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VISUAL DEMONSTRATION, VERBAL INSTRUCTION, AND THE DEVELOPMENTALLY HANDICAPPED

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Visual Demonstration, Verbal Instruction, and the Developmentally Handicapped," submitted by Elizabeth Anne Hughson in partial fulfillment of the requirements for the degree of Master of Science in Education.

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ABSTRACT

Studies in the field of learning and language related to the abilities of the mentally retarded in the acquisition of verbal and motor performance were reviewed, including a discussion of language and mental retardation, language learning and control of motor behaviour, verbal learning, and verbal instruction.

The present study consisted of two experiments:

The first experiment investigated the effects of differing amounts of verbal redundancy on learning. Thirty-six subjects from a vocational and rehabilitation centre for adults were assigned to either a low or high visual-motor performance ability group.

The treatment procedures involved the subjects in carrying out three trials of a non-verbal visual-motor task after receiving minimal, intermediate, or maximal amount of verbal instructions.

The results indicated that varying amounts of verbal instruction affected performance on a non-verbal task, i.e., the fewer the redundant verbal cues the better the performance regardless of verbal or performance ability.

The second experiment investigated the effects of visual and verbal instructions on the performance of a series of non-verbal tasks varying in level of difficulty. In this study, twenty-four subjects were assigned to high and low verbal ability groups and were given four visual-motor tasks which increased in difficulty level. The methods of instruction were: demonstration only, demonstration plus

minimal amount of verbal instruction, and demonstration plus maximum amount of verbal instruction.

The results indicated a significant difference between difficulty levels, but no significant difference associated with type of instructions. None of the interaction terms attained significance.

The effects of type of instructions and task complexity were discussed. A number of explanations were put forward, including the possibility that visual demonstration of a non-verbal task is critical for certain kinds of learning. It was also suggested that minimal amount of redundant information should be used by instructors, and where possible visual demonstration should be employed.

The implications of these results for further research were discussed.

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

In the last few years an increasing amount of research has been carried out into the difficulties encountered by the mentally retarded in learning vocational and social skills (Clarke and Clarke, 1965; Gunzburg, 1968). Research studies have in particular included investigations into motivation, learning, motor performance, memory, and language. These aspects of learning and performance have been investigated to evaluate the deficiencies and developmental differences within the subnormal group. Some studies have been concerned with comparing and contrasting different handicapped groups while others have been directed towards a comparison with normal subjects. The merits and demerits of such comparisons have been discussed by Mittler (1971). Emphasis is beginning to be placed on applying the principles of learning to the teaching of basic skills (Brown, 1972) and, as research continues to accumulate, the need to attempt such application to the development of training programs and practical teaching situations becomes more obvious.

In the last few years, a great deal of work has been carried out concerning the relevance of language in the learning of both non-verbal and verbal tasks. The review of the research in this thesis includes studies in the field of learning and language as related to the abilities of the mentally retarded in the acquisition of verbal and

motor performance. It is followed by an account of two experiments which investigate instruction procedures in the developmentally handicapped.

Language and Mental Retardation

A great many studies have noted the relationship between language efficiency and mental retardation (Jordan, 1967). Jordan indicated that the frequency of language difficulties in the mentally retarded ranges from estimates of 41 to 79 per cent. The figures all showed a high incidence of problems, and differences cited appeared to be due to definitions of language handicap and reference groups. Language difficulties in the mentally retarded fall essentially into three overlapping categories:

1. delayed speech development caused by physical defects of the speech and sense organs;
2. developmental disorders of early origin including environmental experience and genetic defects; and
3. linguistic disorders and poor abstraction abilities related directly to cognitive functioning.

Language difficulty not only correlates with mental retardation, but is also a dimension or observable indication of intellectual functioning, possibly because language has a mediating influence on behaviour and cognitive processes (Luria, 1963). The resulting effects of poor language achievement, according to Luria, include a failure to reach certain levels of conceptual development. Jordan (1967) also

pointed out that language behaviour is one of the major processes to be considered when children fail to reach certain educational and developmental norms. This often occurs when the child reaches school age, though the language problem is frequently apparent before this time. Language achievement is an attribute, which fluctuates as a consequence of the child's circumstances. A variety of influences may shape language development apart from "mental retardation" per se. Such influences include poor home environment, disruption of mother-child relationship (Lyle, 1959), poor mothering (Mowrer, 1960), and institutionalization (Lyle, 1959). Theoretical contributions of the role played by social class and language as factors related to verbal difficulty and concrete thinking have been made by Bernstein (1958, 1959). He attempted to show a relationship between two forms of linguistic expression and the resulting problem solving and educational levels of functioning. Bernstein postulated that one linguistic code, public language, is used by the poorer social economic groups. This involves the use of words of concrete meaning, simple sentence structure, and implies a low level of conceptualization. On the other hand, the formal language code, which is used by the middle class groups, involves a more abstract conceptual hierarchy. If language is linked to motor and visual perceptual behaviour, the social group differences in the use of linguistic codes may suggest reasons for problems in acquisition of non-verbal behaviour in the socially deprived. This further emphasizes the hypothesis cited by Fawcus (1965) that intelligence is not necessarily the cause of lack of speech and language development but the result of it.

However, evidence indicated that gross intellectual deficiency may be responsible in some cases for the delay or absence of speech. Other reasons for poor or delayed language development include secondary handicaps, such as, hearing loss, lack of stimulation, motivation, emotional disturbance, cerebral palsy, and disorders of articulation.

Luria and Yudovich (1959) suggested that language regulates behaviour, facilitates abstract reasoning, stabilizes perception, and allows comprehension of complex relationships. Therefore, as Benton (1964) indicated, this research provides additional support for the view that an individual with a language handicap will perform poorly, not only on verbal, but also on non-verbal tasks, even though the latter do not require language in the formal sense.

The present thesis attempts to investigate the role of language instruction in the performance of non-verbal motor tasks. However, before proceeding with this, a critical summary of studies in language, as it relates to learning and performance in non-verbal tasks, is presented.

Language Learning and Control of Motor Behaviour

Recent work in the area of verbal control of motor behaviour has developed around the research of Luria (1959) and Luria and Vinogradova (1959) who investigated the association between verbal and motor systems in the mentally retarded. This work emphasized that the retarded child's language does not sufficiently develop to assume a regulating function.

O'Connor and Hermelin (1959) attempted to test Luria's views. They hypothesized in their studies on discrimination and reversal experiments that discrimination is not under verbal control in the retarded and consequently a strong generalized verbal habit does not have to be extinguished in reversal problems. The results upheld Luria's basic premise of dissociation between verbal and motor systems.

Denny (1964) summarized the lack of verbal control and motor behaviour in the retarded as being manifested in the following ways:

1. Failure to follow verbal instructions explicitly.

It should be noted that this type of statement which is common in the literature appears too general and leads to misconceptions regarding the handicapped. The statement should be qualified by indicating the manner in which instruction is given, the meaningfulness of content, the form of extraneous stimulation, and the complexity of language used.

2. Responses to verbal signals show generalization effects involving a similar sound but less generalization in meaning.

It should be pointed out that one must take into account the familiarity of the subjects with the language being used. This type of statement underlines the fact that meaning must be identified in relation to the subject.

3. The effect of verbal instructions, which have been initially effective, fade over time.

It is necessary to ensure that initial verbal instruction is the variable involved in fading effects since variables, such as motivation, novelty, and reinforcement may also be relevant. Another

consideration involves the amount of overlearning that occurs in the initial phase and whether the experimenter is measuring a memory deficit or language difficulty.

It is obvious from these statements and the subsequent comments that sweeping generalizations are made in relation to the mentally retarded. Careful research and critical appraisal suggest a considerable range of variability in handicapped persons.

Studies by Ammons, Alprin, and Ammons (1955) and Ellis and Sloan (1957), comparing normals and retardates on rotary pursuit performance, indicated that with mental age controlled, there appears to be no evidence of low IQ deficit associated with poor motor learning. Malpass (1960) also found that IQ was not related to motor performance and that male-female differences were insignificant. Other studies comparing mentally retarded and normals, when matched on C.A. and M.A. level, have been summarized by Denny (1964) and indicated that if a task is difficult, then low M.A. or low IQ become relevant variables. The mentally retarded, excluding the severely retarded, although initially exhibiting a deficit in motor performance, improve more rapidly than normals with practice and can equal the performance of normals over time (Tizard and Loos, 1954; Clarke and Hermelin, 1955). Thus, it would appear that difficulty level of the initial task is critical in determining level of performance though practice cancels out intelligence effects.

It appears that performance can be improved in several ways in the area of motor learning and language (Denny, 1964):

1. Long-term training in attending to task stimuli, especially

verbal stimuli is required.

2. Motivation should be increased. This may be done by providing for success through small learning steps and gradually building in new information as learning proceeds.

Vygotsky (1939) made a distinction between the role of speech in affecting the behaviour of other people and the role of personal speech as a means of affecting one's own behaviour. The child first allows his behaviour to be directed by the speech of others. Later speech is used to direct his own behaviour as a by-product of his responsiveness to what others have said to him.

Luria (1959, 1960) indicated that when the child is from one and a half to two years of age, he demonstrates an orienting response to language, the words serving to attract or gain his attention. At a later stage, verbal instruction seems to have the primary effect of controlling the child's motor performance. Luria called this an impulsive or releasing function. Language then acquires a selective function as a child responds by obeying simple commands. The most advanced function of language, as described by Luria, is that of pre-selection which may be described as self-instruction which is at first overt and then becomes covert or internalized speech. By this stage, the child will be able to withhold a response or respond appropriately in accordance with a set produced by previous instruction. Luria went on to discuss the difficulties encountered by the retarded in establishing connections between verbal instructions and manipulation of concrete materials.

Other Russian work in the area of motor movement and perception

by Zaporozhets (Berlyne, 1963) has indicated that there is a relationship between eye and hand movements. For example, if a new stimulus is presented visually, there are wide sweeping eye movements, which seem to have the function of fixing the stimulus in space and this is followed by more precise movements exploring the stimulus. The same sequence is found for hand movements when an object is explored tactually. This would seem, as Berlyne has pointed out, that verbal instructions and imitation are likely to be more effective if they are directed toward orienting responses as well as executive responses. This means verbally teaching a person what to look at, directing attention to the appropriate cues, and using feedback from both the external situation and from the actions carried out.

In discussing this area of orienting responses and attention, it is important to briefly mention the work of Zeaman and House (1963). Their basic contention was that a chain of two fundamental processes underlie discrimination learning:

1. observing the various stimulus dimensions; and
2. making the instrumental response.

The basic problem for the retarded is cited as a low initial probability of attending to the relevant dimensions. The retardate's capacity to acquire an instrumental response is not in question, but rather his ability to attend to the relevant and critical stimulus dimensions that lead to making the appropriate discriminations. This initial process consists of teaching the subject to attend to the appropriate stimulus dimension. Zeaman and House postulated that learning is confined to a single dimension at a time. Thus, they hypothesized that the retarded

learner:

1. attends to a smaller set of dimensions giving him a poorer chance of identifying the relevant one; and
2. he is less able to ignore those that are likely to be irrelevant.

Although it should be noted that this work is in relation to discrimination learning, it would appear to be relevant to the process of verbal instructions used in teaching a motor task, i.e., in what way does the verbal instruction help or hinder attention to a motor task?

Verbal Learning

In considering the mediating effects of language on performance, it is necessary to review some of the extensive experimental research in relation to mental retardation. Many intelligence tests, particularly those used in educational systems, predominantly measure the use of language. Also, much of classroom learning is essentially by means of verbal communication.

Baumeister (1967) pointed out, in his review of studies in the serial learning of verbal material, that there is a tendency to use less meaningful material than in paired associate studies. It is of interest that the subnormal tended to do as well as normals in the latter studies when matched for M.A. but not in the former. This perhaps tends to support the suggestion that verbal mediators must be meaningful to the subjects if language is to be a facilitator of learning (see also Jensen and Rohwer, 1963).

These observations imply that learning is related to concrete

meaningful material to which clear-cut verbal labels can be applied, thus enhancing verbal mediation. Furthermore, some studies indicated that if the mentally retarded are first taught to mediate cues with concrete labels, discriminitive and associative learning performance improves (Baumeister, 1967). Jensen and Rohwer (1963) indicated that learning is more effective if verbal coding of stimulus material is used and the context is a meaningful one.

Baumeister (1967) emphasized the following points to be considered in practical situations:

1. Meaningful material should be used as often as possible, and when new material is presented, the retarded should be allowed to apply mediators to the material, for example, it may help the individual if he is given a name or label to a stimulus before being required to respond.

2. Mediational responses do not necessarily have to be verbal, for example, motor responses can gain cue valency and thus language is not necessarily a condition for effective use of mediators.

More recent studies of some of the specific problems in the experimental area of verbal learning shed some light on the effectiveness of language as a mediator. Briker and Briker (1971) examined three groups of subjects, one using verbal labels in training, the second, non-verbal discrimination training, and the third, a control group receiving neither training on discrimination problems or verbal labelling. The two experimental groups were undifferentiated from each other but significantly different from the control group. The authors concluded that training procedures including language must be refined

to be of any significant use.

Borkowski and Kamfonik (1972) carried out a study into verbal mediation in moderately retarded children using a three-stage mediational paradigm with paired associate material. They concluded that mediated facilitation of paired associate learning with mentally retarded is probably limited to a restricted range of procedural variations with length and nature of test trial and degree of task difficulty being of critical importance. Results also indicated that the superiority of the mediation group over control group increased from session one to session two. It was hypothesized that this may be explained by a "learning to mediate" process, i.e., mediational strategies developed in the first session could transfer to session two and facilitate the mediation group's ability to master more quickly a more difficult list. In summary, this research suggested that mentally retarded are able to profit from experimentally produced verbal mediational chains during paired associate learning, that mentally retarded appear capable of learning how to mediate when common words are used as associative links, and can also develop mediational strategies which enhance learning capabilities. There is also evidence (MacMillan, 1970) that normal children may spontaneously generate verbal mediators to a greater extent than educable mentally retarded.

Other research (Gordon and Baumeister, 1971) has supported the hypothesis that the mentally retarded benefit from instructions to use either experimenter-supplied mediators or self-generated mediators. Performance improved directly as a function of increasing M.A. though this does not agree with Milgrim's (1968) results.

The papers by Milgrim (1971) and Zigler and Balla (1971) pointed out several other conceptual difficulties and inconsistent empirical findings relevant to verbal mediation theory. A great deal of discussion of these papers centres around the interpretations of Luria (1961, 1963) who argued that the mentally retarded do not utilize verbal mediators in their behaviour to the same extent as intellectually average adults. Zigler and Balla pointed out that other researchers argued from a standpoint of deficiency in usage not from a deficiency in attainment. There is also argument over developmental lack according to mental age. In debating these theoretical points of view and reviewing the conflicts and the results of research in this area, Milgrim pointed out a very salient argument regarding the need to examine the effects of language. He stated language is the verbal medium which provides communication and attention directing service for the primary adaptive functioning of the individual. Thus, excessive dependence on verbalization in assessing the cognitive repertoire of a young child can be misleading. The extensive use of the verbal medium in augmenting this repertoire in formal education is suggested as unwise and ineffective. He stated that the lack of correspondence between cognitive process and verbal product is especially noted in the mentally retarded child which Milgrim conceptualized as a development lag of the verbal medium behind cognitive development and is presumed to vary with M.A. Milgrim hypothesized that this conceptualization of IQ-related inefficiencies in working cognitively in the verbal medium, may account for some of the performance differences favouring non-retarded over M.A.-matched retarded children. He also stated that M.A. matching by psychometric

tests does not provide adequate controls.

A further study by Rosenberg, Katz, and Karp (1972) discussed the theoretical differences between Luria's theory of deficiency in verbal mediation versus Zigler and Balla's argument that experimental differences are the result of non-intellectual experimental factors and are not inherent physiological differences between non-mentally retarded and retardates of equivalent M.A. One of the difficulties in the comparisons used in earlier work is the tendency to employ conceptual tasks in which presence or absence of verbal mediation is inferred and not experimentally manipulated. This study also emphasized the need to minimize the effects of such outstanding differences as institutionalization when comparing the two populations. Type of institutionalization may be another relevant variable. Differences associated with institutionalization are in accord with the results of Baumeister (1967). Several possible explanations were offered:

1. Methodological problems. For example, the retarded although matched with normals on M.A., differ along other experimental concomitants of verbal behaviour (educational background and attainment).

2. Mediation behaviour may be conceptualized as a developmental continuum ranging from considerable mediation deficiency to increasing utilization of verbal cues.

From this and other studies, it appeared that there is a need for further investigation of the developmental aspects of mediation in relation to verbal learning at different levels of cognitive development.

In a review of the process variables in paired associate learning of the mentally retarded, Baumeister and Kellas (1971) summarized several points. They stated that verbal learning behaviours of the mentally retarded are best explained in terms of a developmental rather than a pathological conceptualization, and that performance differences observed between individuals of different levels of intelligence seem to be more quantitative than qualitative in nature. In the associative stage of learning, the process of cue selection is a fundamental one occurring over a wide developmental range, i.e., cue selection behaviours are similar for normal and mentally retarded children. However, mentally retarded make less spontaneous use of cue selection strategies. The two factors that appear to govern the cue selection behaviours of both normals and mentally retarded are stimulus meaningfulness and attentional set. Another point made in this overview was that normal individuals bring their entire pre-experimental history to bear on any given task whereas the mentally retarded appear to approach learning tasks more passively. This passivity is demonstrated, according to the authors, by the latency patterning and instructional manipulations which suggest that generally the mentally retarded are bound by the experimenter's instructions. This is seen as an important point in relation to the design of the experimental situations which are not often fully specified by research workers and lead one to question the results. The importance of this instructional factor is relevant to this thesis in investigating the effects of various forms of verbal and non-verbal instruction.

Verbal Instruction and Non-verbal Tasks

The following studies are directly related to the effects of verbal instruction on non-verbal performance.

Bryant (1965a, 1965b, 1966) has carried out considerable work on the effects of verbal labelling on recall and recognition. The results indicated that verbal labelling improves performance when the test of memory requires a verbal response. It was also found that with this kind of test the severely subnormal score relatively poorly unless they are encouraged to verbalize. In Bryant's (1966) experiment, he attempted to examine the effects of verbal instruction on the learning of a simple discrimination task by normal and severely subnormal children. The procedure in this experiment concerned the type of instruction given during an initial task. The first subgroup received no instruction; the second, instructions about both the colour stimuli used in the experiment, after the subject had given a response, and the third, instruction about only one of the two stimuli after he had given his response. Each subject then underwent a post-test. The procedure used in the post-test was identical to that of the initial test, except that no verbal instruction was given. Four main points were made regarding the results of this experiment. Firstly, both groups learned a simple colour sorting discrimination at the same rate, and benefitted to a similar extent when both colours were verbally labelled. Secondly, the effect of verbal labelling of only one of the colours was relatively specific to the subnormals in that they made more errors than normals in this condition. Thirdly, the difference in error scores was

confined to errors made in placing the colour which was not labelled. Fourthly, this relative independence in the learning of the two responses did not appear to be a function of the introduction of a single instruction. The post-test results indicated that when one colour is held constant and a new colour is introduced, subnormals made more errors with the novel than with the established response. Thus, unlike the normals, the subnormals appear to have to learn the novel response independently of the established response. Since no instruction was given during the post-test, Bryant suggested this supports the contention that subnormals learn two responses in a sorting discrimination relatively independently whether instruction is given or not. These results implied the need to consider the effects of the introduction of verbalization in terms of the learning strategies which exist prior to any verbalization. It was also hypothesized that because the subnormals learned the two responses independently, whereas the normals didnot, these differences in learning strategies show some basis for indicating that verbal labelling has more specific effects with severely subnormal than with normal subjects. As Bryant pointed out, it has been reported that in comparison with normal children of equivalent M.A. levels, severely subnormal children are relatively handicapped in the spontaneous formation of verbal connections (Baumeister, 1967) and the use of a verbal connection in solving learning problems (Luria, 1963). Thus, he suggested that these results can partly be explained in terms of learning strategies in severely subnormals and normals which exist independently of verbalization and which in subnormals are maladaptive to the introduction of verbalization.

As described earlier, the work of Luria (1961) and Vygotsky (1962)

has emphasized the role of language in the development of behaviour. Generally, this work indicated that overt verbalization is also psychologically necessary in developing adequate control of perceptual motor environment, and gradually this overt verbalization becomes internalized. However, there is some work which implied that under stress or when trying new complicated tasks, older children and adults will frequently spontaneously verbalize aloud (Brown, 1965). Brown (1970) has also indicated that overt verbalization changes its qualitative nature as task difficulty increases. It has been found that, when tasks are easy, verbalization is likely to be irrelevant to the task. With increasing task difficulty, however, task-orientated verbalization increases until the maximum is reached, which approximately coincides with the 50 per cent failure point. Increase in task difficulty beyond this point appears to result in a reduction of relevant verbalization but an increase in irrelevant verbalization. As Brown (1970) stated, it seems possible that this type of language acts not only as a controlling mechanism to non-verbal behaviour, but as an attention gaining device. It does not seem unreasonable therefore to suggest that verbal instructions may have a similar effect on performance.

A further study, investigating the effects of concurrent verbalization upon performance of motor tasks by trainable mentally retarded boys, has been carried out by Hirsch and Keogh (1971). In this experiment performance tasks were evaluated. Two conditions, demonstration only and demonstration plus verbalization, were used. In both conditions, subjects observed a demonstration and imitated the movements.

In the verbalization condition, the imitation was accompanied by concurrent verbalization of the steps and sequence of action. The results indicated that performance under the demonstration only condition was better than performance under the demonstration plus verbalization condition. It was indicated that concurrent verbalization hampered achievement of the task for these subjects. The results suggested that the addition of verbalization made the task more difficult in that it became a double, rather than a single, dimensional learning task which moderately retarded with poor verbal development were unable to master successfully. This could imply that without reasonably adequate verbal skills, verbalization is disruptive. It also seems reasonable that for these subjects, the visual information to learn the tasks was sufficient on its own. Furthermore, measures of intelligence had consistently significant relationships with motor and verbal skills and were facilitated by concurrent verbalization, whereas lower IQ subjects with poorer verbal skills were negatively affected by this condition. The work perhaps demonstrated not that verbal instructions should be abandoned, but that if verbalization is found to be ineffective one should switch rapidly to demonstration techniques.

A detailed discussion of the investigation of verbal instruction in the performance of non-verbal tasks by Brown and Hughson (1972) is particularly relevant. This research was concerned with learning in the developmentally handicapped adult. Its aims were to clarify the ways in which different forms and levels of verbal instruction influenced performance.

One experiment was designed to investigate the effects of

varying decibel levels of instruction on task performance. Subjects were randomly allocated to four subgroups each receiving different decibel levels of instruction. The sound levels used were (a) 70-76 db, (b) 80-88 db, (c) 90-100 db, and (d) 102-110 db. The results indicated no differences between decibel levels of instruction; however, there was a non-significant tendency associated with the low ability group for mean scores to decrease with increase in decibel level of instruction. Therefore, it appeared that despite the lack of significance in the results, instructors and teachers may find it worth lowering voice levels when repeating instructions to the handicapped who have already had difficulty in carrying out a task. The main conclusion drawn from the experiment was that in decibel level of instruction, no clear-cut advantage was obtained by increasing decibel level of instruction and in some cases the opposite may be true. However, because of considerable variability, further experimentation seemed warranted.

Another experiment by Brown and Hughson (1972) investigated the effects of speed of instruction on task performance. Instructions were given by a tape recorder. The rates of instruction for the three groups were 95 w.p.m., 135 w.p.m., and 243 w.p.m. The results indicated a significant interaction between speed of instruction and trials in the low ability group of subjects (i.e., borderline severely subnormal). The results suggested that subjects of lower ability tended to be influenced by instruction speeds over a series of trials in such a way that slow instruction speeds were more effective than fast speeds particularly during initial instruction. It was, therefore, implied that for subjects of low ability, instruction rates of 95 w.p.m.

are more effective than faster rates of presentation. It also seemed possible that faster speeds of instructions may become increasingly effective with several presentations of the instructions. Although caution is necessary in interpreting the results, it was hypothesized that slow speeds should be used for considerable periods of time with the person who suffers from severe retardation, but in the case of mild retardation, slow initial speeds should be replaced by more rapid instruction rates. Furthermore, the results implied that much of the work involving either verbal instruction or research investigating verbalization in the retarded should have paid attention to the rate of verbal instruction within the experiments. This may have played a crucial role in some of the conflicting results of the research discussed earlier. It does suggest that speed of instruction should be quoted in experimental work. This point was underlined by the fact that the first trial performance became ten times worse in the low ability group when the rate of verbal instruction was increased by two and one half times the basic rate of 95 w.p.m. A similar increase in speed of instruction in the high ability group resulted in a decrease in performance of only around 50 per cent.

A further experiment by Brown and Hughson (1972) investigated the use of (a) a visual model, and (b) a visual demonstration with and without minimal verbal instruction. The question investigated was whether the presence of a model, a demonstration of the assembly of an item, or a demonstration with minimal verbal instruction would be equally efficient in promoting learning and performance, or whether one of these techniques would be superior to the others. In view of the

discrepancies between verbal and performance behaviours in the handicapped, it was thought appropriate to look at both aspects of ability in relation to instruction effectiveness. The groups were formed, in the first instance, on the basis of performance scores on the Brown Discrimination Board, and later re-allocated on the basis of their raw scores on the Peabody Picture Vocabulary Test.

The results indicated that there were significant differences between high and low visual discrimination ability groups in favour of the former and significant differences over trials. The results indicated no significant differences associated with type of instruction used. It would appear that subjects who showed relatively high visual discrimination ability are, as a rule, more able than those of low ability, though this difference is not seen when verbal ability is taken into account. Cognitive differences did not seem to be associated with the mode of instruction. It should be noted that many subjects in the high ability group reached the ceiling of the task throughout the experiment, and, therefore, discrimination between the instruction modes was less likely to occur.

In summary, these experiments suggested that differences in administering verbal instructions in terms of speed and work content do affect learning and performance. Secondly, in terms of response to verbal instruction, subjects of lower ability perform somewhat differently from those of higher ability. It is also possible that visual demonstration is more effective than verbal instruction, though it should be remembered that many real life situations necessarily involve total verbal instruction. There is no evidence from this research that

presenting information in two modalities (visual and auditory) impedes performance.

Summary

The work already presented implied certain contradictions, but also indicated procedures which might be adopted in developing research. Work carried out by Zeaman and House (1963) indicated that within the initial stages of learning (see page 8) handicapped persons often need to have relevant cues within a task heightened if they are to effectively master the perceptual aspects of the training process. Wallace (1968) indicated that verbal labelling used in "chunking behaviour" may also accelerate performance. In contrast, Bryant (1965) has indicated that verbal information may inhibit the learning of non-verbal tasks in severely subnormal subjects. Also, Clarke and Blakemore (1961) and Clarke and Cookson (1962) used essentially no verbal instructions and only demonstration, with rewards and praise at the end of each session, and found that these conditions maximized performance in a transfer task. Furthermore, the review of the literature indicated the importance to non-verbal learning of language which is familiar to the retarded (Baumeister, 1967) and also suggested that there may be an interaction between the use of language instruction, task difficulty, and the frequency of task exposure (Brown and Hughson, 1972). Finally, the complexity of language, regardless of familiarity, may also be a relevant variable. Bearing the above points in mind, it would seem appropriate to examine the role of language complexity in further detail. One aspect of this complexity is verbal redundancy. The

extent to which redundancy is a relevant or irrelevant cueing mechanism for learning in a non-verbal task is unknown. However, one may speculate that ratios of redundant instruction, as measured by amount of information given, might affect performance in a new learning task. In this case, the experiment is concerned with relevant redundancy which refers to the use of words unnecessary for carrying out a task, though related to the task in hand. Redundancy implies increasing the number of verbal cues above the minimum number theoretically necessary to solve the task. Such cues may or may not heighten attention potential and influence learning. The question, therefore, is how do different amounts of relevant redundancy in instruction modify learning and performance?

CHAPTER II

THE EFFECT OF VERBAL REDUNDANCY ON LEARNING

Method and Experimental Design

The study was concerned with investigating the effects of varying amounts of redundant but relevant verbal instructions on the performance of a non-verbal task. The research was designed to examine the effect of amount of verbal instruction in relation to differing performance and verbal decoding abilities of developmentally handicapped adults.

In this chapter, the method is discussed in terms of the sample, materials, and treatment procedures used. The experimental design is also described.

Sample

Fifty subjects were pre-tested on Brown's (1968) Visual Discrimination Formboards, and from this group eighteen of the highest and eighteen of the lowest performers were selected. The subjects were adults attending the Vocational and Rehabilitation Research Institute (VRRI) and were involved in programs in the areas of vocational, social educational, and social skill training. The time spent at the Institute ranged approximately from three months to three years. The trainees were described as developmentally handicapped, in most cases were of below average intelligence, and their condition resulted from experiences which occurred in childhood or before birth. Many of the trainees came from socially or educationally deprived environments,

while others suffered from organic injury or genetic defects.

In this study, no attempt was made to control for social background or organic impairment by matching groups. There are several reasons for not using this type of control. Such requirements as social experience and education, and current training regimes varied considerably. As Ryan (1970) indicated, it is not known which of these variables should be matched, and the process of random allocation should take into account differences. However, small sample size, which is almost inevitable in this type of research, can create further problems. This procedure would seem consistent with the studies summarized in the review of the literature.

However, information regarding baseline verbal decoding ability was used. The Peabody Picture Vocabulary Test, Form A, was administered to all subjects. Raw scores were used as the conversion scores to IQ and mental age are not adequately standardized for the age range or ability of this sample. Also, it would seem that raw scores provide a finer discrimination of individual variation and an indication of actual performance on a verbal task regardless of age.

Due to the nature of the experimental task, subjects with major hearing loss, visual defects, or severe physical handicaps which interfered with manual dexterity were excluded from the sample, since any marked problems in these areas could drastically influence performance and in some cases render performance impossible.

Details of age, sex, Peabody Picture Vocabulary Test scores, and performance scores on the pre-test, are given in Table I.

Table I

Sex, Age, Peabody Raw Scores, Mental Age, and Pre-test Performance of Subjects Divided into High and Low Pre-test Performance Groups

Group	Male n	Female n	Chronological age (years, months)	Peabody raw scores	Mental age (years, months)	Pre-test performance range (seconds)
High performance	9	9	Mean: 25-5 Range 17-8 to 42-6	Mean: 66.12 Range 55-90	Mean: 9-7 Range 6-10 to 15-5	Mean: 41.01 Range 21-55
Low performance	7	11	Mean: 23-10 Range 17-7 to 36-10	Mean: 70.05 Range 55-96	Mean: 10-3 Range 4-11 to 16-11	Mean: 71.16 Range 65-93

Experimental Procedure and Design

Brown's (1968) Visual Discrimination Transfer Formboard was used as the basis for allocating the subjects into high and low performance groups. This perceptual-motor task was administered using taped instructions in a standard room and under standard procedures. Scores were obtained by recording the number of seconds required to complete the task in one trial.

The experimental task was administered in a standard room to which the subjects had been familiarized on the pre-test task. The task required the subjects to construct a set design from lego blocks according to size, colour, and position (see Figure 1). Instructions were presented by a tape recorder at the beginning of each trial, using a standard volume of 70-76 db, for all subjects.

The three levels of instructions were:

a. Group 1--maximum amount of verbal instruction using 81 words

b. Group 2--intermediate amount of verbal instruction using 65 words

c. Group 3--minimum amount of verbal instruction using 46 words.

These instructions did not take the same amount of time, the maximum taking slightly longer to present. The complete instructions are given in Appendix A. Each set of instructions varied in the number of cues. Each level of instructions was given to six subjects in the low pre-test group as outlined in Table II. It should be noted that all the verbal instructions were relevant to the task and instructions in Group 3 were embedded in Group 2 which was in turn embedded in Group 1. In this manner, the length of instruction has been increased

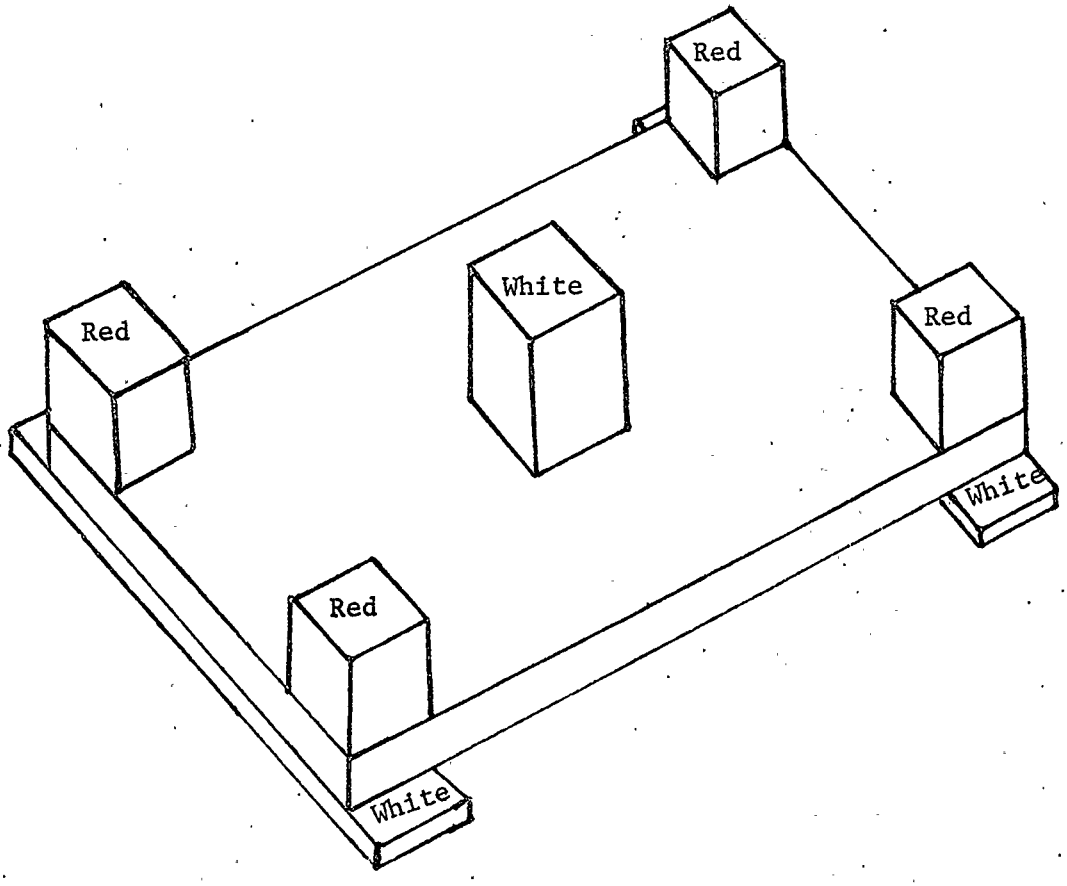

Figure 1

Experiment I: Experimental Task

Table II

Experimental Design of Experiment I

Level of Instruction	Groups of Subjects	N	Trials
1 (maximum)	High pre-test group	6	1, 2, 3
	Low pre-test group	6	1, 2, 3
2 (intermediate)	High pre-test group	6	1, 2, 3
	Low pre-test group	6	1, 2, 3
3 (minimum)	High pre-test group	6	1, 2, 3
	Low pre-test group	6	1, 2, 3

by increasing the number of relevant verbal cues. Each of the eighteen high and eighteen low performers was randomly assigned to one of the three levels of verbal instruction making six groups of six subjects.

Subjects were given three trials, allowing a maximum of three minutes on each trial to complete the task. Each trial was preceded by the assigned instructions for that group. Scores for each trial were established by the number of items correctly placed with a range from 0 to 7. No item was dependent on the placement of a previous item.

It was further speculated that subjects respond differently to varying levels of instruction according to their verbal abilities. This aspect was examined by collapsing high and low performance groups (according to the visual discrimination pre-test task) and re-structuring the subjects into high and low verbal abilities, according to their raw scores on the Peabody Picture Vocabulary Test. This was done for the twelve subjects in each of the three instruction groups. Although in this analysis the subjects were grouped differently, according to verbal rather than performance ability, their scores as obtained on the previously described experimental task were used to measure the effect of amount of verbal instruction.

Experimental Design and Statistical Procedures

The model for the experiment was a three-factor design with repeated measures on one of the factors. Factor A referred to the two performance ability levels of the subjects, Factor B referred to the three types of verbal instruction, and Factor C referred to the three trials. This was a 2 × 3 × 3 factorial design with repeated measures

on the last factor, with a cell size of n = 6. The second analysis was identical except that the performance ability grouping under Factor A became the verbal ability grouping.

The experimental design and statistics employed were based on a model suggested by Winer (1971). The analysis is parametric which appeared to be the most appropriate procedure to use. Parametric tests involve quantitative models and are seen as more robust than non-parametric procedures. They account more accurately for variance. Furthermore, the measures used in the present experiment are objective scores, with an equal interval scale and an absolute zero.

CHAPTER III

ANALYSIS AND DISCUSSION--EXPERIMENT I

Results

The data were analyzed taking into consideration the subjects' pre-test performance scores and dividing them into low and high performance ability groups. A three-way analysis of variance with repeated measures indicated that there was no difference between the two groups, but the "amount of instructions" and the "trials" variables were significant (see Table III). In both the low and high performance ability groups, those subjects given minimum instruction performed best initially and improved over trials to a greater extent than subjects given more instruction (see Figure 2). The trials by instructions interaction term reaches a probability level of $< .10$.

Although the task was non-verbal in nature, there was a considerable verbal component in that the verbal instructions had to be followed to complete the task. A further analysis of the data was thus carried out using high and low verbal ability groups to determine possible differences. Also, the previous analysis, based on performance ability, indicated no significant differences between groups and thus supported the decision to divide the groups on a verbal variable.

A three-way analysis of variance with repeated measures was carried out to determine whether differences in verbal ability accentuated the effects of amount of verbal instruction. A summary of the analysis of variance (Table IV) indicated that the anticipated

Table III

Three-Way Analysis of Variance with Repeated Measures Relating to Amount of Verbal Instruction (Visual Discrimination Ability Groups)

Source	SS	Degrees of freedom	Mean squares	F-ratio	P
Between subjects	201	35			
A (visual discrimination groups)	2	1	2.00	2.00	ns
B (amount of instruction)	37	2	18.50	3.93	<.05
AB	20	2	10.00	2.11	ns
Ss w. group	142	30	4.73		
Within subjects	71	72			
C (trials)	6	2	3.00	3.45	<.05
AC	4	2	2.00	2.29	ns
BC	7	4	1.75	2.07	<.10
ABC	2	4	.50		ns
C × Ss w. groups	52	60	.87		ns

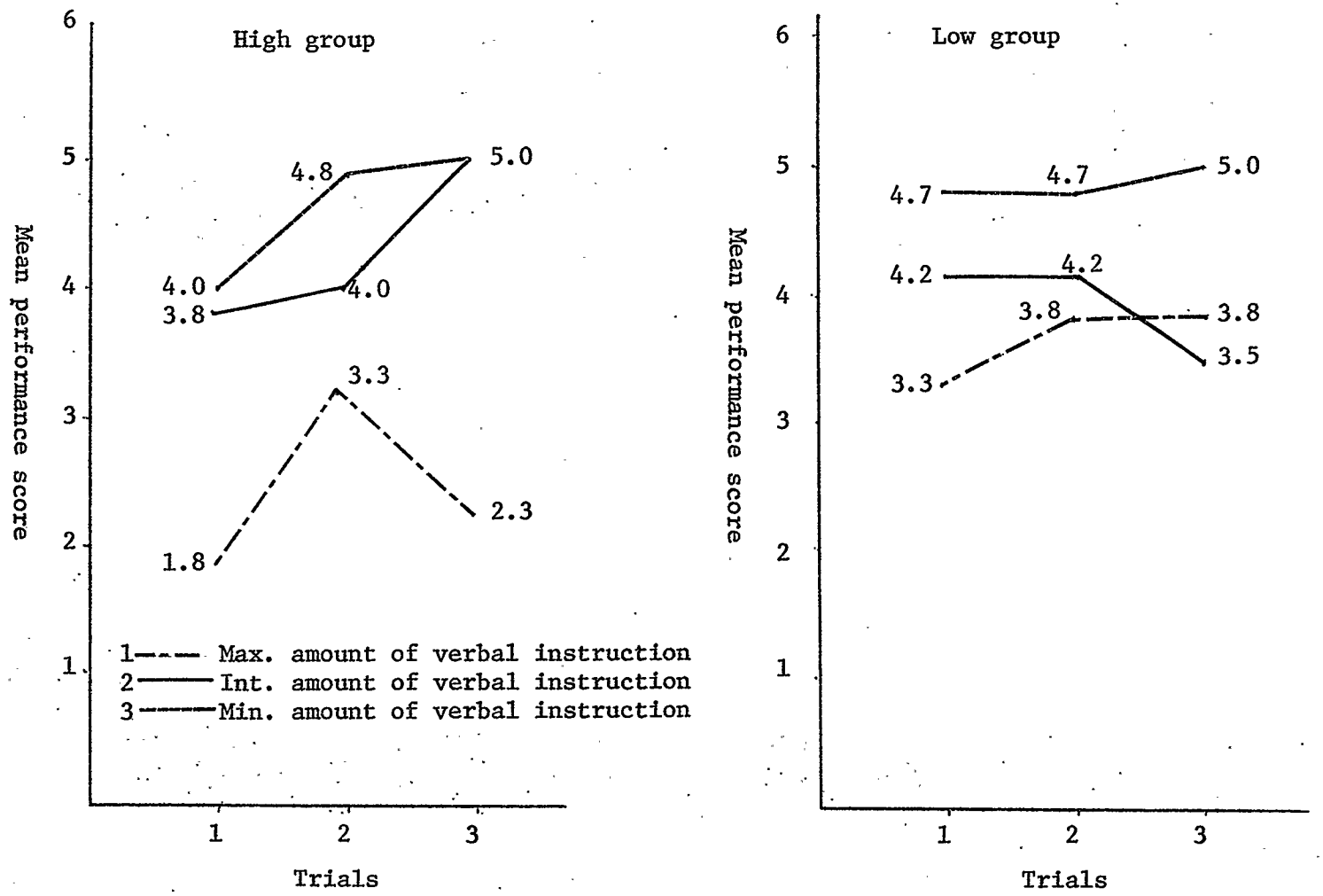

Figure 2

Mean Scores for Two Groups (High and Low Visual Discrimination Ability) Obtaining Different Amounts of Verbal Instruction

Table IV

Three-Way Analysis of Variance with Repeated Measures Relating to Amount of Verbal Instruction (Peabody Raw Score Groups)

Source	SS	Degrees of freedom	Mean squares	F-ratio	P
Between subjects	201	35			
A (verbal groups)	27	1	27.00	6.33	<.05
B (amount of instruction)	37	2	18.50	4.34	<.05
AB	9	2	4.50	1.05	.25
Ss w. group	128	30	4.26		
Within subjects	71	72			
C (trials)	6	2	3.00	3.52	<.05
AC	2	2	1.00	1.17	.25
BC	7	4	1.75	2.05	<.10
ABC	5	4	1.25	1.47	.25
C × Ss w. groups	51	60	.85		

differences in the two groups was significant at the .05 level, as were the "amount of verbal instruction" and "trials" variables. The mean performance scores of the groups (shown in Figure 3) indicate that initial performance was higher for both high and low verbal groups given minimum amount of verbal instructions. The performance graph (Figure 3) of the low verbal ability group indicates that only the group given minimum instruction attained performance scores comparable to the high verbal group. The only important interaction effect was that of instruction by trial which reached the .05 level on a one-tailed test. This interaction is seen in Figure 3 and, in particular, the performance of the high verbal ability group should be noted, together with decrease over trials with maximum instruction.

Discussion

The results of this study indicated that varying amounts of relevant verbal instruction significantly affected performance on a non-verbal task for developmentally handicapped subjects. It was found that when fewer redundant cues were given, i.e., instruction Group 3, subjects performed better regardless of their verbal or performance ability as assessed by the pre-test tasks.

The superiority of minimal instructions was also demonstrated in that although the low performance group given instruction level 3 had lower scores initially than the high group, this group improved to equal that of the high performance group by the third trial (see Figure 3). The practical implications of these findings are discussed in Chapter VI.

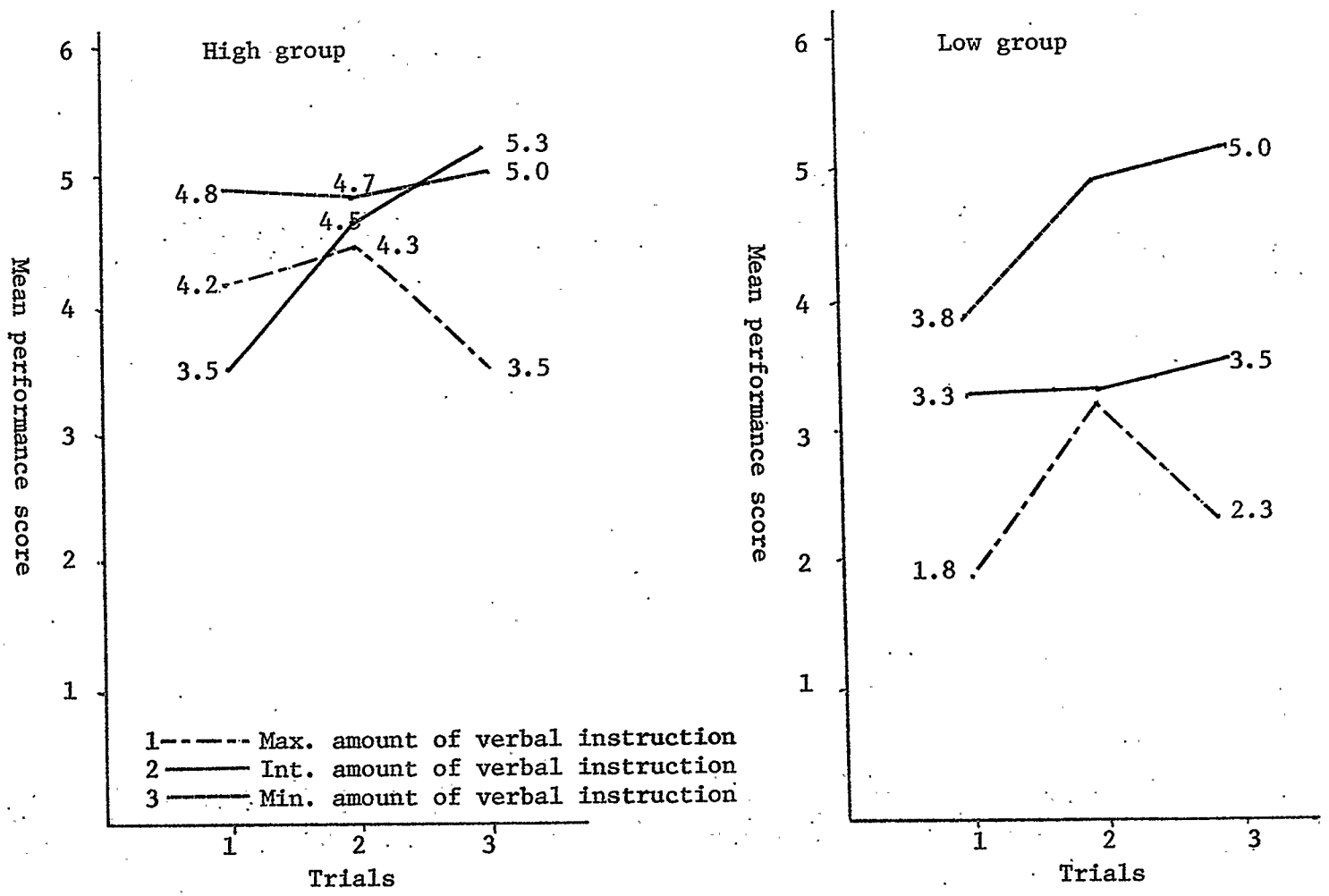

Figure 3

Mean Scores for Two Groups (High and Low Verbal Ability) Obtaining Different Amounts of Verbal Instruction

Although the results were generally clear-cut, the trend requires further investigation since performance was measured over only three trials and small numbers were used in each group. Furthermore, the effects of instructions may be modified by the difficulty level of the initial task. Indeed, because early learning (Hebb, 1949) is slow and provides particular problems for the handicapped, the initial learning of tasks which differ in complexity may require different levels of verbal instruction. This formulation was the basis of the next experiment.

CHAPTER IV

TASK COMPLEXITY AND INSTRUCTION

Method and Experimental Design

The second experiment investigated the effects of visual demonstration and verbal instruction on the performance of a series of non-verbal tasks varying in level of difficulty. The three methods of instruction were: (1) demonstration only, (2) demonstration plus minimal and simple verbal instruction, and (3) demonstration plus lengthy and complex verbal instruction. The non-verbal tasks differed in level of difficulty and involved motor and visual perceptual abilities and were dependent on effective immediate or short-term memory. The manual dexterity required was of a level which would not be difficult for most moderately retarded subjects, provided they had no major manual physical handicaps.

In this chapter, the method is discussed in terms of the sample, materials, and treatment procedures used. Details of experimental design are also described.

Sample

The sample consisted of 24 subjects, 12 males and 12 females. The subjects, as in the previous experiment, were adults attending the Vocational and Rehabilitation Research Institute (VRRI) and were involved in the same programs as described earlier.

As in the previous study, no attempt was made to control for social background or organic impairment by matching groups. However,

information regarding baseline verbal decoding ability was used. The Peabody Picture Vocabulary Test (P.P.V.T.), Form A, was administered to all subjects and the raw scores were used as baseline measures. Since verbal ability is known to vary between sexes (Jordan, 1967), the groups were balanced for sex differences.

Due to the nature of the experimental task, similar precautions, as in the first experiment, were undertaken to eliminate those subjects with gross visual, motor, or auditory handicaps. The sample required that the raw scores from the P.P.V.T. (Form A) be used to divide the sample into two groups designated as a high verbal ability group and a low verbal ability group. Using the mean score as a guide, the high verbal ability group resulted in subjects with raw scores of over 80 points and the low verbal ability group with subjects having raw scores of less than 70 points.

The above process of selection was followed until six male and six female subjects were assigned to the high ability group and six male and six female subjects were assigned to the low verbal ability group. The subjects were then randomly assigned to the three instruction groups within the high and low verbal ability groups with the stipulation that there be two males and two females for each instruction group. There was no analysis with a performance pre-test in this experiment, since only the verbal ability grouping had been shown to be significant in the previous experiment.

Table V gives details of the subjects in terms of sex, age, and P.P.V.T. scores.

Table V

Sex, Age, and P.P.V.T. Raw Scores of Subjects Divided into High and Low Verbal Decoding Ability Groups

Group	Sex		Age		P.P.V.T.					
					Raw score		M.A.		IQ	
	Male	Female	Range (years)	Mean (years)	Range	Mean	Mean	Range	Mean	Range
High verbal ability	6	6	17.0-30.3	22.2	82-100	90.2	12.11	11.0-15.7	81	73-91
Low verbal ability	6	6	17.0-41.0	23.5	47-68	60.2	6.10	4.8-8.5	<56	<56-59

Pre-test Treatment

Each subject was given a short set of pre-test questions to allow the trainee a period of time to become familiar with the experimental situation. It is well known that handicapped persons are considerably affected by unfamiliar situations and experience a drop in performance which might influence the results in the present experiment (Brown, 1965). The experimenter familiarity variable was reasonably controlled in this experiment since the experimenter was well known to the subjects. The pre-test was also given to determine whether all subjects could respond appropriately to labels for colour, direction, and position in space. A board on which nine colours were painted was presented to each subject (see Figure 4), and the following questions were asked by the experimenter:

1. Tell me what colour this is . . . (The experimenter asked this question for each colour on the board in a standard sequence.)
2. What colour is in the very middle? (The experimenter indicated all the colours.)
3. What colours are on top?
4. What colours are on the bottom?
5. What colour is in the top right-hand corner?
6. What colour is in the bottom left-hand corner?
7. What colour is below yellow?
8. What colour is next to black?

All subjects could identify the colours on the board. If the subject had difficulties with labels for position, this was discussed briefly

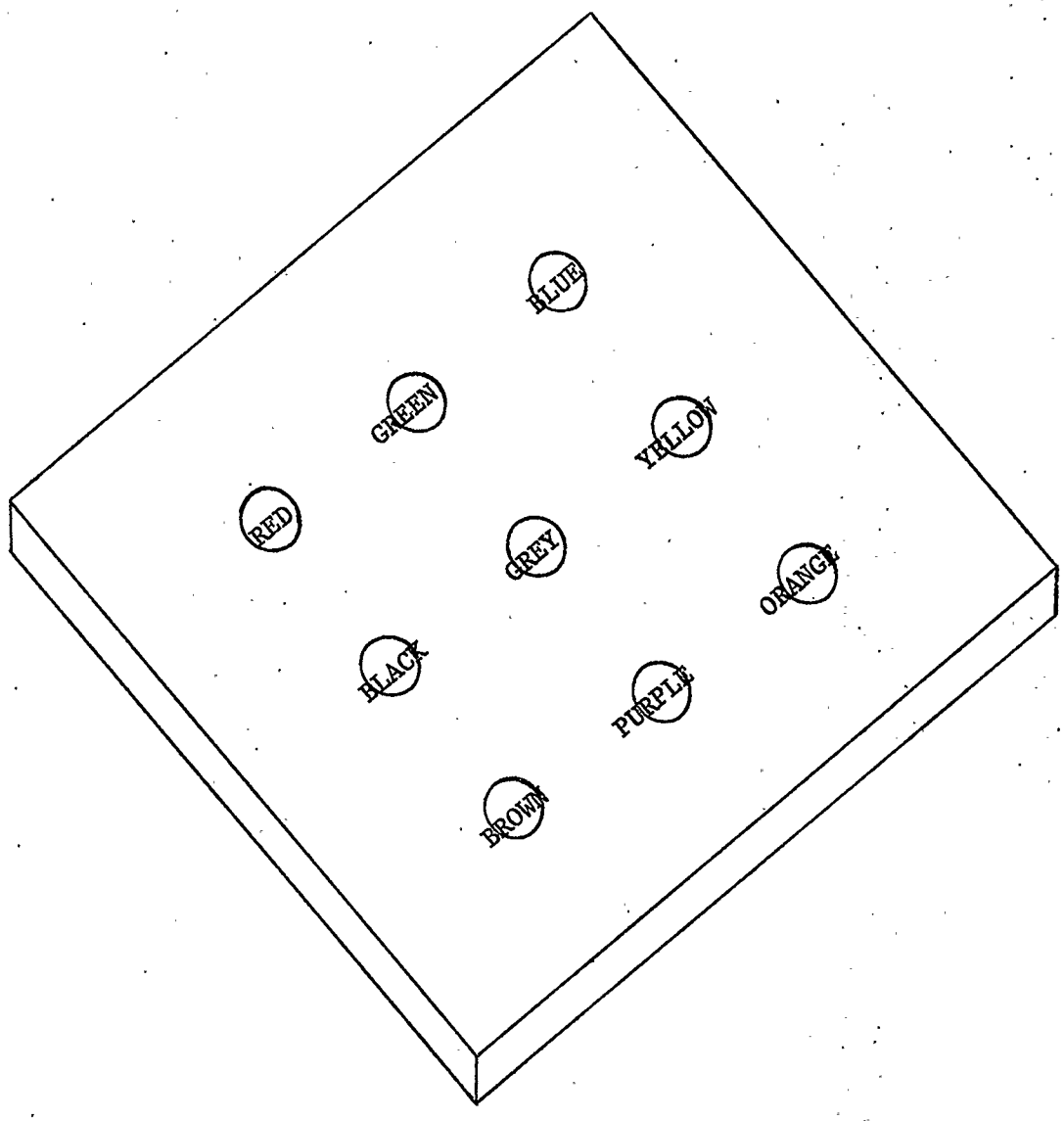

Figure 4

Pre-test Task

by the experimenter and the subject was then able to respond correctly. Five minutes were allowed for the pre-test period and the subject was given verbal praise for responding.

Experimental Procedure

Three methods of instruction or treatment were administered to the three groups of subjects. Each group received only one set of instructions. The experiment was conducted in a standard room with which the subjects had been familiarized. The instructions were presented by a cassette tape recorder--number of words, speed (approximately 95 words per minute), and volume (70-76 db)(Brown and Hughson, 1972). Each group of subjects was given four tasks varying in levels of difficulty. One specific method of instruction was employed with each group of subjects. Difficulty level varied within each group in such a manner that each subject received a particular, but different, order of presentation resulting in a balanced ordered design. This was done to account for order of difficulty, unfamiliarity, fatigue, and other random effects within each of the instruction groups. The four orders of presentation were randomly allocated within each cell. Table VI indicates the order of presentation used for one cell, the rest of the cells being allocated the same random order.

The designs of the four tasks are illustrated in Figures 5 through 9. Subjects were given one trial at each level of task difficulty and allowed a maximum of three minutes to complete each task. Each task was preceded by the assigned instructions for that instruction group. The demonstration time was constant throughout.

Table VI

Order of Presentation of the Four Levels of Difficulty for One Cell

Subjects	Order of difficulty level presented
1	1 2 3 4
2	2 3 4 1
3	3 4 1 2
4	4 1 2 3

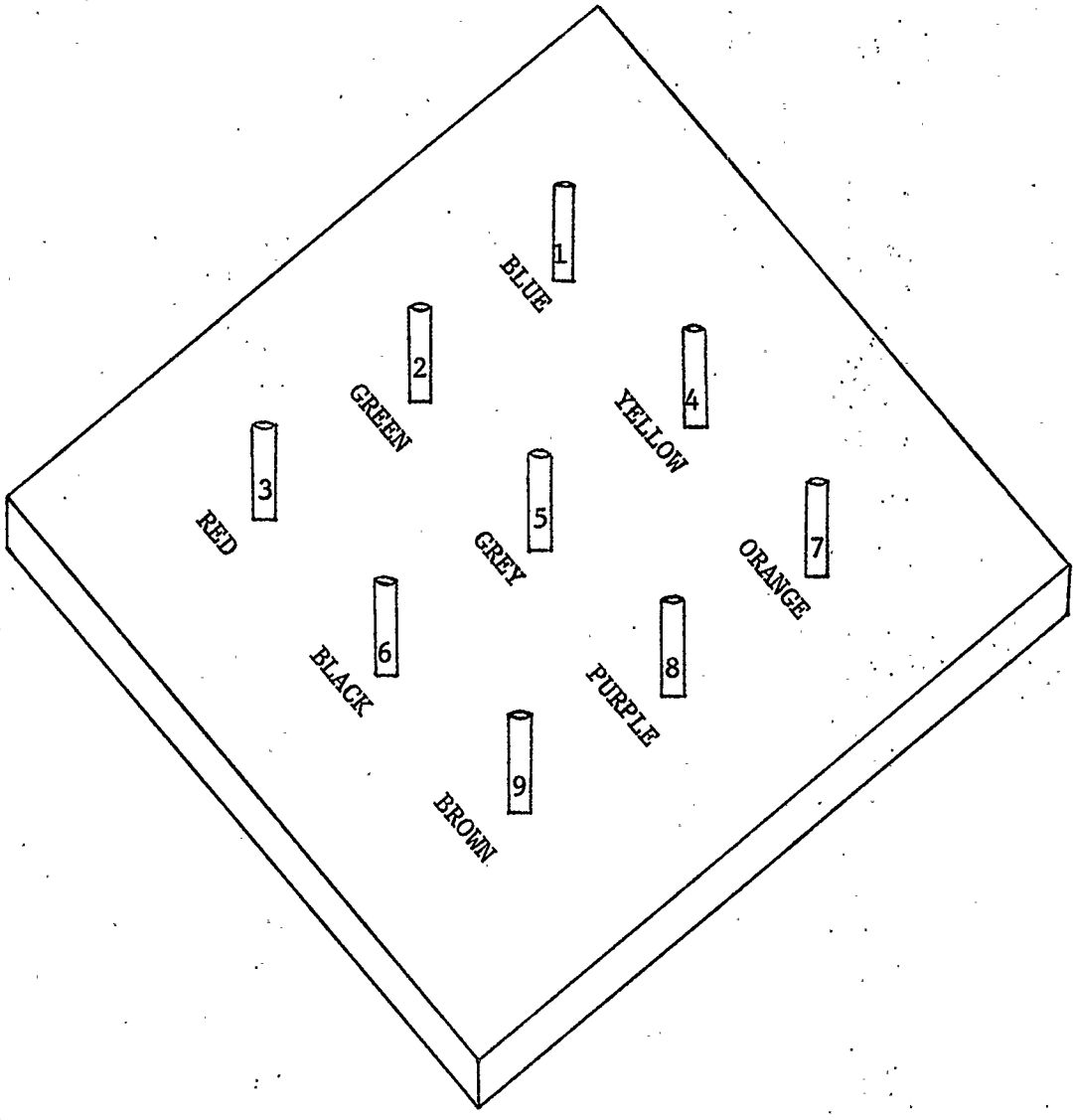

Figure 5.

Experiment II: Experimental Task
(example)

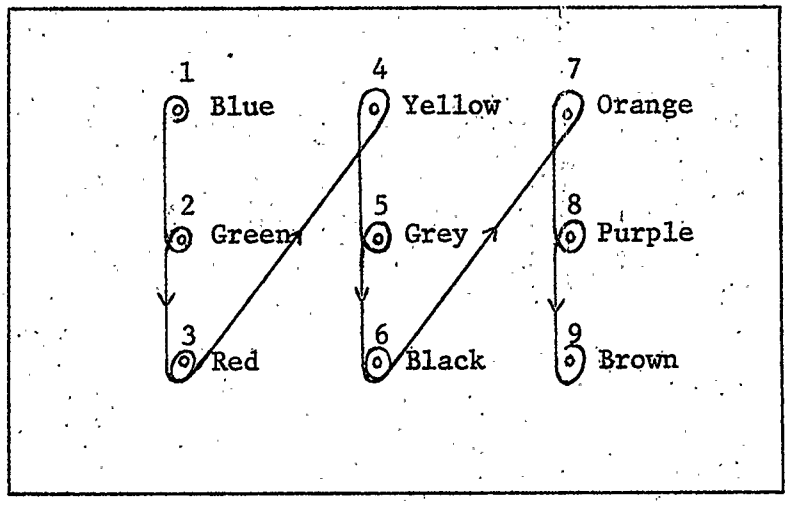

Figure 6

Task 1

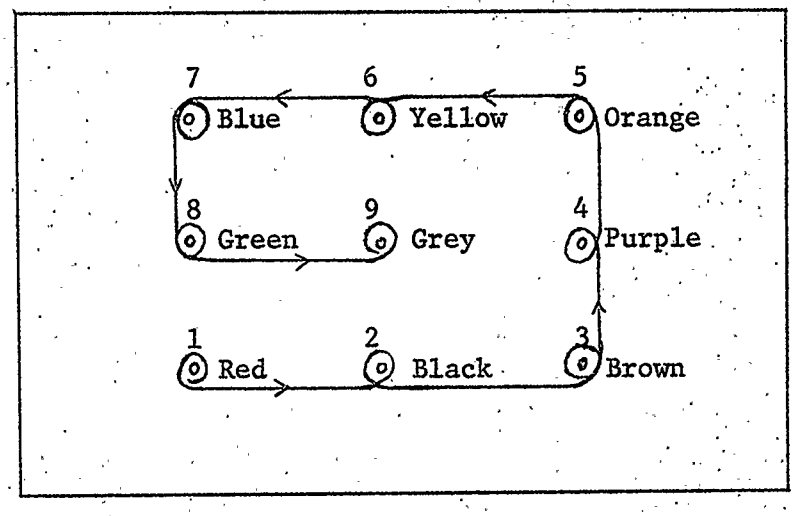

Figure 7

Task 2

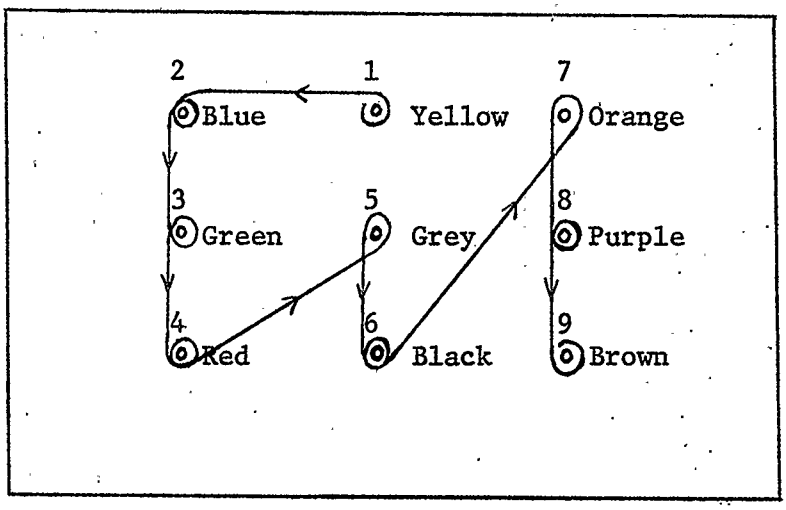

Figure 8

Task 3

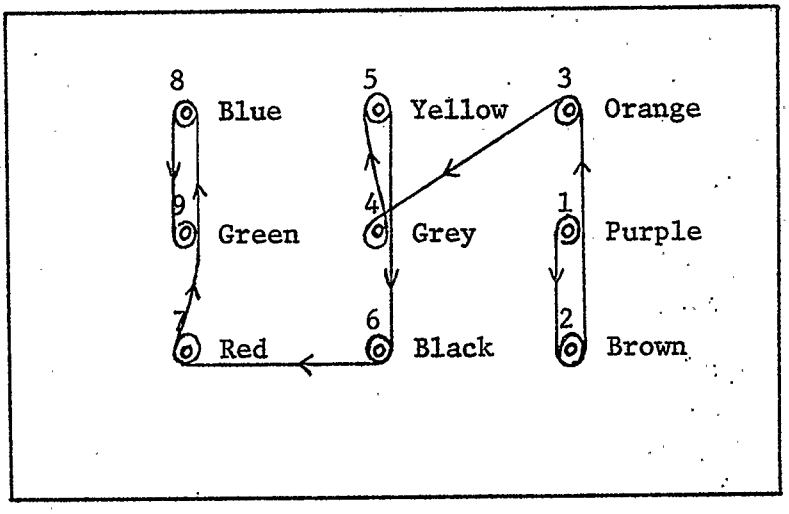

Figure 9

Task 4

Several steps were taken to compose the simple and complex instructions used in this experiment. In an endeavour to create practical instructions, it was initially decided to tape the instructions used by six trained supervisors from VRRI as they taught the four tasks to trainees. The instructions proved to be lengthy and difficult. Therefore, the number of words were reduced considerably while retaining the basic vocabulary for the simple instructions. From the simple instructions, all these words were embedded in the complex instructions with additional cues. Therefore, the complex instructions had the same relevant words but also additional relevant but redundant verbal cues to increase the amount of instructions presented.

The three treatment procedures and the exact instructions are presented below.

Treatment 1: Demonstration Only:
Four Levels of Difficulty

1. One pegboard and leather thong were placed in front of the subject.

2. The experimenter then said, "Here is a pegboard with different coloured pegs and a string. I am going to wind the string around the pegs in a certain way. Watch what I do. When I am finished, I will give you the string and I want you to make a pattern the same as mine."

3. The experimenter demonstrated the pattern for that task, allowing 45 seconds to demonstrate the nine steps of the task.

4. The experimenter then removed the pegboard and string used for the demonstration and placed another pegboard and string, which was

exactly the same as the first set, in front of the subject in the same position as the first had been.

5. The experimenter then said, "Now, you do it."

6. Following this, each difficulty level (different pattern) was then presented by the experimenter saying, "Now watch again," and demonstrated the appropriate pattern for 45 seconds. Then steps (4) and (5) above were repeated.

7. The time taken and the exact moves made by each subject were recorded during each task.

8. The experimenter praised the subject at the end of each task by saying, "Very good."

9. If there were any questions by the subject, the experimenter responded with "Do it the way you think it should be done."

Treatment 2: Simple Instruction and Demonstration: Four Levels of Difficulty

1. The pegboard and leather thong were placed in front of the subject and the following general instructions were given to each subject in this group prior to the first task only: "I am going to show you a pegboard with different coloured pegs and a string. I am going to wind this string around the pegs. I will show you how to do this while the tape recorder tells you what to do. Listen to the tape carefully. When it is finished, I will give you the string, and you make a pattern the same as mine."

2. The following instructions were then presented by the tape to the subject for Task 1 (difficulty level 1) as the experimenter demonstrated each step at the same time: "Look, start by putting the

loop on the blue peg. Then wind the string around the green one; wind it around the red one. Wind the string around the yellow one, then the grey peg and then wind the string around the black one. Then wind the string around the orange, followed by the purple, then wind it around the last peg which is brown. . . . Now you do it."

3. The experimenter then removed the demonstration set and placed another pegboard and string (which were exactly the same) in the same position in front of the subject.

4. The time taken and the exact moves made by the subjects were recorded at the time of each task.

5. The experimenter praised the subject at the end of each task by saying, "Very good."

6. For the other three tasks (difficulty levels) the same instructions as described in step (2) above were used, except the colours of the pegs were changed to indicate the different patterns required for each task. Then, step (3) above was followed.

7. The four sets of instructions each contained 70 words.

8. The amount of exposure to each task as it was demonstrated was 45 seconds and the words per minute were approximately 95 words per minute.

9. If there were any questions by the subject, the experimenter responded with, "Do it the way you think it should be done."

Treatment 3: Complex Instructions and Demonstration: Four Levels of Difficulty

1. Step (1) was presented as outlined in step (1) in Treatment 2.

2. The following instructions were presented by the tape to the

subjects for Task 1 (difficulty level 1) as the experimenter demonstrated each step at the same time.

a. Task 1: "Look. Start by putting the loop on the blue peg at the top left-hand corner of the board, then go down the board and wind the string around the green one. Wind it around the red one at the bottom. Then pull the string and go up across the board and wind the string around the yellow one. Go down to the next one, the grey peg in the middle of the board, wind the string around and then go down to the bottom and wind the string around the black one. Then go up and across the board again, and wind the string around the orange peg, followed by the purple which is below. Then wind it around the last peg which is brown and on the bottom right-hand corner. . . . Now, you do it."

b. Task 2: "Look. Start by putting the loop on the red peg at the bottom of the board and wind the string around the black one. Continue and wind it around the brown one at the bottom right-hand corner. Then pull the string up the board, wind it around the purple peg and then go up and wind around the orange one in the top right-hand corner and then across the top of the board and wind the string around the yellow one. Go to the blue peg in the top left-hand corner and then across the top of the board and wind the string around the yellow one. Go to the blue peg in the top left-hand corner, wind the string around. Then go down to the green one below, wind it around, then end by pulling the string around the grey peg in the middle of the board. . . . Now, you do it."

c. Task 3: "Look. Start by putting the loop on the peg which is the middle one at the top of the board. Go across the top and wind the string around the blue one. Continue down the board and wind the string around the green one and then go down and wind the string around the red one in the bottom left-hand corner. Then pull the string up to the grey peg in the centre of the board. Wind it around and then go down and wind the string around the black one. Then go up the board and wind the string around the orange peg at the top right-hand corner. Then go down to the purple one below and wind the string around. Then wind it around the last peg at the bottom right-hand corner of the board which is brown. . . . Now, you do it."

d. Task 4: "Look. Start by putting the loop on the purple peg, which is the middle peg on the right side of the board. Then go down and wind the string around the brown one, which is on the bottom right-hand corner. Pull the string up the board and wind it around the orange peg. Then go to the centre and wind the string around the grey one. Then go up to the yellow peg and wind the string around. Then up to the blue peg at the top left-hand corner and wind the string around. Then down and wind it around the last peg which is green. . . . Now, you do it."

3. Procedures 3, 4, 5, and 9 as described in Treatment 2 were employed in Treatment 3.

4. The four sets of instruction each contained 137 words, and the words were presented at approximately 95 words per minute.

Scoring

For each of the tasks, the range of scores was from zero to nine points. Points were based on the following criteria:

1. One point for starting on the correct peg.
2. One point for each correct move in which the string was extended in the right direction between two correct pegs.

There were four sets of scores for each subject.

Experimental Design and Statistical Procedures

The model for the experiment was a three-factor design with repeated measures on one of the factors (Winer, 1971). Factor A referred to the two verbal ability levels of the subjects; Factor B referred to the three types of instructions; and Factor C referred to the four levels of task difficulty. This was a $2 \times 3 \times 4$ factorial design with repeated measures on the last factor, with a cell size of $n = 4$. The design is schematically represented in Table VII.

Table VII

Experimental Design of Experiment II

Group of Ss (A)	Type of instruction (B)	Number of subjects	Difficulty level (C)
High verbal ability group	1*	4	1 2 3 4
	2†	4	1 2 3 4
	3‡	4	1 2 3 4
Low verbal ability group	1*	4	1 2 3 4
	2†	4	1 2 3 4
	3‡	4	1 2 3 4

*Demonstration only

†Demonstration and simple instructions

‡Demonstration and complex instructions

CHAPTER V

ANALYSIS AND DISCUSSION--EXPERIMENT II

Results

A 2 × 3 × 4 analysis of variance design with repeated measures on the last factor was employed. The independent variables were verbal ability level of the subjects, type and degree of instruction, and task difficulty levels. The dependent variable was the number of correct moves on a non-verbal motor task.

Table VIII summarizes the analysis of variance and indicates a difference, significant at the .01 level, between difficulty levels. There was no significant difference associated with type of instruction or verbal ability. None of the interaction terms attained a significant level of difference.

As might be expected from the design of the experiment, there was significant difference between task difficulty levels. Figure 10 indicates the means for each of the four levels of difficulty. Task 2 was the simplest as indicated by the highest mean score of 7.7; Task 1 was more difficult with a mean score of 6.8; Task 3 was of higher difficulty with a mean score of 5.9; and the highest level of difficulty was Task 4 with a mean score of 4.1.

Discussion

The lack of significance in the results is the main feature of this experiment. It is of interest that "demonstration only" did not

Table VIII

Analysis of Variance Between Verbal Groups, Instruction, and Difficulty Level

Source of variation	SS	df	MS	F
Between subjects	543.0	23		
A (verbal groups)	30.4	1	30.40	1.20
B (instructions)	9.3	2	4.65	.18
AB	48.3	2	24.15	.95
Ss w. group	455.0	18	25.28	
Within subjects	353.5	72		
C (difficulty level)	165.3	3	55.10	21.11*
AC	6.3	3	2.10	.80
BC	18.9	6	3.15	1.21
ABC	22.0	6	3.67	1.41
C × Ss w. groups	141.0	54	2.61	

*$p < .01$

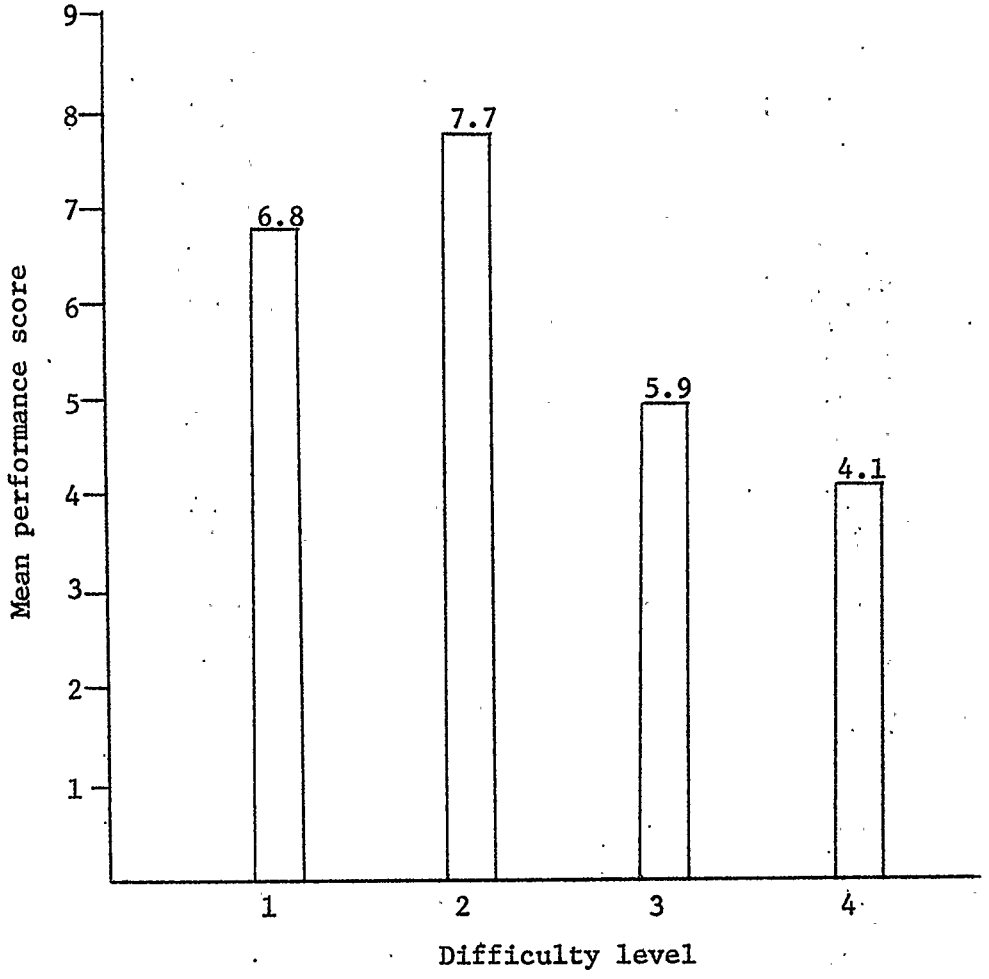

Figure 10

Histogram of Task Difficulty Level Means

appear to be either more or less effective in teaching a non-verbal task than when demonstration was combined with verbal information, even though degree of complexity of the tasks increased. It seems possible that if the demonstration of the task had been excluded, differences over task difficulty may have occurred, depending on the amount and complexity of instruction. This would be consistent with the earlier work of Brown and Hughson (1972) and is in line with the view that visual demonstration is of overriding importance in tasks of this type.

However, the graphical representations (Figures 11 and 12) do indicate a tendency for "demonstration only" in the low verbal ability group to yield higher scores particularly at the most simple task level. This is not significant at this level of task difficulty but it might be worth pursuing this possibility by using much simpler tasks. If this were confirmed, the results would be consistent with the idea that verbal instructions can impede learning in the more severely retarded (Bryant, 1965) and particularly on simple skills. However, a distinction has to be made between verbal instruction slowing initial task performance and impeding learning. Increasing task difficulty may show the importance of the role of verbal instruction.

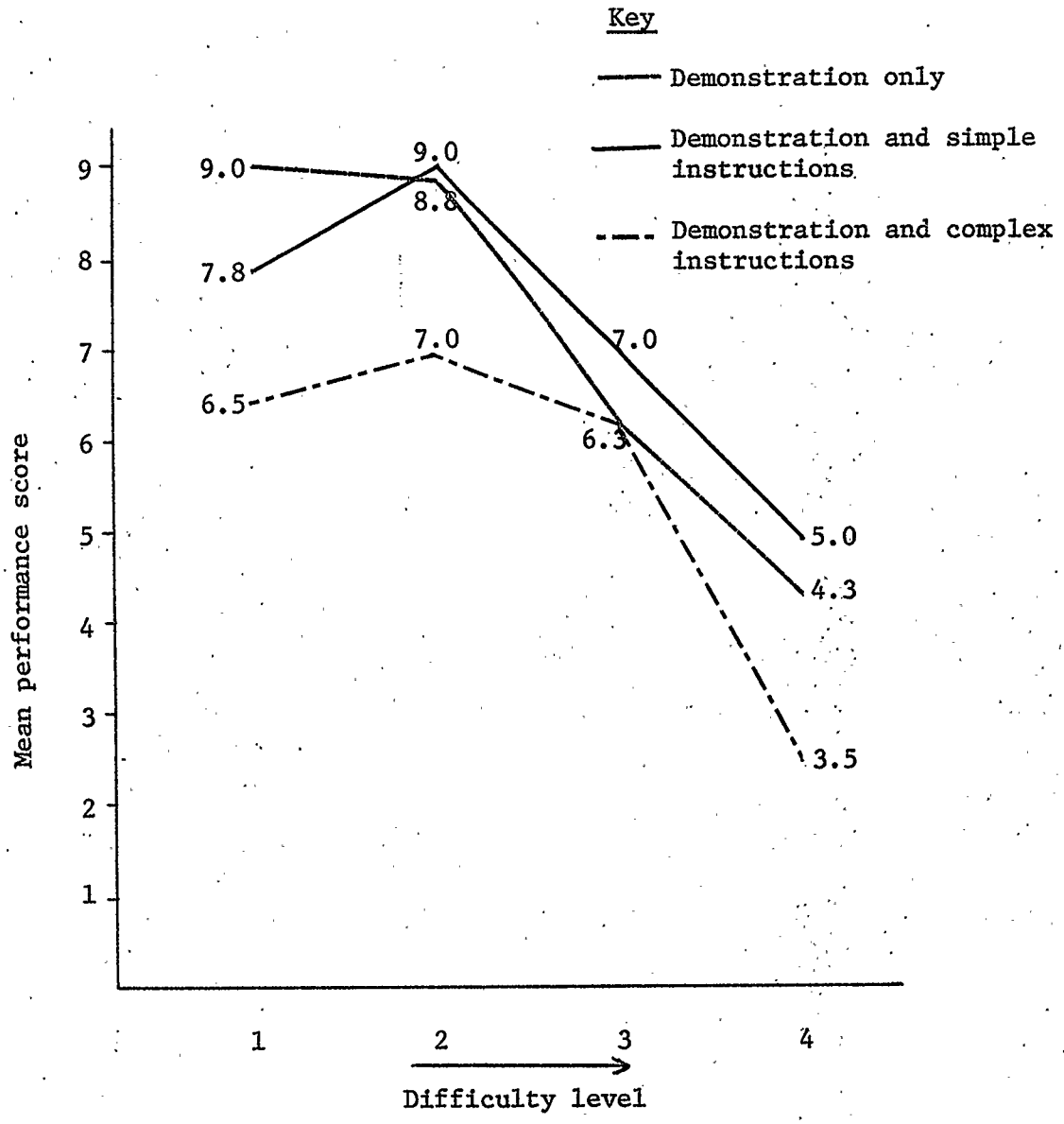

Figure 11

Mean Scores of the High Verbal Ability Group--Three Types of Instruction Over Four Levels of Difficulty

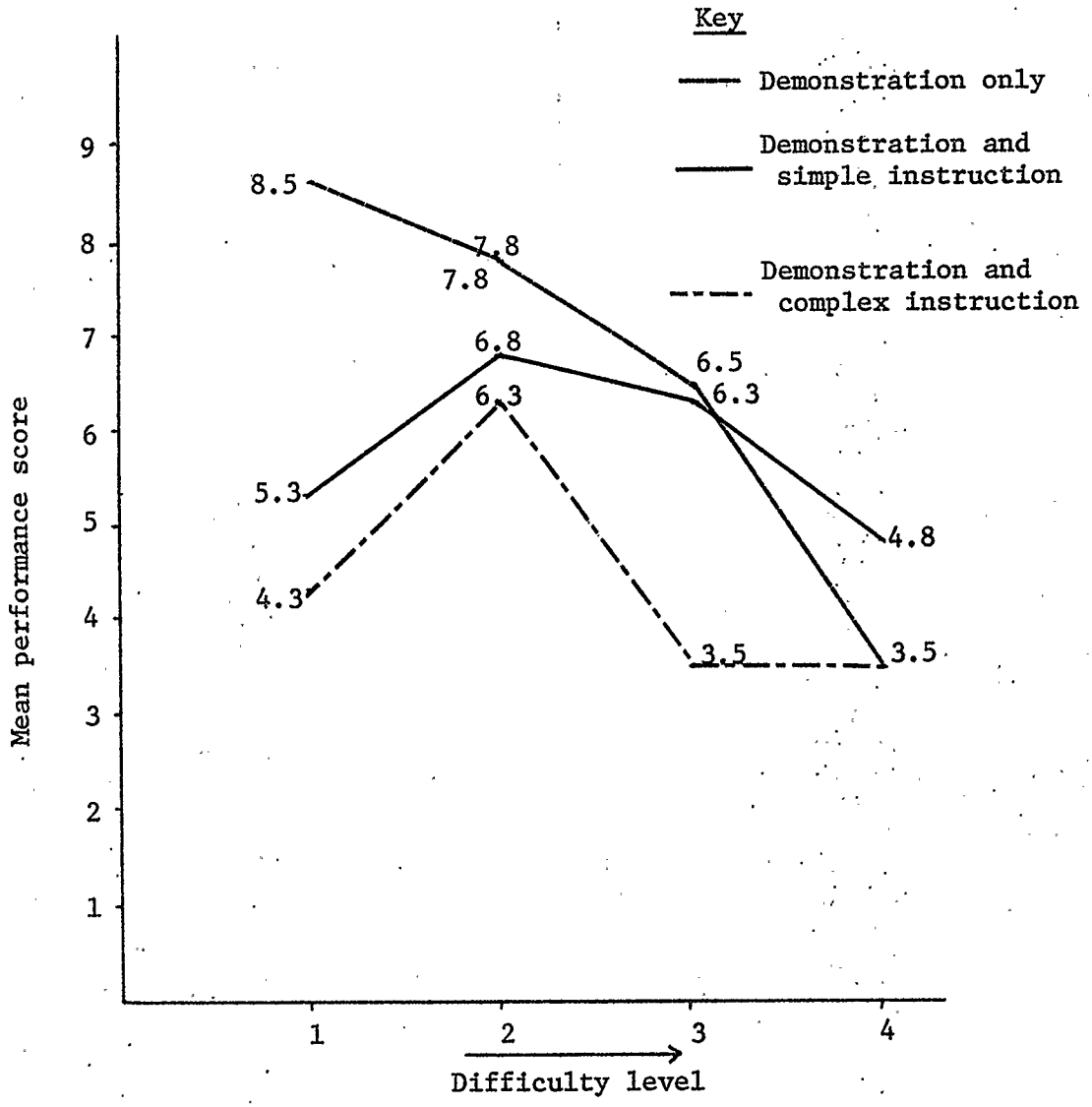

Figure 12

Mean Scores of the Low Verbal Ability Group--Three Types of Instruction Over Four Levels of Difficulty

CHAPTER VI

SUMMARY AND IMPLICATIONS

The results of the first experiment indicated that varying amounts of relevant verbal instruction significantly affect non-verbal motor performance in such a manner that high verbal redundancy is associated with poor performance. A further step to investigate this relationship was attempted in the second experiment, by employing demonstration with verbal information and varying the degrees of task complexity. However, no significant differences were obtained in this study. It is suggested that visual demonstration of a task is of considerable importance and does increase performance to such an extent that the complexity of verbal instructions cannot be evaluated by the present study. It is also suggested that increasing the range of task difficulty to include simpler tasks may clarify the influence of visual demonstration alone, particularly for the severely retarded group.

It may be impossible at times to give other than verbal instructions in the learning of certain non-verbal tasks (for example, directions for travel). In such cases, it is suggested that minimal amounts of relevant information may be more effective than instructions containing redundant though relevant information, regardless of the verbal ability of the subject. Minimal instructions of this type may also be particularly important in the early stages of learning, though demonstration alone may also prove to be very effective in the initial stages. Early learning is slow (Hebb, 1949) and stimuli may need to be

presented many times before learning is achieved. However, it may be relevant that early learning, which in the normal child takes place in the first few years of life, is largely of a visual (or tactile) nature, though a verbal commentary is often present. This is perhaps consistent with the present data in that visual demonstration appears effective on its own and is not significantly impeded by verbal instruction.

Furthermore, there is no evidence to suggest that presenting information in two modalities (visual and auditory) inhibits non-verbal performance or learning. On the other hand, it does seem that the greater the amount of redundant verbal information, even if relevant to the task, the greater the inhibition of learning and performance. This may be seen to be particularly true for those showing particularly poor verbal ability than those indicating low visual discrimination ability.

Increasing verbal redundancy increases the number of cues and creates more stimuli to which one must attend. As Zeaman and House (1963) suggested, such an increase in cues may reduce performance in the early stages of learning particularly for the severely subnormal, since they have not learned which stimuli are relevant.

Amongst the research implications of these studies is the obvious need to explicitly define the way in which verbal instructions are presented to subjects in experimental situations. Research which has been carried out by such workers as Bryant (1965) and Zeaman and House (1963) should have indicated the amount of verbal and visual instruction together with such other variables as speed and volume (Brown and Hughson, 1972).

In terms of practical implications, several points should be emphasized. The results of these and related experiments have application to the assessment and training of the developmentally handicapped. The evidence suggests that to accurately assess performance on non-verbal tasks, minimal instructions, or where possible, demonstration alone, may increase the possibility of establishing the individual's optimal performance. In addition, training should be more effective if short, simple, non-redundant instructions, or just a demonstration of the task are presented, at least in the initial learning of a task.

Subjective observation often indicates that in teaching situations it is common for instructors to increase the amount of redundant information when it appears that a handicapped person is experiencing difficulty. The results indicate that not only should initial instructions be verbally simple or of a visual nature, but that this should continue until the basic responses have been acquired. Although there may be some differences in performance of those with high and low verbal ability, this basic principle would remain the same.

Finally, practical observation by Stuck and Wyne (1971) indicated that, in general, the verbal behaviour of teachers in special classes do not significantly differ from that of teachers in regular classes. This is noteworthy in light of the research indicating the language difficulties of the retarded. This further emphasizes the suggestion that teachers and instructors modify their verbal behaviour to a simple non-redundant level and employ visual demonstration where possible.

A number of recommendations can be made for further studies. In view of the necessity in practical situations, for learning to be transferred to new situations, it would seem appropriate to carry out an investigation of the effects of instruction of an initial task and its transfer to a new task. It is suggested that by establishing the most effective form of instructions on an initial task transfer learning may be facilitated.

Due to the effects of "demonstration only" on the handicapped subjects, it is suggested that further research is necessary regarding the range of task complexity. The use of very simple and difficult tasks may help to point out the limits of the effectiveness of different types of instructions, in particular, visual demonstration. In relation to task complexity, eliminating the "demonstration only" variable may also be warranted in order to observe the effects of language and task complexity.

However, the importance of these findings to practice in the field makes it desirable to increase sample size so that the range of variability and applicability of the results can be ascertained.

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APPENDICES

APPENDIX A

EXPERIMENT I

EXPERIMENT I

AMOUNT OF VERBAL INSTRUCTION

Pre-recorded Verbal Instruction

Instruction One--Maximum Amount

I will give you a big, grey, flat piece of plastic. On its top I want you to place four square red blocks; one at each corner. I then want you to put a square white block in the centre of the grey flat piece of plastic. Then take the two long white pieces of plastic and place them under the big, grey piece of plastic--each one lying completely against one of the short sides of the grey plastic piece.

Instruction Two--Intermediate Amount

I will give you a big piece of plastic. I want you to place four red blocks--one at each corner. Then put a square white block in the centre of the grey flat piece of plastic. Take the two long pieces of plastic and place them under the big grey piece--each lying completely against one of the short sides of the grey piece.

Instruction Three--Minimum Amount

I will give you a big piece of plastic. Place four red blocks, one at each corner. Then put a white block in the centre. Take the two long pieces and place them under the grey--each lying against the short sides of the grey piece.

APPENDIX B

EXPERIMENT I RAW SCORES

Table IX

Experiment I Raw Scores

Instructions	Subjects	Trial 1 Mean Score	Trial 2 Mean Score	Trial 3 Mean Score	Mean for Each Subject Across Trials
High Performance Ability Group					
1	1	1.83	3.33	2.50	4.33
	2				2.67
	3				1.67
	4				5.00
	5				.33
	6				1.33
2	7	3.83	4.00	5.00	4.33
	8				3.33
	9				5.00
	10				4.00
	11				4.67
	12				4.33
3	13	4.00	4.83	5.00	4.67
	14				5.00
	15				5.00
	16				4.00
	17				2.67
	18				6.33
Low Performance Ability Group					
1	19	4.17	4.17	3.50	4.35
	20				4.33
	21				3.67
	22				4.00
	23				4.33
	24				3.00
2	25	3.33	3.83	3.83	4.67
	26				4.00
	27				5.00
	28				0.00
	29				4.67
	30				3.13
3	31	4.70	4.70	5.00	4.00
	32				5.67
	33				4.67
	34				5.67
	35				4.00
	36				4.67

Code: 1 - Maximum amount of verbal instruction
2 - Intermediate amount of verbal instruction
3 - Minimum amount of verbal instruction

APPENDIX C

EXPERIMENT II RAW SCORES

Table X

Experiment II Raw Scores

Instruction Level	Subjects	Trial 1 Mean Score	Trial 2 Mean Score	Trial 3 Mean Score	Trial 4 Mean Score	Mean Score For Each Subject Across Trials
High Verbal Ability Group						
1	1	6.5	7.0	6.22	3.5	8.25
	2					2.25
	3					
	4					
2	5	9.0	8.75	6.22	4.22	7.25
	6					6.00
	7					7.50
	8					7.50
3	9	7.75	9.0	7.0	5.0	8.25
	10					4.25
	11					8.25
	12					8.00
Low Verbal Ability Group						
1	13	8.5	7.75	6.5	3.5	7.00
	14					7.75
	15					7.25
	16					4.25
2	17	4.22	6.22	3.5	3.5	3.50
	18					3.75
	19					1.25
	20					9.00
3	21	5.22	6.75	6.22	4.75	.50
	22					6.00
	23					8.25
	24					8.25

Code 1 = demonstration only
2 = demonstration plus simple instructions
3 = demonstration plus complex instruction