ABSTRACT

THE EFFECT OF PHOTOGRAPHIC PRODUCTION ERRORS IN THE VISUAL TRACK OF A MULTI-SENSORY PROGRAM FORMAT ON COGNITIVE LEARNING

By

Bruce Leslie Miles

An important activity of many media specialists and virtually every person involved in the process of teaching or the management of learning, is the design, production, and delivery of instructional messages. Frequently such messages are multi-sensory in design.

Precisely how to consistently deliver a viable instructional product is a dilemma which suffers from a recognized paucity of empirically derived guidelines. Thus, the design and subsequent production of such messages is accomplished largely through procedures suggested by tradition, intuition, or experience.

One production aspect which seemingly remains unresolved concerns the relationship between technical quality in the visual channel of multi-sensory modalities and cognitive learning outcomes. This is especially true when the audio channel is the primary message source. Traditionally, the most frequently used guideline suggests that poor technical quality interferes with cognitive learning.

However, other research dealing with channel relationships, information processing, and visual information levels, suggests that such a position might not be intrinsically true, but rather conditioned by other factors including audience characteristics, the learning task, and subject matter.

This study was undertaken to investigate the effect of commonly observed production-type errors on cognitive learning. The test vehicle was a slide tape program rendered in cartoon style and the content, largely unfamiliar to the subjects, was an introduction to an instructional development model. A population of undergraduate education students at Michigan State University viewed one of four versions of the program which varied only in the number of errors present. The experimental control was a no-error version. It was hypothesized that production errors would be observed and that interference from such errors would result in decreased learning as the number of errors increased.

Analysis of variance was performed on the data and yielded a significant difference between groups on error perception. Although all treatment groups scored lower than the no-error control group and there was a trend toward positive correlation between the number of errors and recall scores, differences were not statistically significant.

The obviousness of the errors undoubtedly contributed to the highly significant finding on error perception. Population size, statistical design, channel configuration, and the reliability of the cognitive instrument may have influenced the finding of no significant difference on the learning hypothesis.

Suggestions for future research include replication of the study using more subjects, refined instrumentation, and exposure of treatment groups to increased numbers of errors. Additional suggestions include a version of the study to investigate common presentation (projection) errors; one using different subject matter; and a covariate study investigating audience characteristics, error perception, and recall. It is strongly recommended that research be continued in the general area.

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B.L.M.

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CHAPTER I

INTRODUCTION

Purpose of the Study

The purpose of this study is to determine if photographic production mistakes in the visual information track of a slide tape program have any effect on cognitive learning as measured by immediate recall of audio and visual channel information.

The visual track of a professionally produced cartoon style slide tape presentation was degraded to include common mistakes--hereinafter referred to as production errors or simply errors--which may occur during production of conventional 35 mm (2 X 2) color slides. The four error types selected included misspelled words, poor or incorrect exposure, focus, and copy techniques. Three experimental groups were exposed to one of three versions of the presentation which varied only in the number of production errors involved. These were compared to a control group which viewed a version without errors. Each treatment group was subsequently compared to each other treatment group.

The study specifically tested the following hypotheses:

1. Viewers will show evidence of having observed production errors in the treatment versions.

2. The effect of production errors will be to lower cognitive learning as measured by immediate recall.

3. The effect will be inversely related to the number of errors observed.

This study was performed on a group of 59 undergraduate teacher education students enrolled in Education 101A, Introduction to Elementary Education, at Michigan State University during fall quarter, 1973.

The Nature of the Problem

The essence of the problem is whether or not photographic production errors in multi-sensory instructional materials negatively influence the amount of cognitive learning derived from such materials and, if so, to what extent. In effect, the entire instructional materials industry has operated on the principle that productions had to be completely accurate and technically perfect if satisfactory learning results were to occur.

The distinct possibility that this cornerstone of instructional media has been accepted under circumstances which are empirically suspect motivated the investigation. It seems quite clear that important pedagogical and economic considerations are involved.

From an historical perspective, instructional media--the large and expanding collection of sensory stimuli including photographic materials--owes much of its existence to the photographic technology--a technology less than 150 years old. Unsure of the value of their discoveries, certainly unaware of future applications, early technologists could only speculate that the photograph might become useful and popular (Life, 1966).

Clearly the photograph did become useful--and popular--and somewhat of an enigma for as applications were discovered and proliferated, people came to attach great significance and value to the visual image. While in many ways this was justifiable, man's predisposition to assign pictures an intrinsic goodness in no small measure contributed to his parallel success in endowing photographs and pictures with values which came dangerously close to constituting a mythology--a mythology which in many ways persists to this day and in essence held that pictures were good <u>because</u> they were pictures. Characterized some years later by those many persons who strongly believed that "a picture is worth a thousand words," it was simply assumed that pictures would be even more powerful if combined with other information channels.

For whatever reasons, there were those who found it impossible to accept the attributes assigned to photographic materials from such an apparently naive and illogical information base. While admittedly speculative, the motivation to question the nature and values of the photographic medium may have resulted from the realization that research efforts to provide badly needed factual information were being restrained by tradition and even emotion. Thus principles of design and use slowly emerged to become part of the body of knowledge associated with instructional media.

It is unfortunate that tradition and assumption have played such major roles in the formative years of visual communication for certain residual effects may remain as deterrents to progress and needed research. There is also the probability that many of the principles which have evolved are not principles at all but rather are, according to Travers [1967] "based largely on practical experience rather than on research" [p. 17]. There is no intent to deny the value of experience as an adjunct to research. However, in a real sense many of the new "principles" have combined to form what is essentially a new mythology and thus within recent history can be found the interesting paradox of one mythology evolving to counter the effects of another.

For whatever reasons, a research effort evolved and some important issues have been resolved. Representative of those topics which have not received adequate attention and thus remain largely unresolved is the concern--or lack of concern--for the effect of the technical quality of visual materials used in multi-sensory formats on cognitive learning outcomes. Traditionally, the field has voiced support for the seemingly logical production and use guidelines integral to a point of view often--but not exclusively--associated with Eastman Kodak [1967]. Essentially this position holds that:

> Visuals should always be technically flawless with professional caliber art and photography. Sloppy art work, improper exposure, glare, poor color balance, finger prints on the slides, all detract from the effectiveness of your message [p. 20].
>
> Be accurate. If your audience catches you on one small error, they will be looking for mistakes in each visual that follows, and will not be giving full attention to the presentation [p. 16].

It is virtually impossible to estimate accurately the number of people who actually practice this philosophy in their own production activities or recommend it to others via publications and teaching. Conceivably it may constitute a majority of those considered to be media specialists for seldom does one find public advice to the contrary. It can be speculated with some degree of assurance that adherents either believe or assume that the position is based on scientific research. In fact, however, little research evidence has been found which supports the Kodak position and thus there is reason to suspect that what is held by many to be a principle of visual design and use is not established in research but rather in assumption based largely on opinions and past practices. This suspicion has been reinforced in conversations with leading visual communication authorities including John Debes who speculates that what might be called the "Kodak position" is probably the well intended result of the cumulative consequences of practitioners reporting their own practices--what things worked and what things did not work.

The foregoing is important in that it establishes reasonable cause to question the validity of the position. There remains the possibility that the position is correct.

A key concern of this study undoubtedly involves communication or stimulus noise--production errors which Kornog and Rose [1967] define as "any condition in the stimulus or subject that tends to degrade viewing performance (e.g., blur, glare, stimulus errors . . . etc.)" [p. 456]. As such, it has long been known and subsequently reinforced that this phenomenon interferes with the communication process [Shannon and Weaver, 1949; Berlo, 1960]. Although of a somewhat different nature, the importance of physical clarity of visual materials has much support in research [Seibert, Kasten, and Potter, 1959; Spooner, 1973], and adds to the believable nature of the guidelines suggested by Kodak.

In this event, the present study will serve to reinforce what many already believe and practice. If incorrect, appropriate behavioral modifications can be suggested. In either event, research evidence will substitute for tradition. There is, however, another important aspect involving the "other" group--unknown numbers of teachers and students who are not even aware of the existence of this question or of its implications.

While at one time interest in the production of visual materials was primarily the province of the professional producer or media expert, this has changed. Recently there has been an explosive growth in the number of institutions and individuals who, at one level or another and with varying degrees of skill, produce and use visual materials of some complexity in the communication, teaching, and learning processes. This group of producers may include thousands of instructors and students. In no small way great increases in production and the number of producers have been motivated by the proliferation of instructional media programs, the growing visual literacy movement, the ubiquitous camera and cassette tape recorder, and, of great importance, a realization on the part of many professional educators that visual communication should be incorporated in programs which have historically focused primarily or exclusively on verbal materials.

Something of the implications resulting from the "Kodak position" may now be perceived. As perception grows, some of the consequences are also revealed and it becomes painfully clear that the problem has many crucial dimensions--both pedagogical and economic. The problem is a product of history and has been perpetuated by tradition. Whether or not the "Kodak position" is "right or wrong" is of far less consequence than determining what is empirically defensible for it seems all too apparent that a significantly large segment of the educational community is following erroneous and perhaps harmful educational practices.

<u>Need for the Study</u>

Essential to the present investigation is the concept that the design and production of instructional materials may be perceived as a syntax of critical interacting elements which serve to enhance or lessen the probability that a given message will be encoded, transmitted, decoded, and perceived as the communicator intended. It has long been accepted that "The design of messages (audiovisual) implies certain aspects of production" [Ely, 1963, p. 28]. Thus defined, technical matters, including production errors, are design considerations and as such this study will contribute to documented needs at several levels as suggested below.

1. Much of the existing visual design and communication theory has been experientially derived and is of questionable validity. General principles must be research-based and a concerted effort made to quantitatively expand the base.

2. Instructors, administrators and media specialists lack research-based guidelines which are needed to help them in day-to-day production and use of instructional materials.

3. In view of growing recognition that each visual medium has unique characteristics, values, and limitations, there is need to expand research efforts within specific modalities.

4. Within the specific modality under investigation are economic and pedagogical ramifications of some immediate consequence.

Agonizing as it may seem to those who plan, design, produce or otherwise use instructional materials, it must be observed that far too few decisions and procedures are based on experimentally derived guidelines. As reported earlier, Travers [1967] offers evidence to suggest that tradition and experience often substitute for research in deriving audiovisual theory. Much the same situation may be observed in practice. While attempting to derive guidelines which could be systematically applied to the design of instructional materials, Travers [1967] visited four producers of acknowledged professional competence and found evidence which "made it absolutely clear that there was no agreement among the four concerning principles that should be followed in the design of such materials" [p. 9]. It may be speculated that personal or corporate experience prevails.

Many other investigators acknowledge a similar paucity of research evidence. For example, Bourisseau, Davis, and Yamamota [1967] observe that:

> The comfortable and respectable notion that pictures have a greater sensory appeal than verbal stimuli [represented by printed words] has long suffered from an absence of evidence from solid empirical research. Nevertheless, this belief has persisted and served as a guide to theory and practice concerning the use of audiovisual materials [p. 259].

Even such a relatively contemporary subject as channel capacity is not immune from the influences of tradition and experience. Severin [1967] notes that "over the decades, the combination of channels has been accomplished with no theory and few rules to guide it, and the products have varied greatly" [p. 400].

Unquestionably, the process by which theory is derived has improved markedly in recent years. However, such comments are relevant in that they provide a general historical referent for a problem which has resulted from principle formulation procedures considered to be something less than rigorous.

Another aspect of the needs assessment involves the general theoretical foundation which must exist to provide guidelines for decision making at all levels of media design and use. Simply stated, the present base is weak and incomplete--a fact attested to by a host of writers including such respected persons as Miller [1957], Lumsdaine [1963], Travers [1967] and Dwyer [1970]. The importance of basic research is clearly outlined by Miller [1957] in discussion involving the nature of graphic communication in education.

> The problem of discovering fundamental principles of graphic communication is a part of the general problem of the psychology of perception, motivation and learning. Discovering more about fundamental principles will help us to improve all media and should tell us under what conditions one medium will be superior to another [p. 61].

Conceptually, graphic communication is probably viewed somewhat differently today, but the underlying meaning and intent of Miller's observation is no less viable.

Fundamental theory is of great importance and relevance not only to visual communication but to the instructional media field in general. It seems clear that much remains to be accomplished. However, from a different perspective--that of those who must regularly design, produce and use instructional media--research has limited influence and results in very few helpful guidelines.

A highly representative example of the lack of consistent guidelines can be distilled from the contributions of Hsia [1968, 1969, 1971] directed at channel effectiveness. The discussions and controversies surrounding the topic of channel effectiveness are not atypical and demonstrates the changing and vacillatory nature of research findings.

Which channel is most effective--or does a combination of channels work best? Over relatively short time spans the literature suggests that the visual channel exceeds the audio channel in instructional potency, the audio channel is superior to the visual channel, a combination of channels is superior to both and finally, channel combination is often inferior to either channel alone.

It may be fairly said that the resulting indecision produces frustration which invades the senses of media specialists, teachers and administrators for at one moment it appears that consensus nears and then new information is discovered which causes the original position to be suspect. Progress is frustratingly slow and the resultant collection of new and stable information becomes even slower as perceived by those who wish to use visual communication efficiently and effectively. In essence, practical guidelines have not materialized. Why something works or does not work, that something is correct or incorrect is more relevant and usable.

In a frequently quoted supplement to Audiovisual Communication Review devoted to graphic communication, Miller [1957] states that "Learning is not inevitable. In order to produce efficient learning, good material must be used in the right way" [p. 61].

While "good" and "right" may be perceived as somewhat platitudinous terminology, in the context of discussing the need for research in graphic communication Miller [1957] exposes in a fairly straightforward manner concerns which continue to plague media professionals in their search for a prescriptive science of media design and use. What is good material? How is good material recognized? How can good material be consistently produced and, what constitutes proper or correct use?

Implicit in the above statement is the suggestion that there are answers to what is "good" and what constitutes correctness of delivery. Progress has been made since 1957 but it becomes increasingly obvious that added impetus must be given to the quest for design and use guidelines for educators, media specialists, even commercial producers are forced to make critical pedagogical and economic decisions in the absence of guidelines or on evidence which, at best, may be of questionable value.

From the preceding discussion it may be speculated that there is need to provide real-world guidelines for application in teaching and learning within the walls of thousands of educational institutions. Meierhenry's [1962] exhaustive analysis of research into the educational applications of media tends to support both the lack and the need for practical guidelines. The review indicates "that to give teachers and administrators better recommendations for the use of specific media much more needs to be known" [p. 307].

From the writings of Moore and Sasse [1971] comes additional support. Discussing the relatively new concept of visual literacy they write:

> It appears that the limited research available in visual literacy is insufficient to satisfy the increased interest of educators in the subject. Teachers are seeking practical information concerning projected still images as well as challenging traditionally accepted audiovisual approaches in educational presentation [p. 438].

There has been no intent in the preceding discussion to suggest that research into theory is of questionable value. Rather, the argument underlies the belief that current needs are such that research must be pursued at different levels simultaneously. In light of the fact that multi-sensory materials exist in vast quantities and because such materials are used in ever growing numbers and frequency by both teachers and students, there is pressing need for accurate guidelines to be developed with dispatch.

Accomplishment of this goal may be partially realized through efforts to expand the information base as it relates to specific modalities such as the slide tape format. There is a long and thoroughly documented history of research which has focused attention and attempted to compare the effects of different modalities--motion pictures and still pictures, for example--on a given task. While many such studies are valuable, others have been ill advised for, as Dwyer [1972] suggests, investigations on this level often fail to consider the probability that simple comparisons across modalities are inadequate and inappropriate.

> Many studies attempt to compare the effectiveness of the various media in presenting the same information, but do not give adequate consideration to inherent capabilities and limitations (of a given format). In some instances, it would seem inappropriate to compare the effectiveness of a motion picture and a series of slides abstracted from the film in presenting the same information [pp. 79-80].

Early recognition of modality uniqueness is suggested in Miller's [1957] observation that:

> Completely empirical comparisons of different media in a given situation can yield results which are largely an artifact of unspecified characteristics of the particular representatives of the media which the experimenter happens to use. Such results tell us little about the inherent properties of different means of representation [p. 61].

However gradual, there now exists what Spooner [1973] describes as an "increasing awareness by instructional technologists that each individual medium has unique characteristics and limitations which influence its role in instruction" [p. 12]. As attention is focused on the desirability of learning more about specific modalities under clearly identified conditions, needs and interests become increasingly specific. Popham [1969] reports that research attention is being directed at the isolation of treatment variables within specific modalities and their effects on learning "of most interest are those that are 1) readily manipulable, that is, relatively easy to modify, and 2) significantly correlated with learner accomplishment" [p. 28].

It would appear that this position is essentially what Dwyer [1970] is alluding to when he proposes systematic evaluation among various types and complexities of visual treatments in order to provide users with selection criteria based on specific objectives.

> Much has been written about the uses and advantages of the visual medium for instructional purposes. Little has been done, however, to identify which physical characteristics contained within the various types of visual illustrations are most efficient in facilitating student achievement of different types of educational objectives. Since there are no definitive rules or principles that enable a teacher to select the types of visual illustrations best suited for instruction, it seems evident that the instructional media that depend primarily upon the visual channel would profit from a program of systematic evaluation. This evaluation should be focused on relative effectiveness varying amounts of realistic detail, facilitate student achievement of specific educational objectives [p. 235].

Campeau [1972] brings the need for the present study into sharp definition by suggesting that one important research area in need of attention relates to the isolation of those factors which interfere with learning when a specific medium or a combination of media are used under a given set of physical and pedagogical conditions.

Summary

At the present time there is a paucity of research concerning many important aspects of visual design, production, and use, including research on treatment variables within a particular modality such as the slide tape. One such variable is the effect of visual interference--production errors--on cognitive learning. Presently there are few data-based guidelines in this area which address the problem in terms of multi-channel modalities. Those guidelines which exist derive in large measure from the suggestions of Eastman Kodak, which, apparently, are based largely on experience rather than research.

Intuitively it makes a certain amount of sense to accept the

Kodak guidelines. There is a modicum of logic involved and at least a suggestion of support in research directed at the effects of communication noise as well as studies which investigate the influence of physical clarity and legibility on learning.

If the Eastman position on the importance of high quality is defensible, mere subjective analysis will suggest that many mediated learning strategies involving visual information channels are less effective than instructors suppose for errors may frequently be observed especially in locally produced materials. There is an affective aspect, also, for it is suggested [Eastman Kodak, 1967] that in the presence of low quality visuals, message importance is lowered and it can be speculated that source credibility suffers. Implicit, also, is the possibility that the attitude of students toward the topic and perhaps even toward the media has been negatively affected because of the effects of repeated experiences involving error-ridden media productions.

On the other hand, if quality is not actually a problem, vast sums of money, energy and human resources have perhaps been expended needlessly for it is difficult to disprove the position [Eastman Kodak, 1967] "good visuals cost money and more than money, they take time, thought, and imagination to design" [p. 10]. And to these costs can be added those associated with quality production.

It has been suggested that the present study is needed to make contributions at several research levels including fundamental theory development and inter-modality understanding. Of greater priority, however, is the effect the investigation may have on the need to provide guidelines which may be applied to issues of immediate and practical concern--the day-to-day production and use of multi-sensory instructional materials.

CHAPTER II

REVIEW OF THE LITERATURE

In Chapter I the nature of this study is shown to be an inquiry into the effects of visual interference on recall of cognitive information. The test vehicle is a slide tape presentation and interference is induced through production errors in the visual channel.

As evidence by such compendia as Traver's Research and Theory Related to Audiovisual Information Transmissions [1967], Chu and Schramm's Learning from Television: What the Research Says [1967], Bali and Byrnes's Research Principles and Practices in Visual Communication [1960], Saul's A Review of the Literature Pertinent to the Design and Use of Effective Graphic Training Aids [1956], and Hoban and van Ormer's Instructional Film Research: 1918-1950 [1951], there is no dearth of research and literature pertaining to the several discrete information transmission formats involving multiple channel communication. What can be synthesized from these and other works is the efficacy of audiovisual communication devices to function effectively in teaching and learning. Not so clear, however, are the variables or conditions which tend to influence the efficiency and effectiveness of multi-sensory materials. In reviewing the literature on instructional television, Allen, [1971] states:

> That students learn from televised teaching cannot be doubted, but the conditions under which such learning takes place and the specific characteristics of televised presentations that bring this about are yet to be determined, . . . [p. 10].

There is no apparent reason to doubt the applicability of this statement to motion pictures as well as other multiple channel modalities involving visual communication.

Given this base, a good deal of research effort has been focused on experiments which attempt to isolate test variables in what might be termed the conditions of multiple channel communication.

In Chapter II the literature most closely associated with this study is reviewed. While a number of areas are of related interest, four have been identified as particularly pertinent to the purpose of this study:

1. Communication noise and visual channel interference
2. Relevant and irrelevant attention-gaining devices
3. Communication properties of pictures
4. Legibility and technical quality

At this point it must be noted that the relationship between experimental research and media applications impose important limitations on the relevance of much of the literature reviewed. Specifically, the review process clearly exposes the fact that a majority of the research studies in multi-sensory formats assumes a condition of visual primacy. Experiments tend toward conditions in which the visual channel is the primary message source.

Given that this level of research is needed, there is much evidence to support the contention that in the every day production and use of instructional television, motion pictures, slide tapes, or sound film strips, audio primacy has and continues to represent the norm. In an evaluation of a study conducted by VanderMeer [1950], Hoban and van Ormer [1951] report that the investigator found:

> a growing tendency to put the greater part of the learning material in the verbal element of the filmstrip (the titles and the teacher's notes or guide to explain the material), while the pictorial materials serves merely as an approximate illustration of the verbal content [p. 8-22].

From a review of film studies, Travers [1967] confirms this tendency. "In present-day instructional movies the sound track contributes a greater share of the transmitted information than does the visual" [p. 58]. More recently, Anderson [1972], in commenting on contemporary instructional television research, writes that "A majority of the studies have used television not as a visual medium, but as a pipeline for whatever incidental activities accompany a primarily verbal communication" [p. 58].

Thus, while much of the data reported herein have relevance, they are somewhat modified and conditioned by the fact that the communication vehicle used in this investigation was purposely selected because of its "real" nature--the presentation is typical in that a close examination of both channels indicates that by far the greater portion of the message is embedded in the audio channel with the visual channel serving an illustrative or attention-attracting function [Hartman, 1961].

Communication Noise and Visual Channel Interference

Both communication and learning involve two fundamental elements--stimulus and response. In discussing communication models, Ball and Byrnes [1960] note that:

> whenever humans learn or humans communicate some stimulus is present . . . We can define the term "stimulus" in rather broad terms to take in anything which we can perceive through one of our five senses . . . We can also point out that whenever there is a stimulus there is also some response. By response, we mean simply that the individual perceiving the stimulus does something, i.e., votes, runs away, talks, thinks, changes an attitude, etc. [p. 33]

It is given that a communicator normally attempts to produce messages of the highest possible fidelity--another way of saying that the stimuli will be received as intended. To insure fidelity of reception, theory has dictated that communication noise must be reduced for, as Berlo [1960] indicates, "noise and fidelity are two sides of the same coin. Eliminating noise increases fidelity; the production of noise reduces fidelity" [p. 40-41]. Hsia [1968] describes the importance of noise in communication thusly:

> Another factor of fundamental importance in communication is noise which, in a broad sense, is unwanted information, an inevitable occurrence in any I.P. (information processing) situation [p. 246].

In Chapter I the equivalence of production errors and noise is suggested. It is speculated that statements which predict a negative impact on learning as a result of technical imperfections such as production errors are either largely unsupported by research or at least subject to important qualifications. For example, an Eastman Kodak publication [1967] suggests that:

> Ours is a visually sophisticated age. Magazines, motion pictures, television, advertising . . . all have created an audience who take good visuals for granted. It is also an audience which has been trained since infancy in the fine art of tuning out amateurish, poorly done, or annoying visual messages [p. 18].

Although the topic will be discussed in some detail later, Levie's [1973] summary statement dealing with technical quality of the visual channel in training films is relevant to and somewhat unsupportive of the Kodak position. While few specific studies are cited, he concludes that:

> Researchers have demonstrated that variation in technical quality do not affect the acquisition of information so long as the relevant cues are available to the learner [p. 31].

This would suggest that under conditions of audio primacy, the effects of visual channel interference would be negligible. However, in summarizing even more limited numbers of audiovisual studies involving audio channel noise, Chu and Schramm [1967] state that:

> Noise will reduce the effectiveness of learning from film and television so far as part of the learning comes from the auditory medium [p. 72].

Support for this conclusion is found in two recent studies which include, among other treatments, visual channel interference.

A study conducted by Hsia [1969] which investigated intelligence as related to auditory, visual, and audiovisual information processing is highly relevant. A group of 192 seventh grade students were presented verses of English poetry under three channel conditions--audio only, visual only, and audiovisual. While all conditions were exposed to noise, of most immediate interest was the introduction of noise in the treatments involving visual presentation. This interference "consisted of random black dots scattered over the visual stimuli blackening about 25% of the visual space" [p. 27]. Audio channel interference was 25% "white" noise. Recall was tested immediately following each presentation by having the subjects check whether or not they observed or heard a certain word in the presentation.

In terms of the effects of noise, the investigator concluded that "it seems to be conclusive that noise was a detrimental factor that hindered both HI (high intelligence) and LI (low intelligence) Ss with much more severity on LI Ss" [p. 279]. Interestingly enough, the channel which was affected least under noise conditions was the visual channel. This was attributed to the type of noise (scattered dots) which "afforded comparatively easy discrimination" [p. 280]. A logical implication to be drawn from this finding is that extreme care should be taken to insure high fidelity channels in situations where the average intelligence level of an audience is either unknown or recognized as low.

The above point is reinforced by Severin [1967] in discussing the importance of using relevant pictures (as opposed to irrelevant) in multiple channel communications. He states:

> If interference is accidentally introduced between two channels, then much effort, time, and money is wasted, for one channel could then communicate more efficiently. If, on the other hand, single-channel communications are not effective enough for a specific task, the combination of channels with cue summation could prove to be the solution to more effective communication. This could be the solution in situations where the literacy or intelligence level of the members of the intended audience is known to be low, where presentations may have to be made under conditions of high "noise" (interference in the audio or visual channels from sources either within or outside the message source), or where the material is relatively difficult for a given audience [p. 400].

In his conclusion, Hsia [1969] seems to say much the same thing:

> In order to increase the IP (information processing) rate of LI Ss it seems imperative to reduce noise and to employ the AV channel in which BCR (between channel redundancy) should be made as high as possible [p. 281].

A second experimental study which incorporates one highly relevant aspect was conducted by Schlater [1966]. That part of the two part experiment which investigated the effects of irrelevant cues on recall of audio channel information is particularly interesting for at least some of the cues--superimposure (credits), boom shadow, ornate frame, letters/numbers in grease pencil, shadow of hand or finger pointing--can be considered production errors.

Schlater's study dealt with speed of presentation and interference variables in the video channel of a series of short presentations on Greek temple architecture. Presentation rates included one to nine visuals per 30 seconds and interference variables were measured by Ss viewing 45 visuals while varying the number (0-45) and rate (0-5 per 30 seconds) of irrelevant inclusions. In each case there were six treatment groups.

Using 910 high school seniors as subjects, standard 2 X 2 slides of the material selected were simultaneously transmitted via television to Ss located in 30 rooms on the Michigan State University campus. The audio channel was held constant throughout both experiments. The narration was related to but not redundant with the pictures as presented. Recall of information was tested with multiple choice pictorial video questions and verbal audio questions.

Schlater [1966] reported that interference from increasing speed of presentation (from one visual per 30 seconds to nine per 30 seconds) produced a significant difference ($p < .05$) when tested using verbal questions, no significant difference under pictorial questioning and no significant effect on comprehension of information presented in the audio channel.

More closely allied is the second part of the experiment. The six treatment groups viewed 45 relevant visuals for six seconds each and were exposed to either 0, 9, 18, 27, 36 or 45 irrelevant inclusions. These in turn were presented at rates up to five per 30 seconds of presentation. Boom shadow, for example, was seen once by the first treatment group and five times by the fifth. Results indicated that interference did not significantly affect recall of video information when tested by pictorial video question or verbal video questions, but did significantly affect ($F = .01$) recall of audio information. However, the expected pattern--poorer recall as the number of irrelevancies increased--did not emerge. By way of explanation, the investigator suggested that some of the irrelevant cues were probably not obvious enough and thus may have gone unobserved. Such a lack of interference was at least implied in the preceding study by Hsia [1969] who also found the visual channel to be more resistant to the effects of interference.

Whether or not audiences generally perceive technical flaws or errors such as misspelled words or poorly focused visuals has been a matter of conjecture--primarily among professionals in the field of design and production. No audiovisual studies were found which tested this specific point, but two relevant print studies were found which appear to relate.

Sencer [1965] conducted an experiment on 350 male college freshman to test the effects of incorrect grammar on attitude and comprehension. Five degrees of error--zero to 51 per 500 words of message--were introduced into a basic 1200 word essay. The finding of no significant difference in comprehension elicited the conclusion "that noise in the communication system can be tolerated in terms of comprehension, at least, to quite an extensive degree" [p. 50]. The experiment did indicate that errors were observed and perception of errors was positively related to Ss measured level of verbal ability.

Razinsky [1967] also found that Ss perceived errors in an experiment to determine the effects of message quality deterioration. The finding of no significant difference in comprehension supports Sencer's [1965] findings although Razinsky does note, in contrast to Schlater [1966], a linear decrease in comprehension as the number of errors increased. He concludes that " . . . errors influenced learning only to the extent that they are actually perceived" [p. 28].

Relevant--Irrelevant Attention Gaining Devices

While it is yet to be established that production errors or other forms of visual interference are consistently perceived, it seems fruitful to pursue a course of inquiry based on the assumption that errors are observed--at least under certain conditions. If errors are noticed, do they gain attention to the degree that interference results? Fleming [1967] states that:

> Attention is drawn to changes in stimulation, changes from immediate-past experience and changes from long-term experiences. In a sense, the more the new stimulation differs from the prevailing, the more distinctive or attention-gaining it is [p. 23].

The effects of relevant and irrelevant attention-gaining devices on channel effectiveness have been the subject of numerous studies and offer interesting and relevant data. In an early study, Neu [1950] found:

> No evidence that the relevant attention-gaining devices as used in these experimental films (closeups, spotlighting, pointing finger, unusual camera angles, voice clues, sound effects) added to the instructional effectiveness of the film [p. 8-24].

Hoban and van Ormer [1951] agreed with Neu [1950] and suggested that "Devices which call attention to irrelevant materials may interfere with the learning of more important items" [p. 8-33].

The topic of relevant-irrelevant materials or devices is also discussed by Chu and Schramm [1967] with respect to research in instructional television. They conclude that "attention-gaining devices can add to learning." Miller [1957] speculates that it is possible for cues or attention-gaining devices to both contribute and detract from message fidelity.

> When cues from different modalities (or different cues within the same modality) are used simultaneously, they may either facilitate or interfere with each other. When the cues elicit the same responses simultaneously or different responses in the proper succession, they should summate to yield increased effectiveness. When the cues solicit incompatible responses they should produce conflict and interference [p. 78].

Hartman [1961] agrees with the essence of this statement.

> It may be argued that additional cues are excellent attention-gaining devices. So they are, if carefully handled. But a cue which has gained attention is likely to hold it. Too often the attention-gaining device is allowed to continue in competition with the attention-getting device. Attention may be gained but communication of the message may not result [p. 255-56].

A number of investigators have moved beyond inquiries into pure attention-gaining devices to considerations of the effects of irrelevancies in general. Ketcham and Heath [1962] report on an investigation involving pictures which are unrelated to the material being presented. A major finding of this study suggests interference resulting from irrelevant visual materials. The investigators reported that:

> the results suggest . . . that the projection of abstract forms on the screen distracts attention more than it improves concentration, and that the distraction is worsened by the increased detail, or the incongruity, of an irrelevant picture [p. 92].

Shamo and Meador [1969] support this general conclusion. In an experiment in which subjects were shown a number of irrelevant slides while they listened to short persuasive messages, they found that the irrelevancies produced a significant reduction in the amount of recall of the content of the audio message.

Severin [1967] investigated the interaction of relevant and irrelevant pictures in multiple channel communications and concludes that pictures which are unrelated to the message content--therefore irrelevant--produce the least amount of learning. Accounting for the finding, Severin [1967] indicates that it is "because of the irrelevant cues introduced . . ." [p. 392]. From an investigation of circumstances involved in the effective transmission of information in multiple sensory presentation Travers [1964] concludes:

> Devices which have been used to draw attention to the information transmitted through one sense modality tend to depress information received through the other [p. 378].

One finding which differed significantly is reported by Severin [1967] in the experiment previously described. In the treatment which varied the number of irrelevant cues presented, the investigator found ". . . that more recognition resulted from the treatment with the more irrelevant cues, rather than the less irrelevant ones, . . ." [p. 399]. He suggests that blocking may have taken place which effectively reduced the level of interference. The explanation would be consistent with that of other investigators such as Travers and Alvarado [1970] who report that:

> Living organisms are systems with a limited capacity for handling information and have to be selective in what they attend to. If they were not, they would constantly find themselves swamped with large volumes of useless information [p. 57].

Hsia [1969] suggests a related phenomena when he postulates that there is a "positive correlation between intelligence and noise-filtering capacity; . . ." [p. 273].

On the basis of the evidence it appears that visual irrelevancies do tend to affect learning negatively but not under all conditions. At what point and under what conditions the human information processing capacity is seriously affected is not completely known.

Communication Properties of Pictures

Introduced by Schlanger [1966], the term "visual task factor" is defined by Perrin [1969] as relating to "the work the viewer must do to extract the necessary information (from the picture)" [p. 375]. Conceptually the term seems highly relevant to this discussion for attention is focused on the fact there is more to visual communication "than meets the eye." In other words, a visual is not good because it is a visual, but rather because it accommodates certain critical requirements of visual perception and thereby increases the efficiency of the communication.

That there is a definable level of necessary information is interesting in its own right and is supported by numerous researchers. Arnheim [1962] suggests that the basis of visual education is found in the understanding that "every picture is a statement" [p. 20]. As such, the statement is not the thing or object but rather "a set of propositions about the object; . . ." [p. 20]. He concludes that "these propositions are stated in a visual language" [p. 20].

While the existence or level of a visual language has been questioned [Travers, 1967], there is support for the premise that communicable elements must be present in visual materials at some minimum level of recognition before communication (and therefore learning) can be achieved. Arnheim [1962] refers to such elements as "visual properties" [p. 20]. From the research evidence in information processing which suggests that humans have limited information processing capacity, Travers [1967] postulates that "the design of audiovisual teaching materials requires that he concentrate on essential information" [p. 97]. Here, then, is the additional suggestion that a maximum level of information may also be identified.

The implications to be drawn from Travers' statement are clear. First, the amount of information to be communicated in any given situation must receive close scrutiny by the message designer. For example, Spaulding [1961] indicates that "the amount of information communicated by a pictorial illustration is inversely proportionate to the complexity of the drawing (or otherwise stated, the amount of information in the drawing)" [p. 61].

Optimum information levels have been considered in depth by several researchers. Dwyer [1970] tested critical information levels by manipulating amounts of detail in visuals. His findings suggest that:

> The effectiveness of a particular visual in facilitating student achievement of a specific objective depends on the type of information needed by the student to achieve that objective [p. 247].

Fonseca and Kearl [1960] tested a similar concept and came to essentially the same conclusions. However, they offer a note of caution by suggesting that, under certain conditions:

> Excessive deletion of detail, by requiring the viewer to mentally complete the detail of a schematic drawing, reduces comprehensability [47:6].

This is entirely consistent with the impact of the visual task factor discussed by Perrin [1969] who also indicates that under certain circumstances visual cues can become so abbreviated or compressed as to increase the visual task factor.

A second implication suggests that once the appropriate information level is known, information must be encoded and transmitted with as much fidelity as possible. Stated another way, the visual properties of the message must arrive in a readable condition for, as Arnheim [1962] infers, "The picture itself must steer perception" [p. 19]. The directing or steering mechanism apparently derives from the presence of the original referent are portrayed in the picture.

Gibson [1954] suggests that an object has many visual properties which are of concern in producing pictorial surrogates and concludes that "the most important ones (for most human purposes) are the form, shape and proportion of its edges and surfaces" [p. 21]. The picture, he writes "like a model, has many dimensions of fidelity to the object, . . ." [p. 21].

These "dimensions of fidelity" are not unlike the visual properties which have been delineated by others, including Arnheim [1962] and Harrison [1964]. Discussing the perceptual properties of pictures, Arnheim [1962] draws on Gestalt psychology in stating that "The shape of contours, the contrast of brightness, the structure of the over-all pattern will determine what is seen" [p. 19]. Additional dimensions are added by Harrison [1964] in commenting on the importance of figure-ground relationships. He observes that:

> We might also predict that contrast between symbol and background will be important. If the original referent has color, texture, or shading, it may be important to retain this in the symbol, particularly to the degree it increases the contrast with background [p. 39].

In his work on the classification of illustrations, Fleming [1967] includes the term "pictorial elements" as a descriptor for critical perceptual attributes and describes them as:

> Those configurations of line, dot, or area and any combination of these three that resembled events or objects (persons, places, and/or things) either as perceived or as generally conceived [p. 247].

Harrison [1964] indicates that color may be a perceptual cue if color is important in the original referent. There are many studies which attempt to evaluate color as an instructional variable and include, among others, McLean [1930], Long [1946], VanderMeer [1948 and 1954], Fullerton [1956] and McCoy [1962]. While findings have varied with the balance clearly in favor of color not being a significant learning factor, research and discussions continue and there is growing support for a modified position. While agreeing with the general conclusion, Chu and Schramm [1967] are of the opinion that:

> We must not overlook the possibility that in certain particular learning tasks, color may play an essential part. For instance, certain substances, like blood, have no definite shape and can only be identified by color [p. 25].

Based on his own research, Dwyer [1970] concurs and adds broader dimensions to the possible value of color.

> For specific objectives the addition of color in certain types of visuals, for students in specific grade levels, appears to be an important instructional variable in improving student achievement [p. 247].

On the basis of the evidence it seems conclusive that there exist certain critical visual properties which, once the optimal information level of a picture is stated, are responsible for successful communication.

Legibility and Technical Quality

The retention and transmission of visual properties are closely related to discussions of legibility and technical quality of media. Again, channel primacy influences the degree of relevance and most studies deal with situations where the visual channel is considered by assumption or design to be primary.

The literature on legibility includes numerous studies on such topics as the type and size of characters, viewing conditions, viewing angle and distance, and resolution of displays. Although of interest from the stand-point of simple visibility, standards and guidelines resulting from such studies have little relevance to the present study other than the obvious premise by Spooner [1973] that, "If a student is to learn from visual materials, he must be able to see them; that is, physical clarity of visuals is fundamental to a student learning from them" [p. 10].

This, again, suggests that under conditions of visual channel primacy the critical visual properties of a picture must be visible, above the visual threshold as discussed by numerous writers, including Siebert, Casten, and Potter [1959] and Spooner [1973]. Early research was not always so conclusive, however, and led Hoban and van Ormer [1951] to observe that:

> Physical surroundings and conditions of projection, except, of course, when the room is fully illuminated, are not likely to be critical factors in effecting factual learning from motion pictures [p. 8-43].

Later, Miller [1956] suggested that this position might be true but added an important condition.

> With highly motivated students who are experienced viewers of pictures, one might expect such factors as size of screen, distance from screen, angle of view, and illumination to be critical only if they interfere seriously with the presentation of the relevant cues [p. 82].

The importance of this condition is apparent in research on instructional television. Summarizing the available research, Chu and Schramm [1967] conclude that such factors as angle and distance can interfere with learning in a situation "where accurate perception of images is an important part of learning, . . ." [p. 68]. Blackwell [1968] and Perrin [1966] concur on the importance of illumination. Perrin [1966] concludes that "different visual tasks require full screen illumination in a glare-free visual field" [p. 374]. He further suggests important relationships between image resolution, density of materials, and visual acuity.

A review of the literature pertaining to technical quality shows that quality is largely associated with production variables--slickness and embellishments. The history of this type of research indicates relatively consistent results. Hoban and von Ormer's [1951] survey of the literuature led to the conclusion that the visual influence of motion pictures is "relatively unaffected by 'slickness' of production as long as meaning is clear" [p. 9-5]. Similarly, Chu and Schramm [1967] point out that with the possible exception of motor skill learning where research indicates the use of a subjective camera angle:

> There is no clear evidence on the kind of variations in production techniques that significantly contribute to learning from instructional television [p. 48].

As a production variable related to quality, the use of color, as reported earlier, makes little or no difference except where color represents a critical perceptual property.

Numerous additional references such as Lumsdaine and Gladstone [1958], Baker and Popham [1965], and Levie [1973], support the general conclusion that slick or highly embellished visuals are not significantly more effective in learning than simple, unembellished versions. However, a study by Baker and Popham [1965] exposed an affect on attitude of viewers. They conclude that it may be unsafe to assume that embellishments serve no real purpose.

Chu and Schramm [1967] extend a similar caution based on the lack of knowledge as to what influence vastly increased exposure to quality visual materials will have on audiences in the future.

On the basis of the latest evidence, Levie [1973] has concluded that "when the attainment of cognitive learning objectives is the criterion, insistence upon flawless technique is unjustifiable" [p. 31].

Summary

A careful review of the literature spanning a period of at least 50 years failed to disclose any studies which could be characterized as being "highly similar." There is a long history of studies which attest to the instructional value of media, but the conditions under which instructional materials function most effectively remain unclear.

Most research dealing with variables within modalities has been carried out under conditions of visual channel primacy whereas audio channel primacy is more often representative of the norm in multi-sensory designs. The present study is based upon the use of visual auditory messages in which there is audio channel primacy and therefore most reviews are only tangentially related.

Four related areas were explored. Most literature confirms the importance of communication noise per se. When applied to interference phenomena in such areas as relevant-irrelevant attention-gaining devices, legibility, and technical quality, noise theory is modified. For example, studies within these areas of inquiry report noise effects ranging from interference to enhancement of learning.

Increased learning under noise conditions--usually characterized as a "surprising finding"-- is currently explained as the result of blocking or filtering, the limited information processing capacity of humans, and high intelligence.

Numerous studies in human information processing have undoubtedly motivated related but limited research directed toward determining optimal information levels in pictorial surrogates via manipulation of the known visual properties of pictures. Findings are varied but useful in that evidence grows to support the emerging knowledge that pictorial content and optimal information level is a function not of the media but of the audience and instructional task. Once an optimum information level is reached, it may be speculated that visual interference exerts a negative effect on learning. That an individual must be able to see a visual to learn appears as a given in most of the literature. Yet, the most recent review of studies dealing with legibility and technical quality suggests that technical perfection is unjustifiable when cognitive learning is the goal.

CHAPTER III

PROCEDURES AND METHODOLOGY

Statement of the Problem

The principal concern of this study is to determine whether or not photographic production errors in the visual channel of a multi-sensory program exhibiting audio-primacy message design characteristics will exert any influence on cognitive learning as measured by immediate recall of information presented within the program. Stated somewhat differently, it is postulated that interference may result from the recognition of technical imperfections in pictorial material and reduction in learning will occur which will be inversely proportionate to the number of imperfections observed.

Hypotheses

Stated in null form, the hypotheses are:

1. There will be no difference between groups in their perception of production errors.

2. There will be no difference between groups in cognitive learning due to the presence of production errors.

3. In the event of significant effect, there will be no relationship between the number of errors perceived and scores on the cognitive measure.

Population

The experiment was conducted with a population of 59 students enrolled in Education 101A, Introduction to Elementary Education, at Michigan State University on November 19, 1973. Relevant data concerning the population are shown in Table 3.1.

Table 3.1. Population demographics.

	Sex		College level				
	M	F	Fresh.	Soph.	Jr.	Sr.	Grad.
Control	1	12	1	6	5	1	0
T1	4	10	0	6	7	0	1
T2	1	16	0	7	8	0	2
T3	3	12	0	5	7	2	1
Totals	9	50	1	24	27	3	4
Percentage	15.3	84.7	1.7	40.7	45.7	5.1	6.8

Selection of the population was based on the following criteria. First, it was desirable that the population be related to the audience for which the original test vehicle was designed--instructional or administrative personnel in grades K-12. Secondly, it was important that the population be largely unfamiliar with systems theory in general and with the three-stage, nine-function Instructional Development Institute model in particular. Finally for statistical reasons, it was necessary to have a population of approximately 60 persons. Permission to utilize this population was obtained from the course instructor and details of the experiment and procedures were communicated to her in advance of the actual experiment (see Appendix A).

Instrumentation

Two evaluation instruments were constructed to accommodate the design of the study--a 35 item multiple choice recall test (see Appendix B) and a 10 item error perception questionnaire (see Appendix C).

Preliminary discussions with colleagues and members of the Department of Counseling Personnel Services and Education Psychology resulted in the decision not to use a pretest since the procedure would necessarily expose subjects to the precise content and language they would receive in the test presentation material which was purposely selected because of its unfamiliarity to the subjects.

An initial pool of 45 questions was prepared. Each consisted of five possible choices including a constant option of "I really don't know." Designed to provide another measure of the possible effects of production errors, it was hypothesized that the latter option would remove the necessity for guessing where subjects truly did not know the answer. Subjects were instructed not to guess and encouraged to use this option when it represented the best answer.

Following the first validation ($n = 22$), individual questions were analyzed and the number reduced to 35. Ambiguities and inconsistencies were eliminated and questions with more than one possible response were reworked. A second validation (n = 20), produced, with minor changes, a final instrument with Kuder Richardson reliability of .694 on the control group.

In the final form the instrument consisted of 23 audio and 12 visual channel questions. Of these, 24 specifically tested content at error locations, a requirement of the design. The order of questions was randomized.

A second instrument was designed to elicit information concerning the perception of production errors. Given the constraints of clouding the real purpose of the instrument and not suggesting information about errors--existence, number, type, and effect--until appropriate, conventional paper-pencil tests were discarded and a different design was sought. Valuable advice was offered by colleagues and testing specialists and a prototype six item tape recorded questionnaire resulted.

A tryout on 20 students was used to test the instrument and suggested the addition of questions which would refine the probing steps and also produce additional information. The final version, consisting of 10 questions and a response form, was tested on a second group (n = 22) and appeared satisfactory in every way. Discrimination between the control and experimental group (T3--the group subjected to the most errors) was obvious.

Message Design

The study was implemented by using a modified version of a slide tape presentation entitled "A Fable Revisited" which was designed and produced for the National Special Media Institutes, Instructional Development Institute (IDI) program (see Appendix D). As originally designed, the purpose of "A Fable Revisited" was to teach the component elements of a particular instructional development system (IDI) in an entertaining manner and to motivate acceptance of using a systematic approach to problem solving. It contained 71 visuals and had a running time of eight minutes and ten seconds. The program is rendered in cartoon style and employs a conversational narration style.

Modification of "A Fable Revisited" was required for purpose of the study. The need for introducing errors in the visual channel necessitated the replacement of certain slides with slides containing injected errors. This in turn necessitated rephotographing all art work so that every slide would be of t e same quality. Secondly, a detailed audition of the original audio channel provided evidence that some of the system's terminology which identifies elements and activities within the IDI model were either overused or completely missing from the narration. Some potentially troublesome ambiguities and inconsistencies were also identified. As modified, the test presentation contains the same 71 visuals as the original, but has 79 seconds additional running time. The increase is largely attributable to inherent differences in speaking rate and slight changes in the timing of slide changes. The original narrative style remains essentially unchanged.

The selection of "A Fable Revisited" was based on several criteria. An important condition was established by Debes [1973] who indicated that the vehicle selected for a study of this nature should meet the qualification of "goodness." This, in effect, suggested that the material selected exhibit high initial technical quality, some degree of validation in terms of stated objectives, and acceptance based on multiple use. "A Fable Revisited" is recognized for its high quality, has been used several hundred times and validated under field conditions. This investigator has personally used the material on as many as 50 occasions and has found the attitude of audiences toward the material to be extremely positive. Administration of semantic differential instruments has confirmed this observation.

A second criterion suggested that the material selected be typical in terms of channel conditions. As indicated earlier, much multi-sensory material is designed and/or produced in such a way that the audio channel transmits most of the information. Analysis of "A Fable Revisited" demonstrated this condition. A third consideration was that both channels be completely open to inspection so that channel relationships could be objectively determined as suggested by Hartman [1961]. Fourthly, a content was needed which would tend to negate the effect of past experience--something relatively if not completely unfamiliar to the subjects. Past experience of this investigator with students enrolled in the introductory level teacher education courses suggested that an in-depth familiarity with "systems" was unlikely and that there was virtually no chance of previous exposure to the specific model presented in this presentation. Finally, in terms of relevance and generalizability, the final criterion was to use material of demonstrated "real world" applicability rather than something specially created for empirical study.

Audio Channel Revision

A typewritten copy of the narration was prepared and analyzed for the presence and use of key and related terms which represent the language of the IDI model, applications of the concepts presented, and any other information of an explanatory nature. Key terms are those which identify stage and function names; related terms are those which represent sub-concepts and activities under function headings (see Appendix E).

The analysis exposed some deletions as well as a certain amount of redundancy. For example, the key term "develop" was used twice in the narration while the key term "evaluate" was totally missing. Following a minor rewrite, each of the key or related terms was used once in the narration thereby allowing greater control and discrimination in preparing the cognitive evaluation instrument and subsequent analysis of data should significant differences by found.

A check of the audio channel also exposed some inconsistencies. Representative of this type of inconsistency is the following statement which, in the original version, stated:

> This pig--we'll call him "Straw Pig"--never really saw the wolf. He concerned himself mainly with the problem of protecting himself from the elements of the weather [slide #9].

A few seconds later the narration includes the following information.

> His solution strategy was simple: build a house for protection from the wolf and the weather [slide #13].

The inconsistency of the two narratives derives from the addition of a further dimension to the problem--the wolf. Should a random error be associated with either frame it would be difficult to determine whether a viewers response was due to the unintended ambiguity or to the inaccuracy of one or the other. As revised, the initial statement is left intact, but the second if modified to maintain consistency:

> His solution strategy was simple: just build a house for protection from the wind and rain [slide #13].

Following the revision process which resulted in so little recognizable change that persons intimately acquainted with the program were unaware of the modification, the new narration was recorded in a professional sound production studio. Prior to recording, the narrators listened to the original audio channel and rehearsed several times in order that the original style, inflection, humor, and overall effect would be faithfully reproduced in the new version. The finished narration was pulsed for synchronized presentation on a 3-M Model 2550 cassette tape recorder.

Visual Channel Preparation

From a preliminary list of 10 possible production related errors, four were selected for use in this study, namely errors in copy technique, exposure, focus, and spelling.

Selection criteria for these four types of errors were based upon conversations with photographers, graphics technicians, and persons regularly involved in producing, viewing, and evaluating materials of the type used in the study. Selection was also influenced by the opinions, observations, and experiences of the investigator as an instructor of photography and message design. Further, the investigator was closely associated with the design of the Instructional Development Institute and with production of the materials used in this study and personally observed all of the selected error types during the process of developing and testing the prototype of "A Fable Revisited" as well as other slide tape presentations used in the Institute.

Determination of specific locations for each of the errors injected was made according to procedures which accommodated constraints imposed by the nature of the visual channel and of the experimental design.

An obvious constraint, for example, was that a spelling error had to be placed on a slide that included words. It was necessary, as well, that the words were an essential part of the message design, that the words were large enough to be read, and that projection time was sufficient for the words to be read. Finally, in order to avoid questions of relevance, it was determined that the title slide would not be used for any error.

A major condition applicable to the location of all errors was that the narration opposite a slide containing a visual error provide sufficient content to allow a correct response to a logical and answerable question.

Given the above constraints, 51 possible error locations were identified. Of these, only eight could be considered as spelling error locations. The remaining 43 locations were satisfactory for any other error type. All locations were numbered on 1" X 1" card stock and a random selection procedure was used to first determine the location of spelling errors in the three treatment groups. This procedure was necessitated by the chance that selection of the other three error types would exhaust the limited number of spelling error locations.

Procedurally, the eight numbered squares were placed in a container and a number was drawn. This number became the location of the single spelling error for T1, one of the two locations for T2 and one of the three locations for T3. A second number was drawn which represented the second of two locations for T2 and the second of three for T3. A final number was drawn which determined the third location for T3. The unused spelling location numbers were then placed with the others and in a similar manner the locations of the remaining error types were selected. Other than spelling errors, the order of error type selection was random. Error locations are shown in Table 3.2.

Table 3.2. Location of errors and error-types by slide number.

Error type	T1	T2	T3
Spelling	27	27, 50	27, 40, 50
Focus	37	37, 45	37, 45, 68
Copy	9	9, 47	9, 47, 62
Exposure	49	43, 49	14, 43, 49
Totals	4	8	12

During initial data analysis a mistake was discovered which resulted from human error. While loading slide trays, the focus error in T1 (location 37) was missed and an extra copy error was inserted (location 62). In T2, one of the two focus errors intended for location 45 was missed and an extra copy error was inserted. The number of errors remained correct, but in these two instances the error types were incorrect. The actual error locations are shown in Table 3.3.

Table 3.3. Corrected location of errors and error-types by slide number.

Error type	T1	T2	T3
Spelling	27	27, 50	27, 40, 50
Focus	--	37	37, 45, 68
Copy	9, 62	9, 47, 62	9, 47, 62
Exposure	49	43, 49	14, 43, 49
Total	4	8	12

The photographic production of the revised version of "A Fable Revisited" was done by the researcher from the original art work. All exposures were made on Ektachrome X film with standard copy equipment and lighting facilities. A gray card reading was used to determine correct exposure. Error slides were handled in the same manner with the exception that various degrees of error were photographed. Final selection was based on a single criteria that the error was obvious enough to be seen by most observers in a series of tryouts. From these masters, four duplicate copies were prepared by a professional photographic technician who was also given instructions not to alter or attempt to correct any of the error location slides. The duplicate copies were subsequently evaluated for consistency and utilized in the study as the Control, T1, T2, and T3 treatments.

Channel Relationship

Hartman [1961] suggests that in studies involving multiple channels ". . . the relation of the information in each channel to the information of other channels should be specified" [p. 242]. In an attempt to determine channel relationship and thereby provide evidence concerning the source or sources of the message (audio, visual, or audio visual primacy), the 71 slides representing the audio channel were shown to a group of 21 undergraduate education students at Michigan State University.

The first effort at content identification involved the students recording their impression of what the slide "said" by writing a single word or short description of each. The following directions preceded the presentation of the slides. In no case was the narration used.

> "These slides illustrate a modern version of the old three-pigs fable and their trouble with the wolf. They are used to illustrate visually (with and/or without an accompanying narration) a problem-solving system which we wish to teach to others. As I show you the slide, please write in the space provided a simple observation about what is happening--one word could be enough or it may take a short statement."

Following the initial presentation, the slides were shown a second time under somewhat different conditions. Each person was provided with a copy of the instructional development model which is illustrated by "A Fable Revisited" (see Appendix F) containing only the stage and function names. The following directions were given:

> "As a slide is shown, write the number of that slide under the concept--such as "Identify Problem" or "Specify Methods"--which you feel is most closely related to the picture. If you feel that a picture is not related to any concept, write the number of that slide at the bottom of the page. Pictures may or may not relate to one of the nine concepts. You'll be given each slide number twice, once at the beginning and once before the next slide is shown.

Each of the pairs of tests were then compared for commonalities and on the basis of a lengthy analysis and comparison to previously determined audio channel content, the channel relationship at each slide location was estimated. This information is recorded in the script (see Appendix G). Utilizing Hartman's [1961] channel relationship categories of redundant, related, unrelated, and contradictory, the analysis indicates that all channel conditions except contradictory are represented. For the most part, the channel relationship may be characterized as being related, that is to say that the narration tends to describe either the object or the situation shown in the visual channel at any given point. On this basis "A Fable Revisited" can be said to be "audio primary" in design.

Equipment and Facilities

Extreme care was taken to ensure high quality message delivery for it was of the utmost importance that any errors reported, or the possible effects of such errors, be attributable to the experimental design--not the result of accidental projection errors, distortion resulting from keystoning, lack of light control, poor audio quality, or viewing conditions.

Four manual focus Kodak Ektagraphic Model B slide projectors equipped with new lamps and F/3.5 4" to 6" zoom lens were used for projection. The projectors were placed behind and slightly above the subjects at a 90 degree angle to 6' X 6' matched matte white screens. The audio channel was delivered by a 3-M Model 2550 tape recorder located at the center of the room and synchronized with the projectors for slide changes with a specially designed wire set. The sound was amplified and transmitted through the internal public address system of the facility.

The Erickson Kiva, a large-capacity, multiple-tiered, circular classroom with sunken center section, was used for the experiment. Light control was achieved with heavy lined window drapes and conditions during the experiment may be described, by consensus of the subjects, as somewhat too dark for comfortable note taking. Because the investigator regularly teaches in this facility, it can be stated that lighting conditions were "characteristic" at the time of the experiment and consistent over the several groups tested.

Technical Assistance

Eight technical assistants were used during the experiment to assure consistent projection and sound. One person operated the tape recorder, four were assigned to projectors, two manned the distribution table at the entrance of the room, and one person served as an overall monitor.

Prior to the presentation, all technicians and assistants were briefed on the nature of the study, on what was going to take place during the experiment, and on how to react to anticipated emergencies or problems. This included a written set of instructions including procedures to follow in the event of such emergencies as a failure of the tape recorder, blown projector lamps, failure of a slide to drop, loss of synchronization, and the like. All appropriate personnel were given scripts to follow and instructed to note any irregularities observed during the presentations.

During the pretest rehearsal, the control projector failed to respond to the tape signal and thus this unit was operated manually following the script which was provided for such an emergency. No apparent problem resulted from this emergency. Insofar as the investigator and the monitor could discern, there were no distractions or deviation from what was planned as a normal environment.

Upon arrival, subjects received a sheet containing instructions and group assignment which had been previously determined using a table of random numbers (see Appendix H). Assistants helped direct subjects to clearly identified group locations and to randomly selected seat locations within these areas. Inidividual seats were identified by name and by an identification code on test packets.

Four nearly identical viewing areas were arranged around the floor and first two tiers of the Kiva type classroom. Seating was arranged so that the projection screen and 16 chairs were located within a rectangular area--approximately 10 X 16 feet.

While all groups were located in the same room, the circular design of the facility and placement of groups and equipment precluded any person from viewing any other image.

Immediately prior to the presentation of "A Fable Revisited," subjects were shown a test slide which was similar in design, style, and lettering to those used in the experiment. Subjects were instructed to exchange seats if they were unable to easily read the lettering on the test slide. No person was observed to move from his assigned position.

The experiment was conducted during a regularly scheduled 50 minute class period. Prior to the presentation, subjects were given a brief verbal introduction which included a caution against any conversation for the remainder of the period.

A two-minute tape recorded message (see Appendix I) served as the formal introduction to the activity which was explained to be a validation procedure. The message was designed to provide a motivational element and also to serve as an "advance organizer." Specific activities which would take place during the course of the experiment were described.

The above introduction was followed immediately by the presentation of the slide tape program. Verbal instructions were then given for the cognitive test. The subjects were asked to open their test booklets to the first page, read the directions, complete the test, and to close the booklet after completing the last question. An opportunity was given for questions concerning the test or the machine scored response form, but none were asked. Seventeen minutes were devoted to the cognitive test. Upon completion of the 35 item cognitive test, subjects were asked to open the test packets to the last page which was the response form for the error perception test. Because of the need to hide the purpose of this instrument, it was necessary to select a system for exposing questions one at a time. Therefore, both directions and questions were presented by tape. This procedure took four and one half minutes.

The period was ended on a brief note of appreciation from the investigator and assistants then held a short debriefing session for the purpose of determining if any irregularities were noted. Other than the synchronization problem reported previously, no further irregularities were revealed.

Summary

A population of 59 elementary education students were the subjects of this experiment to attempt to determine if cognitive learning is affected by the presence and recognition of common production errors in the visual track of a slide tape program. Errors included poor copy technique, incorrect exposure, poor focus, and misspelled words. Subjects were randomly assigned to a Control and three treatment groups and were presented a professionally rendered cartoon slide tape presentation designed to teach a particular instructional development paradigm and related system's terminology.

With the exception of the number of errors present (Control = 0, Treatment 1 = 4, Treatment 2 = 8, Treatment 3 = 12) the message and viewing conditions were virtually identical. Following the presentation, subjects completed a previously validated 35-item multiple choice instrument designed to test recall and a 10-item error perception test which was designed to determine if errors were actually seen. The experiment was completed as planned and the results are reported in the following chapter.

CHAPTER IV

ANALYSIS OF DATA

Review of Experimental Procedure

The purpose of this study was to determine if photographic production errors in the visual information track of a slide-tape program had any effect on the recall of audio and/or visual channel information.

A population of appropriate subjects was drawn from an undergraduate Elementary Education class and randomly assigned to four treatment groups.

The message, an introduction to the systems concept and a specific instructional development paradigm, was presented via an existing professionally rendered cartoon style slide-tape presentation.

The experimental design involved four treatment groups and four degrees of visual interference ranging from a no error version in the control to four, eight, and twelve errors respectively in T1, T2, and T3. The four versions were shown simultaneously and used a common audio source. Immediately following the presentations, subjects completed two evaluation instruments. The first attempted to measure recall of information contained in the presentation. The second, a tape recorded questionnaire, was designed to determine if errors were perceived and, if so, to what extent.

Hypotheses

Three hypotheses were tested. In null form, they are:

1. There will be no difference between groups in their perception of production errors.
2. There will be no difference between groups in cognitive learning as measured by immediate recall.
3. In the event of significant effect, there will be no relationship between groups in the number of errors perceived and scores on the cognitive measure.

Perception of Errors Hypothesis and Data Analysis

Null Hypothesis: There will be no difference between groups in their perception of production errors.

The design of the error perception instrument (see Appendix C) suggested two analytical procedures. Questions 1, 2, and 3 elicited yes-no answers and thus were simply tabularized.

One way analysis of variance (ANOVA) was used to test for effects between groups on questions 4, 5, 6, and 10. The F statistic was used to determine significance.

For convenience in interpreting the data, the questions from the instrument are restated below and the results displayed in subsequent tables.

1. Did you observe any deviation from the generally high quality of the visual material? Circle yes or no.
2. Did you observe any instances of what might be called

production mistakes or errors in photography? Circle yes or no.

3. Production mistakes include such matters as misspelled words, poorly focused or "fuzzy-unclear" slides, improperly exposed slides which are excessively light or dark, and poor copy techniques which allow things to show in the slide which shouldn't be there. Did you notice any instances of these kinds of mistakes? Circle yes or no.

Responses to these questions are shown in Table 4.1.

Table 4.1. Responses to error perception Questions 1, 2, and 3.

Treatment	Question 1		Question 2		Question 3	
	YES	NO	YES	NO	YES	NO
Control	2	11	0	13	2	11
T1	1	13	6	8	8	6
T2	3	14	7	10	17	0
T3	13	2	14	1	15	0
Totals	19	40	27	32	42	17

Statistical analysis was not performed on these data. However, inspection indicates a pronounced tendency for treatment groups to differ and clear evidence that all three experimental groups experienced and perceived errors at a level obviously greater than the control group. This is especially evident in T2 and T3.

Computer analysis was performed on the data resulting from questions 4, 5, 6, and 10. In each case, and at the .05 level of confidence with 3 and 55 degrees of freedom, an F value of 2.76 would allow rejection of the hypothesis of no difference. The questions are:

4. If your answer to question three was yes, how many mistakes do you think you observed? Write the estimated number.

Table 4.2. Estimate of errors observed--Question 4.

Frequency	Control	T1	T2	T3
0	11	7	0	0
1	0	4	6	0
2	2	2	6	1
3		1	3	3
4			0	2
5			2	4
6				2
7				1
8				0
9				0
10				2
Total observed	4	11	37	78
Total errors present	0	56	136	188
Mean no. observed	.308	.785	2.176	5.200

Analysis of the data is displayed in Table 4.3.

Table 4.3. Analysis of variance table for estimate of errors observed--Question 4.

Source of variance	Sum of squares	Degrees of freedom	Mean square	F value
Between groups	209.562	3	69.854	30.984 S
Within groups	123.997	55	2.254	
Total	333.559	58		

There is an obvious statistical difference between the groups in their ability to perceive errors. Therefore, the null hypothesis of no difference is rejected.

5. With the exception of the word "tunnel" which was intentionally misspelled, did you notice any misspelled words? If yes, write the estimated number.

Table 4.4. Estimate of spelling errors observed--Question 5.

Frequency	Control	T1	T2	T3
0	13	9	8	4
1		3	7	1
2		1	2	7
3				1
4		1		1
5				1
Total observed	0	9	11	27
Total errors present	0	14	34	45
Mean no. observed	.000	.643	.647	1.800

Analysis of the above data is presented in Table 4.5.

Table 4.5. Analysis of variance table for estimate of spelling errors observed--Question 5.

Source of variance	Sum of squares	Degrees of freedom	Mean square	F value
Between groups	24.063	3	8.021	7.949 S
Within groups	55.497	55	1.009	
Total	79.560	58		

There is statistical difference and thus the null hypothesis is rejected.

6. Four different versions of "A Fable Revisited" were shown today. The one you saw contained either no mistakes, four mistakes, eight mistakes or twelve mistakes. Which did you see--none, four, eight or twelve? Write the number.

Table 4.6. Determination of 0, 4, 8, or 12 error version--Question 6.

Version	Control	T1	T2	T3
0	11	5	0	0
4	2	9	17	5
8				10
12				
No. actual errors	0	4	8	12
Mean of estimate	.615	2.574	4.000	6.667

Analysis of the data is shown in Table 4.7.

Table 4.7. Analysis of variance table for determining error version--Question 6.

Source of variance	Sum of squares	Degrees of freedom	Mean square	F value
Between groups	274.398	3	91.466	38.157 S
Within groups	131.839	55	2.397	
Total	406.237	58		

A significant difference is clear and the null hypothesis is rejected.

10. Upon reflection, how many of each of the possible mistakes do you think you saw? Write the estimated number opposite the letter standing for copy, exposure, focus, and spelling.

Totals of all error types observed are summed in Table 4.8 to provide a further measure of the ability of subjects to detect errors.

Table 4.8. Retrospective estimate of errors observed--Question 10.

Frequency	Control	T1	T2	T3
0	11	5	2	0
1	0	4	3	0
2	0	1	4	1
3	0	1	5	1
4	2	3	2	3
5			1	1
6				2
7				3
8				2
9				1
10				0
11				1
Total observed	8	21	39	91
Total errors present	0	56	136	188
Mean no. observed	.615	1.500	2.294	6.061

Analysis for these data is shown in Table 4.9.

Table 4.9. Analysis of variance table for retrospective estimate of errors observed--Question 10.

Source of variance	Sum of squares	Degrees of freedom	Mean square	F value
Between groups	250.312	3	83.437	25.990 S
Within groups	176.569	55	3.210	
Total	426.881	58		

The null hypothesis was rejected.

Additional Findings

Data which may have relevance for future studies were gained from responses to error perception question 7 and 8.

7. Assuming you saw a version with mistakes, did these bother you in any way? Yes or no.
8. If your answer to the last question was yes, did any one type bother you more than the others? If yes, indicate which--copy, exposure, focus, or spelling by circling c, e, f, or s.

The combined results of these question are reported in Table 4.10. Responses tabulated under the "none" column are equivalent to a "no" answer to question 7. The remainder are "yes" responses.

Among those subjects responding to question 7 in the affirmative, by far the greatest number indicate focus errors as most bothersome. The notable exception is in T1 where, as previously indicated

Table 4.10. Type of error causing most concern--Questions 7 and 8.

Treatment	None	Copy	Exposure	Focus	Spelling
Control	11	0	0	2	0
T1	11	3	0	0	0
T2	1	0	2	13	1
T3	0	0	1	14	0
Total	23	3	3	29	1

(see page 47), the single focus error intended for that version was inadvertently omitted.

On the basis of the evidence, it seems quite clear that subjects were able to perceive production errors. Moreover, inspection of the tabularized data clearly indicates that the number of errors perceived increases as the incidence of increased numbers of errors present in a version becomes greater.

Cognitive Learning Hypothesis and Data Analysis

Null Hypothesis: There will be no difference between groups in cognitive learning as measured by immediate recall.

The statistical design for testing this hypothesis anticipated several analyses in the event of significance. These included one-way analysis of variance on the cognitive test, on classes of question within the total test and on types of errors. Finally, the Tukey (if subjects were equally distributed between groups) or Scheffé (if unequally distributed) test for multiple comparison of means would be applied post hoc.

Computer analysis was performed on the data. At the .05 level of confidence with 3 and 55 degrees of freedom, an F value of 2.76 would allow rejection of the hypothesis of no difference (see Table 4.11).

Table 4.11. Analysis of variance table for effect on recall.

Source of variance	Sum of squares	Degrees of freedom	Mean square	F value
Between groups	63.231	3	21.077	1.688 NS
Within groups	686.905	55	12.489	
Total	750.136	58		

On the basis of this analysis there is no statistical difference between the groups, and the null hypothesis cannot be rejected. Due to this finding no further analysis was performed on the data.

Error-Performance Relationship Hypothesis and Data Analysis

Null Hypothesis: In the event of significant effect, there will be no relationship between groups in the number of errors perceived and scores on the cognitive measure.

Statistical analysis of this hypothesis was dependent on a finding of significance in the preceding hypothesis. Since there was no significant difference in cognitive learning, statistical investigation is inappropriate.

Summary

The error perception hypothesis was first tested with three yes-no questions. A strong tendency toward differences between groups was noted and four subsequent error-estimate questions all provided statistically significant ($p = .05$) evidence that errors were perceived and the null hypothesis was rejected.

Although all three experimental groups exhibited lower mean achievement scores on the cognitive instrument as compared with the control group, such differences were not significant ($p = .05$). The null hypothesis of no difference due to production errors was therefore accepted.

Because of the finding of no significant difference for the learning hypothesis, the error-performance relationship hypothesis was not analyzed statistically. However, a trend was noted between C, T1, and T2. While T3 consistently reported higher mean scores on error observations, the mean achievement score failed to follow the downward trend established between control, T1, and T2. That is, $C > T1 > T2 < T3$.

These findings will be reviewed and further discussed in Chapter V; implications of the results of the study will be analyzed and certain suggestions offered for future research.

CHAPTER V

SUMMARY, CONCLUSION AND DISCUSSION

Summary

The literature dealing with inter-modality variables such as color, legibility, technical quality, channel effectiveness, and information level, clearly indicates that far too few prescriptive guidelines have been developed empirically. Likewise, there is much evidence that such information is sorely needed by producers and users alike.

One such factor which has not received adequate attention is that of the effect of low quality visual materials on cognitive learning. The most frequently applied guidelines, possibly resulting from a combination of early communication noise research and practical experience, mandates virtual technical perfection in the production of visual materials. This topic is not to be confused with earlier embellished-unembellished materials studies for unembellished materials are not necessarily of poor technical quality.

An extensive exploration of the topic yielded practically no research information which would help resolve the issue. Thus an experiment was undertaken whereby a population of undergraduate education students, unfamiliar with the subject matter of instructional development, were exposed to four versions of a professionally prepared cartoon style slide tape program in which the visual channel varied only in the number of technical imperfections--production related errors including poor copy techniques, under or over exposure, poorly focused slides, and misspelled words. The number of errors ranged from none in the Control group to 4, 8, and 12 in the three treatment groups. The presentations were made simultaneously under virtually identical physical conditions in a large, circular, Kiva-type classroom and utilized an identical audio channel delivered from a common audio source. Following the presentations, two evaluation devices were admininstered--a 35 item multiple choice test designed to measure cognitive learning and a 10 item error perception instrument constructed to determine if subjects actually perceived the induced errors.

Three related hypotheses were tested.

1. There will be no difference between groups in their perception of production errors.

2. There will be no difference between groups in cognitive learning as measured by immediate recall.

3. In the event of significant effect in the second hypothesis, there will be no relationship between groups in the number of errors perceived and scores on the cognitive measure.

Subsequent analysis of the data produced the following results. In all cases, simple one way analysis of variance (ANOVA) was the statistic of choice and significance was calculated at the .05 level of confidence using the F statistic.

1. Hypothesis 1 - A significant effect was found, $p > .01$.

2. Hypothesis 2 - A finding of no significant difference resulted, $p < .10$.

3. Hypothesis 3 - Not analyzed statistical because of NSD in the second hypothesis. However, a trend toward positive correlation was noted.

Conclusions

On the basis of the data reported above, several observations are offered.

On the perception hypothesis a pronounced error recognition effect was noticed with a significance level exceeding the .01 level of confidence on all questions designed to be evaluated. On the basis of this finding, several conclusions may be drawn.

1. Subjects did observe errors in the treatment versions.
2. Such observations were in direct proportion to the number of errors present in a given version. That is to say, the group exposed to the 12 error version reported seeing more errors than the group experiencing 8 errors, and they saw more than the group subjected to the 4 error version.
3. Treatment groups consistently underestimated the number of errors present in a given version. However, estimates were more accurate as the number of actual errors present in a version increased.
4. Of the four error types used in the study, subjects overwhelmingly reported focus errors as most bothersome.

It therefore seems apparent that in the present study errors were seen by those groups who were exposed to errors in direct proportion to the number of actual errors present. It is also suggested that not all error types are perceived in the same proportion nor do they appear to be equal in influence.

No significant difference was found for the major hypothesis of effect on cognitive learning ($p < .10$). Though not statistically significant, the following observations are of interest (see Table 5.1).

1. The control group consistently displayed a higher mean score on the recall instrument than any of the treatment group.
2. Mean recall scores demonstrated a tendency toward proportional lowering between the Control, T1, and T2 groups--a direct relationship between lower scores and increased incidence of errors present and/or observed. This tendency was not maintained in T3, the group receiving the largest number of errors, for the mean T3 groups recall score was higher than T2.

Table 5.1. Achievement scores--cognitive test.

	Control	T1	T2	T3
	14	7	9	15
	17	16	11	14
	18	17	12	17
	15	13	11	11
	17	10	12	12
	15	10	17	10
	12	18	17	20
	16	17	22	18
	14	17	16	13
	19	13	8	15
	14	16	11	12
	14	9	10	23
	14	13	14	12
		13	11	7
			12	14
			5	
			14	
Total	199	189	212	213
Mean	15.308	13.500	12.471	14.200

No absolute conclusions can be drawn, but there is a small, statistically insignificant trend toward a possible interference effect as well as a similar relationship between scores and errors. The case of T3 could be due to chance or it may substantiate like findings in a few previous studies. In this event, several theories are of interest and will be considered later in this chapter.

As indicated, the third hypothesis was not analyzed and therefore no conclusions are offered.

Given the conditions and restraints imposed on the present study--population, subject matter, design characteristics, vehicle (slide tape), style (color cartoon), channel design and relationship, type of errors employed and type of learning involved--two conclusions may be offered.

First, there is nearly unmistakable evidence that subjects did perceive production errors when, in fact, errors were present. Moreover, perception was based on and directly related to the number of errors present in a version.

Lastly, there is no statistically significant evidence that production errors interfere with the cognitive learning process. On the basis of this finding, it is probably unjustifiable to automatically concentrate human and financial resources on attaining technical perfection given the conditions outlined above.

Discussion

Whether or not audiences are generally aware of technical imperfections in media presentations has long been a matter of conjecture among media professionals. Direct personal observation of audiences noticing--or apprently not noticing--misspelled words or poorly focused slides, perhaps has influenced how a given media producer looks at the question. Some persons have maintained that audience characteristics undoubtedly influence error perception. For example, media specialists or photographers see technical errors, and English teachers are particularly sensitive to spelling errors.

Studies which have specifically tested these perception/non-perception positions are rare and, in fact, most information is by implication. Schlater [1966], in a previously reported study, felt that errors were not perceived. While he found a significant lowering of learning in material presented in the audio channel in the presence of production errors, this effect may well have been due to a second variable--speed of presentation. The explanation for lack of effect otherwise was that the errors probably were not obvious enough.

Sencer [1965] and Razinsky [1967] did test perception of errors in printed material and determined that errors were definitely observed. Hsia [1969], in a study using 25% black dots as visual channel interference, reported a significant effect, that is, lowering of learning. Interference was said to be the probable cause. However, perception of the interference source was apparently not singled out for testing. Thus perception of the interference source is by implication. The present study has shown that errors were seen. A possible explanation rests in the fact that the four error types were made visable--as obvious as possible without exceeding the limits of reality and common sense.

There existed an early suspicion that errors might be tabulated--counted--as the program was presented. If so, logic suggested that the very process of remembering the number of errors might cause interference. Estimates of errors, before and after the subjects had been given an indication of the number of errors they might have seen, were consistently less than the actual number present. Response to a direct question of whether subjects found themselves overtly counting errors brought an overwhelming "no" response. Thus the tabulation theory seems, on the surface at least, nonexistent. However, not all error types were equally obvious.

Copy and exposure errors were reported by 37% and 32% respectively of those subjects exposed to errors while spelling errors were reported by 60% of the subjects. By far the most frequently reported error type, and that which was judged most bothersome (see Table 4.10), was focus. Reported by almost 100% of the subjects in treatment groups having focus errors, this overwhelming response is interesting and deserving of further investigation simply because this probably represents the most frequently occurring error in day-to-day presentations. The present study did not answer the question of <u>why</u> focus errors were most bothersome, but it may be speculated that subjects felt that something important was being withheld. Focus was the only error type which actually distorted an image beyond recognition. The distortion hypothesis would be consistent with Levie [1973], Arnheim [1962], and Harrison [1962], all of whom maintain that there is a point beyond which compression (or withdrawal) of relevant cues--the minimum information level at which desired visual perception can occur--becomes dysfunctional and impedes or makes visual learning impossible. Even though there was no apparent effect on learning, the feeling among subjects may still persist.

While there are no data upon which to speculate about the relatively low incidence of reported copy and exposure errors, one possible explanation lies in the fact that these error types were not perceived by most subjects as errors at all. Rather, such imperfections are representative of everyday occurrences among amateur photographers. Over and under exposed slides and snapshots are common and extraneous materials, hands, heads, and other unintended items are all too frequently seen and accepted in the work of amateur photographers.

Thus there is the distinct probability that error types are not equally dysfunctional or observable by general audiences and that audience characteristics may well exert an influence on how different types of errors are perceived.

There are at least two interference theories or positions which are relevant to the outcomes of the present study. The literature on communication noise as characterized by Shannon and Weaver [1949], Berlo [1960], and others, postulates the negative effects of noise on communication while a comparatively small conditional representation summarized by Levie [1973] suggests that noise (as represented by technical quality) is not dysfunctional per se--only when relevant (necessary) visual cues are obliterated or otherwise masked. The assumption of noise/technical quality equivalency has apparently been assumed. Yet, there is evidence that under certain previously assumed noise conditions interference does not occur. Thus an intriguing possibility exists that the concept "noise" is not a general concept but rather specific to the situation. Moreover there is a suggestion that interference effects are again conditioned by audience characteristics--the intelligence relationship suggested by Hsia [1969] or the limited information processing capacity of humans reported by numerous writers, including Broadbent [1958], Travers [1964], Severin [1967], Hsia [1968], and Travers and Alvarado [1970].

Severin [1967] tested the effects of irrelevant cues and found greater recognition learning coming from the treatment with the more irrelevant cues and speculated that "It may be that subjects ignored the obviously irrelevant cues, . . ." [p. 399]. The term "blocking" was also used to explain the finding. That is, the subjects blocked the channel with the irrelevancies and relied on the other for information.

The finding of no significant difference in the present study may indeed be explained in part by Severin's [1967] comments. A second and closely related possibility may be attributed to information processing capability. Travers and Alvarado [1970] write that

> Living organisms are systems with a limited capacity for handling information and have to be selective in what they attend to. If they were not, they would constantly find themselves swamped with large volumes of useless information [p. 57].

Closely related to this explanation is that of Hsia [1968].

> It has been suggested that man is not motivated toward hearing or seeing all stimuli surrounding him; he either subconsciously refuses to process all the information--his defensive mechanism in IP (information processing) performs homeostatic functions to fend off excessive information--or he selects only the information which has "surprise value," or "predictive value" [Cherry, 1961], or is essential for his survival [pp. 255-56].

Hsia [1968] offers a further explanation in the possibility that when information overloads the information processing system the amount of information serves to overextend the processing capacity of the central nervous system.

The finding of no significant difference on the major hypothesis is, in a real sense, significant if not generalized too far beyond the conditions of the present experiment. As indicated previously, there is at least a hint that technical perfection is unnecessary and possibly a waste of resources. However, the consistency of lower scores in all treatment groups as compared to the control group is of interest and quite logically motivates a nagging feeling that some effect is present, that something perhaps has been missed.

The finding that the group subjected to and observing the most errors (T3) failed to follow a pattern of lower scores as the number of errors increased is interesting but not too surprising for the data tend to confirm, to some extent, previous findings of Schlater [1966] and Severin [1967].

The question of channel relationship must necessarily be raised. As reported earlier, the message vehicle used in the present study was purposely selected because it was representative of contemporary channel design--audio primacy. If a vehicle had been selected which displayed visual primacy, would the interference effects have been greater? The answer can only be speculative, but there is evidence [Schlater, 1966], Severin [1967], and Hsia [1969] that the visual channel is more resistant to interference than the audio channel and thus similar findings would be a distinct possibility.

There remains the possibility that the results of this present study may be attributed to chance or population characteristics. It is, however, interesting to note that the results of pre and post experiment testing of the media and evaluation instruments were extremely similar even though audiences were older on the average and established in elementary and secondary education curricula rather than just beginning. Thus it is felt that the population was representative.

A further consideration involves the instrumentation used in the study. While the reliability of the error perception was assumed, all tryouts, before and after the experiment, yielded highly consistent results. Reliability of the cognitive instrument was determined to be nearly .70 on the Kuder Richardson scale and again pre and post experimental uses showed consistency. However, an interesting--and thus far unexplained--event occurred during the actual experiment. When the Kuder Richardson reliability coefficient was calculated for the control group following the experiment, it was found to be -.69, a highly unusual measurement. The data were re-analyzed by computer and eventually by hand, but the coefficient remained the same. Numerous consultations and work by testing specialists failed to determine the cause and the only plausible explanation offered is related to the unusually narrow range of scores for the Control group (see Table 4.12) as compared to the treatment groups. This chance distribution may be responsible for the negative reliability of the instrument.

A final comment involves the level of confidence ($p = .05$) used to measure significance and suggests caution--along with the reliability aspect--in accepting the finding of no significant difference on the major hypothesis. If a confidence level of p = .25 is used, there is significance. Although the incidence of chance error is obviously greater, this combined with other factors suggests future research direction.

Implications for Future Research

There are numerous research directions either suggested by this or related studies. Most obvious, perhaps, is a replication of the present study in which several modifications should be considered.

1. The cognitive instrument should be further refined to achieve higher reliability. It is likely that the negative reliability coefficient would disappear in such a replication.
2. A large population ($n > 25$ subjects per group) should be used in any replication and an attempt made to isolate a second variable related to audience characteristics--intelligence for example.
3. A fourth and possibly fifth treatment group (T4) should be added and be exposed to 16 and 20 errors, respectively, to maintain the established linear progression. This would serve to determine whether the upward swing in mean score demonstrated by T3 would continue upward, stabilize, or regress. In effect, this condition would be a check against current information processing theory discussed previously.
4. Consideration should be given to a different subject

matter and the possible use of a pre-test.

Other follow-up studies might include design variables such as the following:

1. Using measured error perception data and recall scores as covariables, data might be obtained to demonstrate whether the presence of errors per se has any effect or whether such errors must be overtly perceived before possible interference results.
2. A second multi-variable design could use attitude, perception, and recall data. The attitude element becomes important whether an effect is noted or not for, as in the case of color vs. black and white film studies, there is growing speculation that attitude toward the message, source, or indeed, the medium itself, may be highly important. A logical application of this concern might be in teacher education where poor attitude toward a medium could conceivably influence use at a later date.
3. In view of the reported "bothersome" nature of focus errors, a study which used only that type of error seems logical for, as mentioned previously, focus errors are perhaps the most common error in day-to-day applications. This is more directly related to presentation errors--those which occur during projection--since the combination of different types of film emulsions and slide mounts naturally produce out-of-focus images and

very few schools currently own or use so called "auto-focus" slide projectors.

4. The preceding study suggests an entire experiment devoted to presentation errors--focus problems, blown lamps, the failure of a slide to drop, and the like. Such errors are clearly more obvious and thus may produce interference--if only from delays or disruption of message continuity. If negative effects are found, a logical application of the data would be to develop corrective procedures such that information from the message would not be lost. The implication, therefore, is that the experiment would be designed such that presentation errors would be corrected in one version, uncorrected in another.

5. No attempt was made in the present study to specifically measure the influence of a given error or error type on information processing at the point of the error or on information which immediately preceded or followed that error.

6. A further area of interest involves audience expectations and technical quality. What are the effects, for example, when an audience expects high quality but experiences poor quality or expects low quality and experiences low quality.

The preceding suggestions are by no means exhaustive for so little is known and so much is needed. For example, much is known about comparative learning--both simultaneous and sequential--under ideal conditions. What happens under conditions of noise or interference when, for example, a sequential comparison strategy is used? The answer, it is speculated, is very little, and yet comparative learning strategies are frequently used in media design--often times without realization and recognition. It is entirely possible that the value of the strategy is negated under such possible interference conditions.

It is hoped that the present study has made some small contribution to the instructional media field in general and to message design and delivery in particular. Certainly one of the most important efforts that present and future scholars can make is in the direction of developing a prescriptive message design and delivery technology, a technology which, given objectives, audience or individual characteristics, message content, and other necessary inputs can deliver a product which will be both effective and efficient educationally.

APPENDICES

APPENDIX A

LETTER TO PROFESSOR BREHM

November 1, 1973

Dr. Shirley Brehm
Elementary Special Education
351 Erickson Hall
Campus

Dear Shirley:

I truly appreciate your willingness to assist with my research study. I have delayed the inevitable much too long. Now, however, my degrees of freedom are somewhat restricted and so away we go!

The nature of my study seems somewhat simplistic on the surface, but as one delves into the problem it becomes quite apparent that it is not simple at all. The study is tied into a whole range of related kind of things including information processing, channel capacity and communication noise to mention but a few.

The title of the study is "The Effect of Production Errors in the Visual Track of a Multi-Sensory Program Format on Cognitive Learning," and is motivated by the fact that many of us in the "media business" have traditionally tended to follow a position which is often associated with Eastman Kodak. The essence of their advice is that visual errors of any kind, low quality visuals of any kind, are to be avoided like the plague for they associate this with reduction in cognitive learning and a negative attitude shift. For years, many people have followed this position literally without question. In my own experience I have often seen multi-sensory materials--slide tapes, motion pictures, television and the like--used in classrooms with apparent disregard for this advice. I often wondered what might be happening to viewers. As time went on evidence began to make me suspect that some of these production errors--things like bad exposure, poor focus, misspelled words, sloppy copy techniques and the like--might not be as bad as we were lead to believe. By contrast it would be dysfunctional. My own personal practice over the years has been to make my multi-sensory programs as perfect as possible. I know what it means in terms of time and money to perfect programs and thus this also became a concern.

Eventually I decided to look into research and to my amazement discovered that there was little or no research to support this particular position. Upon talking to people at Eastman Kodak I discovered that the basis for their contention was probably a result of experience rather than any kind of empirical evidence. I then talked to a number of visual communication experts around the country and they were supportive of this suspicion.

Procedurally the study will go somewhat as follows. I selected a professionally produced cartoon-style slide tape presentation which was originally designed to teach groups of educators the essense of an instructional development systems model--a very simple model consisting of three stages and nine functions. I went through fairly rigorous procedures in analyzing the information content of both the audio and visual track--something which is only infrequently done in research studies of the type I am concerned with. Following this I rephotographed all of the art work and at previously and randomly selected points induced production type errors into the otherwise perfect visual channel. Called "A Fable Revisited," the three pigs are the vehicle for presenting the information and the story is very similar to the original with the exception of the systems terminology.

There will be a control and three treatment groups. The control group will see a perfect presentation, T1 will see a version with four errors, T2 will have eight errors and T3 will have twelve. Following the nine minute presentation, all populations will take a paper and pencil test of information presented in any of the channel options. Following this, they will complete a short questionnaire designed to determine if errors are actually perceived.

I am hypothesizing that the errors will cause a lowering in cognitive learning and that this will be directly related to the number of errors involved. However, the fun thing about this piece of research is that I don't really care how it turns out for either way we will get information which is immediately applicable within the restrictions imposed by the study. Part of the application value resides in its association with the whole visual literacy movement for there is sure a lot of material of questionable quality being produced in our schools. We also have several spin-off studies in mind depending on which way the thing goes.

Again Shirley, I wish to extend my sincere thanks and I will do everything possible to make this valuable to your students--including any follow up information which some of them might like. I would like to get a class list as soon as possible so that I might make assignments to groups.

Sincerely,

Bruce L. Miles

Bruce L. Miles

Please answer the following questions to the best of your ability. Work quickly and complete each question in order. Do not return to a question or change your answer once you have left the question. First impressions and answers will be most representative and accurate. In each case there is only one best answer. Do not guess unless you are reasonably sure your answer could be correct. Use response (5) when you really don't know the answer. Please mark the number which corresponds to your choice on the response form.

1. Upon entering the first stage in the systems process, the team attempted to:

    (1) identify performance objectives
    (2) specify methods to solve their problems
    (3) organize themselves
    (4) determine their problem
    (5) I really don't know

2. According to A FABLE REVISITED, the Systems Approach may best be described as a process for:

    (1) solving problems
    (2) measuring solutions
    (3) specifying problems through team work
    (4) data-based problem specification
    (5) I really don't know

3. The evidence indicates that Straw Pig selected his source of building material:

    (1) on the basis of need
    (2) completely by chance
    (3) with little thought
    (4) after very brief discussions with other pigs
    (5) I really don't know

4. In one scene System Pig made task assignments. There is evidence to support the following statement:

    (1) he had written assignments for all team members
    (2) there is no evidence to suggest that assignments were in writing
    (3) assignments may have been written for all team members, but only one pig actually had a sheet
    (4) he had written assignments for Straw and Twig, but not for himself
    (5) I really don't know

5. Twig Pig showed some evidence of having:

    (1) thoroughly researched wolves
    (2) organized management
    (3) analyzed the setting
    (4) defined his problem correctly
    (5) I really don't know

APPENDIX B

RECALL INSTRUMENT

6. At one point the wolf was shown carrying a bag. On the bag was written:

    (1) bag "o" tricks
    (2) nothing was written on the bag
    (3) pig "skinning" tricks
    (4) bag of tricks
    (5) I really don't know

7. The second step in the final stage was to:

    (1) construct the actual house
    (2) recycle on the basis of data from the test
    (3) test the actual house
    (4) analyze results of model test
    (5) I really don't know

8. "What must be done," "what should be" and "what is" are most closely associated with:

    (1) identifying performance objectives
    (2) a needs assessment
    (3) organizing management
    (4) testing the real house
    (5) I really don't know

9. Straw Pig selected his building material:

    (1) after very brief discussions with other pigs
    (2) on the basis of need
    (3) completely by chance
    (4) almost by chance
    (5) I really don't know

10. The third stage is:

    (1) the evaluation stage and that is where the simulated wolf attack came in
    (2) the evaluation stage and it was here that the proposed solution was built
    (3) not the last stage in the system model
    (4) the development stage and this comes before the evaluation stage
    (5) I really don't know

11. From the evidence it is safe to say that:

    (1) pig resources were brought in to build the model
    (2) human resources were brought in to build the model
    (3) only human resources were consulted
    (4) pig resources were consulted but only in the planning stage
    (5) I really don't know

12. According to A FABLE REVISITED, the Development Stage:

    (1) is the second stage and the first activity in that stage is to identify the problem
    (2) is the second stage and the first activity in that stage is to identify performance objectives
    (3) is not the second stage
    (4) is the first stage and the first activity in that stage is to identify the problem
    (5) I really don't know

13. At one point we saw the wolf holding a sign. The sign said:

    (1) do not disturb, watching pigs
    (2) pig watching, do not disturb
    (3) do not disturb, pig studying
    (4) do not disturb, pig watching
    (5) I really don't know

14. In the process of identifying their problem, the pigs collected information on wolves. At this point they were:

    (1) analyzing the setting
    (2) in the development stage
    (3) identifying performance objectives
    (4) specifying methods and means
    (5) I really don't know

15. When the Three Pigs collected information on the wolf they:

    (1) had completed the first activity in the first stage
    (2) were in the second stage
    (3) were doing a needs assessment in the first stage
    (4) had started the third activity in the second stage
    (5) I really don't know

16. At one point the team built a model of their proposed solution. It was also referred to as:

    (1) a prototype or simulation
    (2) a simulation
    (3) a prototype
    (4) a protosolution
    (5) I really don't know

17. In one scene Straw Pig carried an umbrella. The color of the umbrella was:

    (1) red
    (2) black
    (3) orange
    (4) blue
    (5) I really don't know

18. The performance objective as identified by the pigs is best stated as follows:

    (1) design and construct a defense system to ward off all wolf attacks as soon as possible
    (2) plan and test before the wolf comes a defense system for preventing wolves from successfully huffing and puffing
    (3) plan, test and build a defense system against all possible wolf attacks before he comes
    (4) plan, test and build a defense system to ward off all possible wolfian attacks
    (5) I really don't know

19. At one point the wolf was shown carrying a bag. From the evidence shown, the bag contained:

    (1) some explosives, a saw and a mallet
    (2) some explosives, a club and a saw
    (3) some explosives and a saw
    (4) some explosives and a mallet
    (5) I really don't know

20. The straw house was built:

    (1) with little or no thought
    (w) with no thought at all
    (3) on the basis of little thought
    (4) thoughtfully, but of the wrong material
    (5) I really don't know

21. Straw Pig's approach to the world of troubles may be characterized as:

    (1) no approach at all
    (2) an incomplete systems approach
    (3) a very weak systems approach
    (4) almost no approach
    (5) I really don't know

22. In the scene where the pigs were building the house:

    (1) one pig had a hammer, a second a trowel
    (2) one pig had a trowel and no other tools were shown
    (3) one pig had a hammer and no other tools were shown
    (4) all three pigs had tools
    (5) I really don't know

23. In one scene System Pig held a list of simulated wolf attack results. Listed:

    (1) were two results
    (2) was one result
    (3) was no results
    (4) were more than two results
    (5) I really don't know

24. As far as problems are concerned, Straw Pig's concern was:

    (1) he wasn't concerned
    (2) protection from the weather and the wolf
    (3) protection from the wolf
    (4) protection from the weather
    (5) I really don't know

25. After constructing the model, the first thing the system team did in the final stage was to:

    (1) test the model
    (2) evaluate the results of the model test carried out in the second stage
    (3) check the results of the model test carried out in the second stage against the objectives
    (4) construct the actual house
    (5) I really don't know

26. According to System Pig, which of the following best represents the concept of needs assessment?

    (1) What should be
-What is
What will be

    (2) What must be done
-What is
What should be

    (3) What is
-What should be
What must be done

    (4) What should be
-What is
What must be done

    (5) I really don't know

27. The pig team determined the availability of resources--human, pig and material. This was a part of:

    (1) organizing their management
    (2) analyzing the setting
    (3) the development stage
    (4) specifying methods
    (5) I really don't know

28. According to A FABLE REVISITED, assigning tasks is a part of:

    (1) the first stage and third activity
    (2) the first stage and second activity
    (3) the second stage and third activity
    (4) the second stage and second activity
    (5) I really don't know

29. According to the story the wolf:

(1) spent a good deal of time studying pigs, but little time observing them
(2) spent a good deal of time studying and watching pigs
(3) spent a good deal of time watching pigs
(4) spent a good deal of time watching pigs, but little time studying them
(5) I really don't know

30. The narration indicated that "there is more than one way to skin a pig and . . .

(1) the wolf has alternate methods
(2) the adversary has alternate strategies
(3) the wolf has optional strategies
(4) the adversary has optional plans
(5) I really don't know

31. The final house which was built:

(1) had a door bell
(2) didn't have a door bell
(3) may have had a door bell
(4) may have had a door bell, but there is no evidence to tell
(5) I really don't know

32. According to A FABLE REVISITED, the Design Stage:

(1) is not the first stage
(2) is the first stage and the first activity in that stage is to analyze the setting
(3) is the first stage and the first activity in that stage is to identify the problem
(4) is the second stage and the first activity in that stage is to identify performance objectives
(5) I really don't know

33. After entering the second stage, our pig heroes first:

(1) developed a model of the proposed solution
(2) identified the proposed solution
(3) recycled performance data
(4) identified performance objectives
(5) I really don't know

34. When the team was testing the model, the "huff and puff" control was:

(1) set on medium speed
(2) set on high speed
(3) not set on high speed
(4) not shown in the picture
(5) I really don't know

35. After checking the results of the simulated wolf attack, the pigs discovered that:

(1) they needed more defense devices
(2) there was a weakness in the chimney
(3) they needed a trap door
(4) the fireplace showed a weakness
(5) I really don't know

APPENDIX C

ERROR PERCEPTION INSTRUMENT

AND RESPONSE FORM

ERROR-PERCEPTION INSTRUMENT
(Tape Recorded)

I hope you have enjoyed viewing and listening to "A Fable Revisited" and participating in this validation. For your information the slides were prepared by taking pictures of original art work of professional quality.

Our final task is to respond to 10 short-answer questions regarding the visual materials. You'll have approximately eight seconds to respond to each question on the answer sheet provided. Remember, this concerns only the visual material.

QUESTION 1

Did you observe any deviation from the generally high quality of the visual material? Circle yes or no.

QUESTION 2

Did you observe any instances of what might be called production mistakes or errors in photography? Circle yes or no.

QUESTION 3

Production mistakes include such matters as misspelled words, poorly focused or "fuzzy--unclear" slides, improperly exposed slides which are excessively light or dark and poor copy techniques which allow things to show in the slide which shouldn't be there. Did you notice any instances of these kinds of mistakes? Circle yes or no.

QUESTION 4

If your answer to the last question was yes, how many mistakes do you think you observed? Write the estimated number.

QUESTION 5

With the exception of the word tunnel which was intentionally misspelled did you notice any misspelled words? If yes, write the estimated number.

QUESTION 6

Four different versions of "A Fable Revisited" were shown today. The one you saw contained either no mistakes, four mistakes, eight mistakes or twelve mistakes. Which did you see--none, four, eight or twelve? Write the number.

QUESTION 7

Assuming you saw a version with mistakes, did these bother you in any way? Circle yes or no.

QUESTION 8

If your answer to the last question was yes, did any one type of mistake bother you more than the others? If yes, indicate which--copy, exposure, focus or spelling by circling c, e, f or s.

QUESTION 9

Assuming you saw a version with mistakes, did you find yourself counting or keeping track of them? Circle yes or no.

QUESTION 10

Upon reflection, how many of each of the possible mistakes do you think you saw. Write the estimated number opposite the letter standing for copy, exposure, focus and spelling.

APPENDIX D

CREDITS FOR "A FABLE REVISITED"

RESPONSE FORM - PART II

<u>QUESTION 1</u>

YES NO

<u>QUESTION 2</u>

YES NO

<u>QUESTION 3</u>

YES NO

<u>QUESTION 4</u>

____

<u>QUESTION 5</u>

____

<u>QUESTION 6</u>

____

<u>QUESTION 7</u>

YES NO

<u>QUESTION 8</u>

c.

e.

f.

s.

<u>QUESTION 9</u>

YES NO

<u>QUESTION 10</u>

c. ________________

e. ________________

f. ________________

s. ________________

CREDITS

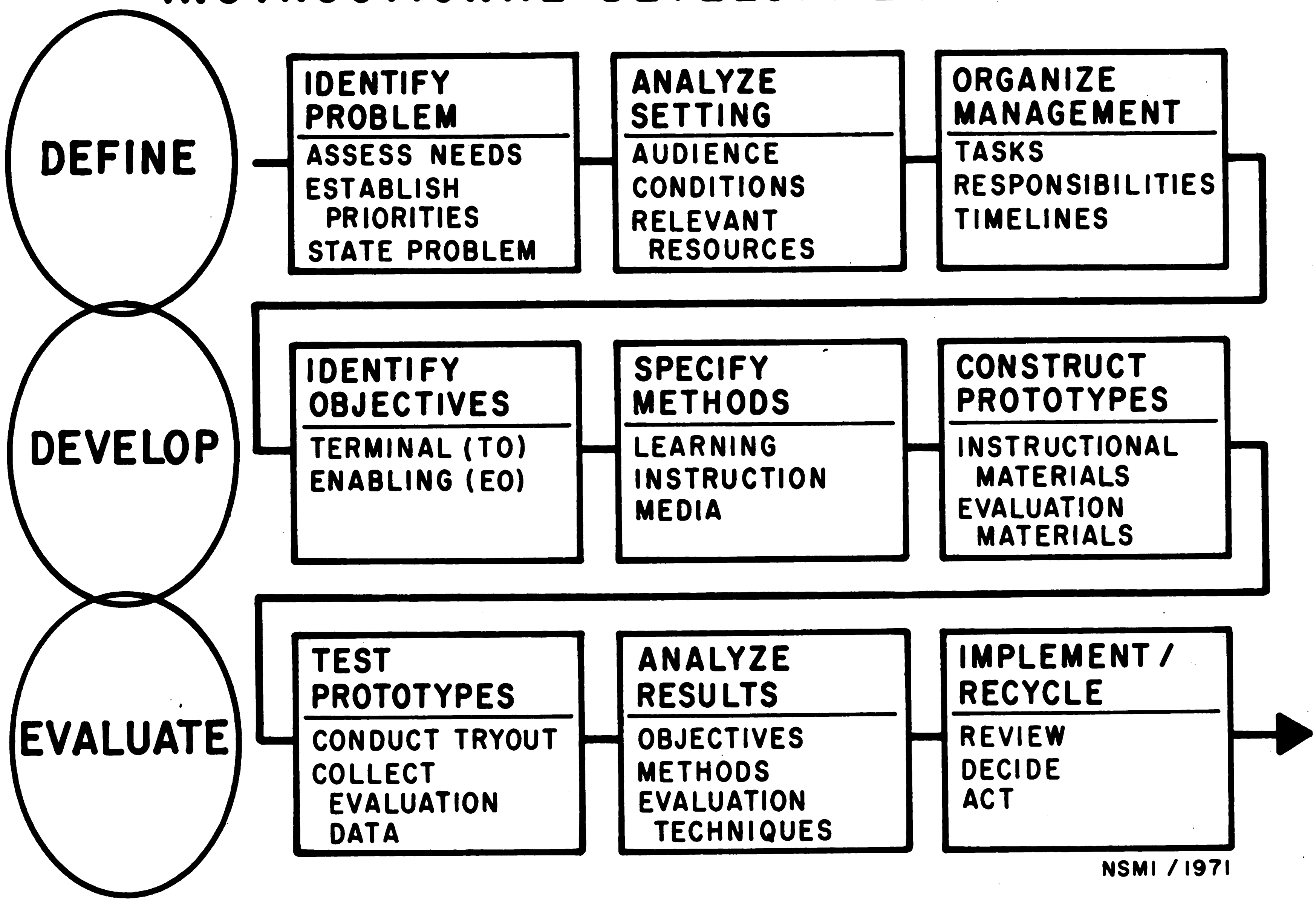
The author wishes to acknowledge the use of "A Fable Revisited." This material was designed and produced for the National Special Media Institutes, Instructional Development Institute by Doug Armstrong, Peggy Laird, Arlene Magnus, Russ McGregor, and Sue Meador, all from the University of Southern California. The excellent art work was by Ms. Laird and the entire production was adapted from an original idea by Dr. Roger A. Kauffman. "A Fable Revisited" is used by permission of the National Special Media Institutes, Dr. Charles F. Schuller, Director.

APPENDIX E

INSTRUCTIONAL DEVELOPMENT MODEL

(IDI)

INSTRUCTIONAL DEVELOPMENT MODEL

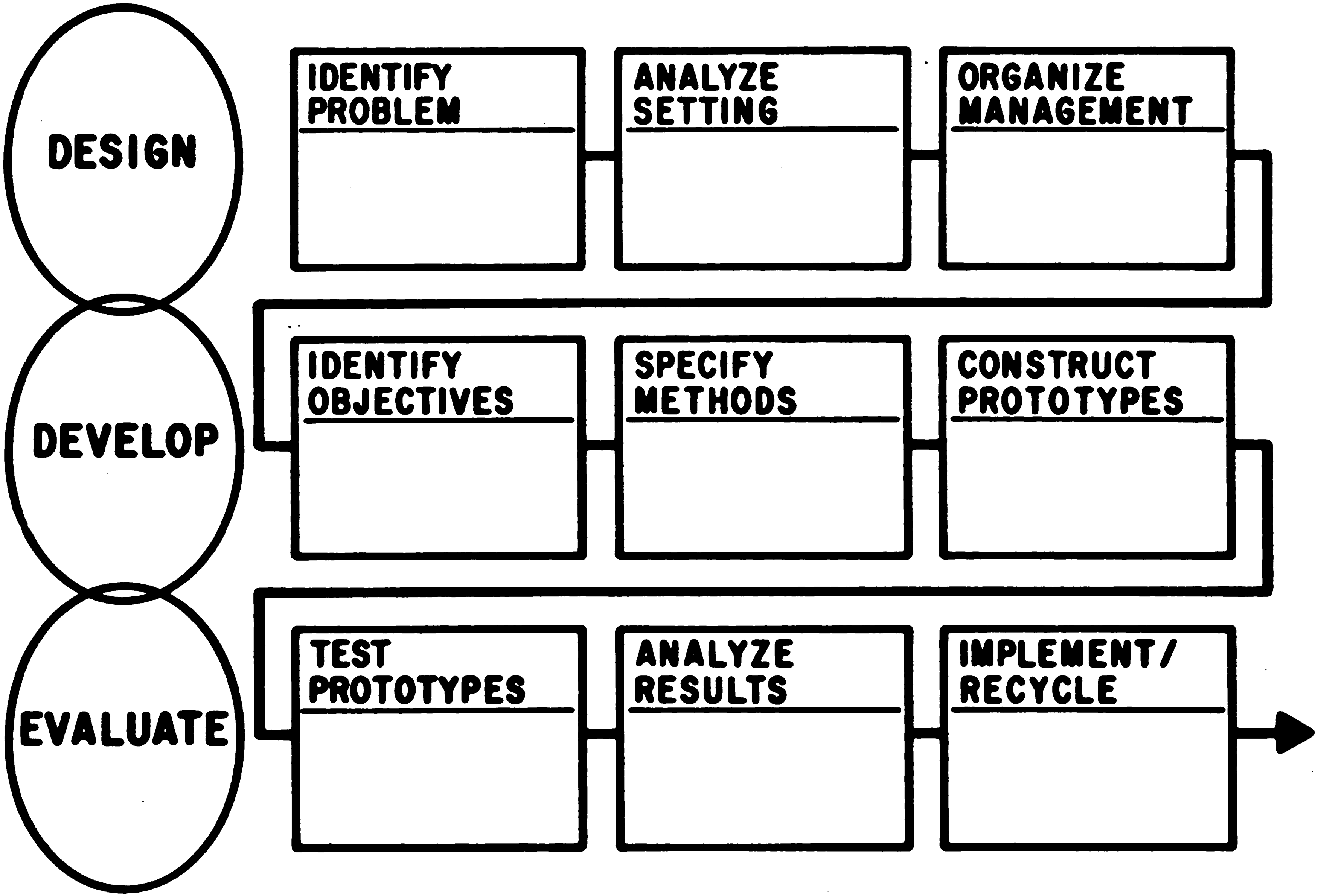


APPENDIX F

AUDIO CHANNEL CONTENT DETERMINATION FORM

(MODIFIED IDI MODEL)

INSTRUCTIONAL DEVELOPMENT MODEL



APPENDIX G

SCRIPT FOR "A FABLE REVISITED"

WITH ERROR LOCATION AND TYPE

AND CHANNEL RELATIONSHIPS

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
1 ERROR LOCATION none CHANNEL RELATIONSHIP	7.5	6.5	G: Now, let's consider how this space conquering strategy might be used in a problem of less cosmic dimensions.
2 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	8.5	5.0	G: Take for instance a problem which faced three of nature's creatures not too long ago . . .
3 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	10.0	9.5	G: They lived--if you could call it that--out in the country, where lurked a number of problems--not the least of which was simple survival.
4 ERROR LOCATION none CHANNEL RELATIONSHIP related	9.5	9.0	G: You remember these guys. Each one looked for solutions to a pressing problem in a different way--and with varying degrees of success.
5 ERROR LOCATION none CHANNEL RELATIONSHIP redundant	6.5	5.75	G: It was this fellow--a very clever character indeed--who presented the most immediate hazard.

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
6	6.5	6.25	G: Now don't forget that we are looking at this story with an eye to the Systems Approach. M: I gotcha.
ERROR LOCATION none CHANNEL RELATIONSHIP unrelated			
7	6.0	6.0	G: Okay, the first pig, you will recall, was a very improvident soul. M: My hero.
ERROR LOCATION none CHANNEL RELATIONSHIP unrelated			
8	14.0	14.25	G: Right. It is pretty obvious that he didn't use the systems approach. In fact, he had no approach at all--let alone a systems approach. He was happy and carefree. M: Yeah, my hero. G: Just like you, George.
ERROR LOCATION none CHANNEL RELATIONSHIP related			
9	9.5	9.75	G: This pig--we'll call his "Straw Pig" had never really seen the wolf. He concerned himself with the problem of protecting himself from the elements of the weather.
ERROR LOCATION Copy, T1, T2, T3 CHANNEL RELATIONSHIP unrelated			
10	7.5	7.25	G: So our pig went on his way, easy and carefree, until he met, by chance, a man carrying straw.
ERROR LOCATION none CHANNEL RELATIONSHIP redundant			

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
11 ERROR LOCATION none CHANNEL RELATIONSHIP related	7.0	6.75	G: Ah, this would do nicely for a house! Besides it was free or inexpensive building material
12 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	6.5	5.25	G: "Straw Pig" had no plans. Pig lore had it that some protection was helpful for pig survival.
13 ERROR LOCATION none CHANNEL RELATIONSHIP related	6.0	5.25	G: His solution strategy was simple: just build a house for protection from the wind and rain.
14 ERROR LOCATION Exposure, T3 CHANNEL RELATIONSHIP unrelated	8.5	8.25	G: As we have seen, the straw house was built with little or no thought . . . and then guess what happened? M: The wolf came. G: Right.
15 ERROR LOCATION none CHANNEL RELATIONSHIP related	7.5	8.0	G: With minimum effort and a little huffing and puffing on the part of the wolf the straw house was an easy victory.

VISUAL CHANNEL		AUDIO CHANNEL		
Slide	Time	Time		
16 ERROR LOCATION none CHANNEL RELATIONSHIP related	8.0	7.75	G:	Perhaps "Straw Pig" had been too hasty. It's entirely possible that he got the cart before the horse, so to speak.
17 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	3.5	3.25	M:	He was just busy playing and gamboling around, that was all.
18 ERROR LOCATION none CHANNEL RELATIONSHIP related	12.0	12.0	G:	Yes, but meanwhile, our second pig named "Twig" has been casually inquiring about the prospects of a wolf attack. He discovers that wolves huff and puff.
19 ERROR LOCATION none CHANNEL RELATIONSHIP related	6.0	6.25	G:	His neighbors and "Straw Pig" warn him about the especially clever wolf who skulks nearby.
20 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	6.0	6.0	G:	"Twig Pig" is convinced not only should he protect himself from the weather, but also from the wolf.

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
21 ERROR LOCATION none CHANNEL RELATIONSHIP related	5.0	4.5	G: "Twig Pig" quickly looks into the methods and materials available to him.
22 ERROR LOCATION none CHANNEL RELATIONSHIP related	11.0	10.75	G: Now, based on the experience of your "Straw Pig"--he decides to use something more creative and effective! Genuine lath and plaster twigs would do the trick!
23 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	14.0	13.75	G: "Twig Pig" has a better insight into the situation, right? M: Yeah. But he hasn't gone far enough. G: His information is casually selected--it's incomplete. After all, what does he actually know about the wolf?
24 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	10.0	10.25	M: Well, he knows he huffs and puffs and stuff like that. G: Right. He thought his plan might work. M: Well that's about all you can hope for in this world.
25 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	6.0	6.75	G: Now, wait a minute, back at the wolf lair, our antagonist--in his own crafty and intuitive way . . .

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
26 ERROR LOCATION none CHANNEL RELATIONSHIP related	6.5	7.0	G: looks into his problem. Being a very hungry fellow, he is highly motivated to succeed,
27 ERROR LOCATION Spelling, T1, T2, T3 CHANNEL RELATIONSHIP related	5.0	4.0	G: he has spent a good deal of time studying and observing pigs.
28 ERROR LOCATION none CHANNEL RELATIONSHIP related	11.5	10.5	G: Would you say our wolf is well prepared? M: Ah hum, ah hum . . . G: Yes, he uses some very creative approaches before resorting to the huff and puff business.
29 ERROR LOCATION none CHANNEL RELATIONSHIP related	5.0	5.0	G: And . . . well you have to admit George, the planning wasnt' too thorough here--was it?
30 ERROR LOCATION none CHANNEL RELATIONSHIP related	7.0	6.5	G: The problem sure overcomes our loveable but less than successful firend. Guess he forgot something too.

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
31 ERROR LOCATION none CHANNEL RELATIONSHIP related	6.5	5.75	G: But you'll be happy to know that "Twig" and "Straw" escape by the hairs of their you know whats. M: Oh yeah.
32 ERROR LOCATION none CHANNEL RELATIONSHIP related	5.5	5.5	G: Now for the moment you have been waiting for. Is pig #3 a systems pig?
33 ERROR LOCATION none CHANNEL RELATIONSHIP related	6.0	5.5	G: How will he react to the wolf threat? Flippantly lay his plans? M: I bet he will.
34 ERROR LOCATION none CHANNEL RELATIONSHIP related	3.5	3.5	G: Casually gather information? M: That's the way he'll do it.
35 ERROR LOCATION none CHANNEL RELATIONSHIP related	4.5	4.25	G: Or will he approach his problem differently? M: Go on, go on . . .

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
36 ERROR LOCATION none CHANNEL RELATIONSHIP redundant	2.5	2.5	G: He is our system man--I mean pig.
37 ERROR LOCATION Focus, T2, T3 CHANNEL RELATIONSHIP related	13.5	12.75	G: First, the DEFINE stage. Together with "Twig" and "Straw" pigs they proceed to thoroughly identify the problem. G. Want to know how? M: Go ahead, you'll tell my anyway.
38 ERROR LOCATION none CHANNEL RELATIONSHIP related	14.5	14.75	G: For instance they analyze the setting by collecting information on their adversary: the wolf--his characteristics, size, likes, dislikes, you know--abilities, habits and that type of thing.
39 ERROR LOCATION none CHANNEL RELATIONSHIP related	8.0	8.5	G: You might say, they assessed their needs. Well you might not say that. M: No, I wouldn't have said that.
40 ERROR LOCATION Spelling, T3 CHANNEL RELATIONSHIP redundant	9.0	8.5	G: They decided WHAT MUST BE DONE to protect themselves from the wolf by finding out WHAT IS and comparing it to WHAT SHOULD BE.

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
41 ERROR LOCATION none CHANNEL RELATIONSHIP redundant	6.0	5.0	G: . . . THEN IT'S ONLY A MATTER OF assigning priorities and starting to work, right? M: Right.
42 ERROR LOCATION none CHANNEL RELATIONSHIP redundant	7.0	6.75	G: Wrong: The team must still determine what resources are available, like materials, people or pigs.
43 ERROR LOCATION Exposure, T2, T3 CHANNEL RELATIONSHIP Related	9.0	8.5	G: Recognizing the value of team work, System Pig had earlier organized the management by assigning tasks to himself and the others.
44 ERROR LOCATION none CHANNEL RELATIONSHIP related	12.5	12.0	G: The second stage in our team's survival plan was the DEVELOPMENT stage. They first identified their performance objective. You knew they had to come in here somewhere didn't you? M: I figured.
45 ERROR LOCATION Focus, T3 CHANNEL RELATIONSHIP redundant	8.5	8.0	G: . . . to design, test and complete a a defense system against all possible wolfian attacks, as soon as possible.

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
46	5.0	4.75	G: Now they attempted to specify methods which could be used to help solve the problem.
<u>ERROR LOCATION</u> none <u>CHANNEL RELATIONSHIP</u> related			
47	6.0	5.75	G: They called in experts and they constructed a model or a prototype of the proposed solution.
<u>ERROR LOCATION</u> Copy, T2, T3 <u>CHANNEL RELATIONSHIP</u> related			
48	7.0	6.5	G: But . . . before building the actual house our team found it necessary to take care of some other details.
<u>ERROR LOCATION</u> none <u>CHANNEL RELATIONSHIP</u> unrelated			
49	10.5	10.5	G: They now entered the final or evaluation stage. First they tested the model with a simulated wolf attack . . . if you can imagine a simulated wolf! M: Speaking
<u>ERROR LOCATION</u> Exposure, T1, T2, T3 <u>CHANNEL RELATIONSHIP</u> related			
50	9.0	8.5	G: They analyzed the results of the test and concluded that in order to outfox the wolf, something had to be done about the chimney.
<u>ERROR LOCATION</u> Spelling, T2, T3 <u>CHANNEL RELATIONSHIP</u> related			

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
51 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	6.0	6.0	M: To outfox the wolf--that's like being Shanghaied to Tokoyo. G: Right!
52 ERROR LOCATION none CHANNEL RELATIONSHIP related	7.5	7.75	G: The data were recycled and modifications made. Now our friends are ready to implement their plan on a full scale.
53 ERROR LOCATION none CHANNEL RELATIONSHIP related	6.5	5.75	G: The final house was also tested. Although the brick house took longer to build . . .
54 ERROR LOCATION none CHANNEL RELATIONSHIP related	3.0	3.25	G: When the last brick was in place, they were ready:
55 ERROR LOCATION none CHANNEL RELATIONSHIP related	6.0	3.5	G: So the stage is set for the final scenes in our drama.

VISUAL CHANNEL		AUDIO CHANNEL		
Slide	Time	Time		
56	2.5			Change after 3 seconds of silence.
ERROR LOCATION none CHANNEL RELATIONSHIP related - 55				
57	2.5			Change after 3 seconds of silence.
ERROR LOCATION none CHANNEL RELATIONSHIP related - 55				
58	2.5			Change after 3 seconds of silence.
ERROR LOCATION none CHANNEL RELATIONSHIP related - 55				
59	7.5	5.75	G:	This part is the one in which our System Pig's "System Approach" is a real life-saver.
ERROR LOCATION none CHANNEL RELATIONSHIP unrelated				
60	7.0	6.75	G:	The wolf came and he huffed and puffed . . . and he puffed and he huffed to no avail.
ERROR LOCATION none CHANNEL RELATIONSHIP unrelated				

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
61	3.0	3.0	G: A pig more clever than he? But as you know
<u>ERROR LOCATION</u> unrelated <u>CHANNEL RELATIONSHIP</u> related			
62	6.5	5.25	G: there is more than one way to skin a pig and the adversary has alternate strategies.
<u>ERROR LOCATION</u> Copy, T1, T2, T3 <u>CHANNEL RELATIONSHIP</u> related			
63	4.0	5.0	
<u>ERROR LOCATION</u> none <u>CHANNEL RELATIONSHIP</u> related - 62			
64	4.5	5.0	
<u>ERROR LOCATION</u> none <u>CHANNEL RELATIONSHIP</u> unrelated - 62			
65	4.5	5.0	
<u>ERROR LOCATION</u> none <u>CHANNEL RELATIONSHIP</u> related - 62			

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
66 ERROR LOCATION none CHANNEL RELATIONSHIP related	4.5	21.25	After--seconds of music.
67 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	8.0	8.5	G: Now, it's important to note that our team survived not necessarily because they were smarter than other pigs, just more knowledgeable.
68 ERROR LOCATION Focus, T3 CHANNEL RELATIONSHIP unrelated	6.5	5.0	G: System pig knew about the System Approach to problem solving and he used it.
69 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	6.0	6.0	G: And don't forget, a casual intuitive approach to problems may be better than none at all . . .
70 ERROR LOCATION none CHANNEL RELATIONSHIP unrelated	3.0	2.25	G: But a system approach is better still.

VISUAL CHANNEL		AUDIO CHANNEL	
Slide	Time	Time	
71	7.0	5.5	G: The moral of this fable is--the world belongs to him who does his homework.
ERROR LOCATION none CHANNEL RELATIONSHIP unrelated			
ERROR LOCATION CHANNEL RELATIONSHIP			
ERROR LOCATION CHANNEL RELATIONSHIP			
ERROR LOCATION CHANNEL RELATIONSHIP			
ERROR LOCATIONS CHANNEL RELATIONSHIP			

APPENDIX H

INSTRUCTION-GROUP ASSIGNMENT FORM

VALIDATION PROCEDURES

Please read the following directions carefully.

1. Make sure you have a pencil.
2. Locate your name under group 0, 1, 2 or 3 below.
3. Note that group numbers are displayed on the screens. Proceed immediately to the seating area in front of the screen displaying your group number.
4. On the seats are packets of materials. Your name in on one. Please locate it and sit in that seat.
5. DO NOT OPEN this packet until you are instructed to do so.
6. Shortly, an image will be projected on the screen. If you have difficulty reading the material exchange places with someone nearer the screen.

0	1	2	3
Budziszewski, P.	Billig, M.	Berger, B.	Adcock, A.
Cavanaugh, S.	Coomes, C.	Bowden, C.	Bascom, K.
Champine, E.	Croucher, L.	Chance, L.	Borean, S.
Garner, P.	Frank, M.	Dul, P.	Cardinal, P.
Gedert, R.	Gendein, C.	Florea, K.	Caruso, J.
Hyde, P.	Gillman, S.	Hodge, D.	Czarnecki, L.
Leavens, G.	Kaniarz, P.	Jacoby, P.	Evans, S.
Marks, L.	Mabley, A.	Janer, N.	Gibler, M.
Mattice, B.	Madden, P.	Kronberg, L.	Gifford, M.
Maurer, M.	Mihaly, D.	Kuczynski, D.	Grymonprez, D.
McGrath, M.	Morrison, C.	Medley, D.	Hunt, C.
Meloche, R.	Nobliski, K.	Montei, D.	McQueen, J.
Mohr, M.	Peggs, C.	Olton, L.	Mieczkowski, L.
Prevost, A.	Reinertson, S.	Oneil, K.	Monks, K.
Reeves, R.	Revak, D.	Packer, S.	Payne, L.
Samra, M.	Ryde, L.	Roller, M.	Ross, D.
Wander, M.	Sturley, J.	Rowe, L.	Stein, C.
Webb, L.	Towslee, L.	Thorndill, R.	Smith, L.
Wonnacott, S.	Yancey, P.	Tilben, B.	Swartzendruber, R.
			Vansyckle, J.

APPENDIX I

SCRIPT OF TAPE RECORDED INTRODUCTION

PRE-PRESENTATION INTRODUCTION
(Tape Recorded)

Good afternoon. In a few moments you will see and hear a slide tape presentation entitled A FABLE REVISITED. This short program consists of a series of slides and an audio-tape narration and was produced at the University of Southern California for a nation wide training project carried out by the National Special Media Institute which has its national office at Michigan State University. In its entirety the presentation is designed to introduce the concept of systems to educators and the strategy goes something like this.

Mary, who is an elementary teacher, is attempting to explain the systems process to one of her colleagues and convince him that this approach is valuable for certain educational purposes. George has difficulty accepting and comprehending either the value or the procedure. In a final almost desperate effort Mary turns to an example which she feels even George can understand.

Before joining some old friends I would like to offer a few words of explanation. You have probably surmised that we are going to compare something--in this case four versions of our story. This is a validation and should tell us which version is most effective. In the process you will acquire some new and useful information. There is still another reward in that we will discover some facts about this type of presentation which will be of immediate importance and application to virtually every teacher in this country. The extent to which the results are valuable depend entirely upon your attention and cooperation during the next few minutes. Following the slide tape you will be asked to respond to a series of questions to see what you have learned and then we will ask your opinions on certain aspects of the program. Now, let's join Mary.

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