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ABSTRACT

The level of abstraction of the message and the educational effects of five media presentations (Print, verbal sound, print/pictures, print/verbal sound, and pictures/verbal sound) were experimentally investigated. The media components were presented singly or in combination to 6th grade students in a uniformly controlled consistent environment. Measures of media preference, learning from media, and attitude toward the scriptlearned were statistically analyzed in relation to the five media presentations, two reading achievement levels of the students, and two different scripts. Results were traced to the media-message components of the media presentation. Among the many findings were: students did not necessarily choose the medium best suited for their own educational needs. Also, the results of print/sound presentation did not concur with results of previous research. However, high individual scores were obtained from each of the five media presentations, a fact which supports the inclusion of a wide variety of media in a media center collection to meet individual differences. (WCM)

Media and the Learner: the Influence of Media-Message Components on Students' Recall and Attitudes Toward the Learning Experience

by

John Orson Hempstead

A thesis submitted in partial fulfillment of the requirements for the degree of

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INTRODUCTION

The problems of predicting which medium is most effective in promoting student learning and which medium encourages the most favorable attitude toward the learning experience are examined in this study. It is hypothesized that some media are more effective than print in promoting learning and in encouraging a favorable attitude toward the learning experience. The purpose of this study is to isolate factors which contribute to effective educational communications.

First a communication model is formulated consisting of seven elements: source of the message, sender, message, medium, channel, receiver, and effects of the message. The weak links in many of the media research studies examined tends to center around two areas of the problem investigated: 1) message abstraction, the interaction of the source of the message and the sender which results in the message code, and 2) the effects of the message on the message receiver. Previous attempts have been made by others to develop a media taxonomy. This seems premature because many commun ion factors had not been included, in particular the following: 1) message codes, the products of message abstraction, and 2) media-message components, the products of interactions by message codes with sensory modality. Results of this study are intended to increase knowledge relevant to functions of selection, production, message design and guidance in media use practiced by media specialists.

Several factors related to the seven elements of the communication model are examined in chapter one. In chapter two specific variables are selected for study; the variables under study are defined, preliminary procedures are described, questions are raised, and hypotheses are stated with anticipated results. Chapter three consists of data analysis procedures and statistical decisions. Conclusions are presented in chapter four without the statistical data along with alternate hypotheses, limitations and recommendations for futher research.

CHAPTER I

BACKGROUND, LITERATURE REVIEW AND RATIONALE

Historically there has been a division of labor within the professions administering educational media services to schools. An early text of school librarianship by Fargo referred to audiovisual aids or just visual aids to instruction,[1] implying two accepted values: an emphasis on instruction rather than learning, and an attitude that a message conveyed by any means other than print was in some way inferior. An early AV text by Dent encouraged use of audiovisuals "to facilitate the understanding of the written or spoken word"[2] rather than as information sources useful in their right. Fargo also suggested that poor readers were the primary beneficiaries of the use of audiovisuals.[3] This suggestion is not supported by this study which indicates that good readers benefit most from some audiovisual presentations.

The print orientation appears to date back to the Middle Ages when the emphasis on citing authority to legitimatize one's thinking was crystalized. Saettler states that in medieval times the role of intellect in learning was stressed and the senses were held in suspicion because reports based on sensory experience differed among indivuduals and were therefore thought to be unreliable. At that time information based on the intellect as portrayed in printed works was thought to be reliable because it was stable and dependable.[4]

The librarian's traditional prejudice against "sensory" or visual media was based on the mistaken notion, expressed by Ralph Ellsworth in his book on school librarianship as recently as 1965, that all communication can effectively be reduced to text. In Ellsworth's opinion, tapes are no more than spoken text, microforms are text reduced, and all visual communications are ultimately based on text.[5] Similarly many librarians and other educators have been blind to the realization that tape recordings can capture original sounds that defy translation into print, and that still and motion photography allow viewers to learn inductively from inferences based on iconic relationships presented pictorially (or aurally) rather than to learn deductively from symbols presented in a linear sequence on a printed page.

Many audiovisualists, on the other hand, have regarded librarians as keepers of books unwilling or unable to provide learners with information in any form other than the printed word, which they also regard as an inferior means of communication. The recently reported findings of Kittilson in his doctoral dissertation, may reflect a problem or prejudice of a more basic nature. He found that teachers viewed audiovisualists as educational leaders and librarians as clerical types. However, he found that teachers viewed male librarians as educational leaders.[6] Clearly there is need both for a role change and a revised image based on broader media capabilities.

Several historical forces have contributed to a convergent course for the roles performed by professionals involved with print and non-print media. Title II of the Elementary and Secondary Education Act

(ESEA) of 1965 encouraged the purchase of audiovisual media through established school libraries. This incentive provided the encouragement for school librarians to become actively involved in the process of selecting and administering audiovisual media and AV related services. The resulting expanded media services led to a re-conceptualizing of the role of the school librarian. Ultimately the terms "media specialist" and "media generalist" were adopted to convey to educators the expectation that the administrator of the school media center (formerly school library) must be skilled in providing both print and non-print (audiovisual) media services. The 1969 Standards for School Media Programs adopted use of the term media specialist. Approved jointly by the American Association of School Librarians of ALA and the Division of Audiovisual Instruction of NEA, these standards assigned the media specialist an active role in working with the curriculum and in providing greater skills and leadership in the area of media production.[7]

Increasingly there are responsibilities indicated in the literature for the media specialist to not only select educationally effective media, but to be able to design effective educational messages as well.[8] While concern for the ideal of selecting effective material based on research findings which investigated user response has long been urged by library leaders,[9] emphasis on designing and producing effective media has increased greatly since 1965, culminating in the recommendations of the 1969 Standards for School Media Programs which established these duties for the school media staff in implementing the media program:

Serving as instructional resource consultants and materials specialists to teachers and students

Selecting materials for the media center and its program

Assisting teachers, students, and technicians to produce materials which supplement those available through other channels

Working with teachers in curriculum planning

Working with teachers to design instructional experiences 10

The merging of roles of print and non-print media personnel has been accompanied by an increase in concern for the needs of learners as well as a more active role in aiding the programs of the instructional staff. These expanded service roles must necessarily be accompanied by expanded media utilization skills based on predictive knowledge concerning learning effectiveness of various media in a given learning situation.

Ideally a media center would employ a staff with various capabilities for selecting, designing and producing effective learning media. However, with the current record of governmental agencies for reducing funds for educational programs, school media centers are increasingly being staffed by one media professional with professional education for competencies in both school library and audiovisual services. To support the educational programs that are evolving to provide these competencies, current research investigations could aim to synthesize theory and research findings of related educational fields with concerns identified by the school library and audiovisual fields.

LITERATURE REVIEW

Preparatory to identifying researchable problems relating to the media concerns of present and future media professionals, doctoral dissertations relating to school librarianship and school media were examined. Twenty-four dissertations investigated some aspect of audiovisual services. Most of these studies examined the role of the media person in the school's program, feasibility of setting up programs in a district, impact of audiovisual teaching programs, and similar topics. Two studies experimentally investigated learning from media, and related results to other factors involved in the communication process. These two studies, directed by Wm. H. Allen and conducted by Russell[11] and Daehling,[12] were largely unsuccessful because of several weaknesses in conception of the research design and because of low reliability of the measuring instruments. However, the researchers isolated several areas of concern which are worthy of continued investigation.

An examination of related media research indicated many studies which have implications for the educational media professions. While none of these studies is directed toward solving the problems of the educational media professions, this research provides an effective base on which to design studies with direct application for professionals working with educational communications.

Early media research up to World War II was characterized by comparisons of learning from one given medium with learning from another medium or from a lecture.[13] During World War II and the immediate post-war period extensive research was carried on to investigate the several

effects of films, including psychological effects of propaganda, effective production techniques, and methods of film utilization.[14] Following these postwar film studies was a period of research into learning from programed instructional materials and instructional television.[15] In 1958, Title VII of the National Defense Education Act and in 1965, Title III and other titles of the Elementary and Secondary Education Act, led to funding of numerous research studies. The effectiveness of the federally funded nondirective research grants offered through these acts is questionable when one examines the "isolated and independent studies" produced by grant recipients.[16] While precise proposals were required to obtain a grant, no attempt was made to encourage in-depth research into the most relevant problems of the educational media professions.[17] Nevertheless, this previous research has set the stage for a synthesis of concerns relating to educational media communications. With this synthesis, directed federal funding could support a concentrated in-depth effort to solve problems of educational media communications similar to the vast strides made in the physical sciences[18] first by individual researchers such as Louis Pasteur, who as a non-subject specialist was able to develop strong inference studies which solved problems of fermentation where subject specialists had failed,[19] and later with federal programs, such as the Manhattan project which developed the Atomic Bomb. An example of the low inference studies currently coming out of the media field, are studies with a concept of media which has allowed media presentation mode and message code variables to exist unrecognized as rival hypotheses within the same general concept. Identification of

these and other communication variables which must be considered before one can construct a strong inference study is continued below.

RATIONALE

Examination of the limitations of previous research findings should indicate to educational media researchers the importance of specifically defining variables to be investigated, drawing up testable hypotheses, rigorously controlling the experimental environment and data analysis, arriving at conclusions which suggest new testable hypotheses, and communicating results with implications which satisfy the concerns of practicing media professionals.

Concerns of media center personnel persistently mentioned in current library literature, relate to the performance and/or supervision of the following operations:

1. Selection of school media appropriate for learners of different abilities, in various subject areas, and for identified learning objectives.
2. Message design of appropriate code, content and form of communication to meet specifications of teachers and students in relation to curriculum needs.
3. Production or creation of media to meet instructional requirements.[20]

Media selection and production and message design must result in communication tools which effectively elicit desired learning behaviors from students. To accomplish the functions of providing effective communication tools, the media specialist must be capable of making decisions based on unique qualities of media and predictable responses

of learners based on the relationships of several variables. In the literature of instructional technology, formerly called the audio-visual literature, much attention has been given to a "systems approach" to instructional media research.[21] The scope of this research is involved with the entire communication process. Traditionally the communication process is considered to have three variables: sender, message and receiver. With the development of communication technology, the number of variables is commonly increased to five: sender, message, channel, receiver, and effects. This communication model is well illustrated with a statement by Lasswell:

> Who
> Says What
> In Which Channel
> To Whom
> With What Effect?[22]

Two additional variables must be considered for an educational communication model: source of the message, and medium as distinguished from channel. The seven elements of this expanded communication model are as follows: source, sender, message, medium, channel, receiver, and effects. Lasswell's statement can thus be expanded to read as follows:

> Who
> Says What
> From What Source
> In What Form
> In Which Channel
> To Whom
> With What Effect?

In educational practice, each of these variables has numerous subfactors which if not recognized are often intervening variables in an experimental situation. Particular attention must be paid to the

effect of the communication in present-day media research.

The sender-communicator variable may include such factors as concepts or message the sender desires to communicate, intended outcome of the communication, psychological relationship of sender to receiver, and many other factors. If, for example, it is not recognized that the intended message and the message received are not identical, results of the communication are vulnerable to numerous misinterpretations.[23] Sender variables must be either carefully varied and tested or held constant in any successful experiment.

The message variable consists of the content of the communication: knowledge or information, understanding, attitudes, skills, or in fact anything that has meaning. For the media specialist we can add to this variable the sub-factors of message design, code, content, and other factors. Message design begins with learning goals: defining the nature of the message to be communicated, establishing specific terminal behaviors of receivers of the message, selecting presentation elements which will lead to desired behavioral effects, assembling the most favorable media component combinations and media-mix of presentation devices to communicate the message effectively, and arranging an effective presentation environment.[24] Learning goals can be formulated after the model of the taxonomies of educational objectives: cognitive domain: knowledge, comprehension, application, analysis, synthesis and evaluation;[25] and affective domain: receiving, responding, valuing, organization, characterization of a value system.[26] Or goals may be formulated after other models of types of learning, such as Gagne's eight types: signal learning, stimulus-response learning, chaining,

verbal-associate learning, multiple discrimination, concept learning, principle learning, and problem solving.[27] Undoubtedly numerous experiments would be needed to discern which media would be most effective for each learning goal relating to the above objectives, even if all other factors are held constant.

Numerous other message factors must also be considered. The internal elements, arrangement and structure of a message offer additional possibilities for research with implications for media production even more than for selection. The outcome of such research would lead to recommendations as to which aural, visual and verbal elements combine, sequence and compliment one another well to result in an effective learning tool.

Message code is another internal device which can result in a confounding of variables. Message code, discussed more fully later, is the method of abstracting the communication from the source or reality base of the message and the level of abstraction from the basic source of experience. Messages may be coded in three ways (see Diagram 3, page 34) 1) Primary or natural code messages are abstracted from sources which could be experienced directly by the learner. While these messages are not transformed by the recorder of the message, sensory impressions are necessarily limited by the message recording devices which currently record only limited stimuli for senses of sight and hearing. Sound recordings, still and motion photographs, and video tape recordings of natural sounds or objects are examples of primary code messages. 2) Synthetic code messages are abstractions

once removed from the primary code. These messages may resemble the primary code message closely or be entirely unrelated to experiences obtained naturally through the senses as they are produced or transformed by the message creator. Music and artistically created graphics or realia are examples of synthetic code messages. 3) Linguistic or symbolic code messages are abstractions twice removed from the source of experience. Experience is first transformed into ideas in the mind of the creator and then translated into words or symbols before the receiver has contact with the message. Spoken words and printed symbols are examples of the symbolic code.

Message can also be analyzed in regard to level of abstraction of concepts communicated. Diagram 1, page 16, shows two possible methods of abstracting knowledge from experience. It should be noted that at the primary level of reality, here called the process level, the message receiver has no definite knowledge or even experience. According to Hayakawa, scientific inference has allowed most observers to conclude that the objects of our sensory experiences consist of possibly an infinite number of particles which are beyond the range of our unaided senses, and are much smaller than molecules, protons or electrons.[28]

Concrete objects of our experience interact with our nervous system in such a manner as to convey a finite pattern of sensory impressions. Thus sensory experiences of humans are relatively similar even though limited by our individual senses, just as the senses of the human species are limited when compared to the senses of other animals as for example the hearing range of dogs. Furthermore, Hayakawa states, our sensory experiences are limited by our cultural expectations.

According to Havakawa, our senses often reject what our culture feels is unimportant or improper. Before our sensory experiences can be communicated, they must be subjected to another limiting factor that may lead to further distortion: our thought processes. Ideas and concepts result from our experiences, but these ideas are never completely communicated by the words or images selected to convey our messages. The ideas are less than experience because our senses do not record all of experience in a way the brain can translate into words, and ideas are more than experience because the brain contributes associations not inherent in the experience.[29] If the sender-communicator-recorder of a message chooses the print method of communication, he must translate his ideas of experience into words, thereby discarding many details of the experience level as the words he chooses are necessarily based on his ideas of the experience. Similar objects of experience may be grouped together by use of words, when successively more abstract terminology is used. For example, a horse named Secretariat may be called a horse, which eliminates many details about that particular horse. Other details would be eliminated if he were referred to as a thoroughbred, a quadruped, an animal, or an organism. Collectively he could be grouped with racehorses, property, assets, investments, wealth or even the gross national product.

This process of abstracting may be counterproductive when examined in light of our educational goals, if print is the only method of communication utilized. Not infrequently, so many details are abstracted out of a print message that the original experience is completely eliminated.

Using newer media, the process of abstracting knowledge follows a similar pattern with an important difference. Diagram I shows that communications consisting of media-message component combinations are still based on ideas of experience which may not be entirely communicated by the verbal and iconic components selected to convey the message, but these components also include sensory experience details eliminated by the print medium. If Secretariat is the subject of a film about horses, he is also likely to be present when other horses are shown. The concept of racehorse is created by showing him in action. The property concept is created by showing Secretariat in relation to the proud owner. Wealth is also inferred from a concrete relationship and higher order abstractions can result from the use of montage, the piecing together of sections of film in a meaningful pattern. The incidental details included either accidentally or intentionally in pictures or on a sound track allow the message receiver to place additional values on, or even formulate his own interpretation of, the experience which is the basis of the message. This fact accounts in part for the revolution in lifestyle evidenced by some members of the first generation to be raised with continuous access to television and film as suggested by McLuhan.[30]

As Jussim points out neither print nor the newer mass media are able to record for more than two of our senses, and it is becoming increasingly obvious that the method by which we receive our primary source of knowledge helps to shape our thinking patterns.[31] The addition of artificial or synthetic code sensory stimuli, such as a sound track of mood music, may increase the cultural bias or propaganda effect of

DIAGRAM I

LEVELS OF ABSTRACTION
IN EXPERIENCE AND IN COMMUNICATION

Read from the bottom UP
for increasing levels of abstraction

PRINT LADDER	MEDIA MOSIAC
With each successively more abstract concent, words convey successively fewer characteristics of the object of experience.	Words used in combination with iconic representations of experience, include the primary objects of experience and thus fewer characteristics are eliminated.

Gross National Product	Montage of Secretariat's winnings/ other wealth indicators
Wealth	Picture of owner receiving winning money check
Property	Picture of Secretariat with his owner
Racehorse	Picture of Secretariat racing
Horse	Picture of Secretariat with other horses
WORD IDENTIFICATION LEVELS	
NAME IDENTIFICATION LEVEL	
Secretariat	Pictures of Secretariat
IDEA OR THOUGHT LEVEL	
EXPERIENCE LEVEL	
Sensory interchanges	
PROCESS LEVEL	
Molecules, atoms, etc.	

our perception of the recorded experience. The use of print with English and other European languages results in letters following each other to form words, sentences, paragraphs, pages and chapters all arranged in a left to right linear sequence which has resulted in a detachment which has enabled us to think in fragmented assembly-line terms and thus develop modern technology. On the other hand it has resulted in a society which is able to talk peace and make war simultaneously with no obvious contradiction to some receivers of official messages because words actually take precedence over action. The press release rationalizations have more power of conviction than do bombing missions. McLuhan's theoretical discussions suggest several hypotheses for research into the effects of media-message components as well as the message carrier (media) on both the thoughts and attitudes that are stimulated or created by media use.[32] The message factor can also be examined from the aspects of subject matter or topic, type of story such as narration or exposition, and difficulty level. It is conceivable, as evidenced by some learning research, that both message code and media presentation mode should vary with subject matter.[33] Synthetic codes such as line drawing graphics may prove to be consistently more effective for abstract subjects such as mathematics or chemistry, while primary code messages may produce more effective results with subjects such as the natural sciences.[34] Difficulty level may show similar trends with symbolic codes encouraging better results for more difficult material. The less concrete message codes may also favor exposition over narration. All of these factors are as yet largely untested.

Media variables are frequently analyzed from the viewpoint of presentation mode characteristics, which range from three-dimensional objects and realia to either still or motion projected visuals to signs, symbols, concepts and words. Combinations of sound and projected visuals result in different learning potentials and McLuhan suggests that researchers can expect to find subtle differences in psychological responses toward an identical message presented by sound motion pictures or by sound video visuals because of the difference in definition of the image.[35] Diagram 3, page 34 helps demonstrate a relation between message code and media presentation mode. Message code may become a confounding variable for researchers investigating media presentation modes in several ways. Some of the ways this confounding can occur are discussed below.

For research purposes it is inadequate to classify media by sensory media presentation modes alone. By examining Diagram 3, page 34, it can readily be seen that an "audiovisual" may consist of several message code combinations: two linguistic codes (spoken words and printed words), two synthetic codes, or two primary codes; one synthetic code and one linguistic code (music and print, or spoken words and picture graphics), one primary code and one linguistic code (natural sound and printed words, or spoken words and photographs), one primary code and one synthetic code (natural sound and graphics, or music and photographs), etc. These are but a few of the possible simple combinations of media-message components, all of which could be lumped under the headline of two component audiovisuals or sometimes called two channel audiovisuals because one audio and one visual

presentation device are used to present the message to the learner. In addition, numerous triple or multiple combinations of components may be used together to form an "audiovisual".

Previous field research with educational media has too often failed to recognize that message code is potentially a confounding variable for media presentation modes.[36] It is insufficient to conclude that two component or two channel audiovisuals are more or less effective in promoting learning than a one component medium without identifying which message codes were employed with each of the media. It is not uncommon for media producers to include messages of all three codes on a single sound track, but researchers doing field studies have not yet sufficiently probed the effects of message codes used singly or in combination to attribute differences in learning effectiveness to use of specific audio message components. Visual components offer even more of a challenge for the educational media researcher to insure control of extraneous variables. Not only must he consider presentation factors of still or motion or graphic images, but graphic images may be in two or three dimensions. Also motion pictures present more images than a similar presentation of still pictures. Motion pictures presented on a screen in a darkened room have a clearer and more highly defined image than motion pictures presented on a television screen. Images in color or in black and white have also been found to produce different learning patterns.[37]

In regard to graphics, the researcher must consider detail of the images. Line drawings have been shown to be more effective than elaborately detailed images for concept learning in some experiments.[38]

The factor of image size for visual messages enters into studies where print or pictures are used.[39]

The number of possible experiments involving comparisons of media-message components alone, numbers in the hundreds of thousands if approached haphazardly. Researchers must use strong inference studies to arrive at useful conclusions in fewer experiments. Even using strong inference comparisons, many carefully controlled and coordinated experiments must be conducted to approach the goal of predicting learning effectiveness based on the use of specified media-message components. It would also be desirable to relate results of media-message component experiments to channel and receiver-learner variables.

Channel variables are often thought of as the machinery or devices that present the medium to the receiver. Channel may, however, also include the physical facilities and the personal elements which contribute to completion of a communication process. Analysis of audiovisual equipment variables is the most mechanical of media study variables. While practitioners are continually evaluating and reevaluating equipment as new items reach the consumer market, there is still room for more research on the effects of equipment on the learning process. Variables such as volume, intensity, distortion, and other physical characteristics of both sound and visual messages as well as size, weight, ease of operation in units of time or number of mistakes, and other factors relating to operation of equipment are readily available for comparative purposes. Additional equipment options, such as a zoom lens, which offer flexible use of equipment in different settings, may be examined in relation to both physical and channel factors.

Equipment and physical facility variables tend to merge into a single variable as one considers such factors as built-in speakers, sound-proof projection booths, rear screen projection centers, listening centers or stations with earphones, study carrels, remote control devices, etc. The physical aspects of channel variables such as room size, heat, lighting, ventilation, presence of doors and windows or carpeting, color, texture, and materials of the surfaces enclosing the space used for the media presentation, and other tangible factors, form pitfalls because of possible extraneous variables unless calculated as factors for investigation. Other channel variables include size and composition of the group using the medium; learning can be expected to differ when use is individual rather than group. Size of group may alter learning differences as potential for distractions increases and sense of individuality is lost in the group. Heterogeneous sex groupings may produce differences in learning on some subjects when compared to groupings of a single sex. Similar findings may be expected from groupings by mental ability, subject achievement, age, maturity or other factors.

As yet it is unclear what effect interaction of users has on cognitive and affective responses to media. Subtle group interaction may heighten enjoyment of film and television communications that are well matched to receiving audiences and increase disturbances when communications are not well matched to audiences. Media users reading printed words may be better behaved because they are less able to interact with other users. In the case of presentations to children, the person presenting the media may have a pronounced effect on the receiver-

learner's relation to the medium. Research has concluded that some learners achieve more for a teacher with whom they can identify in regard to sex, race, or some other factors.[40]

Equipment utilization techniques, learning cues or strategies, teacher expectations, and other presentation interface techniques or devices are all channel factors to be controlled or tested to reduce extraneous variables and to increase generalizability of results.

Receiver-learner variables are potentially the most important variables in educational media research if the media professions are concerned with the goal of predicting media use as a tool for individually prescribed instruction. Learner variables most commonly considered in educational research are such factors as age, grade level, mental ability, subject achievement (such as reading achievement), and other factors based on standardized tests. External factors such as socio-economic standard (SES), race, national origin, marital status of parents, home environment, etc., are also used to correlate to learning factors. Unique personal characteristics such as motivation level, extrovert-introvert tendencies, verbal tendencies, media preferences, etc., are some factors considered for testing in relation to learning and media.[41] At present there are few measures of unique personal characteristics that are sufficiently objective to serve as a basis for experimental study.

Development of improved measurement criteria and tools must be high priority if researchers are to measure the effectiveness of media as motivational devices to substantiate such claims as the one that film is a motivational tool psychologically related to the dream.[42]

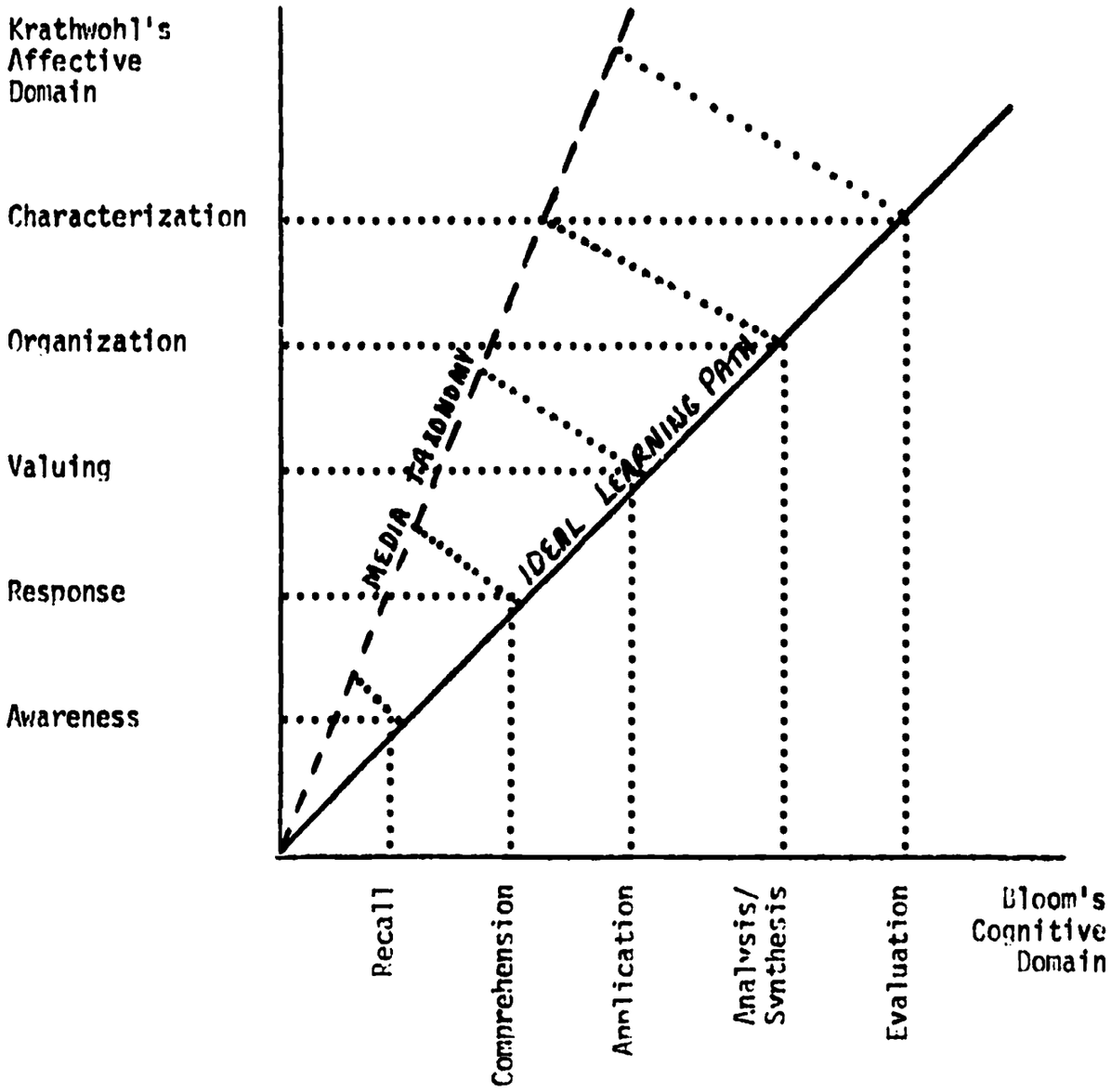
Media "taxonomies" have been developed in tentative form by some media theorists. The purpose of these attempted "taxonomies" has been to relate the unique characteristics of specific media to identified instructional goals. To date the attempts to develop a media taxonomy have met with little success. Briggs, et. al., based their taxonomy on Gagne's eight types of learning.[43] Allen based his attempt on six other types of learning.[44] Others have taken different approaches based on the physical characteristics of the equipment required for media use.[45] There has been little consistency in approach and the work has been based on insufficient identification of media characteristics. Thus no media taxonomy has been created which meets requirements of media theorists and practitioners.

Logically a media taxonomy should relate existing learning taxonomies if it is to be an effective tool for suggesting use of media-message components in an educational situation. Such a relation might be similar to one depicted with Diagram 2, after Douglas & Douglas,[46] in relation to Bloom's Taxonomy of Educational Objectives: Cognitive Domain,[47] and Krathwolh's Taxonomy of Educational Objectives: Affective Domain.[48]

Were a media taxonomy to effectively relate to the cognitive and affective taxonomies, it would form an additional leg in the third dimension directly above the ideal learning path. The media mix - or combination of print, aural and visual media-message components - best lends itself to attaining cognitive and affective goals desired for the learner to achieve. However, for media to form such a relation, it would be necessary for media-message components to form a linear

DIAGRAM 2

A HYPOTHETICAL MEDIA TAXONOMY



A media taxonomy that related effectively to the learning taxonomies would form a third dimensional leg directly above the ideal learning path.[46]

relation among themselves. At present there is little evidence to indicate that such a relation exists. In addition, relation among component variables would have to remain constant as other sender, message, channel and receiver factors vary.

The possibility of other communication variables remaining constant as media variables change, seems remote when one considers such educational theories as Piaget's observations on child development.[49] It seems highly likely that preschool and early primary school children, going through the developmental period of preparation and organization for concrete operation, respond differently to media mixes from children over age seven or eight who have passed into the developmental stage of formal or concrete operations. Rather than a linear relationship among media variables, research is more likely to support a developmental theory of media use similar to the educational practices developed and utilized by Maria Montessori,[50] which allow a child to manipulate concrete objects until his psychological development allows him to graduate to more abstract means of communication.

The above discussion suggests little possibility of developing a media taxonomy based on the relation of media factors alone, not because media offer few possibilities for analysis, but because so many other variables must be considered along with media variables. It is more possible that strong inference research investigating the entire range of communication variables will provide a solid base for developing a taxonomy of educational media communication.

SUMMARY

The literature suggests that school librarians must become media specialists capable of making decisions concerning media selection and production and message design based on unique characteristics of media-message components and predictable responses of learners.

Source, sender, message, media, channel, receiver, and effects variables relating to educational media communications research were examined from a divergent viewpoint to present a broad overview of several possible factors which must be considered in any research investigation. While this overview was in no way intended to be comprehensive, a sufficient number of variables were identified to suggest that media practitioners will not be successful if they consider only media variables. Media researchers must contrast and relate the entire range of educational communication variables to create evidence of the possibility of developing a taxonomy of educational communications.

Notes for Chanter I

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CHAPTER II

PROBLEM, HYPOTHESES & PROCEDURES

PURPOSE OF THE STUDY

This study was designed to investigate both media presentation mode and message code characteristics of a media presentation with a goal of investigating possible relations between type of media presentation and reading achievement characteristics of the student media user.

Three types of data were collected for analysis in this study: a preference score, a learning score and an attitude score. The learning portion of the study examined the comparative overall effectiveness in promoting learning of five media presentations which consisted of combinations of three cells on the media-message component diagram, Diagram 3, page 34. These five media presentations were chosen to allow the researcher to make inferences relevant to questions posed in the problem statement below.

The learning portion of the study was based on a recall and comprehension test given to compare the relative effectiveness in promoting learning of the five media presentations. Effectiveness of the media presentations was in turn traced to the components from which the presentations were formed. Effectiveness of media presentations was also analyzed in relation to the reading achievement level of media users, and two script messages were used to check for consistency of results.

Previous to administering the presentations, a preference poll was taken of the participants, and following the learning test an attitude poll was taken. These polls were administered to check for correlations between 1) students' preference for a medium and learning outcomes, 2) students' media preference and their attitudes toward material learned, and 3) effectiveness of media in promoting learning and students' attitudes toward material learned.

MEDIA PRESENTATIONS

The five media presentations were based on two commercially produced sound filmstrips. They were composed of three media-message components: verbal sound, verbal print, and realistic graphic art pictures. The sound and pictures were unchanged from the commercially produced version, and the print was transposed from the verbal sound track. The media presentations were composed of the three components used separately or in combination as follows:

1. PRINT: slides of a printed page of the verbal message were projected on a screen at the front of the room for students to read.
2. SOUND: a tape-recorded verbal narration of the script message was played to the students through earphones.
3. PRINT/PICTURES: the picture slides which accompanied the verbal message of the original sound filmstrip were projected simultaneously with the print slides used for (1).
4. PRINT/SOUND: the print (1) and sound (2) messages were presented simultaneously through the use of a tape recorder with an automatic advance signal synchronized with the slides.

5. PICTURES/SOUND: the picture slides of the original sound filmstrip were presented in synchronization with the original sound track (2) using an inaudible advance.

MEDIA-MESSAGE COMPONENTS

A descriptive analysis of the media-message components which form the basis of a media communication is included at this point because media are most frequently categorized by their physical characteristics: a) by sensory mode, usually only as either audio or visual; or b) by equipment needed for presentation. For the purposes of this study, message code is also recognized.

Media-message components are identified as a combination of one specific media presentation mode and one specific message code. As shown in Diagram 3, the media presentation code may include one or more of the following types of presentations: audio, still or motion projected visuals, or still graphic visuals. Message codes include 1) primary or natural code messages which are abstracted from information sources that could be experienced directly by the learner, 2) synthetic code messages which are abstractions once removed from the primary code; as these messages are produced or transformed by the message creator, the message source is not available to be experienced directly by the learner, and/or 3) linguistic or symbolic code messages which are abstractions twice removed from the message source because they are translated into a form which cannot be understood without a learned knowledge of the code.

By tracing effectiveness of media presentations back to media-message components rather than just to presentation modes, precision

DIAGRAM 3

MEDIA-MESSAGE COMPONENTS:
SEVERAL RELATIONS AMONG
MEDIA PRESENTATION MODES AND MESSAGE CODES WHICH
FORM INDIVIDUAL MEDIA-MESSAGE COMPONENTS

	Media Presentation Mode			
	AUDIO	VISUAL		
		PROJECTED		GRAPHIC
Message Code		STILL	MOTION	
Primary or Natural Code	Natural Sound A	Photographs D1	D2	D3
Synthetic Code	Music, etc. B	Graphics E1	E2	E3
Linguistic or Symbolic Code	Spoken Words C	Printed Symbols F1	F2	F3

DIAGRAM KEY

A. "Natural" sound

B. "Created" sound

C. Spoken words

D1. Projected still pictures

D2. Projected motion pictures

D3. Photographic prints

E1. Projected still graphics

E2. Projected motion graphics (animated films)

E3. Graphic art works or prints

F1. Projected still printed words

F2. Projected timed or animated printed words

F3. Books and works or printed words

in analyzing ingredients of a successful media presentation is increased. To keep the sample size small for the present study, only three components are examined in this experiment. Additional experiments are needed to continue an analysis of the interrelationships of the components identified as well as to support the results of the present study.

The three component cells examined in the present study are as follows: C (spoken words), E1 (projected still graphics) and F1 (projected still printed words). The three cells are used in five combinations to form the five media presentations: 1) C is spoken words or sound, 2) F1 is printed words or print, 3) E1 and F1 form print/pictures, 4) C and F1 form spoken words with pictures or pictures/sound, and 5) C and E1 form spoken words with pictures or pictures/sound. Other media presentations which could be created from combinations of the three component cells were not used in this study because of limitations of time, subjects, and resources available to carry out the experiment.

EXPLANATION OF DIAGRAM 3 CELLS

CELL A

Recordings present sound messages in their primary or natural form. This may include animal sounds, machine noises, etc. The receiver of the message needs to know no intellectual code to adequately experience the message, especially if the sound is synchronized with related visual messages (D1, D2, D3). The message may be enhanced by audio or visual verbal description of the message content (C, F1, F3).

CELL B

Recordings present sound messages created to evoke some response from the receiver of the message. Music or sound effects may be used alone to create a mood or with visual or audio messages as background or cover sound. Understanding of the synthetic code may enhance the meaning received but is not necessary to experience the message. The role of synthetic audio messages in promoting cognitive learning is a problem ripe for investigation.

CELL C

Recordings present linguistic messages which have the desired effect on the receiver only if he understands the linguistic code.

CELLS D1, D2 & D3

Photographs present a message in natural code. There is evidence that the receiver needs an intuitive knowledge of the coding selection process to understand the message content, but he needs no intellectual knowledge of the code. Whether the message is projected with still (D1) or motion (D2) pictures or graphically printed or produced on a more permanent surface may influence learning because of image size, selection options, montage, and presentation environment as well as number of images presented to the learner.

CELLS E1, E2 & E3

Graphics differ from photographs in that they may be embellished or more selective of details, thereby increasing attention to desired objects. Natural photographs may also be transformed or combined to achieve a learning effect different than was available in the original photographs. A knowledge of the synthetic (graphic) code may increase learning from graphic code presentations.

CELLS F1, F2 & F3

Printed symbols are presented for the receiver-learner to comprehend at his own rate and with his own capabilities (F1 & F3), possible within a given time limit. Timed or animated controlled presentations of printed symbols (F2) are presented in a sequence so that the receiver can attend to only a selected message at any given time as done on the Sesame Street television program.

IMPORTANCE OF THE STUDY

By tracing results about effectiveness of media to the media-message components which make up effective media, this study may benefit media professionals involved in media selection, message design and media production by increasing knowledge of contributions made by different components toward creating an effective media communication. Examination of media effectiveness in relation to reading achievement focuses on problems related to selection tasks, guidance in media use, and creation of educationally effective media productions.

The correlations between pairs of measurements: media preference, media learning and media attitudes, have implications concerning the extent to which students are able to effectively choose media which contribute to their own learning goals and the extent to which they can be more effectively guided by media professionals to sources of knowledge which meet their personal learning needs.

PROBLEM STATEMENT

Three media-message components are used singly or in combination to form five media presentations administered to test the effectiveness

of the components' contributions toward promoting positive affective and cognitive learning responses relative to the reading achievement level of the learners. The purpose of the study is to progress toward answering the questions stated below:

1. Do students learn more effectively from some specific medium relative to other media? Are media learning scores equal?
   a. Are two component media presentations more effective than single component presentations?
   b. Are two component audio and visual presentations different in effectiveness than a two visual component presentation utilizing two different message codes? (With two component presentations, is the number of modes relatively more or less important than the number of message codes in the presentation?)
2. Are there interactions among media presentations and reading achievement levels? Are some media relatively more effective for one reading achievement level than for the other level?
3. Are results consistent from one script message to another?
4. Do students indicate preference to use specific media in a media center? Are media preference scores equal?
5. Do students' attitudes toward a script vary according to the medium from which they learn the script? Are media attitude scores equal?
6. Are there correlations between sets of data: media preference scores, media learning scores, and media attitude scores?
   a. Do students learn relatively better from a medium for which they indicate a use preference?
   b. Do students' attitudes toward a script vary according to the

media preferences they indicated prior to learning the script?

c. Do students' attitudes toward a script vary according to the effectiveness of promoting learning of the medium from which they learned the script?

HYPOTHESES AND ANTICIPATED RESULTS

1. Media learning scores are expected to indicate that media presentations composed of different media-message components and used to present nearly identical script messages, produce different learning effects.

   These differences are expected to be found:

   a. Single component media: print alone and sound alone are expected to be the least effective media presentations because fewer sensory stimuli are available to present information cues to the learner. Predictions are based on surveys of research reported by Briggs.[1]

   b. Two component media with pictures: media with both verbal and pictorial messages are expected to result in the most effective learning of the five media based on reading studies of visual imagery using verbal and pictorial paired associations. These studies reported and analyzed by Levin found that recall was better if material was more concrete than abstract and if the learning strategy facilitated formation of a dynamic, active relationship between pairs of words or pictures.[2] Thus visual images coupled with verbal messages were expected to contribute to a potentially dynamic relationship between messages to facilitate recall.

c. Two component medium without pictures: for high achievement readers the simultaneous presentation of two verbal stimuli is expected to result in an inhibiting effect which reduces learning when compared to the two component media with pictures. This prediction is based on an interference effect hypothesized in research reported by Levin and Kaplan.[3] For low achievement readers the literature left considerable doubt as to what results to expect. Logically and intuitively it is expected that print/sound provides an easier learning task for low achievement readers than does either print or sound alone, as the sound would aid them in maintaining a reading pace that facilitates comprehension and print provides an additional stimulus for remembering.

2. Interactions among media presentations and reading achievement levels are expected to indicate that presentations with print are more effective for high achievement readers and presentations with verbal sound are more effective for low achievement readers, if other factors are equal.

   a. High achieving readers were expected to learn relatively better from print and low achieving readers relatively better from sound. This predicted interaction was indicated by data reported by Levin[4] and Cooper and Gaeth.[5]

   b. An interaction of pictures/sound and print/pictures related to reading achievement of students is expected to correspond to the interaction predicted for the single component media above.

3. Treatment effects due to differences in scripts are equal for nearly

equivalent scripts.

Similar scripts are used as a check for consistency of effects of media. Because similar scripts are used no interactions among script, reading achievement, and media presentation factors are expected.

4. Students are expected to indicate preferences as to which of the five media they would most prefer to use in a media center. Intuitively, it is anticipated that students' most prefer to use media with pictures.

5. Media attitude scores are expected to indicate that students' attitudes toward material learned vary according to the medium from which the script was learned.
   Intuitively, it is expected that students' attitudes toward material learned tend to be more favorable if media with pictures presents the material.

6. Correlations between pairs of data sets are expected to indicate relations between media preference, learning, and attitudes resulting from the learning experience. Correlations are calculated and stated only to provide some basis for continuing research related to students' preferences, learning and resulting attitudes. Carefully designed statistical studies must be performed before inferential conclusions may be stated.

DEFINITIONS

1. MEDIA PREFERENCE SCORES (P): These are the rank scores of students' indicated preference for using each medium relative to the other four media.

2. MEDIA LEARNING SCORES: These are scores based on items of the recall and comprehension test given immediately after exposure to one of the five media presentations.

3. MEDIA ATTITUDE SCORES (A): These are scores based on positive or negative responses to positive or negative statements about the script as related to the media presentation, implying the influence of the media presentation for promoting favorable attitudes toward the script learned.

4. MEDIA PRESENTATION: This term is used in preference to the term channel, which includes more variables, to indicate the specific combination of media-message components and form of the message presented to the learner.

5. MEDIA PRESENTATION MODE: This refers to the either audio or visual mode of contacting the senses of the message receiver and the method of presenting the visuals, as still or motion projected pictures or as more permanent graphic works.

6. MESSAGE CODE: This is the specific type of abstraction of knowledge utilized by the message sender to form a communication of information content. Three message codes are identified below:

   a. PRIMARY OR NATURAL CODE: These messages are audio or visual records of sound waves or light rays exactly as they are received from the message source.

   b. SYNTHETIC CODE: These messages are audio or visual records of sound waves, graphics or three dimensional objects produced or transformed by a message creator.

   c. SYMBOLIC OR LINGUISTIC CODE: These messages are audio or visual

records of words or symbols which stand for the ideas from the mind of the person who experienced the message source.

7. MEDIA-MESSAGE COMPONENTS: As a media presentation may be formed from a number of media presentation modes and a number of message codes, a component is identified as an intersection of one media presentation mode with one message code on Diagram 3, page 34. Thus the media-message component is seen as a basic unit of a media presentation; thus a thorough analysis of the component must serve as a basis for understanding media effectiveness.
8. MESSAGE: This is the content or information of the communication experience.
9. MEDIUM: This is the material which forms the physical shape that conveys the content of the total communication.

RESEARCH DESIGN

The experiment was designed to test the relations among three factors in learning an identical script message from different media presentations:

Factor 1: Media presentations: Five media were compared to ascertain their relative effectiveness for promoting learning of the same message.

Factor 2: Reading achievement: Students were divided into above the median and below the median reading achievement groups to compare the relative effectiveness of media for students with different reading achievement characteristics.

Factor 3: Script: Two script messages were used to isolate evidence of whether relative effectiveness of media was consistent for script messages with similar characteristics and could

DIAGRAM 4

RESEARCH DESIGN:
TWENTY COMBINATIONS OF MEDIA PRESENTATIONS (M),
READING ACHIEVEMENT LEVELS (R), AND
SCRIPTS (S) FORM THE DIFFERENT TREATMENT CONDITIONS

		Media Presentation Modes				
Reading Achievement	Script	M_1 Print	M_2 Sound	M_3 Print/ pictures	M_4 Print/ sound	M_5 Pictures/ sound
R_1 High	S_1	111	112	113	114	115
	S_2	121	122	123	124	125
R_2 Low	S_1	211	212	213	214	215
	S_2	221	222	223	224	225

n=16
N=320

thus be generalized beyond the materials used in the study.

A 5 x 2 x 2 analysis of variance design was the basis for calculating sample size. Allowing a 5% possibility of error in falsely rejecting the hypothesis under test ($\alpha = .05$) and a 90% chance of supporting the alternate hypothesis when it should in fact be supported ($1-\beta = .90$), it was calculated that sixteen subjects would be needed for each cell in the design (n=16) for a total of 320 subjects (N=320). Diagram 4, page 44, portrays the research design for which the sample was calculated (see Appendix III for the calculations).

THE POPULATION OF SUBJECTS

Subjects were drawn from the sixth grade classes of two Madison, Wisconsin public middle schools. STEP scores (Standardized Tests of Educational Progress) of reading achievement served as a basis for blocking students into reading achievement groups of equal numbers. Within the reading achievement blocks, subjects were randomly assigned to one of the five media presentations and then to one of the two scripts within the media presentation condition. Boys and girls were assigned in equal numbers within each reading group and within each treatment as nearly as possible. Equal assignments of the sexes was employed to control for possible differences in interest toward the subject matter but was not analyzed as a factor in the design. New students without STEP reading achievement scores were assigned by their reading teachers to reading achievement groups. Some students were reassigned to a different reading block because their teachers were convinced they had progressed or fallen behind since STEP tests were administered.

SELECTION OF SCRIPT MESSAGES

To provide a link between media experiments in the field of reading and audiovisual media experiments, it was decided to base the present research on commercially produced materials but to compare results with those obtained using laboratory materials. Sound filmstrips were chosen as base materials because they could readily be broken down into sound, pictures and print components. Criteria for selection of the material to be used were the following considerations:

1. Materials not currently available to students for media center or classroom use were examined. Materials with a 1972 copyright were previewed and collections in the district's schools were checked. Materials not currently in the school's IMC's were considered for use in the study.
2. Subjects were examined only if not included in the school curriculum for at least two years, not used as a special interest topic in the classrooms studied, and not a focus of interest for recent mass media newscasts.
3. Narrative and expository materials were to be tested on the children in a pilot study.
4. Two scripts with most characteristics nearly equivalent were to be compared for the purpose of checking for consistency of results.

New materials sent to the Madison School District for preview were examined to select the two sound filmstrips which best met the above criteria as the basis for the five media presentations.

Of materials available for preview, those on Native American Indians most nearly fit the above requirements. Native Americans were not

studied in the Madison curriculum after third grade. Since only recall and comprehension items were included in the measurement instruments, pre-testing procedures were able to minimize the possibility that remembered material would confound results. The pre-testing described below outlines procedures employed to prevent confounding of test results with information previously learned.

DEVELOPING MEASUREMENT INSTRUMENTS

Two filmstrip series, "American Indian Legends" (narrative) and "American Indians of the Plains" (expository history), were tested on sixth grade children not involved in the final study. The process of selecting the specific titles of filmstrips to be used in the study was tied in with the development of measurements which could effectively measure dependent variables for use in analysis of the study.

1. Sound filmstrips were shown to students to determine whether interest level was suitable for the sixth grade age level. Four filmstrips, two from each series, were selected as having met the interest level requirement. A measurement instrument for each of these filmstrips was developed.
2. Measurement instruments for one legend and one history were tested on different groups of children randomly assigned to the groups. A ceiling effect was evident for the test of the legend. As additional test items could not readily be added, the legend filmstrips were eliminated from consideration.
3. Measurement instruments of 30 items each for the two historical scripts were tested on a group of thirty students who had not seen the sound filmstrips. All items that students knew or guessed

right were eliminated from the test.

4. New test items were added to bring the number of items on each test to fifteen. All items were tested on an additional thirty students. If more than one person of the total sixty got a test item correct, it was eliminated from the final version of the test.
5. Two additional tests, a media preference poll and a script attitude scale, were created. After similar pre-testing procedures, the number of items on the script attitude scale was reduced from sixteen to eight.

Appendix I includes the tests and related information.

RELIABILITY OF MEASUREMENT INSTRUMENTS

Scores from one hundred pretest subjects were analyzed using the Kuder-Richardson reliability coefficients formula. Reliability coefficients for three tests are given below:

INSTRUMENT	r
American Indians of the Plains Their History	.85
How They Lived	.68
Attitude Poll	.79

The reliability coefficient is interpreted by Ebel as an expression of the ratio of the variance of true or accurate scores to the variance of obtained scores. Tests with the above reliabilities would get 81 to 87 per cent agreement on assigning subjects to two groups. For a five category distribution such as a grading system, Ebel predicted about a fifty-nine to seventy-two per cent agreement.[6]

DEVELOPING CONSTANT PROCEDURES: THE TRIAL EXPERIMENT

The experiment was planned so that each subject would be administered the treatment and tested individually. However, since federal funded grants for applicable educational research were frozen before the experiment was implemented, the hiring of experimenters to complete the research as planned was not possible; so students were treated and tested in groups of approximately six at a time, the researcher administering all treatment and tests. The trial experiments described in this section were conducted exactly as the final experiment was to be conducted so that irregularities would be eliminated from the procedures.

The trial presentations with N=60 subjects were made to develop a procedure for administering treatment presentations which would be uniform regardless of which presentation was administered. Chairs were placed in two rows so that students could not see the face or paper of the student ahead of or beside them. Earphones were used with all presentations, to listen with during the presentations with sound and to eliminate distractions during the presentations without sound. Lights were on during the testing period and off during the period when students were exposed to the message. Blinds were drawn at all times.

A tape recorder with a synchronized inaudible slide advance was used as the timing device for all presentations. Even when sound was not played aloud, the inaudible track of the tape was used to advance slides. This equipment assured that each group of students would receive the presentation in the same length of time regardless of which medium was used.

An opening statement was developed to impress students with the desirability of being as truthful as possible on the questionnaires and to be as accurate as they could on the test, not for good grades but so they would help the school district discover which media were best for them. A closing statement requested students not to discourse with other students about the study. If asked what they did, students were instructed to answer only that "we answered some questions."

At the conclusion of the trial experiment, the researcher was satisfied that the opening and closing statements were uniform for all presentations, that equipment would operate smoothly to present each of the ten media conditions, and that the environment was consistent for all presentations. The two hundred subjects used during the development of tests and treatments were from the same schools but from different classrooms from those used in the final study to minimize possible discussion of the experiment.

SCHOOLS IN THE STUDY

As indicated by a median score of 61.5 on the reading section of the STEP test, students tended to score higher than average in reading achievement. The range of scores, however, reflects evidence of a wide range of educational development in the student body. Scores ranged from one to 99 with a disporportionate number of 90 plus scores drawn from the immediate neighborhood of the two schools where many students come from homes of university faculty members. Other students, bussed to the school from another area of the city, tended to contribute to a more balanced distribution of scores.

As the population of students tended to have better than average reading achievement skills, results of the study may have tended to minimize treatment differences due to differences in reading achievement skills. While this may have reduced chances of finding interactions between reading achievement and other factors in the study, there should have been no effect on comparisons among media presentations except to make results more easily generalizable to better readers and therefore possibly older students.

READING ACHIEVEMENT GROUPS

As the median STEP reading achievement score for students involved in the study was 61.5, students above that score were classified as high achievement readers. Those below the median were classified low achievement readers. Within the two achievement groups, students were assigned to participate in one of the five media presentations and only one script group.

SCRIPT CONTENT GROUPS

After students were divided into reading achievement groups and randomly assigned to media presentations, they were randomly assigned for exposure to one of the two scripts. An absence of interactions among media presentation, reading achievement and script message factors was looked for as evidence of consistency of results to allow generalization of conclusions beyond materials used in the study.

TREATMENT GRO

In the experiment, each treatment group consisted of an average of six subjects from two different classrooms, usually including three

high achieving readers and three low achieving readers and both boys and girls. However, random assignment resulted in some variation in composition of the treatment groups.

To minimize the possibility of discussion of the experiment among past and future participants and for administrative convenience, all subjects in a given classroom were tested during two nearly consecutive class days. Thus the second day of experimentation was in some measure dependent upon the first day chosen, but time of day was chosen entirely by random assignment.

DATA COLLECTION

The researcher was particularly relieved that the current confrontation at Wounded Knee, S.D. began after the study was completed. Data collection occurred between the inclusive dates of Monday, Feb. 5 and Thursday, Feb. 21, 1973. Occupation of Wounded Knee by Native American tribesmen began on Feb. 27, 1973. Students in the study were coincidentally provided with a timely historical background for the confrontation. Had the confrontation occurred during the course of the study, it may have provided an intervening historical variable which would have destroyed the credibility of the study.

ADMINISTRATION OF MEDIA PRESENTATIONS AND MEASUREMENTS

Subjects reported to the testing room according to a schedule given to the teacher at the beginning of the day. Each group was confronted with treatments and tests in this order:

1. A media preference poll was administered to each group to identify a ranking of relative preference for each of the five media. The

test, included in Appendix I, was administered orally and students were asked to choose which medium they thought they would like to use best in a media center, second best, and so on down to least. The resulting scores are referred to as media preference scores. Time of administration was three minutes.

2. Subjects were exposed to one of the two script messages via one of the five media presentations. The environment of the room was consistently similar for each of the five presentations regardless of equipment or conditions required. Students wore headsets, lights were out, and they faced a projection screen at the front of the room at each session regardless of whether sound or visual images were used in the presentation. Students were seated in two lines of chairs over three feet apart to minimize visual and social interplay. Projection and recording equipment was located at the rear of the room away from students' line of vision. Thus it was inconvenient to watch anything other than the researcher when he was administering tests or the screen when the media presentation was made. The timed media presentations lasted twelve minutes.
3. A factual test was presented orally to the students to measure immediate recall and comprehension. Students were encouraged to answer in a few words or short phrases to minimize differences in writing ability. Test administration time was ten minutes.
4. A poll was given to compare student attitudes toward statements about the script content. From differences in scores, the influence of the medium that presented the script on encouraging students'

positive or negative attitudes toward the script could be inferred.

Notes for Chapter II

1. Briggs, L.J., and others, (see footnote 24, chapter I).

2. Leven, Joel R., "Organization, Comprehension, and Some Evidence "How", Madison, Wisconsin: Wisconsin Research and Development Center for Cognitive Learning, 1972.

3. Levin, Joel R., and others, "Verbal and Visual Processes in Children's Learning: II. Facilitation Differences as Related to Task Variations," Madison, Wisconsin: Wisconsin Research and Development Center for Cognitive Learning, 1971.

   Kaplan, Sandra A., "Elaboration and Reading Achievement as Factors in Children's Learning of Text Materials," Madison, Wisconsin: Wisconsin Research and Development Center for Cognitive Learning, 1971.

4. Levin, Joel R., "Some Thoughts About Cognitive Strategies and Reading Comprehension," Madison, Wisconsin: Wisconsin Research and Development Center for Cognitive Learning, 1971, p. 3.

5. Cooper, J.C., and J.H. Gaeth, "Interactions of Modality With Age and With Meaningfulness in Verbal Learning," Journal of Educational Psychology, February, 1967, 58(2):41-4

6. Ebel, R.L., Measuring Educational Achievement, Englewood Cliffs, N.J.: Prentice-Hall, 1965, p. 318, 330, 334, 336.

CHAPTER III

DATA ANALYSIS

The material in this chapter includes primarily a description of statistical procedures used, data summaries, analysis of data, and a brief statement of results. Numbering of hypotheses tested in this chapter corresponds to numbering of questions and hypotheses stated in Chapter II and questions discussed in Chapter IV. This is done to permit the reader to proceed directly from Chapter II to Chapter IV to examine interpretations and conclusions, facilitating reference from conclusions back to results of data analysis.

Hypotheses are stated before each test in the form of predictions rather than in null hypotheses form to indicate not the statistically tested hypothesis but rather the results that are expected.

HYPOTHESIS 1:

Media learning scores are expected to indicate that media presentations composed of different media-message components and used to present identical script messages, produce different learning effects.

HYPOTHESIS 2:

Interactions among media presentations and reading achievement levels are expected to indicate that presentations with <u>print</u> are more effective for high achievement readers and presentations with verbal <u>sound</u> are more effective for low achievement readers if other factors are equal.

MEDIA LEARNING SCORES

Immediately after the media presentation was completed, a media learning test of recall and comprehension was administered to each student in the study. The appendix has a copy of the tests for each of the two scripts. Raw scores were transformed to T scores before the tests were analyzed to put all scores on the same scale. A T score is a standard score based on data with a mean of fifty (50) and a standard deviation of ten (10).

A split-plot analysis of variance design was used as the basis for analyzing and reporting results. Data were also analyzed by a three-way analysis of variance design as originally planned, but administration of treatments in groups rather than individually resulted in a violation of the independence assumption for individual scores which necessitated a change in the appropriate experimental unit to group scores (see No. 3 below).

Assumptions for the split-plot design include meeting the following conditions: [1]

1. Random selection of subjects from the treatment population.
2. Random assignment of subjects to treatments.
3. Independence in administering treatments to treatment units.
4. Independence in assessing performance of subjects.
5. Normality of the distribution of the treatment populations or large sample size.
6. Equal variances and covariances.

Few experiments validly utilize random selection from the population for which the results are to be generalized. This experiment makes no

claim in that regard, but random assignment has been maintained scrupulously with the exceptions noted in the previous chapter.

The independence of administering treatments applies to treatment groups rather than to individuals with this design and is not violated; independence of assessing performance of subjects was maintained strictly by the procedures described previously.

Normality of the distribution of the parent population is compensated for by large sample size as discussed by Donaldson as he describes his studies on the robustness of the F-test.[2]

The test statistic used with the split-plot analysis of variance design is as follows: $F = \frac{\text{Mean Square Treatments}}{\text{Mean Square Error}} = \frac{MSTr}{MSE}$.

Data computations are based on scores included in Appendix IV. Reading level cells in the split-plot design were proportionate even though treatment group numbers differed. Roman numerals are used as symbols for calculation formulas as described below:

$I = \Sigma X^2$ = (individual group scores squared then summed)

$II = \frac{(\Sigma X)^2}{N}$ = (group scores summed then squared and divided by the number of individual groups, 88)

$III_S = \frac{\Sigma S^2}{n_R}$ = (media group sums squared then summed and divided by the number of reading achievement levels, 2)

$III_T = \sum \frac{T^2}{n_T}$ = (treatment level sums squared and divided by the number of individual groups in that treatment, 16 or 20)

$III_R = \frac{\Sigma R^2}{n_G}$ = (reading level totals squared then summed and divided by the number of treatment groups, 44)

$IV_{TR} = \sum \frac{TR^2}{n_{TR}}$ = (treatment by reading level cell totals squared then divided by the number of groups in the cell, 8 or 10)

Data computations are as follows:

$I = 228,841.579$

$II = 220,264.079$

$III_S = 222,933.177$

$III_T = 221,172.499$

$III_R = 224,520.817$

$IV_{TR} = 225,566.321$

Sum of squares between groups = $III_S - II = 2669.098$

Sum of squares treatments = $III_T - II = 908.42$

Sum of squares error between groups = $III_S - III_T = 1760.678$

Sum of squares within groups = $I - III_S = 5908.402$

Sum of squares [illegible]ing achievement = $III_R - II = 4256.738$

Sum of squares T x R = $IV_{TR} - III_T - III_R + II = 137.084$

Sum of squares error within groups = $I + III_T - III_S - IV_{TR} = 1514.580$

Sum of squares total = $I - II = 8577.500$

Calculation of mean square values are obtained by dividing the sums of squares by the appropriate degrees of freedom. These calculations are most easily reported by including the calculated scores on an analysis of variance table. This table begins at the top of the next page. The decision rule for rejecting the hypothesis under test is as follows: With $\alpha=.05$ and four degrees of freedom for treatments and thirty-nine error degrees of freedom, reject the hypothesis under test if $F > F_{4,39}(.05)=2.62$.

TABLE I

ANALYSIS OF VARIANCE COMPUTATIONS ANALYZING MAIN EFFECTS OF MEDIA PRESENTATION TREATMENTS AND INTERACTIONS AMONG TREATMENTS AND READING ACHIEVEMENT

Source of variance	Degrees of Freedom	Sum of Squares	Mean Square	F
Between groups	43	2669.098		
Treatments	4	908.420	227.105	5.03*
Error	39	1760.678	45.145	
Within groups	44	5908.402		
Reading achievement	1	4256.738	4256.738	(not tested)
T X R	4	137.084	34.271	<1
Error	39	1514.580	38.835	
Total	87	8577.500		

* A statistically significant difference was found.

Decisions: 1) As 5.03 is greater than 2.62, reject the hypothesis that there are no differences among treatments.

2) As the T X R effect is less than 1, do not reject the hypothesis that interactions among treatments and reading achievement groups are statistically equal.

Post Hoc Analysis: Tukey's procedure for making post hoc comparisons between pairs of means is used to isolate differences between effects of media presentations. Tukey's formula for determining a critical value is as follows: $C.V. = \sqrt{q_{\alpha,v} \frac{MSE}{n}}$.

Decision rule: Within the α=.05 hypothesis error rate, 39 error degrees of freedom, MSE=45.145, and the harmonic mean ($\tilde{n}$)=5÷(1/8+1/8+1/8+1/10+1/10)=8.695, assume a statistically significant difference between pairs of means if the difference is greater than the critical value, where $C.V. = \sqrt{(4.045)\frac{45.145}{8.695}} = 4.583$.

Data: Means in T scores

$\overline{X}_1$ (print) = 46.385

$\overline{X}_2$ (sound) = 46.815

$\overline{X}_3$ (print/pictures) = 48.827

$\overline{X}_4$ (print/sound) = 53.376

$\overline{X}_5$ (pictures/sound) = 54.045

The higher scores indicate that greater learning has been achieved. Pictures/sound was thus found to foster the most effective learning. To find statistically significant differences, the critical value may be subtracted from the highest mean score. For pictures/sound, 54.045 - 4.583 = 49.462, and as this number is larger than the mean scores for print, sound, and print/pictures, it can be assumed that pictures/sound was more effective in this experiment than the two single component media and print/pictures.

The next highest score was for print/sound. Subtracting the critical value from the mean, 53.376 - 4.583 = 48.793, it can be noted that the mean for print/sound is statistically higher than the means for print and for sound, but not higher than the mean for print/pictures.

No other statistically significant differences were found between pairs of the five means. Print and sound may be assumed to be equal, and pictures/sound and print/sound may also be assumed to be equal. Print/pictures was midway between the two more effective and the two less effective media presentations, but statistically different from pictures/sound only.

HYPOTHESIS 3:

Treatment effects due to differences in scripts are equal for nearly equivalent scripts.

Script factor: Using the Kruskal-Wallis nonparametric analysis of variance by ranks described in the next section, no statistically significant differences were found between the two scripts or among interactions of the script factor with the reading achievement or media presentation factors using an error rate of $\alpha = .01$.

Results of these analyses were essentially the same as findings of a three-way analysis of variance of individual scores.

HYPOTHESIS 4:

Students are expected to indicate preferences as to which of the five media they would most prefer to use in a media center?

MEDIA PREFERENCE SCORES

Before the media presentation was administered to each treatment group, a media preference poll was completed by each student in the study. A copy of this poll is included in Appendix I. Rankings for each of the media choices were summed across the 321 subjects ranking

the choices for a total media preference score. The Friedman nonparametric rank test was the procedure used for statistical analysis. The Friedman test is appropriate for use if the following experimental assumptions are met:

1. Random assignment is used to place subjects in treatment levels.
2. The underlying probability distribution is continuous.
3. Data (numbers) contain at least ordinal information concerning the effects of the independent variable.

The following test statistic was used in data analysis:

$\underline{X}^2_r = \frac{12}{nk(k+1)} [\Sigma(\Sigma R)^2] - 3n(k+1)$, $\underline{X}^2_r$ is the Chi Square value of matched ranks.

Decision rule: With $\alpha = .01$ and 4 degrees of freedom among the five media choices, reject the hypothesis under test (H_0) if $\underline{X}^2_r > \underline{X}^2_{.01}$, $4 = 13.277$.

Data: The data needed for the test statistic are the sum of ranks(ΣR) for each media choice, the number of subjects (n) and the number of choices (k). These data are summarized as follows: R_1 (print)=723; R_2 (pictures/sound)=765; R_3 (sound)=1002; R_4 (print/pictures)=1121; R_5 (print/sound)=1189; n=320; k=5.

Test: $\underline{X}^2_r = \frac{12}{320(5)6} [(723)^2+(765)^2+(1002)^2+(1121)^2+(1189)^2]$

$-3(320)6 = 217.9$

Decision: Reject H_0 as 217.9 > 13.277, assume that students do in fact have preferences for use of media in a media center. Post hoc analysis

isolates these preferences.

Post Hoc Analysis: These procedures are used to make simultaneous comparison of all mean ranks ($\bar{R}$) of the five media preference choices without exceeding the .01 error rate of the hypothesis. Chi Square ($\underline{X}^2$) value used in the decision rule for testing the hypothesis and the estimated variance of the contrast Var ($\hat{\Psi}$) using the formula C.V. $=\sqrt{\underline{X}^2_{k-1}(1-\alpha)\text{Var}\ (\hat{\Psi})}$, where Var $(\hat{\Psi})=\frac{k(k+1)}{12n}\ a_k^2$ and $a_k^2=2$. For pairwise contrasts of mean ranks, Var $(\hat{\Psi})=\frac{(5)(6)(2)}{12(320)}=.0156$.

Thus C.V. $=\sqrt{13.277(.0156)}=.455$.

Data:

$\bar{R}_1$ (print)=2.259

$\bar{R}_2$ (pictures/sound)=2.390

$\bar{R}_3$ (sound)=3.131

$\bar{R}_4$ (print/pictures)=3.503

$\bar{R}_5$ (print/sound)=3.715

Decision rule: Within the $\alpha=.01$ error rate for the hypothesis under test, assume a statistically significant difference between pairs of mean ranks ($\bar{R}_1-\bar{R}_1$.) if differences are greater than .455.

By adding the critical value to the lowest score which is for print, an upper level of a statistical confidence interval is obtained. Scores greater than that number are statistically different from the lowest score. For print, 2.259+.455=2.714. Thus with $\alpha=.01$ it can be assumed that students' preference for pictures/sound is no different than their preference for print as the mean rank for pictures/sound is less than 2.714. The three mean ranks for sound, print/pictures and

print/sound are greater than 2.714, so we can assume these media are less preferred than print.

For pictures/sound, 2.390+.455=2.845. This value likewise indicates preference for pictures/sound over the three less preferred media. The only other statistically significant difference in preference showed sound, 3.131+.455=3.586, to be statistically preferred over print/sound, 3.715.

HYPOTHESIS 5:

Media attitude scores are expected to indicate that students' attitudes toward material learned vary according to the medium from which the script was learned.

MEDIA ATTITUDE SCORES

The final measure collected from each treatment group was the media attitude score. A test of attitudes toward statements about the script learned was given immediately after the media learning tests were collected.

The statistical procedures used for analysis of this data was the Kruskal-Wallis one-way analysis of variance by ranks. Scores for the media presentations were summed and ranked and the following test statistic was used:

$$H=\frac{12}{N(N+1)}\left(\sum\frac{\Sigma(R)^2}{n}\right)-3(N+1)$$

Assumptions for the Kruskal-Wallis test are the same as for the Friedman test used in the first section of this chapter. The Friedman test is used for matched data scores or choices and the Kruskal-Wallis

is used with unmatched data.

Decision rule: To analyze main effects of media attitudes with $\alpha=.05$ and 4 degrees of freedom among the five media treatments, reject the hypothesis under test (H_0) if $H > \underline{X}^2_{.05.4}=9.49$.

Data needed to conduct analysis are the total number of subjects (N), the number of subjects per treatment (n), and the sum of the ranked scores for each treatment (ΣR).

Data:

ΣR_1 (print) = 11,490

ΣR_2 (sound) = 12,027

ΣR_3 (print/pictures) = 10,723

ΣR_4 (print/sound) = 7830.5

ΣR_5 (pictures/sound) = 9289.5

N=320

n= 64

Test:

$H = .0001168\ (8,425,985.914) - 963 = 21.15.$

Decision: Reject H_0 as $H = 21.15 > \underline{X}^2 = 9.49$, assume that different attutudes result from the use of different media presentations. Post hoc analysis of pairs of means isolates the differences in attitude as related to specific media presentations.

Post hoc analysis: Nemenyi's procedure for post hoc analysis of results allows for simultaneous comparison of all contrasts without exceeding the .05 error rate for all the hypothesis. The critical value

determined by Nemenyi's procedure is C.V. $=\sqrt{\chi^2_{1} - k\text{-}1\ \mathrm{Var}(\hat{\psi})}$ where $\mathrm{Var}(\hat{\psi}) = \frac{N(N+1)}{12} \sum_{k=1}^{k} \frac{a_k^2}{n} = \frac{8560 \Sigma a^2}{64} = 133.75 \ \Sigma\ a_k^2$ with Σa_k^2 or just a^2 is the coefficient of means used in the contrast.

For the contrasts tested below both simple and complex comparisons are used. ($a^2=2$) is the coefficient for a simple contrast of two means. ($a^2=1.25$) is the coefficient for a complex comparison of four means with one mean. ($a^2=1$) compares two means with two others and ($a^2=.833$) compares three means with two others. Examples are in the next section. Therefore, four contrast variances and four critical values are calculated below.

Variances of contrasts:

$\mathrm{Var}(\hat{\psi})$ $(a^2=2)=267.5$

$\mathrm{Var}(\hat{\psi})$ $(a^2=1.25)=167.188$

$\mathrm{Var}(\hat{\psi})$ $(a^2=1)=133.75$

$\mathrm{Var}(\hat{\psi})$ $(a^2=.833)=111.44$

Critical values for contrasts:

$C.V.(a^2+2) = \sqrt{9.49(267.5)} = 50.384$

$C.V.(a^2=1.25) = \sqrt{9.49(167.188)} = 39.832$

$C.V.(a^2=1) = \sqrt{9.49(133.75)} = 35.627$

$C.V.(a^2=.833) = \sqrt{9.49(111.44)} = 32.503$

Decision rule: If the difference between mean ranks of the contrasts exceeds the critical values calculated above, assume significant differences in attitude scores for the contrasts within the $\alpha=.05$ error rate for the hypothesis under test.

Data: $\bar{R}_1$ (print) = 179.531

$\bar{R}_2$ (sound) = 187.922

$\bar{R}_3$ (print/pictures) = 167.547

$\bar{R}_4$ (print/sound) = 122.352

$\bar{R}_5$ (pictures/sound) = 145.148

Tests of contrasts: These significant differences were found among the contrasts tested.

$\hat{\psi}_{1(a^2=2)} = \bar{R}_1 - \bar{R}_4 = 57.18$. As $57.18 > 50.384$, assume that attitudes resulting from print/sound were different from attitudes resulting from print alone.

$\hat{\psi}_{2(a^2=2)} = \bar{R}_2 - \bar{R}_4 = 65.57$. As $65.57 > 50.384$, assume that attitudes resulting from print/sound were different from attitudes resulting from sound alone.

$\hat{\psi}_{3(a^2=1)} = \frac{\bar{R}_1+\bar{R}_2}{2} - \frac{\bar{R}_4+\bar{R}_5}{2} = 49.98$. As $49.98 > 35.627$, assume that attitudes resulting from print/sound and pictures/sound were different from attitudes resulting from print alone and sound alone.

$\hat{\psi}_{4(a^2=1.25)} = \frac{\bar{R}_1+\bar{R}_2+\bar{R}_3+\bar{R}_5}{4} - \bar{R}_4 = 47.68$. As $47.68 > 39.832$, assume that attitudes resulting from print/sound were different from attitudes resulting from the other four media presentations.

$\hat{\psi}_{5(a^2=.833)} = \frac{\bar{R}_1+\bar{R}_2+\bar{R}_3}{3} - \frac{\bar{R}_4+\bar{R}_5}{2} = 44.58$. As $44.58 > 32.503$, assume that attitudes resulting from print/sound and pictures/sound were different from attitudes resulting from the other three media.

In all of the above cases lower scores indicate a more favorable attitude toward the script. Therefore, most favorable attitudes toward the script resulted from the print/sound presentation followed by the pictures/sound media.

Interactions: Using the method described by Bradley,[3] three analyses were conducted at $\alpha=.01$ to look for interactions among media, reading achievement, and script factors. Inclusion of the reading achievement factor produced a significant H, but no interpretable interactions were found.

HYPOTHESIS 6:

Correlations between pairs of data sets are expected to indicate relations between media preference, learning, and attitudes resulting from the learning experience.

CORRELATIONS BETWEEN SCORES

The Kendall Tau Coefficient was used to correlate results of the three previously analyzed measurements. Assumptions for the Kendall Tau include continuously distributed ranks, no tie scores, and that all possible permutation of scores are equally likely to occur.

The Kendall Tau test statistic is as follows:

S=(number of times rankings agree in order about a pair) -
(number of disagreements in order or rankings about a pair).

$$\tau = \binom{n}{2} - 2(\text{number of inversions}),$$

$$\tau = \frac{S}{\text{total number of pairs}}$$

Decision rule: Interpretation of the Kendall Tau will be done as recommended in Hays[4] by stating directly the obtained positive or negative correlation and explaining whether the two scores compared serve as favorable or unfavorable indicators for anticipating a correlation.

Data: Numbering for the media presentations utilized for the purpose of making the correlations is as follows:

1 = print

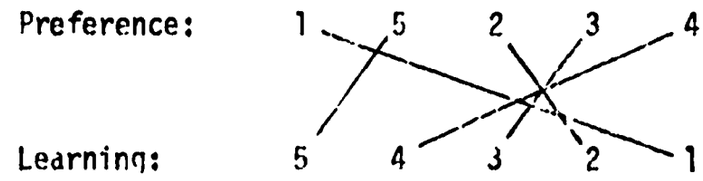
2 = sound

3 = print/pictures

4 = print/sound

5 = pictures/sound

A. Preference and learning score correlations



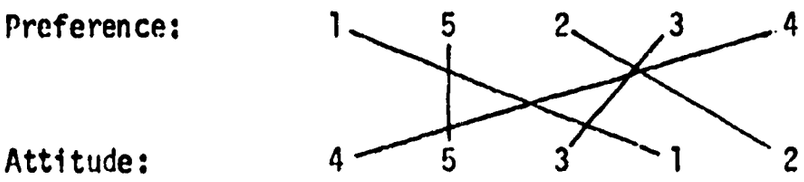
Inversions in scoring order are found by counting the number of times lines to choices cross. On this table there are eight inversions.

Thus: $S = \binom{5}{2} - 2(8) = 10-16 = -6$

$$\tau = -\frac{6}{10} = -.6$$

A negative correlation indicated that it is probably that the medium a student prefers to use will not be the medium the student best learns from.

B. Preference and attitude score correlations

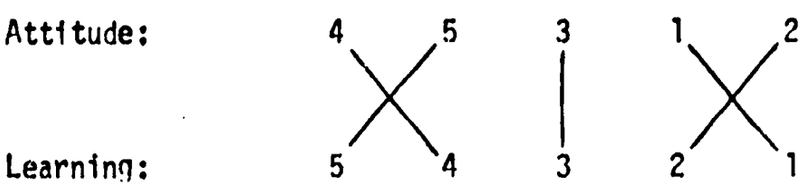


Eight inversions are also present in this table.

Using the same procedure: $\tau = -.6$

Again the negative correlation indicates that it is probable that the medium a student prefers to use will not be the medium that will result in the best attitude toward the script learned.

C. Attitude and learning score correlations



Two inversions are present on this table.

Thus: $S = \binom{5}{2} - 2(2) = 10-4 = 6$

$$\tau = \frac{6}{10} = .6$$

The positive correlation of .6 indicates that it is probable students will have the best attitude toward a script learned from a medium that is effective for them.

CUMULATIVE ERROR RATE

The error rate associated with the hypotheses tested by the above procedures are as follows:

	α =
Media Preference Scores	.01
Media Learning Scores	
Treatments	.05
Treatments x Reading Achieve.	.05
Scripts (interactions)	.01
Media Attitude Scores	.05
Interactions	.01
TOTAL	.18

The cumulative error rate indicates that there is less than one chance out of five that one or more of the decisions resulting from the above analyses was based on the false rejection of the hypothesis under test.

Notes for Chapter III

1. Kirk, Roger E., Experimental Design: Procedures for the Behavioral Sciences, Belmont, CA: Brooks/Cole, 1968, p. 492.

2. Donaldson, T.S., "Robustness of the F-Test to Errors of Both Kinds..." in E.F. Heermann & L.A. Braskamp, eds., Readings in Statistics for the Behavioral Sciences, Englewood Cliffs, N.J.: Prentice-Hall, 1970, p. 85-103.

3. Bradley, James V., Distribution-Free Statistical Tests, Englewood Cliffs, N.J.: Prentice-Hall, 1968, p. 138-141.

4. Hays, Wm. L., Statistics, N.Y.: Holt, 1963, p. 649.

CHAPTER IV

CONCLUSIONS, ALTERNATE HYPOTHESES RECOMMENDATIONS FOR FURTHER RESEARCH AND SUMMARY

By examining the questions posed and hypotheses stated in Chapter II in relation to the statistical decisions stated in Chapter III, conclusions for the experiment are formulated and stated below.

1. Do students learn more effectively from any media relative to other media?

Based on analysis of the media learning scores, media presentations pictures/sound and print/sound can be assumed to be more effective than either print or sound alone but not more effective than the print/pictures presentation. Because the conclusions regarding pictures/sound presentation was a predicted result and the finding concurs with the results of Levin's research, on which the prediction was based, there is no reason to question the finding by posing alternate hypotheses. There are, however, trends in the data which suggest further comparisons of this medium with other media. These trends will be discussed in a later section discussing interactions.

Findings related to the print/sound presentation were not predicted and did not correspond with results of reading experiments upon which the predictions were based. Trend results of the print/pictures and print/sound presentations were reversed from results of the reading studies, although statistical analysis showed no difference. An

important difference in administration of presentations between this experiment and the reading studies may explain differences in trend results. This experiment included no attempt to induce a strategy for learning based on instructions as to how to utilize the message of the medium conceptually. As a strategy was instructed to students in the reading experiments, the difference in results may have been due to the fact that the presentations were administered without instructions. Other alternate plausible hypotheses must be considered which may account for the difference between trends and predictions.

Alternate hypothesis 1:

The timed presentation favored the print/sound presentation over the print/pictures presentation for scripts of the length used in this study. Because advancement of the slides was keyed on a track of the sound tape recording, the print/sound presentation was advanced at an optimum rate which may have encouraged optimum attention by many students using the presentation. The print/pictures presentation was changed too quickly for slow readers to have time to examine the pictures beneficially. In fact it is possible that students who looked at the pictures first were diverted from reading the print message completely. Another experiment would be needed to test this alternate hypothesis adequately.

Alternate hypothesis 2:

Randomization procedures resulted in a chance assignment of unequal samples. The only method of testing this possibility available to the researcher was to examine the SIEP scores which served as the basis for

random assignment. While trends indicated that the subjects assigned to the print/pictures presentation did in fact have a slightly lower mean score than subjects assigned to the other presentations, there were no significant differences among the five mean scores. Thus it must be assumed that randomization procedures were effective and did not result in biased samples.

Alternate hypothesis 3:

The type of question asked on the learning tests favored the print/sound presentation. This possibility was analyzed by examining the answers to all of the test questions. It was found that students answered about half of the questions with specific words or phrases which were included in the written and spoken texts of the print and sound media-message components, but were not necessarily evident from an examination of the picture component alone. These questions did in fact tend to favor the print/sound presentation over presentations with a picture component. The other half of the questions could be answered with more general words and phrases which could be based on impressions received from any one of the three components. The print/pictures presentation tended to be as effective as the pictures/sound presentation for those questions. Thus this hypothesis provides a basis for further experimentation with the three double component presentations.

a. Are two-component media presentations more effective than single component presentations?

Results show that both the print/sound and the pictures/sound

presentations were more effective than print or sound alone. Results concerning the print/pictures presentation were inconclusive. The finding that pictures/sound was more effective than print/pictures suggests that print/pictures has greater similarity to single component media than to the more effective pictures/sound.

b. Are two-component audio and visual presentations different in effectiveness than a two visual component presentation utilizing two different message codes?

Results of this study were not conclusive on the question of modality versus code. The finding that pictures/sound was more effective than print/pictures plus the nearly significant difference between the latter and print/sound suggests that bi-modal media are more effective than a medium with two codes received by the same sense organs. It is possible that the brain cannot process information efficiently if two messages are received by the same sense organs, in this case the eyes. Results may indicate that processing of one audio and one visual message results in more effective learning.

As an alternate hypothesis, it is possible that media with an audio and a visual component were favored by the fact that all presentations were timed and cued by the audio component. For both of the AV media the audio started automatically. For the print/pictures medium there may have been a time lag purely because the student had to begin to read the message of his own volition. For this reason a study with more flexible time conditions and/or which asks questions which allow for more general descriptive answers, may result in entirely

different trends or conclusions. The time conditions were desirable for this first study, but a future study could utilize more flexible conditions which more nearly approximate conditions of media center use.

Two further observations should be mentioned at this juncture. First, the fact that the sound or spoken word component was a common component of the two most effective media, suggests that the spoken word may play a key role in promoting effective retention for immediate recall. Second, the fact that no consistent differences were found among the three double component media supports the assumption stated earlier that it is insufficient to analyze media in relation to the audio or visual sensory presentation mode alone. Future research must examine effects of the message code also to avoid a potential confounding variable.

2. Are there interactions among media presentations and reading achievement levels?

Results of this experiment indicate no interactions among media presentation treatments and reading achievement blocks. Table 2 included in the following section indicates some trends which could be investigated in future experiments.

3. Are results consistent from one script message to another?

To answer this question, tests were conducted to investigate a) script by media presentation interactions, b) story by reading achievement interactions, and c) script by media presentation by reading

achievement three way interactions. Results of these analyses indicate no statistically significant interactions are present. Due to the presence of some interesting trends, however, a simplified data table is presented below to allow for examination of trends which may lead to further studies. The reader is cautioned that data in Table 2 are based on individual scores rather than group scores. Thus inconsistencies may be noted when comparing Table 2 with results of post hoc analysis of learning data.

As numbers have been rounded off to one decimal point, Table 2 is less accurate than post hoc data. Table 2 is included here only for purposes of drawing attention to trends within the data which could inspire formulation of hypotheses to be tested with future experiments.

An additional factor should be mentioned at this point. While every effort was made to select scripts as nearly identical as possible, it was necessary to utilize scripts of slightly different length and contents because of limitations imposed by the use of commercially produced materials. Script 2 (Their History) was approximately one-third longer in the printed version than script 1 (How They Lived) even though the presentation times varied by less than one minute. Length as well as script content are factors which must be considered when examining trend differences.

Possibly due to the different length or content of the print presentation of script 2, it may be noted that with print low achievement readers tended to score lower on script 2 than they did on script 1. Similarly for the sound presentation high achievement readers scored lower on script 1 than on script 2. An aptitude by treatment

TABLE 2

T SCORE MEANS AND STANDARD DEVIATIONS FOR EACH CELL OF THE RESEARCH DESIGN AND MEAN SCORES FOR ROWS AND COLUMNS, CALCULATIONS BASED ON INDIVIDUAL SCORES

		Media Presentation Mode					
Reading Achievement	Script	Print	Sound	Print/ Pictures	Print/ Sound	Pictures/ Sound	Row Mean
1	1	52.5 8.88	49.3 8.98	53.2 6.99	55.4 7.43	61.3 6.74	54.3
	2	54.4 7.69	53.7 9.15	54.9 10.36	58.0 6.7	54.9 7.28	55.0
High Mean		53.5	51.5	54.1	56.7	58.1	54.7
2	1	45.0 11.23	44.5 9.13	44.1 9.72	46.3 7.78	48.4 9.43	45.7
	2	39.8 5.85	44.0 9.76	43.7 6.33	51.3 8.82	46.2 9.96	45.0
Low Mean		42.4	44.3	43.9	48.8	47.3	45.3
Column Mean		47.9	47.9	49.0	52.7	52.7	50.0

Grand Mean, $\bar{X}$ = 50.0
Standard Deviation, S = 10.00
Cell n = 16
Total N = 320

interaction was anticipated with the print and sound presentations. This trend suggests that an experiment which added a factor of script length or content difference to reading achievement and media factors, could possibly isolate a three-way interaction among print and sound, reading achievement, and a script factor such as length or content differences. It must be stressed that the possibility of a trend is conjecture based only on trends. Statistically this trend is explained as a chance occurrence.

Next, it may be noted on the table that the print/pictures presentation did not tend to benefit low achievement readers in comparison to the print or sound presentations. High achievement readers, however, showed a slight trend toward benefiting from the addition of pictures. Given a less restricted time factor, the addition of pictures may prove to be better for both high and low achievement readers.

Last, trends toward two- and three-way interactions may be noted when comparing cells of the print/sound and pictures/sound presentations. Pictures/sound tended to elicit greater benefits from low achievement readers. This trend is magnified even more when one takes into account the script factor. The most effective treatment cell for high achievement readers, 61.3, was for the first script presented by pictures/sound. The most effective treatment cell for low achievement readers, 51.3, was for the second script presented by print/sound. Within each reading achievement level this same treatment by script interaction trend may be noted. While these trends may be explained by chance within the parameters of this experiment, trends suggest further experiments examining media effectiveness in relation to some script factors such

as length or content.

One additional aspect may be noted relating to trends of the presentations including the picture component. Contrary to popular expectation, trends do not support the contention that pictures must be included in media collections for the benefit of poor readers. Conversely, trends indicate that the picture component primarily benefits high achievement readers when coupled with print. These trends concur with McLuhan's suggestion that people must be highly literate to utilize pictures effectively.

4. Do students indicate preference to use specific media in a media center?

Based on analysis of media preference scores, print and pictures/sound media can be assumed to be preferred by students over the other three media. Students probably show a high preference for use of print in a media center, because print is still the most familiar method of storing knowledge utilized by school library media centers. Pictures/sound media are also familiar to students because of TV and film viewing activities pursued after school hours. Both of these media could have been highly preferred because of greater familiarity rather than any other expectation on the part of the student. The other three media could have been given lower preference ratings by students because they were aware of use of such media only in educational settings. It should be stressed that the question asked the students was, "Which choice would you like to use best in a media center?" If the question had been, "Which choice do you think you could learn best from?" it is

possible that rankings could have been different.

5. Do students' attitudes toward a script vary according to the medium from which they learn the script?

The answer to this question must be modified by consideration of two elements of the experiment which may have influenced results. First, the attitude measurements were administered after the students had completed the learning tests. Thus students were in effect influenced by two variables: 1) the media presentation and their reaction to it, and 2) the learning test and their reaction to it. Therefore, their attitudes toward the script learned from these two media may have been due to some extent because they felt they did well on the learning test. Second, as previously noted, students tended to answer some questions with answers worded identically to the verbal text. These questions tended to favor the print/sound presentation. Knowing that they had exact answers to some questions may have given students additional confidence which influenced their attitude favorably toward the script as learned from the print/sound presentation.

Within the constraints explained above, it can be assumed based on analysis of media attitude scores that the print/sound medium encourages a more favorable attitude toward the script learned than do the other four media for a learning presentation followed immediately by a test. Pictures/sound also encouraged a favorable attitude toward material learned. Together print/sound and pictures/sound encouraged more favorable attitudes than did the other three media.

These conclusions are not reported with the expectation that

results are conclusive that media with audio and visual components encourage more favorable attitudes toward material learned. Rather it is intended that these findings provide a basis for further studies which focus specifically on media and attitudes toward learning.

6. Are there correlations between sets of data: media preference scores, media learning scores, and media attitude scores?

a. Do students learn relatively better from a medium for which they indicate a use preference?

Based on the negative correlation between media preference scores and media learning scores, media preference as indicated by student users tended not to be a good indicator of how effectively students can learn from a preferred medium. Stated differently, one cannot expect the best learning to occur if student groups are left entirely to their own preferences. Some form of guidance in media use for groups may be assumed to be desirable to promote effective learning. Further study is needed to see if the same tendency is true for individuals as was found by examining mean scores.

b. Do students' attitudes toward a story vary according to the media preferences they indicated prior to learning the script?

Based on the negative correlation between media preference scores and media attitude scores, students' media preference choices tended not to be good indicators of which medium would encourage a favorable attitude toward the material learned. Again some form of guidance in

media use for groups and possibly for individuals may be assumed to be desirable to encourage a favorable attitude toward the subject of study.

c. Do students' attitudes toward a script vary according to the effectiveness of promoting learning of the medium from which they learned the script?

Based on the positive correlation between media learning scores and media attitude scores, students tended to express the most favorable attitudes toward scripts learned from the most effective media. Going beyond the scope of the present experiment, the positive correlation between learning and attitude suggests additional research based on individual differences. Most of the cells in the research design included a wide range of individual scores indicating that some individuals benefited from each of the different media presentations. Reading achievement was not a favorable indicator for selecting media in this experiment; there is no evidence that IQ or other indicators would be any better.

Media researchers may discover that the best indicators of media effectiveness relate directly to the media. Media tests could be devised to enable a media specialist to predict which media best contribute to an individual's learning or to developing a favorable attitude toward material learned. While it is desirable that research on learning and on attitudes be conducted independently, it is also desirable that results be related so media can be recommended with favorable effects on both learning and attitudes.

LIMITATIONS

Some results of this experiment may have been biased because of experimental methods. One of these methods was the use of groups rather than individual treatments. Four of the five media presentations included a visual message consisting of either a picture or print. The fact that students in these groups had something on the screen to look at discouraged them from looking at each other or at other distractions from the message. The sound presentation, however, did not provide students with a visual message. The fact that their eyes were free to roam may possibly have depressed their performance because of lack of an attention holding device.

Similarly, media presentations without sound, print and print/pictures, may have been effected by lack of a timing device. The timing device was connected to the sound track and could not cue students in these presentation groups to start reading the message. Just a short time lag could cause disorganized readers to fall behind and not finish the message.

The experiment was set up to test the influence of the script among the five media presentations at $\alpha = .01$. No significant differences were found on this test. However, there would be greater power to reject a hypothesis under test if two media presentations had been compared. By examining Table 2 on page 80, it can be seen that the print/sound and pictures/sound presentations show a trend toward a media by script interaction which would not allow generalizability for these two presentations from one script to another. Further study would be needed to isolate what script factors are responsible for this interaction.

Use of a timed presentation limits generalizability to flexible student use patterns currently encouraged in school media centers. A study with flexible timing almost surely would introduce intervening variables.

The decision to use recent commercially produced materials, reduced the ability to specify which types of questions could be asked about the material covered in the script. Use of locally produced materials would allow careful construction of test questions which would increase ability to ask specified types of questions. However, it would not allow generalizability to media selection tasks which was sought in this study.

It must be cautioned that generalizing of these results would be most applicable for students at or near the sixth grade level. Because of differences in maturity at different age levels, entirely different results may be obtained from much younger or much older students. Also it was noted that students in the study were of greater than average reading achievement level. Results may change for students with lesser reading abilities.

RECOMMENDATIONS FOR FURTHER RESEARCH

The problem of predicting which medium is most effective and which is most enjoyable for an individual student must still be extensively investigated. Neither reading achievement nor media preference were shown to be effective prognosticators for media use recommendations. It is suggested that media tests be developed which measure directly how well a student learns from various media and how favorable the

student's attitude is toward the experience of learning from given media. If effective tests were developed, they would be invaluable to the media specialist and the educator in providing guidance to individual media users.

In addition, further research is needed to isolate the influences of message codes and media-message components toward creating media which promote effective learning and favorable attitudes toward the learning experience.

SUMMARY

The educational effects of five media presentations were experimentally investigated with sixth grade middle school students. Measures of media preference, learning from media and attitude toward the script learned were statistically analyzed in relation to the five media presentations, two reading achievement levels of the students, and two different scripts. Results were traced to the media-message components of the media presentation. Media-message components consist of the audio or visual sensory mode of presentation which can include graphic or projected still or motion visuals, coupled with the primary synthetic or linguistic code of the message.

The opinion that students prefer to use the medium best for their own educational needs was not supported by this research. The negative correlation between student preference and resulting learning and attitudes was best demonstrated by the print/sound presentation which was low in preference but resulted in effective learning and favorable attitudes toward the learning experience. Because of this result it should not be assumed that educators should dictate choices to students.

Rather, it is suggested that students are able to recognize when they are learning effectively from a medium only after they have used it.

Results of this research should help to dispel the print orientation which is still maintained by a few librarians and educators. All media tested were at least as effective in promoting learning as print alone. Audiovisual media not only promoted learning more effectively than print, but also promoted a more favorable attitude toward material learned than did print. Results also suggest that additional research be conducted on media-message components to learn more about effects of components in various combinations.

The five media presentations used in the study were print, verbal sound, print/pictures, print/verbal sound, and pictures/verbal sound. The five presentations consisted of three components: print, verbal sound, and pictures. The components were presented singly or in combination in a uniformly controlled consistent environment.

Results indicated that only one media presentation, pictures/sound, was consistently high for all three measures: high in student preference, high in effectiveness of promoting learning, and high in encouraging a favorable attitude toward the material learned. Another presentation, print/sound, was found to be high in effectiveness of promoting learning and high in the resulting attitude toward the material learned but low in student preference. As results of this study in regard to the print/sound presentation do not concur with results of previous research, this medium can only tentatively be given a high recommendation until future research supports or conflicts with these findings. Noting that the two most effective media included in the verbal sound

component in conjunction with either a picture or print visual component, suggests that the verbal sound component may be highly desirable to combine with visuals to promote effective recall learning and a favorable attitude toward material learned. It should also be noted that verbal sound by itself promoted neither effective learning nor a favorable attitude toward material learned for average scores. However, high individual scores were obtained from each of the five media presentations. This fact supports the inclusion of a wide variety of media in a media center collection to meet individual differences.

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APPENDIX I

TESTING INSTRUMENTS

A. Media Preference Test

Before students were given the media preference test, this opening statement was used as a means of gaining the students' confidence and cooperation.

"I am conducting a study in cooperation with the Madison public school system. We nee your help so we can find out what kinds of library media you like best and what you learn from best. Right now you will be given a media poll so you can tell us what media or kinds of material you would choose to use in an IMC. Next you will learn a story from one kind of material, and last we will give you two sets of questions to answer. We hope your answers will help us to make the IMC's more enjoyable and useful for you. So we want you to answer the questions as truthfully and accurately as possible."

A. Media Preference Test

MEDIA POLL

This poll gives you an opportunity to indicate how well you like different types of library media. You may indicate how well you like the media by ranking the five choices from one to five. Write one (1) by your first choice, two (2) by your next choice and so on down to five (5) for your last choice.

EXAMPLE: During winter vacation I like to do these activities:

_____ Toboggan

_____ Travel

_____ Ice Skate

_____ Rest

_____ Ski

Media poll: write the number of your choice in the blanks below.

_____ READ: read a book or printed words.

_____ LISTEN: listen to a tape recording of words.

_____ VIEW/READ: view picture slides with printed words describing the pictures.

_____ VIEW/LISTEN: view picture slides with tape recorded words.

_____ READ/LISTEN: read a book while listening to tape recorded words.

B. Media Learning Performance Test for Script .:

American Indians of the Plains: How They Lived

Directions:

"I will read each question aloud twice. Write your answer below the question after you have heard it read at least once. Try to answer briefly in from one to five words. The words don't need to be spelled right or to make a sentence if you have the right idea. Try to do the best you can."

AMERICAN INDIANS OF THE PLAINS: HOW THEY LIVED

1. Indian women used beads for decoration. What else was used to decorate warrior's shirts?

2. What animal no longer alive in America was hunted by early Indians?

3. Why did early Indians make rock paintings or pictographs?

4. What invention made by the Indian helped him hunt better?

5. What did Indians call the horse?

6. When did Indians start using horses?

7. Indians had many uses for parts of the dead buffalo. Why was buffalo skin folded into parfleshes?

8. What was the buffalo's stomach used for?

9. What was the buffalo's neck skin used for?

10. How did the Indian use buffalo horns?

11. Name a game devised by Indians.

12. How was an Indian tribe governed?

13. When did Indians go to reservations?

C. Media Learning Performance Test for Script 2.

Directions:

"I will read each question aloud twice. Write your answer below the question after you have heard it read at least once. Try to answer briefly in from one to five words. The words don't need to be spelled right or to make a sentence if you have the right idea. Try to do the best you can."

AMERICAN INDIANS OF THE PLAINS: THEIR HISTORY

1. Why were the Spanish disappointed in Indian territory?

2. What did Spanish explorers call the buffalo?

3. What did La Salle do when he canoed down the Mississippi River?

4. Why were Lewis and Clark sent through Indian territory?

5. What did settlers call the covered wagons they took to Oregon?

6. What did a trader tell hungry Indians that led to killing of settlers?

7. What did Indians call a trail used by settlers coming to Indian territory?

8. Who was the "Glory Hunter"?

9. Why did whites win the Wagon Box Fight?

10. What Indian Chiefs fought with Sitting Bull against the whites?

11. What generals led armies defeated by the Sioux and Cheyenne?

12. What whites were even more effective than the army in making the Indians "go to the reservations or starve"?

13. Why did Indians start doing the Ghost Dance?

14. Why did Indians quit doing the ghost dance?

D. Media Attitude Test

ATTITUDE POLL

This poll is an opportunity for you to indicate how you feel about the Indian story you have just learned.

Respond to every item by circling the choice that best expresses your feelings.

You may respond by circling one of four choices: SD D A SA

SD = Strongly disagree

D = Disagree slightly

A = Agree slightly

SA = Strongly agree

As practice circle your choice for the statement below:

0. I would rather ski than ice skate. SD D A SA

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1. This was a dull story. SD D A SA
2. I learned a lot from this story. SD. D A SA
3. It was hard to pay attention to this story.

   SD D A SA
4. It was easy to follow the thoughts in this story.

   SD D A SA
5. This story wasn't as good as most stories.

   SD D A SA

6. This story got me to want to know more about Indians.

SD D A SA

7. This story took too long. SD D A SA

8. I like this kind of story. SD D A SA

Appendix II: Scripts

The scripts included in this appendix are based on the sound filmstrips produced and published in 1972 by Coronet Films, Chicago, Il. entitled:

American Indians of the Plains
How they lived

American Indians of the Plains
Their History

A. Script 1.

AMERICAN INDIANS OF THE PLAINS

HOW THEY LIVED

For many of us the name Plains Indians brings to mind images of camp cirles with warriors in shirts and leggings of deer hide splendidly decorating with beads and porcupine quills.

We see a plains village as a group of gracefully decorated teepees, the women and children of the village waiting patiently for the return of their braves.

Most of all, we see in our minds the proud hunters of the Plains racing their ponies after a herd of stampeding buffalo.

While these pictures capture the romance and beauty of Plains Indian life, we should remember that the culture they depict lasted only a short time, from roughly 1700 to 1880, less than 200 years

By 1880 almost all Plains Indians were cooped up within reservations and the free life of the Prairies which began thousands of years earlier became a thing of the past.

Before the Plains Indian [illegible], guns or iron weapons, he hunted with spears [illegible] were made of stone. Scientists have found these [illegible] in the fossilized

bones of mammoths, fur-covered ancestors of the modern elephant.

For the most part, however, these early men in America hunted animals familiar to us, such as deer, elk, and of course buffalo.

A successful Indian hunter needed great skill to get within a spear's throw of the graceful antelope, the fastest animal of the Plains.

With his primitive weapons, the prehistoric hunter had to be very brave to take on the buffalo. One way to hunt the huge animals was for the whole tribe to cooperate in stampeding a herd over a steep cliff.

Such a cliff is called a buffalo jump. Rock paintings of men and animals mingled with geometric designs can be found on some of these cliffs.

These paintings called pictographs were not made for art's sake. They were thought to be a form of magic. To an ancient hunter, a picture of a buffalo or deer with a spear or arrow drawn through it assured the successful outcome of his hunt.

Often the hunter returned empty-handed. Life was hard for the early Plains dwellers. A family needed a large hunting

territory of many square miles to sustain itself. The early nomads had to be constantly on the move following the game.

Before 1700 the Indians were primitive hunters roaming the Plains on foot. Although some tribes learned to plant corn, beans and squash, they had no horses or tools made of metal.

Before the arrival of the white man, dogs were the only domestic animals. The people of the Plains used to attach a frame made of two sticks to a large dog's back. Bundles were tied to it which the animal could drag along.

No great material culture could develop under these conditions. People lived in caves or primitive brush shelters because they had no way to transport large teepees of heavy hides and lodge poles.

The invention of a spear throwing stick, called an ablotol, was a big step forward from the crude bone and stone weapons used earlier. With it a spear could be hurled farther and more accurately than before.

A giant step forward in human development was the discovery that plants could be cultivated for man's use. Tribes now having learned to practice agriculture as will as hunting, were no longer dependent on luck in finding game and were able to settle down in permanent villages where it was much easier to accumulate material wealth.

But it was the acquisition of the horse around 1700 which almost overnight transformed the life of the Plains Indians from primitive hunters into proud, hard-riding lords of the Plains.

The Indians also obtained metal tools and firearms, first from neighboring tribes and then later from white traders who ventured into the Plains.

The horse gave rise to the typical Plains culture of the 18th and early 19th century.

The Indians, who had no name for the horse called it the spirit dog, could now hunt buffalo from horseback. Suddenly the supply of buffalo seemed limitless.

During this period the economy of the Plains Indians depended almost entirely on the buffalo. The shaggy, magnificent animals roamed the Plains in enormous herds that covered the Prairie from horizon to horizon.

The buffalo furnished the Indian with most of the things he needed for his livelihood. As soon as the animal was killed and skinned, the women busied themselves stretching, scraping and tanning its hide.

The skins furnished covering for the teepees. A small teepee consisted of eight skins. For the Chief's teepee or the

medicine lodge as many as 21 buffalo skins were used. Sixteen lodge poles were needed to support such a large teepee.

Skins were not the only part of the buffalo to be utilized. Their bones had many uses. A flesher was used to scrape hides clean. The knife was sharp and deadly; it was made from a buffalo's leg bone.

The buffalo's bladder was used as a water bag. Pieces of hide were folded into so-called parfleshes, huge envelopes in which people carried their possessions.

Extra thick pieces of skin from the neck of the buffalo were used for shields. Other parts were made into drums.

The buffalo's stomach served as a natural stewing pot. Water was boiled in the stomach which was tough enough to resist fire.

The horns were made into spoons and ladles. No part of the animal was wasted. It is almost impossible to exaggerate the buffalo's importance for the Plains Indian. It has been estimated that no fewer than 87 different articles could be made from a buffalo's body.

Life wasn't all work for the Plains Indian, however. They had time to play. They devised various sports and games such as la crosse.

They spent much of their time dancing. Most Indian dances had religious meanings, such as the buffalo dance. Performing it was like praying for a successful hunt.

Many old dances are still performed today. Indians are as fond of their dances now as they were 100 years ago.

Indian men lived in a democratic society. A man became Chief through his bravery and wisdom. He had to follow the advice of a council of old and experienced men. Obedience to him was voluntary.

Essentially the Plains were a man's world. A man risked his life every day. He might be gored by a buffalo or thrown from his horse or he might be killed in a war against an enemy tribe.

For this reason the man was not expected to work at home, and because so many men did not return from a hunt or a raid, warriors often had more than one wife. Women always outnumbered the men and the Indians believed that none of them should lack the protection of a husband or be denied the joys of rearing a family.

While men ruled the affairs of the tribe, the women ruled the teepees. A proverb said: a beautiful teepee is like a good mother; she hugs her children to her and protects them from rain and snow.

Thus domestic work was for women. They made the teepees. They also cooked meals, tanned hides, made warshirts and moccasins. They spent much time decorating the things they made, and they made sure the man was always fed first.

The life of the Plains Indians before they settled on reservations was often harsh and dangerous, but it was also full of excitement and splendor. It gave the people of the Prairie a wonderful sense of freedom which perhaps has never been surpassed.

An old Sioux chief said:

> When the Prairie was covered with buffalo, nobody was hungry.
>
> Without jails, we had no crime.
>
> Without locks and keys, we had no thieves.
>
> Without written laws, we had order.
>
> Without fences and barbed wire, we were free.

B. Script 2.

AMERICAN INDIANS OF THE PLAINS: THEIR HISTORY

In the far North near the Arctic Circle, America and Asia almost touch. Here, many thousands of years ago, men crossed in search of a better land in which to hunt and fish. These men were the ancestors of the American Indians.

Spreading out over the continent after many generations they arrived on the Great Plains.

Skillfully made spearheads have been found with the bones of extinct animals, proof that man inhabited the Great Plains at least 10,000 years ago.

The Spaniards, searching for gold, came to the new world in the 1500 s. Indians interested them only for plunder or as slaves.

The first white man known to have entered the land of the Plains Indians was Coronado. Looking for the fabled seven sities of gold, he instead found the Pieblo villages of the Zuni and then those along the Rio Grande River.

Not finding any fold, Coronado and his men marched north, penetrating the plains of what is now Kansas, finding villages of grass huts belonging to the Wichita Tribe.

They were also the first white men to encounter buffalo, which they called Indian cattle.

During some of the early Spanish expeditions, some horses escaped from their European masters and in the course of time formed large herds of wild mustangs. The importance of the acquisition of the horse to the Indian cannot be overstressed. It transformed him from a slow-moving wanderer into the swift proud horseman of the Plains.

It was the French and the English who discovered that there was gold in furs, and that the Indians would trade a valuable pelt for a few shiny glass beads.

Traveling in canoes, the exp dition of Messieur de La Salle sailed down the Mississippi River late in the 17th century establishing a string of trading posts reaching from the Great Lakes to the Gulf of Mexico.

Traders following in La Salle's footsteps brought rifles, thread, sewing needles and knives and blankets which they traded for furs.

Late in the 18th century a new kind of hat made of beaver fur became popular in Europe. As the price of beaver pelts skyrocketed, more white trappers than ever before ventured into the Western Plains where they could obtain the desired furs.

These so-called mountain men were mostly Americans. Although trappers and Indians were after the same thing, beaver skins, the red man could get along with the trapper who lived and dressed like an Indian and often married an Indian woman.

In 1804 President Jefferson sent Lewis and Clark to find a route to the Pacific Ocean. The explorers needed the help of a brave 16-year-old Shoshone woman, Sacagawea. Carrying her newborn baby on her back, she was the expedition's guide and translator.

Lewis and Clark gave Americans a better knowledge of the Plains Indians. They described the various tribes and mapped their territories at the beginning of the 19th century.

At first only a handful of trappers had ventured beyond the Missouri. But starting in the 1840s mounting waves of white settlers on their way to Oregon rolled across the Plains. They traveled in covered wagons called prairie schooners.

After them came the 49ers, miners on their way to the newly discovered gold fields of California.

To protect the travelers from unfriendly Indians, the army built a number of forts from which the soldiers controled the surrounding plains. Some gold seekers and settlers changed their minds about going on to the West Coast.

Instead they settled down near forts in Colorado and the Dakotas.

Some tribes, such as the Sioux and Cheyenne, decided to fight for the land they were losing. One chief said: "They told us they only wanted a little land, as much as a wagon could take between its wheels. You can see now what it was they wanted.

Other tribes reckoned that they would do better if they helped the whites. Among these were the Crow, the Arikera, and the Shoshone. Disunity among the Indians helped the white sonquerors.

The battles between whites and Indians who defied the white man's authority are generally well known and resulted in atrocities on both sides.

In 1862 when the Sioux waited in vain for food supplies promised by the government, a trader told them to "eat grass". Grown angry, the starving Indians killed many settlers and stuffed their mouths with grass.

Following their attack on the settlers, 38 of the Sioux were hanged in reprisal.

And when a U.S. Army Colonel, S. M. Chittington, attacked a peaceful Cheyenne village, he told his troups: "Kill and scalp all, big and small. Niffs make life." By this he

meant that it was smart to kill little boys before they could grow up to fight back.

In 1865 the great Sioux Chief Red Cloud tried to halt the construction of a new road through Indian territory. This was the Bowsman Trail. The Indians called it "thieves road", knowing that it would bring more settlers and miners to steal their land.

Determined that the road building should go on, a hot-headed army captain, William Fetterman, said: "With 80 men I could ride through the whole Sioux nation." Fetterman had exactly 80 men when he and his entire command were wiped out by warriors under Red Cloud and another famous Sioux Chief, Crazy Horse.

The Indians had won a victory. But the soldiers then obtained a new kind of rifle that could shoot five times as fast as the Indians' older models. With the help of this weapon, the soldiers killed many Indians during the so-called Wagon Box Fight.

Soon after, a new figure appeared on the Plains, Colonel George Armstrong Custer. This is how one writer described him: "His broad sombrero turned up, his golden locks dangling to his shoulders, a pistol in his boot and a ponderous sword at his side, so rode the wild daredevil with his pack

of 30 dogs braying at his heels."

Custer was nicknamed the Glory Hunter. In the winter of 1868, he surprised a village of peaceful Cheyenne killing hundreds of Indians. The Cheyenne had been flying a large American flag, but it proved to be no protection.

The Black Hills of South Dakota were sacred to the Indians as the dwelling place of their gods. Custer led an expedition into the Black Hills in violation of treaties made with the Indians. Soon the general sent back word: "There is gold in the grass roots."

The gold rush was on. The Indians saw their last hunting grounds overrun. The free life of the Plains Indians was coming to an end. They were told to settle on reservations or die.

In 1876 Sitting Bull, not a war chief but a great spiritual leader, rallied the Sioux and Cheyenne for one last battle saying: "The Great Spirit did not make me a reservation Indian."

In this battle, three army columns converged upon the Indians. One led by General Crook met the Indians at the Rosebud River. The great warrior Crazy Horse led the braves shouting: "It's a good day to die." Crook was defeated and returned to his base.

Now it was Custer's turn. The Glory Hunter had been told to wait for the third army column commanded by General Terry, but instead he attacked as soon as he found the Indians encamped along the Little Bighorn River.

Custer had been lured into a trap. Suddenly a mass of red horsemen led by Crazy Horse, Gaul and other chiefs rode over Custer and his men. There were no survivors. This fight is called Custer's Last Stand, but in reality it was the Indians' last stand.

For the whispering wire and the iron snake, the telegraph and the railroad, soon criss-crossed the Plains making Indian resistance to the white man hopeless.

The buffalo was disappearing. General Sheridan said: "The buffalo hunters have done more to settle the Indian question than the entire regular army. They are destroying the Indians' commissary. They have to go to the reservations or starve."

Chief Joseph of the Nez Piercé Tribe summed up the Indians' plight: "I am tired of fighting. My man are dead. The little children are starving. My heart is sad. From where the sun now stands, I shall fight no more forever."

Great chiefs and warriors became circus performers in Buffalo Bill's Wild West Show as the hunting days came to an

end. The first years on the reservations were hard. The soil was poor and rations were often late or insufficient.

In 1890 a prophet from the Piaute Tribe preached a new belief called the Ghost Dance Religion. It was to bring back the dead Indians and slaughtered buffalo. The Ghost Dance spread quickly from tribe to tribe.

Many whited falsely believed that the Ghost Dance was the signal for a major Indian uprising. At wounded Knee, South Dakota, a band of ghost dancers were surrounded by soldiers of Custer's old regiment. In the massacre which followed over 200 Sioux, mostly women and children, were killed.

Wounded Knee was the end of one chapter in the history of the Plains. But it was not the end of the Plains Indians. Today they are busy writing a new chapter of how to be part of modern America while remaining true to their old proud heritage.

APPENDIX III: Sample Size and Power Calculations

A. Using a formula developed by Levin, Walster and Cleary to find sample size based on a Z (normal) distribution, an approximate sample size was calculated.

Formula A: $$n = \frac{\sum_{k=1}^{k} a_k^2 \, [z_{(1-\alpha)} - z_\beta]^2}{\psi_\sigma^2}$$

where: $\sum_{k=1}^{k} a_k^2 = 2$, the sum of coefficients for a contrast of two means,

$z_{(1-\alpha)} = z_{(.95)} = 1.96$, the cumulative probability for $\alpha = .05$

$z_\beta = z_{(.10)} = -1.282$, the cumulative probability for $\beta = .10$

$\psi_\sigma = .58\sigma$, the difference between two means the researcher wishes to detect.

B. As the F test is not based on the z distribution, n was increased to 64 and a variation of a formula found in Kirk, p. 107-109 was used to ascertain the power of the F test for n = 64.

Formula B: $$\phi = \sqrt{n}\sqrt{\frac{\psi_\sigma^2}{2(v_1 + 1)}}$$ for contrasts of pairs of means

$$\phi = \sqrt{64}\sqrt{\frac{(.58)^2}{2(2)}} = 2.32$$

Reading from Table D.14 in Kirk, p. 540:

ϕ(for $\alpha = .05$) = 2.32 gives a power of .90

Further calculations were conducted to determine power at lower differences between means to see whether trivial differences were likely to be detected.

Relations between power and difference of interest that can be detected between pairs of means are shown below:

Difference of Interest	Power $1 - \beta$	Calculation Formula
.58σ	.90	B
.35σ	.50	B
.30σ	.40	B
.12σ	.10	A

As the split-plot analysis of variance (ANOVA) design used for analysis of learning data was more conservative than the 3-way ANOVA design for which these calculations were conducted, it is unlikely that trivil differences of less than .2σ could be detected.

APPENDIX IV: Scores Collected For The Three Testing Instruments

A. Students Responses on The Media Preference Poll

1. In parentheses find the number of students who chose each ranking for each media choice of the total 320 students.

PRINT:	1(161),	2(46),	3(30),	4(35),	5(48);	ΣR = 723
SOUND:	1(29),	2(79),	3(83),	4(79),	5(50);	ΣR = 1002
VIEW/READ:	1(19),	2(47),	3(85),	4(92),	5(77);	ΣR = 1121
VIEW/LISTEN:	1(91),	2(92),	3(71),	4(53),	5(13);	ΣR = 765
READ/LISTEN:	1(19),	2(57),	3(52),	4(60),	5(132);	ΣR = 1189

2. Each five digit set of data listed below constitutes the five choices of one student. For example, 15433 shows this student ranked media in the following order: Print - 1, Sound - 5, View/Read - 4, View/Listen - 3, and Read/Listen - 2.

15432	14325	23415	14325	45312	32415	12435
45312	53421	15324	42135	15342	13524	15234
15432	13542	12435	24135	42315	13245	21534
13425	12543	54312	34215	15324	24513	34215
51324	32415	41325	53214	15423	12543	52314
13542	15342	13245	53214	15324	15432	51324
12345	12534	45312	23514	12453	42315	54132
31425	13425	12345	21435	15432	53214	54312
14325	12345	54213	13254	54213	23415	53214
14532	13524	13524	31524	43125	12543	54321

12435	14325	25431	35241	43215	15432	42315
34125	13425	14523	12435	12435	32415	13425
23415	13542	12435	42351	13542	13425	32415
12354	14532	12534	54312	21354	43215	54312
12435	34125	42531	54321	14523	14523	13524
35412	24315	23415	21435	12543	15342	15432
53214	14325	14523	53214	35241	24315	21345
51234	14253	15234	13425	21345	12435	52413
12534	14523	14325	13425	14532	13524	43125
12435	14523	13542	12543	12435	14532	54312

15342	13542	12435	14325	13425	15432	32415
52314	12534	52341	41523	13542	12543	14253
23514	14523	15432	15243	15432	12435	53214
13425	43521	13452	54312	13524	14235	14325
43512	14325	13425	14325	12453	23514	34521
52413	42513	13542	51324	15243	32415	54213
25143	31425	12345	52314	14325	43512	15342
52314	13245	34215	42135	13245	52413	12534
52314	12543	13425	14532	14325	34215	13524
43215	14235	12534	15234	15423	32415	12435

45312	51324	15423	23514	14532	13245	23415
25431	54312	13425	15342	32514	13524	24315
24531	54312	41325	14325	14325	12534	12435
13524	24135	34512	43215	14325	34215	51324
15432	23415	12435	54213	12453	12354	21543
41532	43215	15423	13425	45213	25413	25134
23415	15243	13542	14235	34521	14325	54132
34125	41523	25431	43521	51234	15342	21435
12453	43215	32415	15324	15324	12435	54312
45213	12543	23514	34521	13524	21435	32514

14325	25143	52143	32514
54123	23541	23145	51423
21345	45312	23145	34215
12435	13425	54213	13425
21435	23514	23145	41325
23415	12345	54312	15432
14325	12435	14325	52413
12543	23415	14325	13452
24315	12435	51324	12345
42315	12435	23415	43521

B. Student Scores on the Media Learning Tests

1. Individual raw scores in appropriate research design cell for 3 way 5 × 2 × 2 analysis of variance.

Reading Achievement	Script	PRINT 1		SOUND 2		PRINT/ PICTURES 3		PRINT/ SOUND 4		PICTURES/ SOUND 5	
1	1	11	6	10	5	9	7	11	6	12	8
		10	5	9	5	9	7	10	6	11	8
		9	5	9	5	8	6	10	6	11	8
		9	4	8	4	8	6	10	6	11	8
		8	4	6	3	8	6	8	6	10	8
		7	4	6	3	7	5	8	5	10	7
		7	4	6	2	7	5	8	5	9	7
		7	3	6	2	7	1	6	5	9	5
1	2	13	8	13	7	13	7	12	10	12	8
		11	8	12	7	12	7	12	9	11	8
		10	6	11	6	12	6	11	8	11	7
		10	6	10	5	12	6	11	7	10	6
		9	5	10	5	10	4	11	7	10	4
		9	4	9	3	10	4	11	5	9	4
		8	3	8	3	10	1	10	5	8	4
		8	3	7	1	9	1	10	5	8	4
2	1	10	4	9	4	9	4	9	4	10	5
		10	3	7	3	7	4	8	4	9	4
		9	3	7	3	7	3	7	3	9	4
		6	3	6	3	6	3	7	3	8	3
		5	2	6	3	6	1	6	3	6	3
		5	2	6	2	6	1	5	3	6	3
		4	0	5	0	5	0	5	2	5	2
		4	0	4	0	4	0	5	2	5	1

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(table continued)

Reading Achievement	Script	PRINT 1	SOUND 2	PRINT/ PICTURES 3	PRINT/ SOUND 4	PICTURES/ SOUND 5
2	2	6 1 6 1 5 1 4 0 3 0 3 0 3 0 1 0	11 2 10 1 8 1 7 1 5 1 5 0 4 0 3 0	8 4 6 4 6 3 5 1 5 1 5 1 4 0 4 0	11 6 10 5 9 5 9 3 9 3 8 2 8 1 7 1	11 4 11 3 9 2 9 2 6 1 5 1 4 0 4 0

Script 1: $\bar{x} = 5.756$, S = 2.757 n = 16

Script 2: $\bar{x} = 5.843$, S = 3.736 N = 320

2. Individual raw scores in appropriate research design groups for a split-plot analysis of variance design analyzing treatment main effects and treatment by reading achievement interaction effects.

Media Presentation	Script	Group	Reading Achievement 1	Reading Achievement 2
1	1	1	11,10,5,3	9,5,4,4,3
		2	9,6	4,3,2,0
		3	8,5,4,4	10,6,3,2
		4	9,7,7,7,4,4	10,5,0
	2	5	13,9,8,4,2	6,0,0,0
		6	8,3	3,3,1,1,1
		7	11,10,9,3	6,5,0,0
		8	8,8,6	4,3,1
2	1	9	6,3,2,2	9,6,5,3,0
		10	10,6,3	6,3,3
		11	8,5,5,4	7,7,3
		12	9,9,6,6,5	6,4,4,2,0
	2	13	11,10,7,5,5	5,1,0
		14	12,7,1	11,8,7,2,1,0
		15	8,6,3	4,3,1,0
		16	13,10,9,7,3	10,5,1
3	1	17	8,8,7,5	4,4,1,0,0
		18	9,7,7	6
		19	7,7,6,6,5	5,1
		20	8,1	7,6,3
		21	9,6	9,7,6,4,3
	2	22	10,7	4
		23	13,4	8,0
		24	12,10,9,6,1	6,4,3
		25	12,4	6,5,5,4,1,1
		26	12,10,7,6,1	5,4,1,0

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Media Presentation	Script	Group	Reading Achievement 1	Reading Achievement 2
4	1	27	6,6,6,5	8,6,3,2,2
		28	10,10,10,6,6	7,4,4,3
		29	11,8,8,6,5	9,7,5
		30	8,5	5,5,3,3
	2	31	10,10,8,7,5	7,7,6,5,1
		32	12,12,5	11,3,3
		33	11,11,11	8,8
		34	7	9,5,2,1
5	1	35	9,7	4,3,2
		36	11,8,5	9,3
		37	11,10,9	8,5
		38	12,8,8,7	10,9,5,1
		39	11,10,8,8,6	6,5,5,4
	2	40	12,10,4,4	11,4,4
		41	11,9,8	9,3,0,0
		42	10,8	5,2
		43	10,8,4,4	11,9,1
		44	11,8,7,6	6,4,2,1

Reading Achievement: 1 = High
2 = Low

Script: 1 = How They Lived
2 = Their History

Media Presentation: 1 = Print
2 = Sound
3 = Print/ Pictures
4 = Print/ Sound
5 = Pictures/ Sound

C. Attitude Scores

Individual Raw Scores on attitude test in 5 × 2 × 2 Research Design Format

		MEDIA PRESENTATION MODE				
Reading Achievement	Script	Print 1	Sound 2	Print/ Pictures 3	Print/ Sound 4	Pictures/ Sound 5
1	1	29 18 28 18 26 18 23 17 22 15 20 14 20 14 20 13	26 18 25 17 24 16 19 16 19 15 19 15 19 13 18 8	31 20 28 20 26 19 26 19 24 16 23 16 22 15 21 14	31 22.5 30 22 29 20 29 20 27 20 27 19 25 16 24 16	32 21 31 21 30 20 29 19 27 19 26 17 23 15 23 13
1	2	28 21 28 21 26 21 26 20 25 18 25 16 25 14 24 13	25 22 25 19 25 18 24 15 23 14 23 14 23 13 22 12	31 23 30 22.5 28 22 28 20 25 16 25 15 25 13 25 10	31 24 30 22 28 22 28 22 27 18.5 27 17 26 15 26 13	30 22 29 21 29 21 28 19 27 16 26 15 25 13 24 12
2	1	29 20 26 19 24 18 24 17 24 17 23 15 22 14 20 11	32 21 28 21 27 20 26 19 25 18 25 17 22 14 21 14	26 19 24.5 19 23 16 23 15 23 14 22 14 20 13 20 11	28 23 27 22 27 22 26 22 26 21 26 18 25 12 25 10	31 23 31 23 30 22 28 21 27 20 25 17 25 15 23 11

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(table continuation)

Reading Achievement	Script	Print 1	Sound 2	Print/ Pictures 3	Print/ Sound 4	Pictures/ Sound 5
2	2	30 16 26.5 15 25 14 24 12 23 10 18.5 10 18 8 18 8	27 17 26 15 24 14 23.5 14 22 13 21 13 19 9 18 9	26 19 24 19 23 18.5 23 18 22 18 22 16 21 16 21 13	31 24 29 23 28 20 28 20 28 20 25 17 25 17 24 12	32 17 29 17 28 15 28 14 24 14 21 14 20 13 17 13