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THE EFFECT OF DEMONSTRATIONAL-CUES AND
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OF PERCEPTUAL-MOTOR SKILLS FOR TRAINABLE
MENTALLY RETARDED.

The Ohio State University, Ph.D., 1974
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THE EFFECT OF DEMONSTRATIONAL-CUES AND REPETITION IN FILM-MEDIATED INSTRUCTION OF PERCEPTUAL-MOTOR SKILLS FOR TRAINABLE MENTALLY RETARDED

DISSERTATION

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

By

Sidney Rothenberg, B.A., M.A. (Ed.)

* * * * *

The Ohio State University
1974

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To my parents
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through the times of crisis, frustrations, and disappointments which are an inevitable part of the dissertation experience.
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CHAPTER I

INTRODUCTION

Background of the Problem

Education of the mentally retarded has been characterized as a process of dealing with specific learning deficits in areas such as perception, attention, and motor coordination (Blackman, 1971). It is these deficits, in fact, which distinguish the retarded from the non-retarded and have caused the retarded to be excluded from public school programs. It is these deficits also that have created a need for special educational facilities, specially trained teachers, special curricula, and a variety of instructional methods which will accommodate individual learner needs.

The use of audiovisual aids, or instructional technology, as it is now conceptualized (Commission on Instructional Technology, 1970) has long been recognized as a way of meeting individual learner needs. From the introduction of chalkboards and steel pens prior to 1800 to the elaborate computer assisted and computer based systems of the last few decades, media in the United States have been used not only to clarify,
amplify, and intensify the instructional message, but to provide teachers with a variety of means for presenting that message and to provide learners with equally varied ways of receiving that message at their own pace and according to their own learning style. "Group-paced and group-prescribed instruction seems to be a virtual necessity when resources are restricted to teacher and textbook. But technology properly applied opens up many different ways of learning. Individual differences can be taken seriously (Commission on Instructional Technology, 1970, p. 31)."

For the retarded learner, media can be particularly effective. "Generally speaking, many retarded children might be characterized as having deficits in meaningful perception of stimuli, retention, attention, comprehension, assimilation and utilization of the abstract, as well as deficits in speed of learning (Aserlind, 1966, p. 728)." Studies with the trainable mentally retarded have also shown the importance in learning of such factors as repetition, the presentation of relevant stimuli, the use of attention-directing devices, the emphasis on concrete, realistic experiences, and the development of material in sequential, logical steps (McCarthy and Scheerenberger, 1971).

All of these factors can be facilitated by the use of media, especially motion pictures. Films can be repeated easily. The preparation of a film enables careful selection of relevant stimuli and the use
of attention-directing devices, or cues. A film can show the execution of a task as it appears in real life, simulating concrete, realistic experiences. And films can present subject matter in sequential, logical steps.

The questions to be answered in this study are, therefore, not whether or not media can be effective in teaching the retarded, or whether motion pictures have an important place in the learning environment of the mentally retarded. Clearly, research has already shown that media, and, in particular, motion pictures, are effective means for instruction (May and Lumsdaine, 1958; Hoban, 1971). It has also been suggested that the characteristics of motion pictures are especially suited to resolving some of the instructional problems of the mentally retarded (Aserlind, 1966). Rather, the question which will be considered here is one of media design: which elements are necessary in the design of an instructional film to facilitate the learning of specific objectives by the retarded learner?

Statement of the Problem

Among the elements of film design which are relevant to the mentally retarded, demonstrational cues and repetition are especially important. Given the evidence that the retarded learn better when information is presented at a slower rate (Spitz, 1973; Lovitt, 1966)
and when repetition is provided (McCarthy and Scheerenberger, 1971), it follows that the use of slow motion cues and the opportunity for repeated showings should result in improved instruction.

The purpose of this study is to determine the effects of both variables, demonstrational cues and repetition, in film-mediated instruction of perceptual-motor skills for trainable mentally retarded. In this study, the task to be learned, which is demonstrated in the film, is how to tie a square knot.

Will subjects who view a film prepared either in slow motion or as a series of still pictures perform significantly better than subjects who view the same film prepared at a normal viewing speed? Also, will there be a significant improvement in performance if subjects are allowed to view the same film several times? These are the questions which are the concern of this study.

The Design

To study the questions which were identified in the Statement of the Problem, three variables of interest were described. One variable was demonstrational-cue (A), which consisted of three levels: normal motion sequence cue (A1), slow motion sequence cue (A2), and still sequence cue (A3). The second variable, Trial (T), referred to each showing of the film and was designated either as Trial One (T1),
Trial Two (T2), or Trial Three (T3). A third variable was Number of Trials (NT). Since the treatment could be concluded after the first or second trial, as well as after three trials, there were subjects who needed only one trial to complete the treatment, other subjects who needed two trials to complete the treatment, and a third group who needed three trials to completion. The third variable, Number of Trials (NT), allows comparisons between the first trial performances (NT1), the second trial performances (NT2), and the third trial performances (NT3) of these three groups. Figure 1 illustrates the relationship between these three variables.

**Statement of Hypothesis**

The following hypotheses were tested.

**H1**: Trainable mentally retarded who view a film incorporating slow motion demonstrational-cues will perform the task demonstrated in the film with significantly fewer errors than trainable mentally retarded who view a comparable film without slow motion cues.

**H2**: Trainable mentally retarded who view repeated showings of a film incorporating slow motion demonstrational-cues will perform the task demonstrated in the film with significantly fewer errors than trainable mentally retarded who view the same film once.

Stated in null form, there are three hypotheses. H3 is the null
FIGURE 1

RELATIONSHIP OF VARIABLES:
DEMONSTRATIONAL-CUE (A); TRIAL (T); NUMBER OF TRIALS (NT)

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where: A=demonstrational-cue
T=trial
NT=number of trials to completion

A1=normal motion sequence
A2=slow motion sequence
A3=still motion sequence
T1=trial one
T2=trial two
T3=trial three
NT1=first trial performances
NT2=second trial performances
NT3=third trial performances
statement for hypothesis H1. H4 and H5 are the null statements for H2.

Where "A" is demonstrational-cue, "T" is trial, and "NT" is the number of trials, these null hypotheses are:

H3: Controlling for levels of "T", there is no difference in levels of "A".

H4: Controlling for levels of "A", there is no difference in levels of "T".

H5: Controlling for levels of "A", there is no difference in "NT".

Limitations of This Study

In considering this study, it is important to keep in mind that several aspects limit the generalization of its findings. One aspect is the conditions under which the experimental films were presented. For example, the films were presented in relatively isolated settings with few distractions. An attempt was made to conduct the treatment during the morning hours when subjects were presumed to be most responsive. The treatment was preceded by an experience similar to the treatment. The effects of the treatment should be generalized to conditions which are similar to the ones which are described here.

Another aspect is the fact that films were without sound and in black and white. This study should not be generalized to films with sound and in color.
All of the subjects were randomly assigned from a population of non-institutionalized retarded individuals, who were considered by their teachers to have the ability to complete the knot-tying task. The effects of these experimental treatments should be generalized to subjects with similar backgrounds and competencies.

Finally, the results of this study should not be generalized to film-mediated instruction which is not concerned with perceptual-motor skills.

Need for This Study

Discussing the use of media and the mentally retarded, Aserlind (1966) wrote:

Currently vast amounts of audiovisuals are being utilized in almost every classroom for the mentally retarded, and almost without exception these aids are designed for the child of normal and above normal intelligence. This is not to say that the materials are not effective, for they are; but their effectiveness is frequently limited by the deficits of the mentally retarded learner (p. 728).

What is needed, therefore, are instructional materials which are designed to overcome specific learning deficits displayed by the retarded learner.

This study proposes to investigate one aspect of this problem: the elements of demonstrational-cue and repetition in the design of instructional films. Clearly the retarded have deficits in the
processing of visual information. It is suggested that the use of cues, such as slow motion, and instructional methods, such as repetition, may be factors which could be successful in overcoming these deficits. Should the results of this study confirm the hypotheses, instructional designers could have some guidance for creating perceptual-motor training films which are specifically designed for retarded learners, thereby filling the need, in one small way, for well designed instructional materials which can be used to teach the mentally retarded.

Definition of Terms

The following are definitions of terms which are important in this study.

**Perceptual-Motor Skills** - A performance involving sensory-motor processes and their coordination in executing an action or series of actions; for example, typing and driving. Unlike the term "motor skill," the concept of perceptual-motor skill reflects the sensory-perceptual processes which are a part of performance learning (Hoban and Van Ormer, 1950).

**Motion Picture** - A series of filmed images viewed in sufficiently rapid succession to create the illusion of motion and continuity (Davies, 1970). The terms, "motion picture" and "film," will be used interchangeably in this document.
16mm Film - Motion picture film that is 16mm in width.

Slow Motion - A visual effect which is created when the camera takes pictures faster than the speed at which a constant speed projector will project them (Roberts and Sharples, Jr., 1971). For this study slow motion required a camera speed of 64 fps and a projector speed of 16 fps.

Film-mediated Instruction - Instruction which makes use of film in the presentation of information.

Cue - A device that directs attention (Neu, 1950). A demonstrational-cue would therefore be a cue which directs the attention of the viewer to relevant aspects of a demonstration.

Repetition - A condition that exists when the same material is repeated.

Trainable Mentally Retarded - An individual who is (a) of school age; (b) developing at the rate of one-third to one-half of the normal child (an IQ of 30 to 50); (c) is ineligible for classes of educable mentally retarded, but will not be totally dependent; (d) has potentialities for self-care tasks; (e) has potentialities for social adjustment; and (f) has potentialities for economic usefulness (Kirk, 1964, p. 63).

Assumptions

The subject selection required teachers and school personnel
to identify subjects who were capable of participating in the experiment. It was therefore assumed that these staff could identify behaviors, such as motor coordination, the ability to understand verbal instructions, and the ability to follow visual cues, in their students.

It was also assumed that retarded subjects would find the media, including the films and the filmstrip, to be sufficiently motivating for them to want to do well and try their best.

It was assumed that there are levels of performance ability. For example, some retarded individuals may be able to do simple gross motor acts, such as throwing a ball, but are not able to perform a fine motor skill, such as tying a square knot. The ability level of the individual who can throw the ball would therefore be different from the ability level of the individual who is able to tie a knot.

Summary

Education for the mentally retarded has been characterized as a process of dealing with specific learning deficits. The task of the educator, therefore, is to design instruction and the materials of instruction in such a way that these deficits can be overcome.

Instructional technology has long been used to overcome specific instructional problems. Instructional media, such as slides, audiotapes, and films, have been used to clarify, amplify, and intensify the
instructional message and to present that message in ways which are suited to individualized instruction. However, little has been done to demonstrate the effect of specific elements in the design of instructional materials for the perceptual-motor instruction of trainable mentally retarded. Instructional materials for the trainable retarded exist, but these are frequently adapted from materials which were developed for other populations.

What is needed, therefore, is further research to determine the design requirements of instructional materials for mentally retarded. Of particular interest are the design elements of demonstrational-cues and repetition. The use of cues, such as slow motion or still pictures presented as a film, and the practice of repeating the film several times would appear to relate to the processing of information for trainable mentally retarded. With concrete evidence of this relationship, instructional designers would have guidance in the development of perceptual-motor films for the trainable retarded and could help to provide these learners with needed instructional materials.

Organization of the Remaining Chapters

The remaining document consists of four chapters, references, and a section of appendices. These are described briefly as follows.
The second chapter reviews the literature on the information processing of the retarded and on film-mediated instruction. Research on film-mediated instruction with retarded and with normals are considered separately. Since research on film-mediated instruction with normals is extensive, only the following relevant areas were discussed: the use of cues, learner representation, repetition and practice effects, rate of development, slow motion, and motion.

The third chapter includes a discussion of the variables, the subjects, treatment groups, the preparation and description of the experimental materials, the experimental procedure and setting, and the data collection and analysis.

Chapter four presents the data and discusses the results of the main analysis and subsequent post-hoc analysis. The results of discrimination and visual sequence tests were also reviewed and discussed.

The fifth chapter presents a summary of the study. Conclusions are then stated. These are then discussed and recommendations are suggested for future research.

Appendices conclude the document and include illustrations of the experimental materials and setting, records of the scripted portion of the investigator's instructions, and performance criteria for subject selection.
CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The purpose of this study was to determine the effect of

demonstrational-cues in the design of perceptual-motor films and the
effect of repetition in the administration of these films. The more basic
question however is concerned with information processing: Will the
use of cues and repetition facilitate the processing of information for the
retarded? The first section of this literature review addresses this
question in both its theoretical and empirical dimensions.

The next section of this chapter is concerned with the literature
on film-mediated instruction. Research with the retarded is reviewed
first, and studies with normal subjects concludes the section. Since
the literature on film-mediated instruction with normal individuals is
extensive, this review has been limited to studies of the following
relevant variables: the use of cues, learner representation, repetition
and practice effects, rate of development, slow motion, and motion.

14
The Information Processing of Retarded Learners

Theoretical rationale

In the language of information theory, learning is conceived of as a part of a process where an encoded stimulus message is perceived, and information about the stimulus is transmitted through sensory channels to the receiver's central nervous system. The information is there decoded, encoded (or interpreted), and transmitted back in its new or modified form to the source of the stimulus as a response (Bettinghaus, 1960). Several different communication models have been suggested elaborating the specific pathways and routes which may be involved in this process (Shannon and Weaver, 1949; Broadbent, 1958; Berlo, 1960).

Viewed as a process involving a sender, a receiver, a message and a channel for communicating this message, the obstacles to learning become more apparent. Since the human nervous system is limited in its capacity to process auditory, visual, and tactile information (Travers, 1967), it is therefore necessary to optimize all parts of the communication process. Stimuli need to be optimally perceived, channels of communication must be accurately selected and utilized, and the capacity of channels to receive and process information needs to be understood. Hsia (1971) writes:
In an ideal communication situation, error and equivocation (i.e., information contained in the input but not in the output) should be nonexistent; however, in a natural communication situation, they are inevitable occurrences. The objectives for efficient communication are, then, to make error and equivocation as small as possible in order to achieve optimal communication efficiency (p. 54).

It is generally agreed that retardation is the result of specific deficits in such areas as attention, retention, abstraction, perception, and inhibition (Blackman, 1971). It is conceivable that one of these deficits is caused by a limited capacity to channel some kinds of information (Spitz, 1973). One way to compensate for this deficit would be, therefore, to reduce the incoming information which is to be coded. Another solution for this problem could be repetition of the stimulus. As conceived of here, repetition is not so much a simple repeating of the stimulus to, in effect, reinforce existing neural connections (Hebb, 1949), but rather a process of rehearsal, where information is assimilated and interpreted (Sanders, 1961).

Empirical findings

In his analysis of "the magical number seven," Miller (1956) concluded that the human capacity for processing information is seven "bits" plus or minus two. A bit is defined by Miller as "the amount of information that we need to make a decision between two equally likely alternatives (p. 83)." Also, the individual can accommodate
more information if he is able to recode the information into more comprehensive units, called "chunks."

Following up on Miller's work, Spitz (1973) studied the channel capacity of educable mentally retarded learners. The questions Spitz posed were: (1) What is the basic channel capacity of the retarded? (2) Do retarded recode bits into chunks as normals do? (3) If the retarded are assisted in the recoding process, will their capacity for processing information increase? Using adolescents, Spitz tested subject performances on visual-numerosity discrimination, visual and auditory digit span, and visual absolute judgement tasks. Spitz concluded that channel capacity for unpracticed groups of educable retarded adolescents processing unidimensional, like stimuli was more limited than for normals. Performances on absolute judgement tasks were somewhat higher, especially after practice. Spitz also noted that input organization, or "chunking," did not always increase channel capacity, or did to a small degree. Finally, Spitz concluded that "the 'magical number' can be raised by reducing transmission rate. However, a trade-off relationship exists: a decrease in transmission rate raises the amount of information processed, while a decreased amount of information can be processed at a faster rate (p. 154)."

The conclusions that retarded have a more limited channel capacity for information was supported in a study by Lovitt (1966).
Lovitt investigated the preferred rate of narration for ten normal and ten retarded (IQ 50-88) subjects. Each subject had an opportunity to listen to a recorded story at one of five narrative rates: 360 words per minute (wpm), 240 wpm, 180 wpm (normal speed), 120 wpm, and 90 wpm. An operant conditioning responder in the form of a hand switch was used by the subject to switch from one version at one recorded rate to another version at a different speech rate. Results showed that the normals preferred either the 120 or 240 wpm speeds and rejected the extreme rates (360 wpm and 90 wpm). In contrast, the retarded subjects preferred the extreme rates, particularly the slow rate of 90 wpm.

Similarly, information processing of the retarded has been studied in research on rates of learning, in which the number of trials is varied to achieve a criterion performance. In their review of the literature, McCarthy and Scheerenberger (1971) commented that the essential question these studies attempted to answer was whether or not the retarded are slow learners. Generally, the authors found that, when retarded were compared on the basis of mental age with normal subjects, there was no significant differences in rates of learning. However, in studies where retarded were compared on the basis of chronological age, normal subjects consistently outperformed the retarded (Berkson and Cantor, 1960; Ring and Palermo, 1961; and Lance, 1965). It should be noted that the learning tasks in these studies involved either serial
learning or paired-associate learning. Similar studies were not available with the kind of representational and meaningful tasks which were employed in this study. Also, performances frequently required an overlearning response, i.e., several successive correct responses before criterion was reached. In the study presented here only first-trial learning, or one correct response, was required for a subject to reach criterion.

Film-mediated Instruction

Research with Retarded

Studies exploring the use of motion pictures to teach the retarded are few, and are limited to educable mentally retarded and the acquisition of factual knowledge.

Brannan (1965) studied several techniques of utilizing an instructional sound film in classrooms for educable mentally retarded children. The purpose of the study was to determine which technique yielded the greatest acquisition of factual knowledge. Techniques of film utilization involved film showings introduced by the teacher, with either film reshownings, pupil participation, or discussions, or these methods in combination. Results showed that with each method of film presentation or feedback, subjects showed significant learning at the .001 level from pretest and posttest and from pretest to retention test.
Film presentations which employed teacher introductions in combination with either discussions, film reshowings, or pupil participation resulted in significantly greater immediate learning than with only film showings accompanied by teacher introductions.

Goldstein (1964) provided the most recent effort to study the use of motion pictures to train educable retarded. Using a ten-minute color film on food-serving, Goldstein concluded that (1) motion pictures facilitate factual learning, (2) concrete content is more effective than abstractions, and (3) the limited use of narrative sequences is not recommended.

An earlier study by Driscoll (1962) showed similar results. Using retarded children in secondary schools with mean intelligence quotients of between 60 and 70, Driscoll studied the extent of factual learning and attitudinal change which resulted from viewing the instructional films: "Help Wanted," "Our Economy," and "Government." Results of pre-tests and post-tests indicated (1) films facilitated the learning of factual material, (2) films affected attitudes, (3) films as long as thirty minutes maintained interest and learning, and (4) all but the lowest ability retarded generalized ideas and rules of behavior from the films.

Hoban and Van Ormer (1950) reviewed studies on film learning which involved retarded and illiterate subjects. In their summary,
Hoban and Van Ormer concluded that "teaching with a film or with the aid of a film, seems to bring about a greater increment in learning among those of lower intelligence than it does among those of higher intelligence (pp. 7-27)."

Research with Normals

Research on film-mediated instruction of perceptual-motor skills has not been done with the trainable retarded. But this kind of instruction with other populations has been investigated. Variables of interest in these studies include the use of cues; learner representation; repetition and practice effects; rate of development; slow motion; and motion.

The use of cues. A "cue" is a stimulus which directs the viewer's attention. Since many aspects of a film may be considered cues which were not intended to be cues, the following review will include only studies where it is clear that the study of cues was the intent of the research.

Lumsdaine, Sulzer, and Kopstein (1961) studied the effect of animation techniques as cues in film learning with above-average and below-average subjects (as indicated by a qualifying exam for Air Force trainees). Using a training film on reading a micrometer, an experimental version was prepared which utilized moving arrows, pop-in labels, and other similar devices as cues. Results showed that
learning was significantly higher (p < .01) for both above-average and below-average subjects viewing the animated, experimental version of the film.

McGuire (1961) investigated the effectiveness of slow motion and explanatory narration as demonstrational cues in films teaching a pursuit rotor task. The task required the learner to keep the point of a stylus in contact with a target-disk, which was located on a rotating turntable. The subject was scored on the time that the stylus was on the target during successive 30-second intervals and on the extent to which they complied with postural-adjustment directions advocated by the portrayal and narration in the film. McGuire found that the attention-directing devices of narration and slow motion improved learning.

It should also be noted, however, that other parts of the film which were not emphasized with the cues were learned less well.

Commenting on McGuire's study, Lumsdaine (1961) stated:

The study of slow motion . . . is of particular interest because, while somewhat limited in scope, it thus far stands virtually alone in the experimental literature as an inquiry in which this potentially important demonstrational-cue variable has been manipulated as a perceptual mediator of skill acquisition. The poverty of studies dealing with slow motion as a cinematic-perceptual factor in film instruction is quite surprising in view of the fact that slow motion is not only relatively easy to implement cleanly as an experimental variable, but is also one of the very few attributes (if, indeed, not the sole
attribute) that is genuinely unique as an instructional potentiality of motion pictures (pp. 136-137).

Montgomery (1967) also studied the effectiveness of slow motion in demonstrational films. However, the emphasis was on slow motion as a rate of presentation rather than as an attention-directing device. Montgomery's study will be reported on more fully in later sections.

Neu (1950) investigated the use of special attention-gaining devices in instructional films. Neu's study is particularly interesting because it distinguishes between attention-directing, or "relevant," devices which emphasize film content, and attention-gaining, or "irrelevant," devices which bring attention to the screen but are otherwise unrelated to film content. These devices were prepared for both picture and sound portions of the films. Using instructional films on the use of machine shop measuring instruments, Army and Navy recruits were shown one of the film versions and evaluated after with multiple-choice information and device recall tests. Results showed that relevant devices did not add to the effectiveness of the films. To some extent, irrelevant sound devices detracted from the film's effectiveness. Neu concluded that attention-gaining devices did not add significantly to learning in these films. It is important to note that Neu did not discourage all uses of attention-gaining devices, such as spotlighting, zooms, and stop motion. It is only the excessive use of
these devices which may be inappropriate and should be avoided, particularly if they do not emphasize indigenous materials related to the film's subject content.

Learner representation. The classic study in this area is the one by Roshal (1949). Roshal hypothesized that a subjective angle of view in a filmed demonstration will be more effective than objective, or "straight-on" angle. The subjective angle presents the demonstration from the viewpoint of the learner as he would perform the task himself. This realistic effect is achieved by photographing the demonstration over the shoulder of the demonstrator. Other variables which were studied were motion, or movements, in performing the task, viewer participation during the showing, and the use of hands in the film. Using versions of a film demonstrating knot-tying tasks, Roshal found that Navy recruits performed better with the subjective camera angle film versions. Similarly, the films were more effective when movements rather than a series of static shots portraying successive stages of the task were used. Results did not show significant advantages for participation, but some evidence suggested that practicing the task during the viewing may facilitate learning. No definite conclusion was made for the use of hands in the film. However, Roshal cautioned that if hands are shown, they should not obscure important movements of the demonstrator in performing the task.
Repetition and practice effects. The term, repetition, is used differently in different studies. In some studies examples of a demonstration are repeated more than once during the film. In other studies, the film itself is shown more than once before the learner is asked to perform the demonstrated task. With the second technique repetition has been referred to as an element of the instructional method rather than a film variable (Hoban and Van Ormer, 1950).

In the study of Lumsdaine, Sulzer, and Kopstein (1961) previously cited, the effect of repetition was also considered. One version of the animated and nonanimated films included repeated examples of micrometer readings. Results showed that learning was increased when multiple demonstration examples were used.

The use of repeated materials has also been studied within the context of the "whole versus part" issue. The issue is concerned with whether or not it is more effective to master sequences within tasks or the entire task in sequence. The "parts" approach proposes that the learner has less to learn at one time. The "whole" approach proposes that a single static perception (i.e., a "perceptual blueprint") provides contextual cues necessary for recall.

Margolius, Sheffield, and Maccoby (1961) addressed themselves to the whole versus part issue in their study of repetitive (part) and consecutive (whole) practice in the learning of a mechanical assembly
task. Segments of the task were selected as "natural" units. Results showed the superiority of the repetitive, or part, method to the consecutive, or whole, method. Subsequent replications with a different assembly task contradicted these results. However the authors attributed this contradiction to the intrinsic organization of the second task. Their conclusion was that the more a task was inherently well-organized the less there is to gain from procedures designed to enhance organization or to minimize interference between units or sub-units to be learned. Generally, a lengthy serial-learning task may require more frequent practice during the learning period, whereas shorter serial-learning tasks call for the "perceptual blueprint" approach.

Montgomery (1967) studied massed and spaced practice modes. Demonstration films of a knot-tying task were prepared. The spaced practice modes involved watching one filmed knot-tying sequences, and then practicing one knot-tie. The massed practice modes required either watching three filmed knot-tying sequences, and then practicing three knot-ties, or watching six filmed knot-tying sequences and practicing six knot-ties. No significant difference was found between the modes.

McTavish (1949) demonstrated that, for factual films, repetitions resulted in increased learning. Four ten-minute general science films were shown to each of four groups of college students
(N=319) in such a way that each group saw one of the films once, a second film twice, a third film three times, and a fourth film four times. No two groups saw the same film the same number of times. Subjects were pre- and post-tested on the film content. Results indicated significant gains ($p < .01$) in mean scores after two repeated showings (that is, two showings beyond the initial showing). Additional showings, however, seemed to contribute little to learning, and the drop-off in performance was rapid.

An earlier study by Wittich and Fowlkes (Hoban and Van Ormer, 1950, pp. 8-36) also studied repeated film showings with subjects in grades four through six (N=264) with similar successful results. However this study differed from the previous studies which were discussed in that repeated showings were separated by a period of 24 hours.

**Rate of development.** The rate, or speed, at which the content of a film is presented has been studied by Jaspen (1950) and Vincent, Ash, and Greenhill (1949).

Jaspen tested the film variables: verbalization, nomenclature, errors, "how-it-works," repetition, and rate of development in films designed to teach the assembly of a breech block of an antiaircraft gun. In this study, rate of development was either "slow" or "fast" and was produced by allowing more or less time for the showing of the film.
The assumption was that if more time was allowed for the entire film, more time would also be allowed for presenting individual pictorial information. (The sound narration was kept constant.) For the procedure, apprentice seaman (N=2,377) were shown a film version and then asked to perform the assembly task. Subjects were evaluated on performance time, and a total of ten trials were allowed. Results showed significant increases in learning ($p < .01$) for slow rate of development, the showing of common errors, and repetition.

Vincent, Ash and Greenhill were concerned in their research with the question: Does increasing the concentration of facts in a film result in a proportionate increase in learning? To test their hypothesis, four experimental film versions were prepared. Each version included a different concentration of facts, from 224 facts to 56 facts. Words were kept constant by the use of repetitions and other "filler" materials. Subjects were selected from three different groups: twelfth grade students, Air Force trainees, and college students. Based on an immediate retention multiple choice test, results indicated that mean scores for different versions were significantly different for each population ($p < .01$). The High School sample preferred the "Short Heavy" version (14 minutes and 112 facts), while the other two samples preferred the "Long Light" version (29 minutes and 112 facts). The authors concluded that "packing more and more information into a film
yields only very slight increments in total measured learning (p. 14)."

The authors also suggest that interferences may have been set up as a result of too much information and, consequently, less efficient learning.

**Slow motion.** Few studies have dealt specifically with slow motion as a variable in the design of instructional films (Lumsdaine, 1961). Hoban and Van Ormer reviewed the early studies in the area of athletic training which involved slow motion and regular speed silent films (Ruffa, 1936; Priebe and Burton, 1939; Brown and Messersmith, 1948; Adams, 1939). However, according to his summary, these studies were not concerned with the effectiveness of slow motion as a design variable in films. Instead they focused on the effectiveness of film versus non-film instruction, or on other combinations of modes of presentation.

McGuire (1961) appears to be the first to study the factor of slow motion as a design variable in demonstration films. Two versions of a film teaching a pursuit-rotor task were prepared. One version was prepared at a normal viewing speed. The second version showed five critical steps in the task in slow motion (one-third the regular speed). Results indicated that slow motion increased learning of the film content which was presented in slow motion, but at the expense of other content in the film.
Montgomery (1967) also studied slow motion as a stimulus variable in films. However, in Montgomery's study, the entire film was in slow motion. Three versions of a demonstration film on knot-tying were prepared. One version was at a normal viewing speed, a second version was at a medium viewing speed, and a third version was at a slow viewing speed (three times slower than normal). Each film version was assumed to be identical in all other respects. Results showed that the slower rates of presentation were significantly better than the faster rates of presentation in learning a perceptual-motor task.

Motion. Reviewing the literature on the use of motion versus static versions of the same visual materials, Levie and Dickie (1973) concluded: There are usually "no differences in learning except when the concept to be learned deals with motion or change, in which case the motion is superior (p. 874)."

In his study of learner representation, Roshal (1949) compared the use of "live continuous action" in films teaching a knot-tying task with the use of static versions showing only successive stages in the knot-tying process. In some of the static versions, pictures were used where hands were not shown. Results showed that the motion versions were more effective than the static versions. A surprising finding was that the static-no hands version was superior in some films to the static version showing hands. Roshal attributed this to the fact
that hands may get in the way of the demonstration. Also for very simple knots, subjects could draw on their repertoire of experiences, and a picture of the actual knot would be enough.

Allen and Weintraub (1968) investigated the motion variable in parallel experiments in fact learning, serial ordering, and conceptual learning. Stimulus sequences of either motion pictures, sequenced still pictures, or single still pictures were presented to 582 randomly assigned fifth and sixth grade students. Objective tests after the treatment showed the superiority of motion pictures to still sequences and still picture modes, regardless of grade level, sex, mental ability, subject matter content, or instructional objectives.

Houser, Houser, and Van Mondfrans (1970) studied the use of motion pictures and slides to present motion and non-motion concepts to education students (N=41). Results showed that where motion is a defining attribute, it is more effective to use motion pictures.

Spangenberg (1973) studied a motion effect in the learning of a procedural task using a television display mode of presentation. A procedural task involves learning to carry out a series of acts or operations in proper order. The task in this study was the disassembly of a complex weapon. Two studies with two groups of enlisted Army personnel demonstrated the effectiveness of motion over still pictures, but only when the content to be learned consists of the movement
Summary

The fundamental question in this study is one of information processing. Essentially, will the use of cues and repetition facilitate the processing of information in retarded learners?

This review has demonstrated that the mentally retarded have deficits in their capacity to process information (Spitz, 1973; McCarthy and Scheerenberger, 1971). Yet the literature on film-mediated instruction for the retarded shows that little has been done to study the design elements of film which are likely to improve information-processing capabilities.

Studies of film-mediated instruction of perceptual-motor skills with normal populations however are extensive. Since the elements of cues, learner representation, repetition and practice effects, rate of development, slow motion, and motion are particularly relevant to this study, this review was limited to research in those areas. Results indicated that related film techniques, such as demonstrational-cues, portraying action from the viewer's perspective, the repetition of film content, the rate at which exposition is developed during the film, slow motion, and the use of motion itself versus a series of still pictures presented as a film produce significant improvements in perceptual-motor performance.
Relevant findings in the same studies also indicated that it is important to consider these film techniques in context and in relation to the purposes of the film and the nature of the learner. For example, cues can be effective, but only when they are relevant to the material and are attention directing rather than attention gaining. Also, slower rates of development and presentation can be effective but can also detract from other information in the film.

With these limitations in mind, the evidence is clear that the instructional designer would be well advised to make use of cues and repetition in perceptual-motor demonstrational films for normal populations. Does this, however, also apply to films for the retarded? Given the evidence that there are information processing deficits in the retarded, the use of techniques which overcome these deficits would be useful. Since both cues and repetition have been shown to improve learning, it would seem logical that the use of these elements in the design of perceptual-motor films would be as relevant, if not more relevant, for the trainable retarded learner.
CHAPTER III

METHODOLOGY

To study the effect of demonstrational-cue and repetition in the design of perceptual-motor instructional films, three groups of trainable mentally retarded were presented with versions of a film showing how to tie a square knot. After the showing each subject was asked to tie a square knot, and their performances were rated on a scale from one to nine. Data were also obtained on discrimination and visual sequencing ability from tests which were presented to the subject after the treatment. The subjects, subject selection, the experimental materials, procedure, and situation, the analysis of the data and other relevant aspects of the methodology and design are discussed in the following sections.

Design

Sixty-three subjects were studied in terms of two relevant variables. These variables are discussed first. This is followed by a discussion of the subjects and treatment groups.
Variables

Relevant independent variables in the present study were demonstrational-cue and repetition. The dependent variable was performance score. The variable, demonstrational-cue, consisted of three levels: slow motion sequence, normal motion sequence, and still picture sequence cue. Levels of the variable, repetition, were three consecutive trials, or film showings. Performance scores were obtained after each trial.

Subjects

Students were selected from three schools in Columbus, Ohio, under the direction and administration of the Franklin County Program for the Mentally Retarded.

According to the literature distributed by the County Board of Mental Retardation, this program

...provides for children 6 to 18 years of age (21 years in certain cases) who meet certain standards set forth by the State Department of Mental Hygiene and Correction, Division of Mental Retardation. Generally admission is based on an IQ of 50 or below for those children who have been legally excluded from public school. Classes provide training in self-help and self-care; motor skills; daily living; personality and social development and training in academic skills within the child's grasp.
Classes also prepare the child for additional and more specialized occupational experiences.¹

The three schools from which the subjects were selected were Alum Crest School, First Avenue School, and Holy Family School.

Subject Selection

The nature of the experimental treatment made it necessary to select subjects on the basis of specific skills and competencies. Since the treatment involved tying a square knot, it was clear that all subjects would need to have the basic motor and physical coordination which is necessary for knot-tying. It was also clear that subjects would need the ability to go from visual instructions (i.e., the film) to a motor activity (i.e., knot-tying). The pilot experience indicated that lower functioning retarded learners not only had difficulty in manipulating the cords, but did not seem to be able to follow the visual information in the film.

To obtain subjects with the necessary prerequisite skills, the following selection process was used.

1. Teachers were asked to identify children in their classes who were able to tie shoelaces, knots, or bows. These student names formed the initial list of subjects.

¹Franklin County Program for the Mentally Retarded, Leaflet #1, General Information (1971).
2. The Franklin County Program has established a system of performance levels for students, including developmental, primary, intermediate, junior, senior, and pre-vocational. As students improve in ability and are able to meet the criteria of prerequisite skills, they move up to a higher level. It was decided that students at the intermediate level and above should provide subjects with sufficient entry behaviors to do the task. (A copy of the criteria for the intermediate level is included as Appendix A.)

3. Supervisors at each school were asked to select the highest functioning students from the remaining names on the list. With the exception of a few students who were unable to participate in the experiment because of illness, changes in school plans, or similar problems, this list served as the sample for this study. Descriptive data on the sample is included as Table 1.

Treatment Groups

Sixty-three subjects were randomly assigned to three treatment groups. Using a RAND table of random digits, numbers were drawn and assigned to subjects on a comprehensive list of eligible students. The first twenty numbers were assigned to treatment group A1, the next twenty numbers were treatment A2, and the following twenty numbers were treatment A3. Additional assignments were made in the event that substitutions were needed.
TABLE 1

DESCRIPTIVE DATA OF SAMPLE: THE NUMBER OF MALES AND FEMALES, THE MEAN OF THEIR CHRONOLOGICAL AGE (IN MONTHS), MENTAL AGE (IN MONTHS), AND IQ, AND THE ADJUSTED FREQUENCY OF SUBJECTS AT EACH PERFORMANCE LEVEL

<table>
<thead>
<tr>
<th>Sex</th>
<th>Chronological Age (in months)</th>
<th>Mental Age (in months)</th>
<th>IQ</th>
<th>Performance Level* (Adjusted Frequency at Each Level)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M 45</td>
<td>18</td>
<td>135.68</td>
<td>58.25</td>
</tr>
<tr>
<td></td>
<td>F 18</td>
<td>135.68</td>
<td>58.25</td>
<td>45.84</td>
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</tbody>
</table>

*Performance Level Code: 1 - Intermediate level
2 - Junior level
3 - Senior level
4 - Pre-Vocational level
TABLE 2

DESCRIPTIVE DATA OF TREATMENT GROUPS: THE NUMBER OF MALES AND FEMALES, THE MEAN OF THEIR CHRONOLOGICAL AGE (IN MONTHS), MENTAL AGE (IN MONTHS), AND IQ, AND THE Adjusted FREQUENCY OF SUBJECTS AT EACH PERFORMANCE LEVEL

<table>
<thead>
<tr>
<th>Treatment Groups</th>
<th>Sex</th>
<th>Chronological Age (in months)</th>
<th>Mental Age (in months)</th>
<th>IQ</th>
<th>Performance Level* (Adjusted Frequency at Each Level)</th>
</tr>
</thead>
</table>
| Normal motion cue      | 16  | 137.52                         | 56.13                  | 44.34 | 1 - 43.5  
|                        |     |                                |                        |      | 2 - 47.8  
|                        |     |                                |                        |      | 3 - 4.3  
|                        |     |                                |                        |      | 4 - 4.3  
| Slow motion cue        | 12  | 132.45                         | 57.30                  | 45.55 | 1 - 45.0  
|                        |     |                                |                        |      | 2 - 35.0  
|                        |     |                                |                        |      | 3 - 20.0  
|                        |     |                                |                        |      | 4 - 0.0  
| Still sequence cue     | 17  | 136.8                          | 61.65                  | 47.85 | 1 - 45.0  
|                        |     |                                |                        |      | 2 - 45.0  
|                        |     |                                |                        |      | 3 - 5.0  
|                        |     |                                |                        |      | 4 - 5.0  

*Performance Level Code: 1 - Intermediate level  
2 - Junior level  
3 - Senior level  
4 - Pre-Vocational level
Preparation and Description of Materials

Materials for the treatment included three versions of a film on tying a square knot, a knot-tying board with cords, and discrimination test and visual sequence photographs.

Experimental Films

Three film versions were prepared on how to tie a square knot: a slow motion version, a normal motion version, and a still sequence version. All films were prepared on black-and-white 16mm Tri-X film, using a Bell and Howell 70 DR camera which was specially equipped for reflex viewing. In accordance with research, a subjective angle of view was used in the filming (Roshal, 1949).

The slow motion version was photographed at 64 frames per second (fps) in one continuous shot. The normal motion version was photographed at 16 fps in one continuous shot. The still sequence version was prepared on an animation stand and included nine still pictures showing critical steps in the knot-tying task. The pictures were taken when the other films were prepared and were later used for the visual sequence tests. Each picture appeared in the film for approximately five to six seconds. As a result, the slow motion and still sequence versions were the same length (about 50 seconds) while the normal version was about 12 seconds. This provided a four-to-
one difference in camera speeds. The results of the pilot study indicated that a four-to-one ratio was needed to create a slow motion effect.

**Knot-tying Materials**

White cotton clothesline (3/16" in diameter) was used for the knot-tying cords. Two five foot sections of the cord were prepared; one section was dyed dark grey to provide the subject with additional cues. The cords were taped at one end to a piece of grey illustration board. The cords used for the production of the film were also used for the test situation. Green construction paper with light values similar to a Kodak neutral grey card was found to be more suitable as a background for the cords during the film production.

**Discrimination Test Materials**

Three black-and-white 3 x 5" photographs of three different knots were prepared. The knots included a completed square knot, a double-eight knot, and a fisherman's knot. These are shown in Figure 2. The photographs were mounted borderless on poster board to make them more durable.

**Visual Sequencing Materials**

Four 3 x 5" photographs were selected from a series of nine photographs showing critical steps in completing the knot-tying task.
FIGURE 2

DISCRIMINATION TEST MATERIALS
Each was mounted borderless on poster board. They are shown in Figure 3.

Pre-treatment Experience Materials

These materials consisted of commercially prepared materials produced by the Bowmar Company. The materials were from the Body Image Series and included a color filmstrip and a cassette audiotape. The filmstrip was entitled, "Can You Do What I Do?." The materials were available at each of the schools. Several frames from the filmstrip are shown in Appendix B.

Procedure

Treatments were administered to subjects individually and consisted of four major sections. These sections were: pre-treatment experience, pre-test, treatment, discrimination test, and visual sequencing test. Knot-tying materials were left in front of the subjects during the film showings, and subjects were allowed to practice the task during the showing. In addition, the sessions were audiotaped to provide an audio record of the events.

The purpose of the pre-treatment experience was to demonstrate that the subject was able to go from visual instructions to a motor activity. This was done by showing the sound filmstrip, "Can You Do What I Do?." In the filmstrip a young girl asks the viewer to do what
FIGURE 3

VISUAL SEQUENCE TEST MATERIALS

1

2

3

4
she does—touching her head, stretching, nodding.

The pre-treatment experience was followed by a pre-test, in which the subject was given two cords and was asked to tie a square knot.

Next was the administration of the treatment itself. The treatment began with brief verbal instructions and then proceeded with the film showings. Each film showing, or trial, was followed by a performance test in which the subject was asked to tie the square knot "just as the man in the film did."

After three showings and three trials, the subject was shown one picture each of three different knots. The knots showed a completed square knot, a double-eight knot, and a fisherman's knot. The pictures were displayed in front of the subject in random order, which was the same for each subject, and the subject was asked to point to the knot that looked most like the knot the man in the film tied.

The next and final test consisted of four still photographs showing steps in the process of tying a square knot. The pictures were displayed before the subject in random order, and the subject was asked to put the pictures in the correct order. Further instructions were given if the subject failed to respond. A maximum of five minutes was allowed for this test.

The entire procedure is diagrammed in Figure 4. Also a script
*Note: The treatment could be concluded after either Test 1, Test 2, or Test 3. To conclude the treatment after Test 1 or Test 2, the subject would need to obtain a perfect score. Subjects who needed three trials concluded the treatment after Test 3 whether they obtained a perfect score or not.
of the experimenter's instructions is included as Appendix C.

The time for the entire procedure was approximately ten to twenty minutes.

The Observer

A trained observer was present during 53 of the 63 treatments. One purpose of having the observer was to determine if the experimenter was being consistent from subject to subject in either of two categories of verbal behavior: encouragement and direction. Tallies were recorded by the observer for statements of encouragement or direction which were made by the experimenter in addition to the prepared script.

A second purpose for having an observer was to check the reliability of the experimenter's performance evaluations. This was done by having both the observer and the experimenter judge independently the results of each performance test. As a result, two sets of evaluations were available for comparison.

The observer also assisted in operating some of the equipment.

Selection of the Task

Criteria for selecting a task for this study were: (a) it had to be simple enough to be done by a retarded individual, (b) it had to be difficult enough to provide a test of performance, and (c) it had to be
unusual enough to be unlikely that subjects had an opportunity to learn it prior to the experiment. The task of tying a square knot appeared to meet these conditions. It was within the abilities of the retarded, but was probably not taught in the classrooms and was therefore unknown to them. It is also accepted as a useful task and had the added advantage of face validity.

**Experimental Situation**

The experimental treatment was administered to subjects individually, and usually only the experimenter and the observer were present. There were times when it was necessary to share the room with one or two of the school's instructional staff. However during these times it was found that these people were not a distraction as long as the subject could not see them. The fact that the subject could hear the others did not appear to be a problem.

The setting of the treatment involved the following equipment: a 16mm projector with the capability of silent, or 16 fps, projection speed; a filmstrip projector; two audio cassette recorders--one to play the cassette tape which accompanied the filmstrip and the other to make an audio record of the sessions; a portable screen; and a high projection cart, which allowed the visual media to be projected over the heads of the subject and the experimenter; a work table; and
sufficient chairs. The arrangement of the equipment and personnel are diagrammed in Figure 5.

The rooms which were used were generally comfortable. However the nature of the experiment sometimes created a condition where good ventilation and good lighting was not always possible.

Data Collection

The experimental sessions began at about ten o'clock in the morning, and, when possible, continued until one or two o'clock in the afternoon. Each session took an average of 15 minutes. The subjects were excused from their scheduled classes to participate in the experiment.

The Nature of the Data

Two forms were used for data collection. These were the Subject Evaluation form and the Experimenter Evaluation form, included as Appendix D and Appendix E.

Both forms included provision for collecting data on sex, age, IQ, experiment times, and the date of the experiment. The Subject Evaluation form included sections for recording scores on performances for the trials, discrimination test, and visual sequencing test. The Experimenter Evaluation form provided areas for observations in the
FIGURE 5
ARRANGEMENT OF EQUIPMENT AND PERSONNEL
areas of encouragement and direction. The observer also recorded a judgement for each of the trial knot-tying performances. These judgements were shown to be highly correlated with the experimenter's judgements of the knot-tying performances.

The performance trial score was a number from one to nine. Each number represented a sequential step in the knot-tying task and indicated the subject's proficiency in performing the task. For example, a subject who scored a "one" on a performance test could only complete the first step of the task. But a subject who scored "nine" completed nine steps of the task and successfully tied a square knot. Since the steps were sequential (i.e., each step needed to be completed correctly before the following step was attempted), it was impossible for a subject to complete a step in the process without completing the preceding steps. An examination of these scores from trial to trial and from treatment group to treatment group indicated peak performances at step five and step nine. In other words, if subjects were able to reach step five and complete step six, they could generally score a perfect "nine." An analysis of this data is presented in Appendix F.

The discrimination test required the subject to identify the square knot. The score was therefore a correct identification (a "yes") or an incorrect identification (a "no").

The visual sequencing data was the final arrangement of still
pictures showing four steps in the knot-tying task. The steps which were selected for this test were steps one, two, six, and nine of the original nine steps of the task. A further description and analysis of this data is presented in Appendix G.

Analysis of the Data

Performance scores for each trial were considered the primary data for this experiment. Since subjects were drawn from a normally distributed population and an attempt was made to measure the data on an interval scale, parametric statistics were selected for the analysis. However, it should be noted that the statistical technique which was used could accommodate any data: nominal, ordinal, or interval.

The technique for the analysis was multiple linear regression (Bottenberg and Ward, 1963). Normally a repeated measures design would be used. However the existence of empty data cells made it impossible to use this approach. Empty cells were created because of the emphasis of this study on first-trial learning. Although some subjects needed three repetitions, it was inevitable that other subjects would need only one or two repetitions. No substantive purpose was served to have the subject repeat a trial after successfully performing the task.
The multiple linear regression approach described by Bottenberg and Ward overcomes the problem of missing cells by computing data with a multiple linear regression model, but still allows analysis of variance procedures, including the use of an F statistic and the analysis of possible interaction effects.

The technique employed by Bottenberg and Ward allows for the detection of differences in levels of criterion scores derived from sources which are identified with mutually exclusive categories.

Problems of this type are amenable to analysis through the use of vector representation. The general approach to the detection of criterion-level differences is to express the criterion vector of interest as a linear combination of predictor vectors and a residual factor. Values for the weights, or coefficients, of the predictor vectors in the linear combination are chosen so that the sum of squares of the elements in the residual vector will be as small as possible when observed criterion values are compared with estimated values. This minimum sum of squares is referred to as the error sum of squares.

A comparison of the error sum of squares obtained from the restricted linear combination with the error sum of squares for the unrestricted linear combination provides a basis for the acceptance or rejection of the hypothesis which led to the modified set of predictor vectors. Generally, the greater the amount by which the error sum of squares for the restricted model exceeds that for the unrestricted model the more confident we can be in rejecting the hypothesis (p. 48).
The equation for the full model is:

\[ y = b_1v_1 + b_2v_2 + \ldots + b_kv_k + e \]

where

- \( y \) = vector of the dependent measure
- \( e \) = residual vector consisting of discrepancies corresponding to observed and estimated values
- \( b \) = least squares regression coefficient
- \( v \) = classification vector

The equation for the restricted model is:

\[ y = b_0u + d \]

where

- \( y \) = vector of the dependent measure
- \( u \) = unit vector
- \( d \) = residual vector consisting of discrepancies between observed and estimated values of \( y \)
- \( b \) = least squares regression coefficient

The F statistic results from a comparison of the full and the restricted models.

Post-hoc analysis was performed using the Scheffé test. This test is a flexible, conservative, and robust method of analysis for paired and compound contrasts with either equal or unequal \( n \) situations (Kennedy, 1973). The Scheffé equation was:
\[ F = \frac{\hat{\psi}_i^2}{(a-1)(1/n_j + 1/n_{ij})MS_{S/A}} \]

where

- \( F \) is the statistic related to the standard \( F \) distribution
- \( \hat{\psi}_i \) is the multiple comparison
- \((a-1)\) is the Scheffe correction
- \( (1/n_j + 1/n_{ij}) \) represents the differential \( n \) coefficient
- \( MS_{S/A} \) is the sum of squares for error

**Summary**

Sixty-three subjects were randomly assigned to three treatment groups. To test the effect of the variables, demonstrational-cue and repetition, on first-trial learning, each subject was shown one of three versions of an instructional film--normal cue, slow motion cue, or still picture cue--and were allowed a maximum of three showings of the film. A pre-treatment experience was also administered to provide diagnostic information on each subject's ability to go from a visual to a motor task. Also, discrimination and visual sequence tests were administered after the treatment to obtain information on those abilities.

To assure that the experiment was within a trainable retarded's ability, a task was selected which was similar to the familiar task of
knot-tying. As another precaution, subjects were screened for pre-requisite skills. The basis of this selection was the judgement of school personnel.

All of the materials, except the pre-treatment experience materials, were prepared for the experiment and included the knot-tying cords, the instructional films, and the discrimination and visual sequence materials. All materials were prepared according to the evidence of research.

To determine if the experimenter administered the treatment consistently from subject to subject, an observer was present. The observer rated the experimenter's verbal behavior in terms of two categories: encouragement and direction. He also judged the subject's final knot-tying performances. These ratings provided a reliability check on the experimenter's evaluations of subject performances.

Data from the performance test was analyzed with a multiple regression statistic, and post hoc analysis was performed with the Scheffé test. Other data were presented more descriptively.
CHAPTER IV

PRESENTATION OF THE DATA

Sixty-three trainable mentally retarded subjects were randomly assigned to three treatment groups. Subjects in each group were shown one of three demonstration films and were evaluated after each showing on their proficiency in performing the task which was demonstrated in the film. Each subject had a maximum of three opportunities to view the film in order to reach criterion. In addition, subjects were also tested after the treatment for discrimination and visual sequencing ability.

The results of these tests, along with a discussion of the data as they relate to the previously stated null hypotheses, are presented in the following sections.

Results

F statistics and significance levels were calculated, testing each of the three research questions and an interaction question. These F statistics were used to test the significant main effects and
interactions in the relationships between relevant variables of demonstrational-cue (A), trial (T), and number of trials (NT). The results of this regression analysis are presented in Table 3.

Post hoc analysis was required for research question 4, which tested the interaction among levels of T over levels of A. The results of this analysis are indicated in the following significant interactions. (For purposes of clarity, levels of the trial (T) variable have been recoded arbitrarily as levels of "B", as indicated in Figure 6.)

At level A2--

B1 with B3
B1 with B5
B1 with B6
B1 with B2
B2 with B4
B2 with B3
B2 with B5
B2 with B6

At level A3--

B1 with B3
B1 with B5
B1 with B6
### TABLE 3

RESULTS OF REGRESSION ANALYSIS *

<table>
<thead>
<tr>
<th>Research Question</th>
<th>DF1</th>
<th>DF2</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Controlling for the 6 levels of T, do treatments (levels of A) make a difference?</td>
<td>10</td>
<td>156</td>
<td>.30</td>
<td>.97</td>
</tr>
<tr>
<td>2. Controlling for the 3 levels of A, do levels of T make a difference?</td>
<td>13</td>
<td>156</td>
<td>6.09</td>
<td>.001</td>
</tr>
<tr>
<td>3. Controlling for the 3 levels of A, do number of trials make a difference?</td>
<td>6</td>
<td>163</td>
<td>.65</td>
<td>.68</td>
</tr>
</tbody>
</table>

*Note: DF1 = degrees of freedom, numerator  
DF2 = degrees of freedom, denominator
### TABLE 3—Continued

<table>
<thead>
<tr>
<th>Research Question</th>
<th>DF1</th>
<th>DF2</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Are there differences between the levels of T that are constant over the levels of A?</td>
<td></td>
<td></td>
<td>2.36</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>156</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FIGURE 6

RELATIONSHIP OF VARIABLES, WHEN LEVELS OF TRIAL (T) ARE REPRESENTED AS "B"

<table>
<thead>
<tr>
<th>NT1</th>
<th>NT2</th>
<th>NT3</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>B2</td>
<td>B3</td>
</tr>
<tr>
<td>A1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

where:
- **B** = trials
- **B1** = first-trial performance of those who needed 1 trial
- **B2** = first-trial performance of those who needed 2 trials
- **B3** = first-trial performance of those who needed 3 trials
- **B4** = second-trial performance of those who needed 2 trials
- **B5** = second-trial performance of those who needed 3 trials
- **B6** = third-trial performance of those who needed 3 trials
- **A** = demonstrational-cue
- **A1** = normal motion cue
- **A2** = slow motion cue
- **A3** = still sequence cue
- **NT** = number of trials
- **NT1** = first-trial performance
- **NT2** = second-trial performance
- **NT3** = third-trial performance
Means and standard deviations for each treatment group at each level of Trial and Number of Trial is presented in Table 4. Means and standard deviations were also computed for Treatments and Trials without regard to Number of Trials. These data are presented in Table 5. Table 5 reveals that group A2, the slow motion group, scored higher than the other two groups on the first and second trials.

**Discussion**

Findings related to overall means and standard deviations, the null hypotheses, post hoc analysis, and data from the discrimination and visual sequence tests are discussed in the following sections.

**Findings Related to the Null Hypothesis**

As a result of the multiple regression analysis, which is described in Table 3, the following conclusions can be stated concerning the null hypothesis. The relevant variables are: demonstrational-cue (A), trial (T), and number of trials (NT).

**Null Hypothesis 1** - Controlling for levels of T, there is no difference in levels of A.

The F is not significant. The null cannot be rejected. No difference was measured in levels of the treatment variable, demonstrational-cue.
TABLE 4

MEANS AND STANDARD DEVIATIONS FOR DEMONSTRATIONAL-CUE, TRIAL*, AND NUMBER OF TRIALS

<table>
<thead>
<tr>
<th></th>
<th>Number of Trials 1</th>
<th>Number of Trials 2</th>
<th>Number of Trials 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
</tr>
<tr>
<td>Normal Motion Cue (A1)</td>
<td>X=9</td>
<td>X=4</td>
<td>X=3.29</td>
</tr>
<tr>
<td></td>
<td>n=1</td>
<td>n=1</td>
<td>n=21</td>
</tr>
<tr>
<td>Slow Motion Cue (A2)</td>
<td>X=9</td>
<td>X=3.25</td>
<td>X=4.0</td>
</tr>
<tr>
<td></td>
<td>SD=3.0</td>
<td>SD=1.8</td>
<td>SD=2.0</td>
</tr>
<tr>
<td></td>
<td>n=3</td>
<td>n=4</td>
<td>n=13</td>
</tr>
<tr>
<td>Still Sequence Cue (A3)</td>
<td>X=9</td>
<td>No Data</td>
<td>X=3.44</td>
</tr>
<tr>
<td></td>
<td>SD=3.0</td>
<td>SD=1.85</td>
<td>SD=1.88</td>
</tr>
<tr>
<td></td>
<td>n=2</td>
<td>n=18</td>
<td>n=18</td>
</tr>
</tbody>
</table>

*NOTE: The variable, trial (T), is represented as B1, B2, B3, B4, B5, B6,

where: B1=first trial performance of those who needed one trial to completion

B2=first trial performance of those who needed two trials to completion
TABLE 4—Continued

B3=first trial performance of those who needed three trials to completion

B4=second trial performance of those who needed two trials to completion

B5=second trial performance of those who needed three trials to completion

B6=third trial performance of those who needed three trials to completion
<table>
<thead>
<tr>
<th></th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Motion Cue (A1)</td>
<td>X = 3.56</td>
<td>X = 3.90</td>
<td>X = 4.66</td>
</tr>
<tr>
<td></td>
<td>SD = 2.01</td>
<td>SD = 1.95</td>
<td>SD = 2.85</td>
</tr>
<tr>
<td></td>
<td>n = 23</td>
<td>n = 22</td>
<td>n = 21</td>
</tr>
<tr>
<td>Slow Motion Cue (A2)</td>
<td>X = 4.6</td>
<td>X = 5.11</td>
<td>X = 4.46</td>
</tr>
<tr>
<td></td>
<td>SD = 2.34</td>
<td>SD = 2.5</td>
<td>SD = 1.94</td>
</tr>
<tr>
<td></td>
<td>n = 20</td>
<td>n = 17</td>
<td>n = 13</td>
</tr>
<tr>
<td>Still Sequence Cue (A3)</td>
<td>X = 4.0</td>
<td>X = 3.55</td>
<td>X = 3.94</td>
</tr>
<tr>
<td></td>
<td>SD = 2.22</td>
<td>SD = 1.58</td>
<td>SD = 2.38</td>
</tr>
<tr>
<td></td>
<td>n = 20</td>
<td>n = 18</td>
<td>n = 18</td>
</tr>
</tbody>
</table>
Null Hypothesis 2 - Controlling for the levels of A, there is no difference in levels of T.

The F is highly significant ($p < .001$) and the null condition is rejected. Levels of T make a difference at at least one level of A.

Null Hypothesis 3 - Controlling for levels of A, there is no difference in NT.

The F is not significant. The null condition cannot be rejected. No difference was measured among comparisons on Number of Trials (NT).

Null Hypothesis 4 - There are no differences between levels of T constant over the three levels of A.

The F statistic is significant ($p < .05$). Differences between levels of T are not constant. There is interaction.

Findings Related to Post Hoc Analysis

Using the Scheffe test, significant differences were found between levels of T at levels A2 and A3. From these data, it can be concluded that there is a substantial difference for the slow motion cue and still sequence cue between those who performed the task perfectly after only one showing and those who needed three trials to complete the treatment. A significant difference between T2 and T4 at level A2 reflects the improvement which was needed from the first to the second trial for all those who needed a total of two trials.
to complete the treatment.

**Findings Related to Means and Standard Deviations**

A display of means and standard deviations which takes into account all three relevant variables indicates no observable trend (Table 4). However, when these data are grouped without regard to Number of Trials, as in Table 5, a pattern develops indicating the superiority of Treatment A2 (i.e., the slow motion sequence cue) over the other two treatments. This relationship is more evident in Figure 7. A one-way analysis of variance indicated no significant difference between levels of A.

**Findings Related to Discrimination and Visual Sequence Tests**

As indicated in Table 6, a larger percentage of subjects in treatment groups A1 and A3 performed the discrimination test more successfully than subjects in treatment group A2. For the Visual Sequence Test, subjects in treatment group A3 were shown to outperform subjects in the other two groups.

Subjects who viewed the still sequence version were better able to perform the visual sequence task. Similarly, subjects in the normal and still sequence treatment groups were more adept at the discrimination task. Subjects who viewed the slow motion version performed least well on both tests.
FIGURE 7

RELATIONSHIP BETWEEN VARIABLES

Key
- SLOW MOTION CUE GROUP
-- NORMAL MOTION CUE GROUP
----- STILL SEQUENCE CUE GROUP
# TABLE 6

PERFORMANCE SCORES ON DISCRIMINATION TEST AND VISUAL SEQUENCE TEST

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>PERCENT SUCCESSFUL*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DISCRIMINATION TEST</td>
</tr>
<tr>
<td>Normal motion cue (A1)</td>
<td>47.8</td>
</tr>
<tr>
<td>Slow motion cue (A2)</td>
<td>15.8</td>
</tr>
<tr>
<td>Still sequence cue (A3)</td>
<td>45.0</td>
</tr>
</tbody>
</table>

*Criteria for success was the correct choice. The correct choice for the Discrimination Test was identification of the square knot. The correct choice for the Visual Sequence Test was identification of the correct order for the pictures. The data presented here are adjusted frequencies.
CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

Will demonstrational-cues in instructional films and the use of repeated showings increase the film-mediated instruction of perceptual-motor skills of trainable mentally retarded? This is the essential question which this study attempted to answer. The following chapter summarizes the experiment, presents conclusions which resulted from the study, discusses these conclusions, and offers recommendations for future research.

Summary

Sixty-three students from three schools in the Franklin County Program for the Mentally Retarded were randomly assigned to three treatment groups. All of the subjects were categorized as trainable mentally retarded and ranged in chronological age from 6.3 years to 15.8 years.

The treatment groups were defined by the kind of demonstrational-cue which was used in a film on how to tie a square knot. One group
viewed a film version which was prepared as slow motion. A second group viewed a version prepared as normal motion. And a third group was presented with a version which used a successive sequence of still pictures showing nine critical steps in the knot-tying process.

Subjects were shown the film a maximum of three times. After each showing the subject was asked to perform the task and were evaluated on a scale from one through nine, corresponding to the nine steps in the task. Knot-tying materials were prepared especially for this study and were located in front of the subject during the entire period of the treatment. Practice during the showings was allowed.

The treatment also consisted of other activities, including a pre-treatment experience, a discrimination test, and a visual sequencing test. These activities were useful in providing additional data on the subjects and served to add another dimension to our knowledge of the performance of these individuals. The pre-experience treatment was presented before the start of the treatment and used a commercial sound filmstrip to indicate if the subject could perform a motor activity from a visual demonstration of that activity. This activity may also have conditioned the subject to the treatment that followed. The discrimination test followed the final film-showing and presented the subject with the task of identifying a square knot from two other knots shown in separate still pictures. The visual sequence test
was presented immediately after the discrimination test and consisted of still pictures showing four steps in the knot-tying process. The subject's task was to put the pictures in the correct order.

With the exception of the sound filmstrip, all of the experimental materials which were used were prepared specifically for this study. The motion picture films were 16mm, black-and-white, and without narration or other sound accompaniment. The normal sequence version was about 12 seconds, and the slow motion and still sequence versions were about 50 seconds each.

The treatments were administered to subjects individually over a period of a month. Data collection took place during 1974 on May 7, 14, 15, 16, 21, 22, 29, 30, and 31.

Conclusions

An examination of means and standard deviations for treatments and trials indicated a trend toward higher performance for subjects in the slow motion treatment group than for subjects in either the normal motion sequence or still sequence cue groups. This trend was not supported with statistical analysis.

Multiple regression and post hoc analyses were performed on the data, with the following conclusions:

1. Trainable mentally retarded who view a film demonstrating
a perceptual-motor task in slow motion will not perform that task significantly better than trainable mentally retarded who view a similar film with normal motion or still sequence cues.

2. When presented with the opportunity to view a demonstrational film up to three times, a significant number of trainable mentally retarded performed the task after the first showing. Other subjects performed the task after two showings, and the remaining subjects either performed the task after three trials, or completed the treatment without successfully tying the square knot.

3. When equated on the basis of the number of trials needed to complete the treatment, there was no significant difference in groups.

Data obtained from the discrimination test and the visual sequence test were also reviewed. Adjusted relative frequencies were computed for each test by treatment group. Conclusions which were drawn from this data are as follows:

1. Trainable retarded who were in the slow motion group did least well on the discrimination test.

2. Trainable retarded who viewed the still sequence version did best on the visual sequencing task.
3. Subjects who viewed the normal motion cued film tended to order the visual sequence pictures with the last picture in the sequence (picture number nine) first. Those who viewed the still sequence version tended to begin the sequence of stills with the first correct picture (picture number one). Subjects who viewed the slow motion version showed no tendency in the selection of the still pictures.

Discussion

The evidence of this study did not demonstrate that the treatment, demonstrational-cue, had a significant effect on the film-mediated instruction of perceptual-motor skills of trainable mentally retarded. Although mean scores for each treatment at each level of trial indicated a trend in favor of slow motion cue as the high performing group, this trend was not substantiated in subsequent statistical analysis.

In contrast, the variable "trial" proved to be highly significant. However, the direction of significance was not as predicted. Although it was predicted that repeated trials would be better than one trial, evidence demonstrated that, for the slow motion and still sequence groups, the greatest difference was between those who needed only one trial to complete the treatment and those who needed three trials to complete the treatment. In other words, a significant number of
subjects who needed three trials did not outperform those who needed one or two trials. Instead, the largest number of high performers was in the group of subjects who needed only one trial.

Clearly, in the slow motion and still sequence groups, subjects were either very adept at the task and needed little instruction, or they had difficulty with the task and needed the maximum amount of instruction available. Even then they may not have achieved a perfect score. For the subjects who needed only one trial, the film may have contributed to learning, but in a minimal way. In effect, these subjects may have come to the experiment with a greater repertoire of behaviors which allowed easier information coding and mental rehearsal of information, resulting in a quicker grasp of the task requirements.

Similarly, for subjects who needed three trials, the film contributed to learning, particularly for the eight subjects in this group who obtained a perfect score. But even three showings of the film were not enough to overcome the learning deficits of the others in the group who did not score perfectly. Perhaps for those subjects, the task was too difficult and an unrealistic test of performance.

The results of the discrimination and visual sequence tests were also inconsistent with usual expectations of performance. Subjects who had the higher mean scores in the knot-tying task (i.e., the slow motion version) performed least well on the discrimination test. The
evidence of the discrimination test may indicate that trainable mentally retarded are better at imitation than they are at representation of images. They were able to imitate the motor requirements of the task, but failed to form the mental images which are necessary for recognizing the knot afterwards. This evidence conflicts with Kirk and Kirk's findings (1971) that mentally retarded children appear to be superior in representational functions as opposed to the nonsymbolic, or automatic, level. Kirk's findings that some retarded are superior in motor encoding abilities and are deficient in short term memory, however, are confirmed by the results of this study.

Only three out of the nineteen subjects who scored a perfect "9" on the performance tests also identified the correct knot in the discrimination test. This evidence supports the contention that those who scored a "9" after the first showing did in fact learn from the film. If these subjects knew how to tie a square knot before seeing the film and were not screened out by the pre-test, they would certainly have been able to identify the correct knot in the discrimination test.

The results of the visual sequence test was also surprising. The expectation was that those who performed well on the knot-tying would perform equally well on the visual sequence task. The results showed however that the still picture group--a group showing low mean scores on the knot-tying task--had the highest number of perfect
scores on the visual sequence task. The explanation here may be more clear-cut. The still picture version of the film was the version most similar to the still pictures in the test and may have facilitated the association necessary for recall.

Other data, which were not systematically studied and therefore not formally reported, are also of interest. In particular, it seemed that those who practiced during the film showings performed better in the performance test. This evidence confirms research with normals on the variable of practice. Another observation was that subjects who responded better during the pre-treatment experience were more likely to perform better during the treatment, indicating that the ability to recognize visual cues, follow visual information, and translate this information into motor activity may be a determining factor in learning from films.

This data provides evidence that a wide discrepancy in performance exists among trainable mentally retarded. Where some retarded have the mental and physical abilities to understand visual cues and to demonstrate perceptual-motor performance with little instruction, other retarded need far more instruction and direction. The data also suggests conclusions which are contradictory to usual expectations of performance. Principally, motor performance does not appear to be a reliable indicator of discrimination and visual sequence abilities.
It appears therefore that the ability to tie a knot or bow was not sufficient as a prerequisite criteria for the instruction which was attempted in this study. Apparently other factors contribute to successful learning and may have served to confound the results of this experiment.

The question is: what are these factors? An examination of the descriptive data for the treatment groups reveal no unusual trends in chronological age, mental age, or IQ. Performance levels were similar for each group, with the exception of the slow motion treatment group, which had a substantially larger percentage of Senior level subjects. Since the slow motion group did not achieve a significantly higher level of scoring than the other groups, the presence of a greater number of Seniors in the group did not appear to be an important factor in the results.

An attempt was made to determine the source of retardation of subjects to see if the polarity in the data may have been the result of brain-damage or familial-cultural origins. A complete set of these data, however, was not available.

An attempt was also made to correlate the trial scores of each subject with the domain and subdomain scores of the Adaptive Behavior Scales (American Association of Mental Deficiency, 1973). Significant correlations were indicated, but the large number of comparisons and
the difference between the ranges of the trial scores and the adaptive behavior scores leaves these significant levels open to question. These relationships may, however, be a useful area for further study.

It is also conceivable that other factors involved in the experiment contributed to the polarity of the data and the lack of significance between the treatment groups. One of these factors was the task. Since the differences with the greatest statistical significance occurred in differences between the one-trial and three-trial learners, it is clear that for some the task was easy, almost too easy, and for others the task was difficult, perhaps too difficult. Possibly, the three-trial group would be able to learn the task with more trials, but this study was limited to three trials only.

Another factor was the method of presenting the task. The task, tying a square knot, was not beyond the abilities of some of the learners. It may have been possible, however, that the form of presentation did not contribute sufficiently to the particular problems which are a part of tying a square knot. As indicated in the data included in Appendix F, the critical step in tying the knot comes in making the second loop (step six), when the learner must loop the cords right over left, which is the reverse of the previous loop (left over right). The treatment versions, whether it was slow motion, normal motion, or a sequence of stills, did not necessarily focus on this particular step in
the process and emphasized all parts of the sequence equally. Since reversals may be difficult for the mentally retarded (Zeaman, 1973), this lack of emphasis on the "reversal" step in the knot-tying process may have been the reason why those subjects who did not reach criterion did not perform better. For those subjects, the learning deficit may have been an inability to overcome reversals in the instructional task, and the three treatments were equally ineffective in pointing out this reversal.

Another factor may have been the selection of relevant variables. It was observed that subjects who viewed the sequence of stills reacted differently from the subjects who viewed the slow motion version. For example, subjects in the still sequence group seemed to treat each still as if it were not a part of a sequence. As each new still appeared the subject tied and retied the cords to match the visual. Unlike the still sequence group, the slow motion subjects tended to proceed step-by-step with the film action. These important differences in performance were not revealed in the measure which was used. Perhaps other measures of performance, such as manipulative errors and additional trials, would have been useful in providing this information and would have more accurately reflected the variance in performance between the groups.
Recommendations

The significant results of this study may indicate important changes in the study of film-mediated instruction of perceptual-motor skills of the trainable mentally retarded. Given the evidence of this study, it would appear that trainable retarded are not able to be equated on the usual measures of chronological age, mental age, intelligence quotients, and levels of performance in the instruction of perceptual-motor skills from demonstrational films. Other factors appear to be operating. For example, some subjects were able to understand visual cues and to follow visual instructions, but other subjects were not able to process visual information sufficiently to follow the actions which were demonstrated in the film. This condition may have created a dichotomy in the data, with all those who performed well after only one trial at one end of the continuum, and all those who performed poorly at the other end. Future research on the use of motion pictures with trainable mentally retarded would be well advised to be particularly cautious in the selection of subjects, taking into account not only standard descriptive data, but type of retardation and other behavioral characteristics which may reflect the ability to learn from visual instruction.

The results of this study also offer some possible recommendations for the use of motion pictures to teach perceptual-motor tasks to
trainable mentally retarded. Since the statistical analysis failed to support a difference in treatment groups, it cannot be concluded that slow motion as it was used in this study increased learning. However other evidence suggests some recommendations. A trend was indicated in the mean scores, showing that the slow motion group appeared to perform better than the normal motion and still motion groups. This evidence, plus the fact that nineteen of the subjects did in fact learn to tie a square knot from viewing the film, should encourage continued research in this area.

Further research with slow motion would need to be far more precise, using this cue to its greatest advantage. It was pointed out by Neu that cues can increase learning when they are relevant to the subject matter. A technique would therefore be needed which would allow segments of the task which could benefit from slow motion to be shown in slow motion.

The significant data related to repetition has already been discussed. The implications of this evidence for further research would be that studies need to be designed to continue over a longer period of time, so that the investigator has an opportunity to minimize the motivational and inhibitory problems which may have been a part of this experimental setting. The results of this study would appear to support McTavish's study with normal individuals, indicating that two
film showings are optimum for the instruction of perceptual-motor skills. However the fact that subjects needed only one trial indicates that some retarded individuals in this study performed as well as normal individuals. While this kind of data is not uncommon in research with the retarded, it would be more reasonable to conclude that the subjects in the one-trial-only group had mental abilities which made them particularly suited to learning perceptual-motor skills from films, very similar to the abilities of normals. In fact it could be interpreted that subjects who needed two or three trials to complete the treatment were not adequately studied in this experiment, particularly for the factor, repeated trials.

This study was a first-attempt to investigate the elements in demonstrational films which are particularly suited to the instruction of perceptual-motor skills in trainable mentally retarded. Unlike other studies with the retarded, which are concerned with paired-associate learning and simple discriminations and transfer tasks, this study provided the learner with a realistic task and evaluated performance in terms of that task. Admittedly, the task was complex and the measure was gross. But it represents a first step in a method of research with retarded that has been shown to be fruitful with normals. Perhaps, with some modifications, this kind of research can serve also to improve film-mediated instruction for trainable mentally retarded and
to provide these individuals with the much needed materials which are essential for their effective and efficient instruction in perceptual-motor skills.
APPENDIX A

CRITERIA FOR ENTERING INTERMEDIATE LEVEL
I. Gross and Fine Motor

A. Concepts

1. Reinforcement of body image
2. Position in relation to space and objects, identification
3. Body in relation to the objects
4. Objects in relation to body
5. Laterality
6. Moving objects
7. Static symbols

B. Gross Motor Skills

1. Hand and leg (foot) dominance
2. Alternating feet - up and down stairs
3. Walking (forward - backward - sideward)
4. Running
5. Jumping (over object)
6. Hopping
7. Balancing - points of balance (1 foot, hands, feet)
8. Reaching above head
9. Catching (large to medium ball)
10. Throwing (large to medium ball)
11. Kicking (large to medium ball)
12. Sliding (feet in skating motion - sliding sideways)
13. Climbing
14. Tip-toe
15. Galloping

C. Fine Muscle

1. Pencil
   a. Adequate
   b. Top to bottom progression
   c. Patterned scribbling
2. Crayoning (within confined space)
3. Opening and closing scissor (dent in paper)
4. Reproduce horizontal and vertical lines and circle
5. Left to right progression (should be emphasized, but is not a specific criteria for entering intermediate)
II. Self Care

A. Dressing Skills

Reinforce -
1. Put on and take off outer clothing
2. Unbutton - button
3. Unsnap - snap
4. Take off - put on boots
5. Take off - put on shoes
6. Unzip - zip (not starting coat type zipper)
7. Introduce lacing and tying

B. Personal Hygiene Skills

1. Washing and drying hands
2. Clean nose
3. Wipe mouth
4. Brush teeth (w/supervision)
5. Toileting (independently - not necessarily without supervision)

C. Eating Skills

1. Using table utensils properly (spoon and fork)
2. Drinking with straw
3. Proper use of napkin
4. Chewing properly (w/mouth closed when able)
5. Establishing good table manners (not playing with food, not blowing bubbles in milk)
6. Preparation for meal
7. Clean up after

III. Social Development

1. Adhere to classroom limitation
2. Positive use of leisure time
3. Respect for others property
4. Recognition of courtesy terms (please and thank you)
5. Taking turn and sharing
6. Initiative play
7. Supervised social interaction
8. Respects authoritative figure
9. Respects privacy of others
10. Responds to peers needs for help appropriately
IV. Emotional Development

1. Adaptability to change
2. Aware of overt emotions
3. Adequate attention span
4. Accepts direction for handling frustrations
5. Adequate control of behavior in quiet or competitive group
6. Awareness of behavior and its consequence

V. Language

A. Receptive

1. Follows simple directions without prompting
2. Follows chain commands (two directives)
3. Follows group directions
4. Follows words that indicate, identify (nouns, pronouns)
5. Follows words that indicate actions (verbs, prepositions, adjectives, adverbs)

B. Expressive Language

1. Able to speak in phrases or sentences of 2 - 5 words
2. Identify himself verbally
3. Indicates wants by naming objects
4. Able to use pronouns, nouns, verbs, and a few adjectives
5. Able to use plurals and past tense (not always correctly or consistently)

VI. Functional Academics

1. Recognize printed first name
2. Number concepts developed for up to three objects
3. Can count 5 objects
4. Can name primary colors - example: What color is this? (red, yellow, blue, green) and identify some secondary colors (show me)
5. Identify all body parts
6. Recognize basic shapes
7. Grouping and classifying objects
APPENDIX B

SAMPLE FRAMES FROM THE PRE-TREATMENT EXPERIENCE FILMSTRIP
1 Here I am on my chair,  
   Sitting quietly.  
   I'm waiting for you kids  
   To play a game with me.

2 I like to move my arms and legs,  
   My head and body too.  
   Please stand up and follow me.  
   Can you do what I do?

3 Can you do what I do?

4 Put your hands up high.  
   Put your hands up high.

5 Reach up to the sky.

6 Now touch your head,

7 Give a little nod.

8 Up and down you go,

9 Give a little nod.

10 Swing your arms around,
APPENDIX C

INSTRUCTIONS TO SUBJECTS
Experimenter's Script

(Subject's name), this is your chair. Please sit down.

(Pause)

(Subject's name), you're going to see a filmstrip showing a little girl. I want you to watch the filmstrip and do what the little girl in the filmstrip is doing.

(PLAY PRERECORDED CASSETTE/FILMSTRIP)

Very good. Now I want you to take these cords and tie a square knot.

(SUBJECT ATTEMPTS TO TIE THE KNOT)

I see that you don't know how to tie a square knot. That's all right, I'll show you. You'll now see a film showing you how to tie a square knot. Watch it carefully, because after the film, I'll ask you to tie the knot just as the man in the film did. If you want to, you can try to tie the knot as you watch the film. Do you understand?

(SHOW FILM)

Now I want you to take the cords and tie a square knot.

(SUBJECT ATTEMPTS TO TIE THE KNOT, BUT IS UNSUCCESSFUL)

That's not quite right. I'll show you the film again.

(SHOW FILM)

Now I want you to take the cords and tie a square knot.

(...AFTER A SUCCESSFUL TIE, OR THREE SHOWINGS)

Very good. Now I want you to look at these pictures of three different knots. Point to the knot that looks most like the one that was tied by the man in the film.

(SUBJECT IDENTIFIES KNOT)
Good. Now I'm going to show you more pictures. Each picture shows the man in the film as he tied the knot. I want you to put the pictures in the correct order, so I can see what the man did first, what he did next, and next, until he finished. Start here and finish here.

(SUBJECT ORDERS PICTURES)

Very good. You can go back to your room now. Thank you.
APPENDIX D

SUBJECT EVALUATION FORM
SUBJECT EVALUATION FORM

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<th>SUBJECT</th>
<th>___</th>
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TASK PERFORMANCE

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PRE-TREATMENT PERFORMANCE
Number of promptings--
Comments--

GENERAL COMMENTS
APPENDIX E

EXPERIMENTER EVALUATION FORM
EXPERIMENTER EVALUATION FORM

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**Performance**

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APPENDIX F

PERCENTAGE OF SUBJECTS ACHIEVING EACH SCORE
IN EACH TREATMENT FOR EACH TRIAL
PERCENTAGE OF SUBJECTS ACHIEVING EACH SCORE IN EACH TREATMENT FOR EACH TRIAL

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KEY:  
A1 = normal motion sequence cue  
A2 = slow motion sequence cue  
A3 = still sequence cue
APPENDIX G

ANALYSIS OF VISUAL SEQUENCE TEST RESPONSES
**ANALYSIS OF VISUAL SEQUENCE TEST RESPONSES BY PERCENT**

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*Code of responses:

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REFERENCES
REFERENCES


Lovitt, T. C. *Studies of the communication processes of retarded and normal males*. Parsons, Kansas, School of Ed., University of Kansas, 1966.


Miller, G. A. The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychological Review, 1956, 63 (2), 81-97.


