbal cues that direct attention to the verbal information have been studied in the form of redundancy, analogies and advance and post organizers.
Redundancy

In an unpublished study by Kropp, Nelson and King (1967), reported by Cronbach and Snow (1977), learning of textbook information by sixth graders increased with high ability students when the information was compressed by 20 percent by removing details and simplifying the content. Their findings suggested that failure to provide redundancy by removing details, simplifying, and shortening the presentation worked against low ability students and helped high ability students.

Baldwin (1966) found that redundancy in either the audio or visual messages resulted in greater recall of the redundant mode. Redundancy in both audio and visual modes was positively related to recall of both. Bucholc (1976) found no significant difference in learning and retention when using varying levels of redundancy in a slide-tape presentation to eighth grade students.

Redundancy was found to have both facilitating and inhibiting effects (McArthur, 1967). Low levels of redundancy in the visual stimulus only or in both the audio and visual improved the performance of twelve year old subjects. However, performance declined with higher levels of redundancy. There was no significant difference in performance with high or low levels of redundancy in the audio portion only.

Advance Organizers, Post Organizers

Ausubel (1960) (Ausubel and Fitzgerald, 1961) introduced the
use of advance organizers, introductory material used to provide external structure to new material and to relate the unfamiliar material to existing knowledge. Low ability subjects benefited more from advance organizers than the high ability subjects did (Anderson, 1967; Ausubel and Fitzgerald, 1962).

Advance organizers were found (Luiten, Ames, and Acherson, 1980) to show a small positive effect in all content areas with all subjects of all grades and abilities. However, a somewhat greater effect of advance organizers was reported with higher ability subjects.

Other studies had contradictory findings. Kahle (1971) found no significant difference in the learning of elementary education majors enrolled in a biology course at a large midwestern university when advance organizers were used. Similar findings were reported by Bertou (1971) and Mumford (1971).

The use of post organizers, questions presented after the presentation, made no significant difference in learning (Bertou, 1971; Mumford, 1971). However, questions interspersed throughout the presentation resulted in a significant difference in learning (Bertou, 1971).

In a study of 126 college sophomore nursing students (Hart, 1971) advance organizers or pre-organizers were more effective in enhancing learning than post organizers were.

Perhaps the conflicting findings with the use of advance organizers can be attributed to what Ausubel (1980) regarded as a misinterpretation of advance organizers. He wrote that he never
intended the organizers to be an outline presented prior to instruction. Rather, he explained:

...advance organizers explicitly draw upon and mobilize whatever relevant subsuming concepts are already established in the learners' cognitive structure and make them part of the subsuming entity...the principal function of the organizers is described as bridging the gap between what the learner already knows and what he needs to know so that he can learn the task at hand (more expeditiously) (1980:402).

As an example of an advance organizer Ausubel used the idea of discussing Christianity prior to teaching about Buddhism because the learner could compare the unknown concepts of Buddhism with the familiar concepts of Christianity and thereby anchor the unknown with the familiar structure (Ausubel and Fitzgerald, 1961). "The role of the organizer is not only to provide optimal anchorage at an optimal level of inclusiveness, but also to increase the discriminability of the learning passage from analogous and often conflicting ideas in the learner's cognitive structure (1961:266)." In short the advance organizer is an analogy presented to provide a structure for the purpose of organization and comparison.

**Analogies**

Only one relevant study was located that investigated the effect of analogies upon learning. Dowell (1968) found no significant difference in learning with analogies in a study of high school biology classes.

In summary, the review of the literature surveyed some of the research conducted on field dependence, the performance of field
dependent subjects, aural vs. visual attendance, reinforcing statements, and attention directing cues. Further, literature cited dealt with adaptations of media, redundancy, analogies, advance and post organizers.
CHAPTER 3

METHODOLOGY

Population of the Study

The population of this study consisted of all undergraduate education students enrolled at Louisiana State University in Baton Rouge during the Spring Semester, 1981. This population was chosen because a greater number of field dependent students were expected to be in education than in the pure sciences (Witkin, Moore, Goodenough, and Cox, 1977). The sample consisted of students enrolled in three sections of EDAF 3500 (Utilization of Instructional Media) as well as students enrolled in three sections of EDAF 3525 (Selection of Educational Media) during the Spring Semester, 1981.

The total number of subjects in the sample was eighty-five. One section consisting of seventeen subjects was randomly chosen for the pilot study. The remaining sixty-eight subjects served as the experimental group. The subjects were tested with the Aural vs. Visual Attendance Test (N=67) and the Hidden Figures Test (N=68). Of the sixty-eight subjects, fifty-eight completed Test A and sixty-one completed Test B. The mortality on Test A consisted of two FI, six ICS, and two FD subjects. The mortality on Test B consisted of one FI, five ICS, and one FD subjects. The mortality on the Aural vs. Visual Attendance Test was one ICS subject.
Instruments for the Study

Aural vs. Visual Attendance Test (Appendices C, D, and E.)

This test was a bisensory digit span task designed by Ingersoll and DiVesta (1972) to determine sensory preference, measured by the magnitude and direction of the difference between the audio and visual scores. The integers 0 (pronounced "zero") through 9 were used as the digit stimuli. Integers were randomly assigned to four digit spans for each of fifteen trials. The restriction on the assignment was that no number could occur twice within one trial. The audio stimulus duration was approximately 0.8 seconds with a interstimulus interval of 1.2 seconds.

The visual stimuli were four digit spans with only one digit per slide, constituting a series of four slides presented sequentially. The visual stimuli were presented simultaneously with the auditory stimuli. The slides and audiotape were synchronized by an inaudible (1,000 Hz) pulse. The visual stimulus duration was 0.8 seconds with an interstimulus interval of 1.2 seconds.

A series of fifteen trials were performed, ten for practice and the last five trials as the experimental tasks. Prior to the trials the subjects were instructed that the task was a bisensory task, that the numbers should be recalled in whatever way was most comfortable for them and written under the appropriate column.

Subjects were instructed that they would hear on the tape the words "trial number____"; "ready" to signal the start of the presentation; and then the series of four numbers followed by the word
"write", at which time they were to write down the numbers recalled in the order presented.

The tests were scored by the researcher not only for correct recall of the digits but also for the correct position of the numbers. Inversion of two digits during recall would be an error. Each subject received an aural score and a visual score. The preferred sense was determined by the difference between the aural and visual scores. Aural preference was designated by a positive score and visual preference by a negative score.

The validity of the test designed by Ingersoll and DiVesta (1972) and similar to the original work by Broadbent (1956) was previously established by these researchers. The reliability of the Aural vs. Visual Attendance Test was calculated by this researcher as 0.96 for the aural portion and 0.91 for the visual portion.

Hidden Figures Test (CF-1)

This test was an adaptation of the Thurstone Gottschaldt Figures Test which was developed to study field independence. The Hidden Figures Test (HFT) was developed by French, Ekstrom and Price. The test measures flexibility of closure which is "the ability to hold a given visual percept or configuration in mind so as to disembed it from other well-defined perceptual material. Tests of this factor require the subject to search a distracting perceptual field in order to find a given configuration (French, Ekstrom and Price, 1976:19)."

The HFT was used as a measure of field dependency (Ausburn and Ausburn, 1978; Greenfield, 1970; Margulis, 1971; Shapiro, 1970) despite
the confusion over whether field independence and flexibility of
closure were identical constructs (Witkin, et al., 1977). Goodenough
(1981) in research in progress established a correlation between
the Embedded Figures Test by Witkin and the Hidden Figures Test at
0.50.

The HFT consisted of two parts each with sixteen items and a
time limit of twelve minutes for each part. The subjects were to
identify which of five figures was contained in each item. The HFT
were hand scored by the researcher and the score calculated as the
number wrong divided by four subtracted from the number right. The
scores were rank ordered and the top 27 percent designated as field
independent and the bottom 27 percent as the field dependent, the
remaining were classified as intermediate cognitive style. This is the
same designation scale used with similar tests of field dependency
(Greco and McClung, 1979; Maginn, 1975).

The HFT with a high difficulty level was developed for use with
grades six through sixteen. For college levels subjects the reliability
was determined to be 0.80 for females (N=329) and 0.83 for males

Objective Tests A and B (Appendices A and B)

These two tests were designed by the researcher to measure
acquisition of the nine relevant concepts presented in each script.
Each test consisted of nine multiple choice questions with at least
four options each. They were not timed tests. Test A was designed to
be used with script A, the script with redundancy. Test B was designed to be used with script B, the script with analogies.

The validity of the test was established by a panel of experts. After the necessary revisions the reliability of Test A was 0.44 and Test B was 0.64 using the Kuder-Richardson Formula 21. The measure of reliability is related to the length of the tests and is a measure of the least reliability a test can possess (Kerlinger, 1973). Considering the brevity of the two tests, the reliability of these tests was considered adequate for this study.

**Design of the Study**

The design of this study was randomized completely with post-tests only. The attribute variable was the three levels of field dependency: field independent (FI), intermediate cognitive style (ICS), and field dependent (FD). All three groups of subjects experienced both experimental treatments. The independent variables were the use of redundancy and analogies in instruction. The dependent variable was concept acquisition as measured by the scores on the multiple choice tests ($T_A$ and $T_B$). The attribute variables of sense processing and preference were measured by the aural ($R_A$), visual ($R_V$), and the preferred sense recall score ($R_A - R_V$).

**Procedure for the Study**

Three days prior to the first experimental instruction the Aural vs. Visual Attendance Test and the Hidden Figures Test (HFT) were administered. After the subjects read the instructions provided with
the HFT, they took the two sections of the test, each timed for twelve minutes. Following the HFT the Aural vs. Visual Attendance Test was administered.

At the next meeting the first experimental instruction was conducted which consisted of listening to the audiotape A (the script with redundancy) and completing Test A. The subjects were informed prior to the tape A that they would be tested immediately following the completion of the tape.

The second experimental instruction was conducted one week later. At this time audiotape B was played and Test B was completed. The subjects were again informed prior to the audiotape that a test would be administered upon completion of the tape.

**Materials for the Study**

The materials used in the two instructional units of this study were two audiotapes. Tape A was a script using redundancy that lasted five minutes and eleven seconds. Tape B was the script using analogies, and it lasted five minutes and twenty seven seconds. The contents of the tapes were two fictitious scientific topics since scientific material presented the most difficulty for field dependent learners (Witkin, et al., 1977; Rosett, Robbins, Watson, and 1968; Dubois and Cohen, 1970; Greenfield, 1970). Fictitious material was used to eliminate the need for a pre-test. The scripts of the two tapes were judged comparable by a panel of experts. The rate and intensity were the same for each tape as judged by three graduate media students. The male narrator was the same for each tape.
The Aural vs. Visual Attendance Test was a slide-tape presentation. The HFT required writing material and the standardized tests.

Pilot Study

Three weeks prior to the experiment a pilot study was done to test the reliability of the instruments. One of the six class sections was randomly selected to be used in the pilot study. After the initial testing with the Hidden Figures Test and the Aural vs. Visual Attendance Test the two audiotapes were presented one week apart and each was followed by an objective test.

The reliability of the Aural vs. Visual Attendance Test was computed with the Kuder-Richardson Formula 21 to be 0.96 for the aural test and 0.91 for the visual test.

The reliability for the objective test A (for the script with redundancy) was 0.11 using the Kuder-Richardson Formula 21. Revisions were made in test A and subsequent experimental testing revealed a reliability of 0.44.

The reliability of the objective test B (the script with analogies) was 0.16. Revisions were made and subsequent experimental testing demonstrated a reliability of 0.64.
CHAPTER 4

DATA PRESENTATION AND ANALYSIS

The questions answered in this study were:

1) Does the use of analogies and redundancy make any difference in the information acquisition by field independent (FI), intermediate cognitive style (ICS), and field dependent (FD) undergraduate students?

2) Are there differences in the aural, visual, and preferred sense recall by FI, ICS, and FD students?

The null hypotheses tested were:

1) There is no difference in the information acquisition scores ($T_A$) of FI, ICS, and FD subjects when redundancy is used in instruction.

2) There is no difference in the information acquisition scores ($T_B$) of FI, ICS, and FD subjects when analogies are used in instruction.

3) There is no difference in the aural recall ($R_A$) scores of the FI, ICS, and FD subjects.

4) There is no difference in the visual recall ($R_V$) scores of the FI, ICS, and FD subjects.

5) There is no difference in the preferred sense recall ($R_A - R_V$) scores of the FI, ICS and FD subjects.

The data were analyzed in this study by the computerized Statistical Analysis System (SAS). The results are discussed in the following sections.
Research Tests

Hidden Figures Test (HFT)

This test was designed to identify the cognitive style dimension of field dependency. The HFT was used to test sixty-seven subjects. The scores ranged from a negative two to a positive twenty-nine. The top 27 percent of the scores (N=19) were designated as FI. The bottom 27 percent of the scores (N=19) were designated as FD. The remaining scores (N=29) were designated as ICS.

Hypotheses Testing

One way Analysis of Variance (ANOVA) was used to determine whether there were any differences in the performances by FI, ICS, and FD subjects on Test A, the objective test used following instruction with redundancy, and Test B, the objective test used following instruction with analogies. ANOVA was also used to determine whether there were any differences in the aural, visual, and preferred sense recall (the difference between the aural and visual scores) scores for the FI, ICS, and FD subjects. The findings were used to test the following hypotheses.

Hypothesis 1. There is no difference in the information acquisition scores (TA) of FI, ICS, and FD subjects when redundancy is used in instruction.

The mean scores on Test A (TA) which measured information acquisition were computed for the FI, ICS, and FD subjects. The ICS subjects scored slightly better than the FI subjects. Both FI and ICS
subjects scored better than the FD subjects when redundancy was used. The results are listed in Table 1.

Table 1
Mean Acquisition Scores on Test A ($T_A$)

<table>
<thead>
<tr>
<th></th>
<th>Score</th>
<th>Percentage Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Independent</td>
<td>7.29</td>
<td>81</td>
</tr>
<tr>
<td>Intermediate Cognitive Style</td>
<td>7.46</td>
<td>83</td>
</tr>
<tr>
<td>Field Dependent</td>
<td>6.94</td>
<td>77</td>
</tr>
</tbody>
</table>

One way analysis of variance (ANOVA) was computed, using the scores for Test A ($T_A$) which measured information acquisition from the script with redundancy, to determine whether there were any significant differences with FI, ICS, and FD subjects. The $F$ value was determined to be 0.57 which was not significant at the .05 level for two and sixty-four degrees of freedom. The findings are listed in Table 2.

Table 2
Analysis of Acquisition Scores on Test A ($T_A$)

<table>
<thead>
<tr>
<th>Source</th>
<th>$f$</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>$F$ value</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>2.69</td>
<td>1.35</td>
<td>0.57</td>
<td>1.54</td>
</tr>
<tr>
<td>Within groups</td>
<td>55</td>
<td>130.43</td>
<td>2.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>133.12</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The analysis of $T_A$ scores indicated no significant differences in the acquisition by FI, ICS, and FD subjects. The null hypothesis, there is no difference in the acquisition scores for FI, ICS, and FD subjects when using redundancy in the instruction, was accepted.

**Hypothesis 2.** There is no difference in the information acquisition scores ($T_B$) of FI, ICS, and FD subjects when analogies are used in instruction.

The mean scores on Test B, which measured information acquisition from the script with analogies, were computed. The FI subjects scored the highest. The FD subjects scored better than ICS subjects when analogies were used in the instruction. The results are listed in Table 3.

<table>
<thead>
<tr>
<th>Cognitive Style</th>
<th>Scores</th>
<th>Percentage Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Independent</td>
<td>7.94</td>
<td>88</td>
</tr>
<tr>
<td>Intermediate Cognitive</td>
<td>6.80</td>
<td>75</td>
</tr>
<tr>
<td>Field Dependent</td>
<td>7.61</td>
<td>84</td>
</tr>
</tbody>
</table>

One way ANOVA was computed using the scores for Test B ($T_B$) to determine whether there were any differences in information acquisition for FI, ICS, and FD subjects when analogies were used in the instruction. The F value was calculated to be 2.53 which was not significant at the .05 level for two and fifty-eight degrees of freedom. The findings are listed in Table 4.
Table 4
Analysis of Acquisition Scores on Test B ($T_B$)

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F value</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>15.11</td>
<td>7.55</td>
<td>2.53</td>
<td>1.73</td>
</tr>
<tr>
<td>Within groups</td>
<td>58</td>
<td>173.22</td>
<td>2.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>188.33</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The analysis of $T_B$ scores indicated no significant differences in the acquisition by FI, ICS, and FD subjects. The null hypothesis, there is no difference in the acquisition scores ($T_B$) for FI, ICS, and FD subjects when using analogies in instruction, was accepted.

Aural vs. Visual Attendance Test

This test was designed to measure how much information was recalled from the auditory and visual senses. Sense preference was also determined with this test by calculating the magnitude and direction of the difference between the auditory and visual scores.

The number of subjects taking the Aural vs. Visual Attendance Test was sixty-seven. An aural attendance or preference, determined by a positive score after subtracting the visual score from the aural score, was shown by twenty-nine subjects. A visual attendance or preference, determined by a negative score after subtracting the visual score from the aural score, was shown by twenty-nine subjects. No sense preference, demonstrated by a score of zero after subtracting the visual score from the aural score, was shown by nine subjects.
The mean scores for the aural, visual and preferred sense scores from the Aural vs. Visual Attendance Test for the FI, ICS, and FD subjects were calculated and are listed in Table 5.

Table 5
Aural and Visual Recall
Mean Scores (Maximum = 20)

<table>
<thead>
<tr>
<th>Sense Preference (R_A - R_V)</th>
<th>Aural Recall</th>
<th>Visual Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Independent</td>
<td>15.47</td>
<td>16.47</td>
</tr>
<tr>
<td>Field Dependent</td>
<td>15.21</td>
<td>13.68</td>
</tr>
<tr>
<td>Intermediate Cognitive Style</td>
<td>16.00</td>
<td>15.48</td>
</tr>
</tbody>
</table>

One way ANOVA was used to determine whether there were any differences in the aural, visual, and preferred sense recall (the difference of the aural and visual scores) scores for the FI, ICS, and FD subjects. The findings were used to test the following hypotheses.

Hypothesis 3. There is no difference in the aural recall (R_A) of the FI, ICS, and FD subjects.

The ANOVA was computed, using the data for dependent variable R_A (recall of aural stimuli) and the attribute variable of three cognitive style groups, FI, ICS, and FD, to determine if there were any differences in the dependent variable, recall of the aural information. An F value of 0.23 was calculated which was not significant at the .05 level for two and sixty-four degrees of freedom. The results are listed in Table 6.
Table 6
Analysis of Aural Recall ($R_A$) Scores

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>7.78</td>
<td>3.89</td>
<td>0.23</td>
<td>4.11</td>
</tr>
<tr>
<td>Within groups</td>
<td>64</td>
<td>1083.89</td>
<td>16.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>1091.67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This analysis of $R_A$ scores demonstrated no significant differences in aural recall scores for any of the cognitive style groups, FI, ICS, and FD. The null hypothesis, there is no difference in the aural recall by FI, ICS, and FD subjects, was accepted.

Hypothesis 4. There is no difference in the visual recall ($R_V$) of the FI, ICS, and FD subjects.

The ANOVA was computed using data for the dependent variable $R_V$ (recall of visual stimuli) and the attribute variable of three cognitive style groups, FI, ICS, and FD, to determine whether there were any differences in the dependent variable, recall of visual information. An F value of 1.70 was calculated which was not significant at the .05 level for two and sixty-four degrees of freedom. The results are listed in Table 7.
Table 7  
Analysis of Visual Recall (R_v) Scores

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F value</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>76.60</td>
<td>38.30</td>
<td>1.70</td>
<td>4.74</td>
</tr>
<tr>
<td>Within groups</td>
<td>64</td>
<td>1440.08</td>
<td>22.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>1516.68</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The analysis of R_v scores indicated no significant differences in visual recall scores for any of the cognitive style groups, FI, ICS, and FD. The null hypothesis, there is no difference in the visual recall scores for FI, ICS, and FD subjects, was accepted.

Hypothesis 5. There is no difference in the preferred sense recall (R_A-R_v) of the FI, ICS, and FD subjects.

The ANOVA was computed, using the difference scores of R_A-R_v as the dependent variable and cognitive style as the attribute variable, to determine whether there were any differences in the dependent variable, preferred sense recall scores for the FI, ICS, and FD subjects. The F value calculated was 1.01 which was not significant at the .05 level for two and sixty-four degrees of freedom. The results are listed in Table 8.
Table 8
Analysis of Preferred Sense Recall \((R_A-R_V)\) Scores

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F value</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>61.69</td>
<td>30.85</td>
<td>1.01</td>
<td>5.53</td>
</tr>
<tr>
<td>Within groups</td>
<td>64</td>
<td>1959.98</td>
<td>30.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>2021.67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The analysis of the preference scores of \(R_A-R_V\) indicated no significant differences in the preferred sense recall for the FI, ICS, and FD groups. The null hypothesis, there is no difference in the preferred sense recall scores of FI, ICS, and FD subjects, was accepted.

In summary, one way ANOVA was used to analyze the data to test each of the hypotheses. None of the F values were significant so each of the null hypotheses was accepted. The hypotheses accepted were:

1) There is no difference in the information acquisition scores \((T_A)\) of FI, ICS, and FD subjects when redundancy is used in instruction.
2) There is no difference in the information acquisition scores \((T_B)\) of FI, ICS, and FD subjects when analogies are used in instruction.
3) There is no difference in the aural recall \((R_A)\) scores of the FI, ICS, and FD subjects.
4) There is no difference in the visual recall \((R_V)\) scores of the FI, ICS, and FD subjects.
5) There is no difference in the preferred sense recall \((R_A-R_V)\) scores of the FI, ICS, and FD subjects.
CHAPTER 5

CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Conclusions

The statistical analysis of the data showed no significant differences in any of the hypotheses tested. All of the null hypotheses were accepted and the researcher concluded that:

1) There was no difference in the information acquisition of FI, ICS, and FD subjects when redundancy was used in instruction.
2) There was no difference in the information acquisition of FI, ICS, and FD subjects when analogies were used in instruction.
3) There was no difference in the aural recall of the FI, ICS, and FD subjects.
4) There was no difference in the visual recall of the FI, ICS, and FD subjects.
5) There was no difference in the preferred sense recall of the FI, ICS, and FD subjects.

That is to say, there was no trend in the recall of aural and visual information nor any difference in the preferred sense recall by FI, ICS, and FD subjects. All subjects acquired comparable amounts of information when the instructional programs used redundancy and analogies to emphasize the relevant points.
Discussion

Redundancy and analogies

Heap (1968) wrote that reinforcing statements, reiterations and comparison statements in the form of analogies, metaphors and similes could make the important points of the context salient. The instructional audiotapes used in this study contained redundancy and analogies to emphasize the relevant concepts in an attempt to aid the FD learners who have difficulty identifying relevant material from the context. Previous research by Witkin's group (1977), among others, indicated that FD learners had difficulty applying structure to materials and were dependent on outside sources for organization. The use of analogies, which were similar to the concept of advance organizers proposed by Ausubel (1960), were used in this study as "immediate organizers" in an attempt to emphasize the relevant material and provide an external organizational structure for the FD learner to use to anchor and organize the new material.

In short, the redundancy and analogies were used in an attempt to compensate for the perceptual and attentional deficiencies of the FD learner which have been established by research as being responsible for the poorer and less efficient performance by the FD learner when compared with FI learners (Davis and Frank, 1979; Goodenough, 1976; Berger and Goldberger, 1979; Bennink and Spoelstra, 1979; Witkin et al, 1977).

The findings of this research study indicated no significant differences in the acquisition by FI, ICS, and FD subjects of the scientific material presented by audiotapes using redundancy and
analogies. The null hypotheses were accepted and the conclusion was that FI, ICS, and FD subjects all acquired comparable amounts of information from the instructional tapes which used redundancy and analogies. That all participants perform equally well in an instructional program is not a common or expected occurrence.

Numerous research studies have demonstrated that FI subjects performed consistently better and more efficiently than FD subjects performed on acquisition, retention, recall, and short-term tests particularly when tested on scientific material (among others Witkin, et al., 1977; Davis and Frank 1979; Berger and Goldberger, 1979; Nahinsky, Morgan and Oeschger, 1979; Rosett, Robbins, and Watson, 1968; Dubois and Cohen 1970). In a large number of the studies the differences between the FI and FD performances were statistically significant and when not significant the expected direction of FI scoring better than FD was consistently demonstrated (Witkin et al., 1977).

In this research study the expected performance of FI subjects scoring higher than FD subjects was demonstrated in Test A. However, the difference between the two groups was not statistically significant. In Test B the FD performed better than the relatively less field dependent ICS subjects. This difference was not statistically significant.

Gagné (1962) wrote that if instructional programs designed for the needs of the students were perfectly effective the variance in the performance scores would be reduced to zero.

The instructional audiotapes used in this research consisted of scientific material, with which FD and FI subjects have shown the
greatest amount of variance in recall scores. Redundancy and analogies were used in instruction to compensate for the deficiencies of the more FD learners. Objective tests, judged as valid by experts, were used to measure acquisition of the fictitious material. Statistical analysis showed no significant amount of variance either between or among groups. One can conclude that the instructional treatments, redundancy and analogies to emphasize the relevant material, were effective in aiding all subjects acquire comparable amounts of information.

**Aural vs. Visual Attendance**

This research demonstrated that of the sixty-seven subjects in the study, twenty-nine subjects had a visual preference, twenty-nine an aural preference, and nine had no sense preference. This aural and visual preference or attendance was the mode through which the individual attained more information when audiovisual stimuli were presented simultaneously. ANOVA demonstrated that there were no significant difference in the recall performance by FI, ICS, and FD subjects in the auditory, visual, and preferred sense modes.

The no significant difference finding on the Aural vs. Visual Attendance Test was important because it indicated that there was no appreciable difference in the amount learned through the auditory and visual senses by FI, ICS, and FD learners. Previous research (Greco and McClung, 1979) had explained differences in performances by FI and FD learners when auditory cues had been used to direct attention as
possibly occurring because FI subjects learned more through the auditory mode. This research did not support this suggestion since there were no significant differences in performances by FI, ICS, and FD learners.

**Recommendations**

Recommendations for further study would be to repeat this study using a broader population to increase the generalizability of the findings. Improvement of the design of the study is also recommended.

A more definitive influence of the experimental treatment could be demonstrated if a separate control group and two different experimental groups were used. The scripts and tests could be identical with the exception of the use of redundancy and analogies in each script. Also in this way the effectiveness of redundancy and analogies could be compared to each other. The design could be changed to allow for testing retention which was eliminated from this study to maintain a reasonable testing duration.

Another alteration that would improve the experiment would be to vary the order of presentation of tapes and tests to eliminate any multiple treatment interference.

The Aural vs. Visual Attendance Test could be expanded in future research to include contextual verbal information rather than solely numerical stimuli.

Finally, further research needs to be conducted on the auditory and visual components of media and how these may be structured to aid the individual student.
SELECTED BIBLIOGRAPHY


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Luttrell, H.D. 1971. The effect of supplementary audio-tapes on the performance of seventh grade students who read below grade level and were enrolled in an individualized science program--ISCS. Dissertation Abstracts International. 32/03A:1366. (Florida State University).


APPENDICES
APPENDIX A

OBJECTIVES FOR SCRIPT A

By the end of the instructional segment using tape A the student will be able to identify in writing the correct alternative when presented with at least four choices for:

1) the organ for determining the upward direction in space.
2) the system of the body to which the organ for determining the upward direction belongs.
3) what a hormone is.
4) how a hormone works.
5) the hormone secreted by the organ which determines the upward direction.
6) the target organ for the Meissner hormone.
7) how the brain knows when the body is not upright.
8) the location of the Meissner gland.
9) how the idea originated that a physical structure was responsible for determining the upward direction in space.
For years scientists have tried to learn how man determines the upward direction in space. How does one know which way is up?

At one time it was thought that the surroundings identified the upward direction. By looking around and noting which way furniture, trees, and buildings were oriented one could determine the upward direction. But this was not the answer since the upward direction could still be identified even when the surroundings were upside down.

It was later thought that the vestibular system, which includes the organs of the inner ear that sense the body movement and help maintain body balance also enabled one to distinguish the upward direction in space. When the head is moved the fluid contained in the inner ear moves through the vestibular system signaling the brain that the head is moving. This system also signals the brain when the head is rotated. The body then makes the necessary adjustments to maintain its balance.

It seemed logical that this vestibular system was responsible for determining the upward direction. However, this was found not to be the case. Drs. Brewer and Michael of the Washington Institute for Science removed the vestibular system of monkeys and the monkeys were still able to choose the upright trees from both upright and upside down trees constructed in the laboratory.
If the vestibular system is not the answer, how then do we determine which way is up? Recently a scientist at the Southwestern Research Laboratory in Phoenix, Arizona, identified a small gland located in the neck that is responsible for determining the upward direction in space. This gland in the neck is called the Meissner Gland, after Dr. Meissner, the discoverer.

Dr. Meissner first suspected that there was a physical structure responsible for determining which way is up from his work with a motorcycle accident victim. The young man involved in the accident had sustained a crushing blow to his neck. The man was not able to place objects in the upright position. The vestibular system was intact so this supported previous findings that the vestibular system does not help one decide which way is up. Further investigation by Dr. Meissner using laboratory dogs led to the discovery of the Meissner gland. The gland has also been identified in humans by the analysis of tissue samples from cadavers.

The Meissner Gland is an organ of the Palocrine system of the body. The Palocrine system which includes the Meissner Gland works by secreting a chemical substance, called a hormone, which is carried through the bloodstream and has its effect on a particular organ which is called the target organ. The Meissner Gland secretes the Meissner Hormone. This hormone is a chemical secreted by the Meissner Gland. This chemical is carried through the bloodstream to a target organ where it has its effect. The Meissner Hormone, also known as dichlorinol, is carried through the bloodstream to its target organ,
the Scalem Organ within the brain. The Scalem is a tiny sensing organ in the brain. The Scalem has been found to sense minute changes in the blood level of the Meissner Hormone. As long as the body is in the upright direction the Meissner Gland secretes the Meissner Hormone. The hormone is carried to the Scalem Organ which senses the blood level of the hormone and alerts the brain that the body is upright.

However, when the body is not upright the Meissner Gland quits secreting the hormone and immediately the blood levels of the hormone begin to drop. The Scalem senses the drop in the blood level of the hormone and alerts the brain that the body is no longer upright.

The Meissner Gland and Hormone cannot alert the brain as to which direction the body has moved. The Meissner Gland secretes the hormone that the Scalem, as the target organ, senses. When the blood levels of the hormone drop, the brain is alerted that the body is not upright. The Meissner Gland, therefore, is the ultimate organ responsible for enabling one to determine which way is up. Without the Meissner Gland one would not know which way is up.
1) The organ ultimately responsible for enabling one to determine the upward direction in space is the
   A) Meissner Gland
   B) Palocrine Hormone
   C) Meissner Hormone
   D) Scalem Gland
   E) Vestibular Gland

2) This organ for determining the upward direction in space is part of the system called the
   A) Michaelson System
   B) Vestibular System
   C) Scalemic System
   D) Palocrine System
   E) Propriodirective System

3) A hormone is
   A) a part of the brain
   B) a fluid of the inner ear
   C) a chemical
   D) a blood level
   E) an organ
4) A hormone works by
A) affecting a target organ
B) affecting the body's balance
C) affecting the Palocrine Organ
D) affecting the inner ear
E) affecting the Vestibular Organ

5) The hormone secreted by the organ which determines the upward direction is called the
A) Brewer Hormone
B) Palocrine Hormone
C) Meissner Hormone
D) Vestibular Hormone
E) Propriodirective Hormone

6) The organ which senses the blood level of the hormone discussed is
A) Scalem
B) Ear
C) Vestibular
D) Meissner
E) Palocrine

7) Decreasing blood levels of the hormone discussed alert the brain that
A) the head has moved
B) the head has rotated
C) the inner ear is malfunctioning
D) the body has lost its balance
E) the body is no longer upright

8) The location of the organ that secretes the hormone is
   A) in the neck
   B) in the Scalen
   C) in the inner ear
   D) in the brain
   E) in the Vestibular

9) It is now thought that a physical structure is responsible for
determining the upward direction in space because of a doctor's work
   with
   A) Hormone levels
   B) the brain
   C) a motorcycle victim
   D) the blood
   E) the inner ear
NAME________________________

Previous Degree Yes___No___

Answer Sheet A

Direction: Blacken out the letter of the one correct answer for each question. Be sure to blacken out all of the selected letter.

Example: Louisiana is part of which country?

A. England  B. United States  C. Scotland  D. Japan  E. Canada

Answer:  A  C  D  E

1. A B C D E
2. A B C D E
3. A B C D E
4. A B C D E
5. A B C D E
6. A B C D E
7. A B C D E
8. A B C D E
9. A B C D E
APPENDIX B
OBJECTIVES FOR SCRIPT B

By the end of the instructional segment using tape B the student will be able to identify in writing the correct alternative when presented with at least four choices for:

1) the organism that causes crib death.
2) the name of the toxin produced.
3) what substance the toxin causes to be produced.
4) the purpose of the Heinz tissue.
5) the location of the organ responsible for defending the body against the toxin.
6) the function of the anticells.
7) why the anticells attack the Heinz tissue.
8) the function of the tubicular channels.
9) why crib death victims die.
Script B

CAUSE OF CRIB DEATH

(Script with analogies)

Crib death, the sudden and unexpected death of infants, has been a puzzle to scientists for years. Attempts to explain the cause of crib deaths have led to two popular but unsupported explanations.

At first it was assumed that the child had been abused and that this caused either brain or respiratory damage resulting in the child's death. However, study of the infants showed no signs of child abuse.

The second explanation for crib death was that the infant experienced a massive allergic reaction, possibly due to a substance in its food. This massive reaction, called an anaphylactic reaction, caused shock. During shock the blood pressure of the child drops so low that it does not supply enough blood to the brain, heart and lungs and the child dies. Studies of crib death victims again failed to support this explanation.

Studies now being done at the Virginia Pediatric Research Institution seem to have identified the cause of crib death. Dr. Jonas Matthews of the Institution has discovered a virus called Glutatogenex which produces a toxin that ultimately results in the infant's death. This virus was not able to be previously isolated because it was too small to be detected by older microscopic techniques.

The Glutatogenex virus is a tiny organism that produces a poison, called a toxin which has a harmful effect on the infant's body.
The virus' production of a toxin is much like a car producing toxin fumes or a nuclear reactor producing radioactive waste. The substance produced is harmful and may be deadly.

The Glutatogenex virus produces a toxin called Glutoxin. The body in an effort to defend itself against the Glutoxin develops cells called anticells which attack the Glutoxin. These anticells are the body's defense system against the toxin. Just as the National Guard or the Marines are called up to defend the people so the anticells are called up to defend the body. The anticells are manufactured in the anticell organ that is hidden under the spleen next to the stomach. Just like our national missile defense system is buried underground, the anti-cell organ is buried under the spleen.

The problem with the anticells is that they will attack any substance with a molecular structure similar to the toxin. The anticells cannot distinguish between the toxin molecules and the body's own molecules. The anticell attack is like shooting a gun in the dark---the bullet will hit something but it may not be what one intends to shoot.

The Heinz tissue is the supportive tissue of the tiny air passageways of the lungs, called tubicular channels. The Heinz tissue is similar in molecular structure to the Glutoxin. The tubicular channels of the lungs can be compared to the shafts of a mine; both allow air to pass through to the inside. The tubicular channels allow air flow through to the lungs and the mine shafts allow air flow into the mine. The mine shafts are supported by wooden beams that help to
keep the shafts open. In a like manner the tubicular channels are supported by the Heinz tissue that helps to keep the tubicular channels open.

When the Heinz tissue is mistakenly attacked by the anticells, the tissue is destroyed and the channel collapses blocking air flow into the lungs. Likewise, when the wooden support beams of the mine shaft are attacked by termites, the beams are destroyed and the shaft collapses blocking off the air flow into the mine. After the tubicular channels collapse, it is only a short period of time before the child will suffocate.

It is believed that only certain children are attacked by the virus because they lack the natural defenses to fight the virus when it first enters the body. Usually the body's White Blood Cells are able to fight off infection just as soon as the virus enters the body so it is not necessary for the anticells to be produced. This is like how some people can fight off a cold while others cannot. Once a person catches a cold then a different defense system is necessary to fight the cold. Likewise, once the Glutatogenex virus infects the body it is necessary for anticells to be produced to fight the toxin. It is not known at this time why some children cannot fight off the virus initially.
1) The Virus responsible for causing crib death is
   A) Anticell
   B) Heinz
   C) Glutatogenex
   D) Tubicular

2) The name of the toxin produced by this virus is
   A) Anticell Toxin
   B) Heinz Toxin
   C) Glutoxin
   D) Tubular Toxin

3) The toxin stimulates the production of
   A) Tubicular Cells
   B) Heinz Cells
   C) Glutoxin Cells
   D) Anticells

4) The Heinz cells provide structural support for
   A) Glutoxin
B) Anticells
C) Glutatogenex
D) Tubicular Channels

5) The organ that produces anticells is located
   A) in the Tubicular Channels
   B) under the spleen
   C) under the Heinz tissue
   D) in the lungs

6) The anticells are formed by the body in order to
   A) destroy Glutoxin
   B) support the lung tissue
   C) destroy the spleen
   D) destroy Glutatogenex

7) Anticells mistakenly destroy Heinz tissue because
   A) it is a toxin
   B) it has a structure similar to the toxin
   C) it has a structure similar to the spleen
   D) it is a virus

8) The Tubicular Channels provide for
   A) airflow passageways
   B) the blood's defense
   C) blood flow
   D) anticell production
9) It is now thought that crib death victims die because of
   A) abuse
   B) hemorrhage
   C) anaphylactic reaction
   D) suffocation
NAME_____________________

Previous Degree Yes___ No___

Answer Sheet B

Direction: Blacken out the letter of the one correct answer for each question. Be sure to blacken out all of the selected letter.

Example: Louisiana is part of which country?

A. England
B. United States
C. Scotland
D. Canada

Answer: A [ ] C D

1. A B C D
2. A B C D
3. A B C D
4. A B C D
5. A B C D
6. A B C D
7. A B C D
8. A B C D
9. A B C D
APPENDIX C

ANSWER SHEET AURAL VS. VISUAL ATTENDANCE TEST

Name ________________________________

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APPENDIX D

TRANSCRIPT OF THE AURAL VS. VISUAL ATTENDANCE TEST

1. Ready—See 5--1--9--0-- Write
2. Ready—Hear 4--5--7--6-- Write
3. Ready—Hear 5--6--9--2-- Write
4. Ready—Hear 0--9--5--2-- Write
5. Ready—See 2--4--6--9-- Write
6. Ready—See 6--8--1--0-- Write
7. Ready—See 5--8--0--4-- Write
8. Ready—Hear 6--4--0--7-- Write
9. Ready—See 0--2--5--4-- Write
10. Ready 8--1--2--6-- Write
11. Ready 1--9--8--4-- Write
12. Ready 8--2--9--1-- Write
13. Ready 9--8--5--1-- Write
14. Ready 7--8--1--9-- Write
15. Ready 2--1--5--8 Write
## APPENDIX E

**DIGIT SPANS**
**AURAL VS. VISUAL ATTENDANCE TEST**

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APPENDIX F

Hidden Figures Test

FRENCH, EKSTROM, PRICE

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From: Committee on Humans and Animals as Research Subjects  
To: Vice Chancellor for Advanced Studies and Research  
David Boyd Hall

This is to certify that a quorum of the Committee on Humans and Animals as Research Subjects reviewed the above proposal. The Committee evaluated the procedures of the proposal with appropriate guidelines established for activities supported by federal funds involving as subjects humans and/or animals.

Recommendation of Committee ___________ Approved _________________

Comments:

A review of this proposal by the Committee will be accomplished at least on an annual basis and at more frequent intervals depending on the element of risk.

Date __2-6-81_________ W. Sheldon Bivin  
Chairman, Committee on Use of Human and Animals as Research Subjects
APPENDIX H

RE: Doctoral Research by Ellen Wydra
March and April, 1981

I hereby volunteer to take part in the three part doctoral research study investigating learning from media. I understand that the findings will be published but my name will not be published and will remain confidential. I also understand that I have the right to withdraw from the study at any time.

Signature____________________

Date________________________
VITA

Ellen Jane Wyllie Wydra was born August 20, 1951, in Orange, Texas, the fourth of nine children of Dr. and Mrs. James J. Wyllie. She attended St. Mary Elementary School in Texas and later St. Paul the Apostle Elementary and High School in Pocahontas, Arkansas, where she was graduated in May 1969.

She received a Bachelor of Science degree in Nursing from Louisiana State University School of Nursing in New Orleans in June, 1973. She has worked as a registered nurse in Louisiana in the Major Medical Emergency Room at Charity Hospital in New Orleans and as a registered nurse and unit instructor at Earl K. Long Memorial Hospital in Baton Rouge.

She began a career in nursing education in 1975 as an instructor of nursing at the Southeastern Louisiana University School of Nursing campus in Baton Rouge.

In August 1977, she was awarded a Master of Science in Nursing degree from The University of Texas Health Science Center in San Antonio after completing the coursework at the University of Texas in Austin, and the University of Texas Medical Branch in Galveston, Texas.

During 1976-1977 she worked at the university hospitals in Galveston as a Cardiovascular Clinical Nurse Specialist in Cardiac Rehabilitation and was on the team to teach Emergency Nursing at the University of Texas.
After graduation she returned to Louisiana and was an instructor of Critical Care Nursing at Louisiana State University Medical Center School of Nursing in New Orleans. She studied at Louisiana State University in Baton Rouge from September, 1978, until August of 1981 to complete a Ph.D. in Educational Media.

She is married to Donald E. Wydra, formerly of Chicago, Illinois.
EXAMINATION AND THESIS REPORT

Candidate:  Ellen Jane Wyllie Wydra

Major Field:  Education

Title of Thesis:  The Influence of Redundancy, Analogies, and Field Dependency Upon Learning of Scientific Material From Audiotapes

Approved:

[Signatures]

Major Professor and Chairman
Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

July 8, 1981