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One contribution of behavior modification to educational settings is the functional analysis of teaching behavior. The components of teaching consist of (a) prompts which set the occasion for a response to occur; (b) student responses; and (c) consequences which alter the frequency of student responses. Many investigations specifying the functions and parameters of each of these components have been conducted. The present investigation considered instruction as a "package" composed of both antecedent and consequent components. The research question was the relative merits of directing instruction to individuals within a group versus groups of students.

The performance task of beginning archery was chosen as a dependent measure. Twenty-six subjects were matched on shoulder-girdle strength and assigned to one of two experimental conditions. In the individual instructional condition, the instructor was required to direct at least 90 percent of the instructions to individuals within the group; not more than 10 percent of the instructions were directed to the group as a whole. In the group instructional condition, the reverse was true. Daily observations of the teacher's instructional behaviors were used to determine that the experimental conditions of the study were met. The study was conducted over two weeks of training sessions, 16 days of instruction, followed by two days of post-test

performance testing and one day of post-test knowledge testing.

An overall improvement in performance scores occurred over time. However, no significant differences were noted in the knowledge or performance measures for the two experimental groups as measured by percentage of possible points, percentage of hits-on-target, judges' form ratings, or performance on a written knowledge test.

Given the similar performance scores in the two experimental conditions, the analysis of the unit value of instructions became extremely important. Using the more conservative interpretation of number of instructions presented in the group instructional condition by assuming only the absolute number of instructions for the group rather than counting the number of instructions presented times the number of subjects present, the ratio of unit value of instructions favored the group instructional condition in the early stages of training and the individual instructional condition in the later stages of training. Based upon the results of this study, it is thought that the levels of complexity for particular skills being taught might interact significantly with the method of instruction. Identification of those conditions under which such an interaction is predicted remains an empirical question.

IN MEMORY

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# THE EFFECTS OF GROUP DIRECTED VERSUS INDIVIDUAL DIRECTED INSTRUCTION WITHIN A GROUP INSTRUCTIONAL SETTING

by

Jane Ann Ward Hughes

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APPROVAL PAGE

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# CHAPTER I

## INTRODUCTION

The last decade has seen a surge of the use of behavior modification in educational settings (see Hapiewicz, Klein, and Roden, 1973; Nelson, 1974b; Thoresen, 1972; Winett and Winkler, 1972). A review of this literature reveals an emphasis on the systematic arrangement of consequences to alter the frequency of certain student response classes, such as disruptive behaviors and "on task" behaviors. Primarily, these studies have been demonstrations of the effectiveness of the systematic application of differential reinforcement.

It would seem that behavioral technology would have much more to offer education than simply the manipulation of consequences to alter classroom behaviors. The principles and experimental methods of behavioral technology could be profitably applied to both the environmental arrangement of the classroom and to the teacher and student responses which occur within the classroom.

Winett and Winkler (1972) have argued that it is time for the role of the behavior modifier to be extended beyond that of applying simple conditioning principles for the elimination of disruptive classroom behavior. Nelson (1974b)

has also argued for an expanded role of behavior modification in educational settings. Specifically, Nelson has proposed that the scope of behavior modification be broadened to account more for the role of antecedent conditions for classroom learning; that is to say, that class of variables which serve to prompt the occurrence of responses defined as "desirable" or "appropriate."

Finally, recommendations of behavioral investigation in education have been made by Bijou (1970) and Skinner (1968) in discussing a behavioral analysis of teaching. One advantage of the behavioral model is the experimental method in which the interactions between the teacher and student can be systematically observed and measured. A second advantage is the functional analysis available to study the three factors of teaching: (1) the occasion upon which a response occurs, (2) the response, and (3) the reinforcing consequences. This behavioral analysis of teaching will be discussed in greater detail below.

## A Behavioral Analysis of Teaching

According to Skinner (1968), teaching is a situation in which the teacher provides environmental arrangements which expedite learning on the part of the student. Teachers present various setting conditions and arrange contingencies of reinforcement. Within this situation, the instructional behavior of the teacher can be analyzed into prompts (cues

which precede responses) and consequences (feedback and/or motivation which follow responses). The function of a prompt is to set the occasion for the student to respond in such a way that the student's response will be successful (that is, reinforced).

In an institutional setting, consequences have been shown to have dual properties: motivational or drive properties, and informational or signalling properties (see Cairns, 1967; Locke, Cartledge, and Koeppel, 1968; Nelson, 1974a). The motivational or drive properties are said to motivate the subject to try harder or to persist longer at a task. Statements of social praise have been known to have positive effects on the learning of motor skills (McAllister, Stachowiak, Baer, and Conderman, 1969; Harney and Parker, 1972; Kennedy and Willcutt, 1964; Martens, 1971; Roberts and Martens, 1970; Rushall and Pettinger, 1969). However, seemingly greater effects on performance can be obtained by informational feedback, that is, by giving the student specific knowledge of results of his performance. "Studies of feedback or knowledge of results (KR) show it to be the strongest, most important variable controlling performance and learning" (Bilodeau and Bilodeau, 1961, p. 250).

There are many types of prompts (e.g., verbal, physical, modeled) and many types of consequences (e.g., positive social praise, negative social feedback, information

that an answer is correct, information about how to correct an answer). Previous studies of these components of teaching have been concerned primarily with the parameters of the type or amount of prompt or consequence delivered. Although these studies have considerable theoretical merit, the results are relatively impractical in the public school setting. In routine classroom instruction, the teacher utilizes all aspects of each of these components. Instruction is considered as a "package" of prompts and consequences delivered to the student. The component parts of the package, however, can be presented to either an individual student or to a group of students. This latter topic would seem to have great practical relevance to the classroom, since teachers can choose between individual and group instruction. And furthermore, there is growing emphasis in education upon providing instruction so as to meet individual needs rather than merely meeting group needs.

Instructional Method: Group Versus Individual

Manipulation and study of instructional methods as an independent variable has been discussed by many authors in the field of educational philosophy and research (see Brown, 1962; Burdin, Hearn, and Katz, 1972; Hoover, 1970; Silberman, 1970; Travers, Van Wagenen, Haygood, and McCormick, 1964). Each of the authors has discussed the importance of the social environment in which the student receives his instruction.

Although there are many dimensions of the social environment which could be studied in education, the present study will be concerned with group-directed versus individual-directed instruction. Instruction can be delivered to the group as a whole with the individual student being considered only as a single member of the group. Two variables which differentiate these two methods of instruction are (1) relevance of informational feedback and (2) active versus passive learning.

Pepitone (1971) states that group instruction presents a conflict for the teacher. The conflict is created because in the group situation the teacher prompts and corrects only errors common to the group to the possible exclusion of prompting and correcting errors unique to the individual. If common errors do indeed occur in this situation, then the efficiency of this method of instruction for both the teacher and the learner is obvious. However, if errors common to all students do not frequently occur, it is doubtful that the instructions given to the group will be of benefit to the individual student. In the individually instructed group, the student would have the advantage of having instructions given that are pertinent to his performance. Therefore, it would be assumed that the information would have more relevance for him at the time of instruction. Specific knowledge of results has previously been cited as a factor

facilitating learning. It is also more likely that the individually instructed student will have to remember smaller bits of information at a time than the group instructed individual. This would also be expected to facilitate learning.

Also affecting learning is the amount of active involvement of the learner in the learning process. Instruction directed toward an individual might allow for more direct learner involvement. When instruction is given to the individual student, direct interaction between the student and teacher occurs, whereas during group instruction, the individual group members do not always interact with the teacher. Usually, though not always, group responding is restricted to listening to the teacher and/or observing another student demonstrate. In contrast, the individually instructed student usually has the opportunity to respond while the teacher is giving the instruction and to receive some direct feedback concerning his performance. This same opportunity for the group instructed individual is less likely to occur, and if it does occur, it does so with less frequency and on a less systematic basis.

Thus, conditions where instruction is presented to an individual within a group as opposed to all individuals within a group are likely to differ along the following dimensions: (1) relevance of informational feedback, and

(2) degree of involvement. Although direct evidence is not available regarding the effects of these variables within the context of group versus individual instruction, results from the following studies are discussed as supportive of the individually-instructed method.

A study by Van Wagenen and Travers (1963) found subjects who made no overt responses to training on German vocabulary words but rather simply observed, learned less than subjects in the same group who learned through overt responding followed by positive consequences. The following four conditions were compared: (1) Condition A: a simulated classroom in which the students interacted with the teacher on 25 percent of the trials and observed others on the remaining 75 percent of the trials, (2) Condition B: a simulated classroom in which the students did not interact with the teacher, (3) Condition C: students performed on teaching machines which gave knowledge of results on each trial, and (4) Condition D: students performed on a teaching machine which gave knowledge of results on each trial and the teacher gave knowledge of results on each correct trial. Learning was measured by scores obtained on a multiple-choice test of German vocabulary administered to those who had been exposed to the various conditions. In Conditions A and C, gains were found to be significantly superior to those of Conditions B and D. Closer investigation of the

results of Condition A revealed that the specific items on which the student interacted with the teacher produced more learning than on any other of the conditions studied. Performance was poorest when the learning was a relatively passive process. The authors suggest that the level of attention for the "interacting" group was higher, resulting in more learning than the vicarious group. The authors, however, fail to offer an explanation for the performance of Condition D being inferior to that of Condition C, although Condition D appeared to have all the factors of Condition C plus student verbalization and teacher feedback.

In a second study (Travers, Van Wagenen, Haygood, and McCormick, 1964), learning of German words was measured as a function of four different feedback conditions and two different learner involvement conditions. Groups of eight subjects learned sixty German words under four conditions of feedback. In each group, one of the four subjects interacted directly with the experimenter/teacher by guessing the correct answer and then being verbally reinforced for the response. Each of these four subjects directly interacted with the experimenter/teacher on 25 percent of the trials and observed on the remaining 75 percent of the trials. The remaining four "observers" did not interact with the experimenter/teacher on any trials, but merely observed the interaction. Although all subjects had the

same opportunity for hearing verbal feedback containing information as to the correct response, the subjects who had the additional opportunity to interact directly with the experimenter/teacher performed better than those without the opportunity for direct involvement; this was true not only on those items on which they had actually been trained, but also on those items where they had only observed. In other words, learning was facilitated by direct involvement of the learner with the teacher in the learning task. Instructions directed toward the individual might serve a similar function by providing a situation in which the learner has more opportunity to respond directly with the teacher during the instructional process.

In a study by Eberwein (1972), no significantly different results on reading achievement were found between a flexible grouping plan and a three-level achievement plan. The flexible grouping plan was designed to place students in reading groups based on specific needs and levels of achievement. As soon as an individual student completed one level, he was moved to the next most relevant level. This was contrasted with the three-level achievement plan in which a student was diagnosed, placed, and continued in one of three levels of reading achievement (e.g., high, medium, or low). No significantly different changes in reading achievement between the two grouping methods were found.

However, it was found that the children in the flexible grouping plan (i.e., a plan in which the teachers were forced to attend to the students individually on a daily basis) were significantly less ignored on the Long-Jones Sociometric Test. Although these measures were measures of pupil-to-pupil interaction, the authors interpreted these results so that they could have implications for instruction. The authors speculated that the children in the flexible grouping received more attention from the teacher resulting in more attention from the other children as well. Since the dependent measures were reading achievement scores, it was speculated that perhaps these achievement scores were too insensitive to measure changes in reading skills of individual children. If more sensitive measures of reading skills were used, perhaps a shift in reading would have been noted for the students in the flexible grouping plan.

Further review of the literature on group versus individual instruction reveals a primary concern with the contingencies of reinforcement rather than with the "package" of instruction. For example, a study by Axelrod (1973) compared individual and group contingencies in reducing disruptive behavior in two special education classes. The group contingency was found to be equally as effective as the individual contingency. Axelrod suggested that the group contingency may be easier for the teacher to implement.

However, he also recommended that individual development in academic and social skills be considered. In Axelrod's study, the group contingency produced "threatening" behaviors by some of the students toward the disruptive students, producing more nontarget behaviors incompatible with academic progress. Therefore, an individual contingency might have been preferred.

Conflicting results were found in a study by Feldman (1973). The condition of large group reinforcement was more potent in reducing the disruptive behavior of four target students than either the condition of an individual contingency for each of the four target students or several small group contingencies with one of the four target students at the center of each small group. However, all conditions were found to be effective in reducing disruptive behavior. Feldman cited the role of group reinforcement and punishment as one area which needs additional research in understanding the conditions bringing about behavior change.

As reviewed, no direct evidence was available to support variables thought to differentiate instruction directed toward the group versus instruction directed toward the individual. It was thus the purpose of the present study to compare the effects of directing instruction toward the group as a whole versus individuals within a group instructional setting. It was not the purpose of the study to

consider the group process as such. Rather, the students were instructed within a group for economic reasons and so as to resemble as closely as possible instructional settings occurring in public education.

The methods of instruction considered all components of teaching as a "package" of instruction including prompts and consequences with both motivational and informational properties. The group condition was described as instruction being directed to a group of students as a whole at least 90 percent of the time. The individual instructional condition was described as the instruction being directed to an individual student within the group at least 90 percent of the time.

The performance task of beginning archery was chosen as a dependent measure for several reasons. Archery is an activity in which the results of daily performance can be easily quantified and recorded. Because the study took place in an introductory class of beginning archery, measurement of these skills was considered to be sufficiently sensitive to reflect performance changes occurring over the course of the study. Secondly, archery is an independent activity in that the student makes the response alone and independently but still within the context of a group. Such a condition is representative of many types of learning situations within the educational environment. And thirdly,

both methods of directing instruction appeared to be equally applicable to the teaching of archery. Although the group instructional method was most likely to be observed in other beginning or introductory classes, the activity of archery itself did not appear to be biased toward either method of instruction. In addition, measurements could be made in a cognitive or verbal mode as well as performance measures. Furthermore, measurements of generalization to shooting at other than the training distance could be made.

Given equal opportunity for instruction and equal opportunity for practice under both instructional conditions, the null hypothesis of no performance differences between the two instructional conditions was proposed. If significant differences were revealed between the two groups, it may be possible to attribute these differences to the manner in which the subjects received the instruction, that is to say, individually received instructions versus group received instructions.

The group instructional condition could be considered as the manner of presenting instructions most efficient from the teacher's point of view in that each set of instructions would be presented only once. Upon a single presentation of instructions, the entire group would have the opportunity to listen and to respond appropriately. This assumes, of course, that student attention is maintained throughout the

instructions. If true, as it is often assumed, that beginning students make the same common errors, then the group directed instructional method should be the most efficient for both the student as well as the teacher. If the errors of the group are common, the teacher's general corrections and prompts would be relevant to each individual student within the group. The possibility exists, however, that instructions are not useful to each student at the same moment.

The individually instructed method could be considered as the one more efficient for the learner rather than the teacher. Although the teacher may repeat the same set of instructions several times, the conditions under which they occur each time would differ. The instructions should be directed to the individual only when they are pertinent and relate to that individual's performance at that specific time. However, these students would be able to gain from both instruction directed to them individually and from listening to instructions given to other members of the group. Furthermore, student attention should be easily monitored and maintained by this method. Most likely, the student would continue to respond actively during the instruction rather than just standing and listening to the teacher or observing the response of another student while listening. Thus, learning would possibly be facilitated by

providing a more active role in the learning process.

It should be considered that the present study concerned itself only with the overall "package" of presenting instructions to a group versus to an individual. The various components of instruction, i.e., prompts and consequences with both motivational and informational properties were considered as a "package." The varying dimensions along which each of these components could be advantageously manipulated were not considered in the present study.

# CHAPTER II

# METHOD

## Setting

The present study was conducted at Ben L. Smith High School in the Greensboro, North Carolina City School System in one physical education class. The teacher had 11 years of experience in teaching secondary school physical education. The present study was conducted in the first seven weeks of a nine-week unit in beginning archery. The class met five days per week for approximately 45 minutes of instruction per day.

## Apparatus

Each student used a 20-pound weight bow and shot approximately four ends of six arrows daily. An end of arrows consisted of shooting six arrows for an individual. Approximately three or four students were assigned to shoot at each of eight target stands. A cable tensiometer unit was used to match the subjects on shoulder girdle strength.

## Subjects

Twenty-two senior high school students including 14 females and 8 males in grades 10 through 12 served as subjects in the present study. The students came from varying

socio-economic backgrounds. The age range was from 14 to 18 years of age. The students had chosen to enroll in a nine-week unit in beginning archery as one of their physical education requirements. Subjects were matched for shoulder girdle strength because of the suspected importance of this factor in archery performance. A cable tensiometer test (Clarke, 1953) was used to test shoulder girdle strength. The rationale for the selection of shoulder girdle strength as a subject matching variable lies in the fact that in archery, movement (and strength) is primarily concerned with a horizontal adduction of the muscles of the upper arm and shoulder girdle in an arm position parallel to the floor.

The test of shoulder girdle strength was administered while the student stood in a shoulder width stance with his feet pointing in a direction parallel to a wall. The student extended his nonpreferred arm to the wall and placed his hand against the wall at shoulder height. The preferred arm was raised to an elevated position parallel to the floor and extended across the frontal plane of the body toward the wall. The elbow was bent at approximately a 90 degree angle. The student was instructed to hold the bow string with the first three fingers of the preferred hand. The bow string was attached to the cable tensiometer and the force exerted upon this string was measured in pounds. The student was instructed to pull the string to the anchor point against

the face. Three trials with a rest period between each attempt were administered to each subject. The reading, shown in pounds, used to pull the string was recorded from the tensiometer and used subsequently to match subjects. The highest of the three scores was used.

Matching of subjects was made by listing the strength scores in order from high to low. In the group instructional condition, subjects from the following positions were assigned: positions 1, 4, 6, 7, 9, 12, 14, 15, 17, 20, and 22. In the individual instructional condition, subjects from the remaining positions were assigned: i.e., positions 2, 3, 5, 8, 10, 11, 13, 16, 18, 19, and 21.

Subjects were also matched on prior instruction in archery. Four subjects reported that they had previously received instruction in archery. These subjects were divided equally between the two instructional conditions. Furthermore, the distribution of males and females was the same for both groups with each group containing seven females and four males. Other variables were considered to be randomized across the two groups.

The results of a one-way analysis of variance performed on the pre-test scores recorded in pounds of shoulder-girdle strength used for matching of subjects (summarized in Table 1) were not significant ($\underline{F} = 0.06$; $\underline{df} = 1,20$; $\underline{p} \geq 0.05$), indicating no significant differences between

TABLE 1

Summary of the Analysis of Variance on Pre-Test Matching of Subjects in Shoulder Girdle Strength between Group and Individual Instructional Conditions

| Source | SS | df | MS | F | |
|---|---|---|---|---|---|
| Group | 5.50 | 1 | 5.50 | 0.06 | NS |
| Ss within group | 1825.27 | 20 | 91.26 | | |

the two instructional conditions in terms of shoulder girdle strength. Mean strength measures recorded in pounds for the group and individual instructional conditions were 34.18 and 35.18, respectively.

Originally there were 26 subjects in the study. However, due to excessive absences, the scores of four subjects had to be dropped from the final data analysis. Although there was no significant statistical difference between the two groups formed by these original 26 subjects, further data analysis included only the 22 subjects who remained as subjects throughout the study. The mean number of days present for the remaining 22 subjects was 12.73 for subjects of the group instructional condition and 13.82 for subjects of the individual instructional condition.

## Procedure

Routine Daily Procedures. Each class period included approximately 40 to 45 minutes of instruction daily. The students dressed and came directly to the archery shooting range. It was planned that on days when weather did not permit outdoor participation, the class would meet and receive group instruction on topics related to archery but not concerned with skill acquisition and practice, such as history and development of archery or types of archery competition. However, as the weather was good enough daily for outdoor participation throughout the duration of the

study, it was not necessary to make this provision.

To insure maximum safety, standard procedure was followed during each class. When students arrived at the shooting range, they lined up on the shooting line of their assigned group. Physical separation of the two groups was considered to be a necessity so as to eliminate the possibility of the two groups learning from observation of the other group. The groups were separated by an embankment and approximately 75 yards of intervening distance. No one was allowed to begin shooting until signaled by the instructor to do so. When each end of shooting (i.e., when six arrows had been shot by the individual) was completed for all students in the class, the instructor would signal for everyone to put down their bows and go to the targets to retrieve the arrows. At this time the student recorded his score for that end of shooting. When all the arrows had been retrieved, the student returned to the shooting line and the procedure was repeated as many times as time allowed. This basic procedure was followed each day.

Observations of the teacher's instructional behaviors were made on a daily basis. Daily feedback was given to the instructor to insure that she was meeting and maintaining the requirements of the two instructional conditions. This procedure is discussed more fully under the Observation portion of this section.

Students scored and recorded points for each arrow of each end on a daily basis. Standard scoring procedures in archery were used: black, nine points; red, seven points; blue, five points; yellow, three points; white, one point; and petticoat, zero points. The first two weeks of the nine-week instructional period served as a training period for the teacher, students, and observers. During this time, the students were given basic instruction on the safety of shooting archery, requirements for care of the equipment, standard operating procedures to be followed daily, and fundamental skill practice. It was required that at the end of this training period each student was able to nock an arrow properly and release the arrow from the bow string such that the arrow obtained some semblance of flight. These skills were considered as prerequisites to maintain standards of safety in the class. The only measurements taken during this time was that for the matching of subjects on the shoulder-girdle strength test.

Observations and recordings of the teacher's instructional behaviors also occurred during this training period in order to realistically assess the division of instructional time that the teacher could be expected to make between the two experimental conditions. It was found that she could alternate between the two instructional groups for periods of approximately six minutes of instruction.

In addition, during this training period, the observers practiced with the observational code. The observational procedures are described in detail on the following pages.

Manipulation of the Independent Variable: Instructional Conditions. As previously stated in the Introduction, the instructional conditions of this study differed in the manner in which they were delivered to the student. Instruction was defined as those teaching behaviors which could be analyzed as either prompts or consequences. Consequences were said to have both motivational and informational properties. However, for the purpose of this study, the prompts and consequences were considered as components of a "package" of instruction. It was this "package" with which the differences in instructional method were concerned.

Half of the class was assigned to receive the group instructional condition. At least 90 percent of their instructions were delivered to the group of students as a whole. Individual members of the group received individual instruction less than 10 percent of the time and only if it was deemed absolutely necessary (e.g., impeding danger to a student warranted direct instruction to a student). Whenever the teacher was giving instructions, the entire group was called together for instruction.

The second half of the class which was matched on shoulder girdle strength to the first group was placed in

the individual instructional condition. At least 90 percent of their instructions were directed toward individual students within the group setting. The group as a whole did not receive more than 10 percent of any instructions; this was done only when it was deemed necessary. Whenever the teacher was giving instructions, they were directed to one student at a time. However, the other students in close proximity did have the opportunity to hear the instructions being made to other students. This method was not designed to individualize instruction where the student works entirely on his own. Rather, the method was designed to observe the effects of instruction being directed to an individual rather than to a group of students. It was thought that this condition was representative of what may occur in a public school within the confines of a group instructional condition. To eliminate the possibility of interaction with students giving one another instructions, the students were asked not to give instructions to one another and to wait for the instructions from the teacher. As there were 26 students in the class on some days, individual observation of this was not possible. However, the students were extremely cooperative in honoring the request. A reminder was necessitated only occasionally.

In summary, this experiment compared the manner in which the instruction was delivered to the student. In the group instructional condition, a high rate of instructional

behaviors by the teacher was directed toward the group of students as a whole. An extremely low rate of instructional behaviors was directed toward individual students. The opposite practice was in effect in the other instructional condition. In the individual instructional condition, a high rate of instructional behaviors by the teacher was directed toward individual students. An extremely low rate of instructional behaviors was directed toward the group as a whole. A random schedule of the group to receive the first and final sets of instructions was implemented over the 16 days of instruction.

Observations. Observations of the instructional behaviors of the teacher were made by the experimenter to insure that the criteria set for the two instructional conditions were met and to serve as data in the analysis of the unit value of instructions. Checks for reliability of the experimenter's observations to be used as the daily data were made on three occasions by a second observer (an undergraduate psychology major) to give internal validity to the experiment. Prior to the beginning of the study, reliability was taken during two training sessions. Reliability was calculated by placing the number of agreements over the number of agreements plus disagreements. An agreement was defined as the two observers recording an observation of the same instructional category, to the same type of recipient

during the same interval or as the absence of the same type of instructional behaviors. A disagreement occurred when the observation was discrepant on any of these factors. Inter-rater reliability of 94 to 90 percent was achieved during this time. High reliability, to be detailed in the results section, was generally maintained during the course of the study as well. An alternative term to "reliability" in this context is "inter-observer agreement."

Daily observations of the teacher's instructional behaviors were recorded on the "Observation Code Sheet of Recipient of Instructional Behaviors" (see Appendix A). The coding sheet was divided into six intervals. During each interval, a frequency count of instructional behaviors was recorded continuously by the observers. Three intervals were used to observe the instructional behaviors of the teacher in the group instructional condition and the remaining three intervals were used to observe the instructional behaviors of the teacher in the individual instructional condition. In the individual instructional condition, the recipient of the instruction was recorded as well and the information conveyed. This was used in the analysis of the unit value of instructions to be discussed in more detail in another section of the paper. As the teacher alternated between the two instructional groups during each class period, a break in observational and instructional time occurred

between each interval to allow the teacher and observers to transfer from one group to the other.

The instructional categories of the coding sheet were divided into two major categories: prompts and consequences. Each of these categories was further subdivided into verbal, physical, and modeled sub-components of prompts, and positive and negative sub-components of consequences. A general description of these categories is presented here and on the coding sheet. A prompt is said to contain information relevant to the skill to be performed by the student. It is said to have cueing or signaling properties and always occurred prior to the student response. Verbal prompts were distinguished from physical prompts in that verbal prompts included only verbal statements made to the student by the instructor, whereas physical prompts were mediated motorically with bodily contact occurring between a student and the teacher. A third type of prompt considered was a modeled prompt. This included a physical demonstration with perhaps some accompanying verbalizations. Consequences were defined as occurring after the student's response. They could have either informational or motivational properties or both. The purpose of a positive consequence was to encourage or motivate the student to continue to respond. Therefore, it was expected that positive consequences included statements considered to be "socially pleasant." Negative consequences

were considered to have the effect of criticizing the student or his performance. Frequently, a negative consequence was considered to also decrease the rate of responding by a subject. Therefore, these statements would be considered to be ones that were socially "unpleasant." Examples of each of these categories and their sub-components were included on the daily coding sheet to facilitate observer recording and agreement.

Additional recordings made on the coding sheet included filling in the summary data at the top of each recording sheet. Also, beside each group observation, the interval which was being observed was noted. Group A designated the group in which the instructions were directed to the group as a whole; Group B designated the group in which the instructions were directed to individuals within the group setting. The amount of time spent in instruction of each group was recorded daily so that the time was equalized between the two groups to eliminate this factor as a confounding variable.

Following each daily observation the results were tallied and entered on the "Summary Sheet of Instructional Behaviors" (see Appendix B). The total number of instructions observed for each instructional category was entered for each instructional condition. Then the frequency of each instructional category, as directed toward an individual or a group, was totaled and entered. The total frequency of the instructional category for each condition was a sum of the

frequencies of each category as it occurred to an individual and to the group. For example, the total frequency of observations of verbal prompts given to Group A was made. Then this frequency was broken down into verbal prompts which were directed to the designated recipient over the total number of instructions made in that instructional category. For example, the total number of instructions of verbal prompts directed to the group in the group instructional condition was placed over the total number of instructions of verbal prompts occurring in the group instructional condition. This percentage was required to be at least 90 percent to meet the criterion of the experimental design.

These percentages were used to give daily feedback to the instructor regarding her daily instructional behaviors. If the teacher was found not to be meeting the requirements of the experimental design (i.e., differentiating the two conditions of instruction), suggestions were made as to how this could be done within the next instructional session. As will be demonstrated in the results section of this paper, the teacher met the experimental conditions very effectively.

The effect of these teacher behaviors on student behaviors was observed and recorded in terms of performance scores. An analysis of the total outcome data for each experimental group per number of instructions was performed

in order to determine the effectiveness of a unit value of instructions. That is to say, the unit value of instructions was determined by dividing the total points per subject by the number of instructions received by the subject.

Dependent Measures

A brief review of the rationale for the choice of beginning archery as the performance task is as follows: (a) the task was quantifiable, lending itself to measurement of learning on a daily as well as pre-post basis, (b) beginning archery skill acquisition was thought to be sensitive to change, and to differential instructional treatment, (c) the tasks were representative of other learned tasks in that the activity was performed on an individual basis but it could be taught in a group or individually, (d) measurement could be made with respect to both performance and cognitive (or verbal) criteria, and (e) measurement of generalization to shooting archery at other distances could be made.

The two dependent measures were the repeated daily measurements of (a) the number of possible points and (b) the hits-on-target scored for each subject. The scores were recorded daily over 16 sessions (see Appendix C for a copy of the Student Recording Sheet).

The 16 daily sessions were partialled into four equal blocks. A subject was required to be present on two of the

four days in each block in order for his data to be used in the analysis. Blocking was used as an aid in eliminating subjects who were absent excessively and did not experience a sufficient number of days of the experimental conditions. The data for the subjects who were present for at least two of the four days of each block were determined by obtaining mean scores for the number of days present. In other words, the datum for each subject for each block is the mean score of two, three, or four daily sessions. Data for four subjects, two in each experimental condition were dropped due to excessive absences.

It was anticipated that each student would shoot approximately four ends per day (i.e., 24 arrows). However, in the event that 24 arrows were not shot per day, provisions were made to equate the daily scores by calculating each individual's score on a percentage basis. The percentage of possible scores was calculated by placing the student's total number of points in ratio to the total number of points possible for the total number of arrows that were actually shot. For example, if a student shot four ends of six arrows each, each end could be worth 54 points for a total of 216 points for the four ends. However, if he received only 108 points, his percentage score would be only 50 percent. The percentage for hits-on-target was calculated by dividing the number of hits made by the subject by the number of arrows

shot. For example, if the subject shot four ends of six arrows each, he could get 24 hits for the four ends. However, if he made only 12 hits-on-target, his percentage would be 50 percent. Prior to the analysis of variance, it was necessary to perform arcsin transformations on the percentage data. According to Winer (1971, p. 400) arcsin transformations are utilized in order to stabilize the variances when the scores are reported in proportions. Utilizing the transformed data, an analysis of variance (2x4 repeated measures design) was performed to test the significance of the differences between the two instructional conditions over the four blocks. The design was used for both dependent measures, i.e., percentage of possible points, and hits-on-target.

Four additional post-instructional measures were taken. They were (a) a final test of shooting archery at the training distance of 25 yards, using both the dependent measures of percentage of possible points and hits-on-target, (b) a test of skill generalization at a non-training distance of 30 yards, using both dependent measures of percentage of possible points and hits-on-target, (c) a rating of form at shooting archery, and (d) an evaluation of the student's knowledge of archery as measured by a written test. A one-way analysis of variance was used to compare the individual and group instructional conditions on each of these post-instructional measures.

The final tests of performance and skill generalization were given to the students during sessions 17 and 18. Each subject shot six ends of six arrows each, three at a distance of 25 yards and three at a distance of 30 yards. Also during session 17 or 18, a rating of shooting form was made for each subject by two independent judges who were familiar with the prerequisites of good shooting form in beginning archery but were unfamiliar with the design of the present study. The subjects appeared before the judges in random order. Each subject shot from the training distance of 25 yards while being rated by the two judges. The judges were separated by a physical distance of approximately 20 feet.

The judges used a standard rating form designed by the instructor and experimenter. The standards for each behavioral category on which the subject was rated was based on the teacher's objectives for the course. Out of concern for establishing reliability between the two different judges, a written list of standards was given to each judge prior to the beginning of the study. In this context, the term reliability is also used to describe inter-observer agreement as had been done previously. In a training session with the observer-judges, the experimenter discussed various behaviors which the teacher had indicated as falling within the various ranking categories. Although more

extensive training was originally planned and considered desirable, it was not possible in this setting. Therefore, high reliability between the judges was not obtained, as described further in the results section.

The rating scale included the seven categories listed and described on the rating scale (see Appendix D). The judges were instructed to rate each subject on each category using a three-point scale as follows: (1) very acceptable = 3 points, (2) acceptable = 2 points, and (3) not acceptable = 1 point. Each subject's score could then vary between seven and 21 points for each judge's ratings. The final composite score for each subject was the mean score between the ratings of the two judges.

The final post-instructional test was an evaluation of the subject's written knowledge of archery. This test was designed by the teacher, based on her instructional emphases, to assess the subject's responses on questions concerning the skills, techniques, and mechanical principles of archery. The questions were directly related to skill acquisition or to scoring procedures as had been presented in the daily sessions. In other words, the questions were designed to assess only those facts which the subject had the opportunity to learn during actual participation in one of the instructional conditions. The test was administered to the subjects individually during session 19. (See Appendix E for

a copy of the written knowledge test.)

Summary

This study was designed then to compare the effectiveness of instruction presented under two different instructional conditions. In one condition, the instructions were directed toward a group of students. In the other condition, the instructions were directed toward individual students only.

Data analysis included a repeated measures analysis of variance on the daily scores for percentage of possible points and hits-on-target for each experimental condition. Four post-instructional measures were analyzed by a one-way analysis of variance to test if the two instructional methods produced significant differences in (a) a final test of shooting at 25 yards; (b) generalization of skill to shooting at 30 yards; (c) a rating of shooting form; and (d) an evaluation of the student's knowledge of archery on a written test.

An additional analysis of variance was used to assess if a differential number of instructions were presented under each category and overall to each of the two experimental conditions. To determine the relative effectiveness of instructions presented under the two different instructional conditions (i.e., to determine the unit value of instructions), an additional analysis was performed by dividing the total points earned per block by the total

number of instructions received (plus one). The "plus one" was placed in the denominator for purposes of calculation, since some subjects in the individual instructional condition on occasion received no instructions. Furthermore, if a subject had shot less than the average number of arrows shot by most members of the group on a given day, his scores were prorated to eliminate confounding.

# CHAPTER III

# RESULTS

## Check on Experimental Manipulation

Operationally, the experimental condition of individual instruction was defined in the present study as a method of presenting instructions in which at least 90 percent of all instructions were presented to individuals within the group and no more than 10 percent of all instructions to the group as a whole. Conversely, group instruction was defined as a method of presenting instructions in which at least 90 percent of all instructions were presented to the group as a whole and not more than 10 percent of all instructions to individuals within the group. Within the experimental conditions, instructions were subdivided into five categories including verbal prompt, physical prompt, modeled prompt, positive consequence, and negative consequence.

Observer Reliability. Observations of the instructor presenting instructions within each of the two experimental conditions were recorded daily. Prior to the beginning of the study and on three random occasions once the study began, observations were taken by two observers in order to help establish the internal validity of the experiment. During observer training, the reliability measure used was the

number of agreements divided by the number of agreements plus disagreements. Reliability of observational data during the two training sessions prior to the beginning of the study was 94 and 90 percent, respectively. These levels were well above the generally accepted minimal requirements of .85 set for inter-observer agreement.

Once the study began, the Spearman rank-order correlation coefficient was used to calculate reliability. This method was preferred over the Pearson product-moment correlation for several reasons (Hays, 1963). The observational data are of an ordinal nature and discrete rather than continuous. Furthermore, the purpose was not to demonstrate a linear relationship between the observations of the two observers but rather only to demonstrate the extent of agreement between the two.

The Spearman coefficients were calculated by summing observational data recorded during three days of instruction; that is, on days three, four, and six. Although more frequent reliability checks were desirable, it was impossible due to the fact that one observer was no longer present where the study was being conducted. Spearman rank-order coefficients were computed on each of the following reliability measures to be discussed.

Table 2 presents the Spearman rank-order correlations obtained for each of the five instructional categories (i.e.,

TABLE 2

Spearman Rank-Order Correlation Coefficient of Reliability between Observers by Category across Groups ($n$ = 28)

| Instructional Category | Reliability |
|---|---|
| Negative Consequence | 1.00* |
| Verbal Prompt | 0.96 |
| Physical Prompt | 0.86 |
| Modeled Prompt | 0.78 |
| Positive Consequence | 0.35 |
| Total/Overall | 0.95 |

*Perfect agreement occurred in these categories because both observers agreed that no response occurred.

negative consequence, verbal prompts, physical prompts, modeled prompts, and positive consequences) regardless of the two instructional conditions. Correlations are presented in descending order. Overall agreement was 0.95 with the most marked deviation being in the area of positive consequences.

A second reliability check (see Table 3) was performed to determine the agreement by category within each instructional condition. Table 3 reveals that overall agreement between observers was higher when observing the individual instructional condition than when observing the group instructional condition, especially in the category of positive consequences. Reliability between observers for the category of modeled prompts in the group instructional condition was impossible to determine statistically due to only one disagreement among many recordings of zero observations.

As in Tables 2 and 3, the numerical index presented in Table 4 is the Spearman rank-order correlation coefficient. This final reliability check was performed to determine the agreement on the recipient of instructions within each instructional condition. Generally, agreement was highest in two cases: (a) when the recipient of instruction was observed within the individual instructional condition and (b) when group instructions were presented to members of the individual instructional condition (a breech of the operational guidelines for defining the individual instructional

TABLE 3

Spearman Rank-Order Correlation Coefficient of Reliability between Observers by Category within each Instructional Condition ($n$ = 14)

| Instructional Category | Reliability, Group Instructional Condition | Reliability, Individual Instructional Condition |
|---|---|---|
| Verbal prompt | 0.92 | 0.99 |
| Physical prompt | 1.00* | 0.82 |
| Modeled prompt | (not computable) | 0.88 |
| Positive Consequence | 0.28 | 1.00 |
| Negative Consequence | 1.00* | 1.00* |
| Total/Overall | 0.91 | 0.99 |

*Perfect agreement occurred in these categories because both observers agreed that no response occurred.

TABLE 4

Spearman Rank-Order Correlation Coefficient of Reliability between Observers on Recipient of Instructions between Individual and Group Instructional Conditions ($n$ = 42)

| Recipient of Instructions | Experimental Condition | Reliability |
|---|---|---|
| Group | Individual | 1.00* |
| Individual | Individual | 0.97 |
| Group | Group | 0.85 |
| Individual | Group | 0.68 |

*Perfect agreement occurred in these categories because both observers agreed that no response occurred.

condition). Almost perfect agreement ($r$ = 0.97) occurred on those occasions when instruction was presented to individual members within the individual instructional condition. For instructions presented to members of the group instructional condition, however, agreement dropped to 0.85 and 0.68 for group and individual directed instructions, respectively.

Expected and Observed Frequencies of Teacher Presented Instructions. As an overall measure to determine if the experimental conditions of the study were met, the expected percentage of instructions was calculated for each instructional category by multiplying the appropriate percentage (i.e., 90 percent for individual instructions and 10 percent for group instructions within the individual instructional condition; 10 percent for individual instructions and 90 percent for group instructions within the group instructional condition) times the total number of observed frequencies of instruction for that category within the given condition.

Overall results are presented for the experimental conditions under the following headings: (a) individual recipient within group instructional condition, (b) group recipient within group instructional condition, (c) individual recipient within individual instructional condition, and (d) group recipient within individual instructional condition. Furthermore, each recipient is identified by the type of instruction received, i.e., either verbal prompt,

physical prompt, modeled prompt, positive consequence, or negative consequence, and an overall or total category.

Table 5 shows the extent to which the two experimental conditions of individual instruction and group instruction were achieved. A Chi-square Goodness of Fit Test was performed to determine when the teacher did not meet the experimental conditions of the study.

As can be seen in Table 5, the criteria of the experimental conditions for the present study were met in 20 of the 24 instances. The four conditions in which these criteria were not met were as follows: (a) physical prompt to individual recipient within group instructional condition, (b) physical prompt to individual recipient within individual instructional condition, (c) modeled prompt to individual recipient within group instructional condition, and (d) modeled prompt to group recipient within group instructional condition.

In the category involving physical prompts, the teacher presented four physical prompts to an individual within the group instructional condition, and 15 physical prompts to an individual within the individual instructional condition. No physical prompts were presented to the group as a whole in either instructional condition as there exists no way of operationally defining such a response class. Consequently, it was impossible to calculate an expected

TABLE 5

Expected and Observed Frequencies of Teacher Instructional Comments by Instructional Category in Individual and Group Instructional Conditions

| | Individual Recipient Group Condition | | Group Recipient Group Condition | |
|---|---|---|---|---|
| Instructional Categories | Expected | Observed | Expected | Observed |
| Verbal Prompt | 10.3 | 3.0 | 92.7 | 100.0 |
| Physical Prompt | 1.9 | 4.0* | 0.0 | 0.0 |
| Modeled Prompt | 0.5 | 1.0* | 4.5 | 4.0* |
| Positive Consequence | 1.9 | 1.0 | 17.1 | 18.0 |
| Negative Consequence | 0.0 | 0.0 | 0.0 | 0.0 |
| Summary: Overall | 13.0 | 9.0 | 118.0 | 122.0 |

TABLE 5 (Cont.)

| Instructional Categories | Individual Recipient Individual Condition | | Group Recipient Individual Condition | |
|---|---|---|---|---|
| | Expected | Observed | Expected | Observed |
| Verbal Prompt | 81.0 | 90.0 | 9.0 | 0.0 |
| Physical Prompt | 17.1 | 15.0* | 0.0 | 0.0 |
| Modeled Prompt | 23.4 | 26.0 | 2.6 | 0.0 |
| Positive Consequence | 13.5 | 15.0 | 1.5 | 0.0 |
| Negative Consequence | 0.0 | 0.0 | 0.0 | 0.0 |
| Summary: Overall | 130.0 | 146.0 | 15.0 | 0.0 |

*Chi-square Goodness of Fit Test of significance in direction not meeting standards of the experimental conditions.

frequency of physical prompts for the group within either instructional condition. It was possible, however, to determine an expected frequency (percentage) for modeled prompts directed toward individuals within each instructional condition. Although the teacher was not to stay within the operationally defined limits for this category of instruction for either instructional condition, the failure to do so was not found to be statistically significant according to the results of a Chi-square Goodness of Fit Test ($\chi^2 = 3.45$; $df = 3$; $p \geq .005$). It can thus be said on the basis of the present results that the two operationally defined instructional conditions (i.e., group and individual) were achieved in the present study, and furthermore that each was achieved with respect to each of the five specific categories of instruction sampled.

Analysis of Teacher Instructional Statements

The instructional statements presented by the teacher were observed and recorded under one of five categories. These five categories were (a) verbal prompts, (b) physical prompts, (c) modeled prompts, (d) positive consequences, and (e) negative consequences. In combination, these categories were considered to make up a package of instructional behaviors. To determine if any one of the five instructional categories occurred more frequently in one instructional

condition than in the other instructional condition, a 6 x 2 analysis of variance was performed utilizing the instructional categories (i.e., five categories plus an overall/total category) for each of the two experimental conditions. The data points were provided by the number of instructions on each of the 16 days which replaced the usual subjects variable. (See summary of results in Table 6. This and subsequent analyses were performed via computer programs. Slight arithmetical errors occur due to rounding off of figures.)

The ANOVA revealed that the main effect for instructional category was statistically significant ($F = 82.11$; $df = 5,180$; $p \leq 0.01$). Neither the group effect ($F = 0.88$; $df = 1,180$; $p \geq 0.05$) nor the group x instructional category interaction ($F = 1.02$; $df = 5,180$; $p \geq 0.05$) was found to be statistically significant.

A Newman-Keuls post hoc test was performed to determine which frequency of instructional category differed significantly from the other categories. As indicated by these results, the category of verbal prompts was presented significantly more than any other single category. In addition, the total number of instructions was greater than any single category. However, as expected, these findings for both verbal prompts and total instructions were equally true for both experimental conditions. (See Table 7 for summary of Newman-Keuls post hoc analysis.)

TABLE 6

Summary of the Analysis of Variance Comparing the Frequency of Occurrence of the Type of Instructional Categories Presented in the Individual and Group Instructional Conditions

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Instructional category | 2036.17 | 5 | 407.23 | 82.11 ** |
| Group | 4.38 | 1 | 4.38 | 0.88 NS |
| Instructional category x group | 25.34 | 5 | 5.07 | 1.02 NS |
| Days within instructional category x group | 892.77 | 180 | 4.96 | |

**$p \leq 0.01$

TABLE 7

Newman-Keuls Test to Compare the Frequency of Occurrence of Type of Instructional Category to Group and Individual Instructional Conditions

| | Negative Consequence | Physical Prompt | Modeled Prompt | Positive Consequence | Verbal Prompt | Overall Total | q r,180 r .99 | MS error / n |
|---|---|---|---|---|---|---|---|---|
| Cell Means | 0.00 | 0.63 | 0.97 | 1.06 | 6.03 | 8.69 | | |
| Negative Consequence | - | 0.63 | 0.97 | 1.06 | 6.03** | 8.69** | 6 | 1.875 |
| Physical Prompt | - | - | 0.34 | 0.43 | 5.40** | 8.06** | 5 | 1.812 |
| Modeled Prompt | - | - | - | 0.09 | 5.06** | 7.72** | 4 | 1.734 |
| Positive Consequence | - | - | - | - | 4.97** | 7.63** | 3 | 1.623 |
| Verbal Prompt | - | - | - | - | - | 2.66** | 2 | 1.434 |
| Overall/ Total | - | - | - | - | - | - | 1 | |

** $p \leq 0.01$

## Results of Experimental Manipulation

The remainder of the results will now be presented under three major headings: (a) daily performances, (b) post-test performance measures, and (c) unit value of instructions.

### Daily Performances

Daily performance was measured by two dependent measures: (a) percentage of total possible points (defined as the total number of points earned divided by the total number of possible points given the number of actual arrows shot), and (b) percentage of hits-on-target (defined as the total number of hits-on-target divided by the total number of possible hits given the actual number of arrows shot). Although it was the general procedure for each student to shoot six arrows in each end, occasionally a student shot only four or five arrows rather than the maximum of six. Therefore, it was necessary to calculate the data in percentage form and then to use arcsin transformations in order to control for slight differences among individuals as to the exact number of arrows shot in each end.

Differences between the two instructional conditions (i.e., group and individual) for each of the two dependent meaures were analyzed statistically using a 2 x 4 repeated measures design. The 2 x 4 design had two experimental conditions (group and individual instructional conditions)

across four blocks, each block containing four daily sessions. Within each block the data for the four daily sessions were grouped in an attempt to take into account the possibility of occasional student absences. As previously stated, in order for the data to be entered into the statistical analysis, a subject was required to be present and participating on two of the four sessions in each block. In the present study, it was necessary to eliminate the data of two male subjects from each experimental condition. Because these subjects occupied the same ordinal positions in both groups it was not necessary to eliminate the data for any of the other subjects. The mean number of days present for the subjects of the group instructional condition was 12.73; the mean for the individual instructional condition was 13.82.

Figure 1 shows the mean percentage of possible points for each block of four daily sessions for each of the two instructional conditions. The closed circles are data points representing the individual instructional condition; the open circles are data points representing the group instructional condition. While for each block of four daily sessions the percent of possible scores is greater for the individual instructional condition than for the group instructional condition, the analysis of variance (summarized in Table 8) reveals that the difference was not statistically significant ($\underline{F}' = 2.33$; $\underline{df} = 1,60$; $\underline{p} \geq 0.05$). Assuming days to be random

Figure 1

Percentage of Possible Points

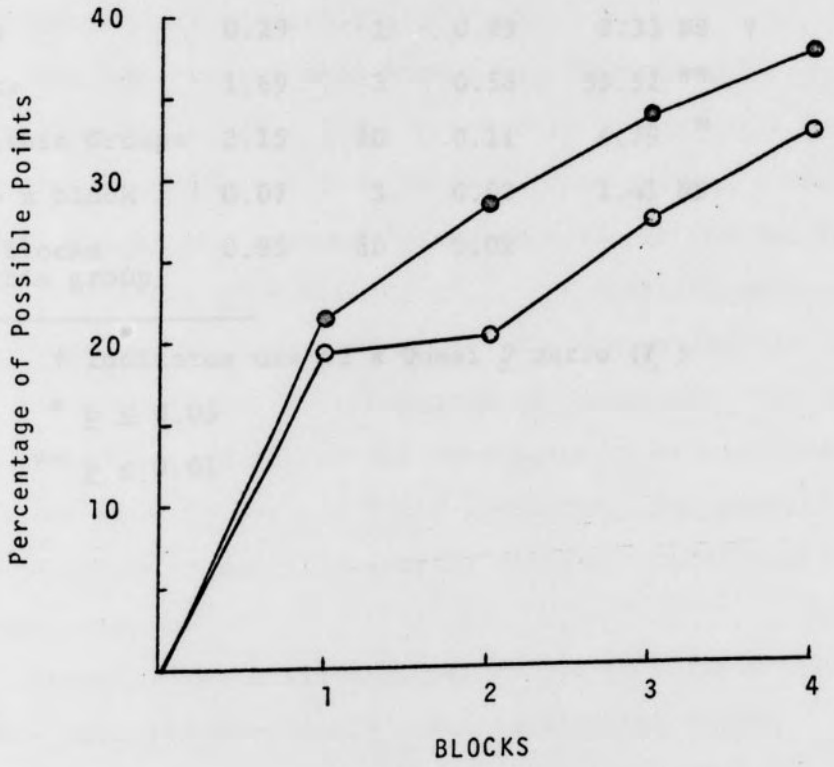


TABLE 8

Summary of Analysis of Variance of Percentage of Possible Points

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Group | 0.29 | 1 | 0.29 | 2.33 NS † |
| Blocks | 1.69 | 3 | 0.56 | 35.52 ** |
| Ss within Groups | 2.15 | 20 | 0.11 | 6.79 * |
| Group x block | 0.07 | 3 | 0.02 | 1.41 NS |
| Ss x blocks within group | 0.95 | 60 | 0.02 | |

† Indicates use of a Quasi F ratio (F')

* $p \leq 0.05$

** $p \leq 0.01$

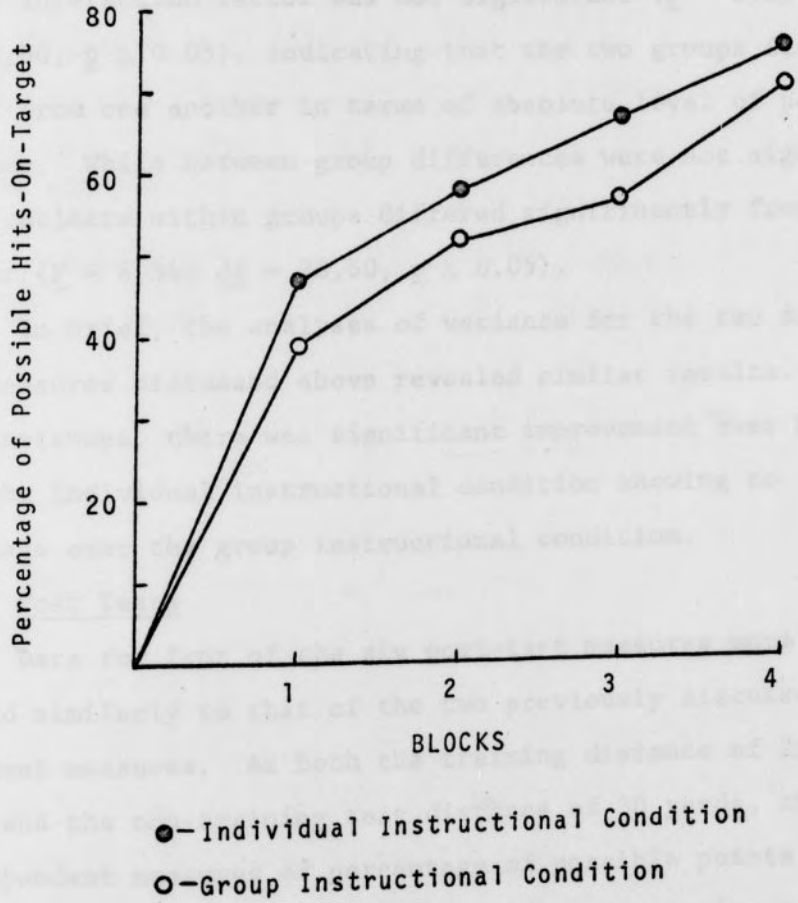
and blocks merely the combination of days, it was necessary to calculate a Quasi $\underline{F}$ ratio because the appropriate $\underline{F}$ ratio could not be constructed by direct application of the rules based upon expected values of mean squares. By adding and subtracting certain of the mean squares, a composite mean square which had the required expected values of mean squares was obtained (see Winer, 1971).

The improvement over blocks was statistically significant ($\underline{F} = 35.52$; $\underline{df} = 3,60$; $\underline{p} \leq 0.01$), indicating a significant improvement over time for both experimental groups. However, the blocks x group interaction factor was not significant ($\underline{F} = 1.41$; $\underline{df} = 3,60$; $\underline{p} \geq 0.05$) indicating that while both groups showed improvement the improvement for neither group was significantly different from the other. The subjects within groups factor was also found to be significant ($\underline{F} = 6.79$; $\underline{df} = 20,60$; $\underline{p} \leq 0.01$) indicating that subjects within each experimental condition differed significantly from one another.

Figure 2 shows the mean percentage of hits-on-target for each block of four daily sessions with the closed circles representing data points for the individual instructional condition and the open circles representing data points for the group instructional condition. Again, while the percent of hits-on-target was greater for the individual instructional condition than for the group

Figure 2

Percentage of Possible Hits-On-Target



instructional condition, the differences were not significant ($F' = 2.25$; $df = 1,60$; $p \geq 0.05$). See Table 9 for a summary of the analysis of variance on the percentage of hits-on-target. As with percentage of possible score, the improvement over successive blocks for percentage of hits-on-target was significant ($F = 39.15$; $df = 3,60$; $p \leq 0.05$). While significant improvement occurred over blocks, the blocks x groups interaction factor was not significant ($F = 0.29$; $df = 3,60$; $p \geq 0.05$), indicating that the two groups did not differ from one another in terms of absolute level of performance. While between group differences were not significant, subjects within groups differed significantly from one another ($F = 6.34$; $df = 20,60$; $p \leq 0.05$).

In brief, the analyses of variance for the two dependent measures discussed above revealed similar results. In both instances, there was significant improvement over blocks with the individual instructional condition showing no advantage over the group instructional condition.

Post Tests

Data for four of the six post-test measures were handled similarly to that of the two previously discussed dependent measures. At both the training distance of 25 yards and the non-training test distance of 30 yards, the two dependent measures of percentage of possible points and percentage of hits-on-target were again used. Again, as

TABLE 9

Summary of Analysis of Variance of
Percentage of Hits-on-Target

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Group | 0.61 | 1 | 0.61 | 2.25 NS † |
| Blocks | 5.11 | 3 | 1.70 | 39.15 ** |
| Ss within group | 5.51 | 20 | 0.28 | 6.34 * |
| Group x block | 0.04 | 3 | 0.01 | 0.29 NS |
| Ss x blocks within group | 2.61 | 60 | 0.04 | |

† Indicates use of a Quasi F ratio (F')

* $p \leq 0.05$

** $p \leq 0.01$

the data were in proportionate form, it was necessary to use the arcsin transformation. Data for a fifth post-test measure, that of judges' ratings, were calculated by summing the ratings for each subject by each judge across the seven categories judged. The mean score for the two judges across all seven categories was determined for each individual. Data for the final dependent post-test measure, that of a written test of knowledge, were the total number of correct responses for each subject.

Each of these six dependent post-test measures was analyzed by a one-way analysis of variance. For a summary of the results of the ANOVA see the following tables: (a) Table 10 for the ANOVA on percentage of possible points at 25 yards; (b) Table 11 for the ANOVA on percentage of possible hits-on-target at 25 yards; (c) Table 12 for the ANOVA on percentage of possible points at 30 yards; (d) Table 13 for the ANOVA on percentage of possible hits-on-target at 30 yards; (e) Table 14 for the ANOVA on judges' ratings; and (f) Table 15 for the ANOVA on written knowledge test performance.

In post tests conducted at 25 yards (the original training distance) and at 30 yards (the non-training test distance), the two instructional conditions did not differ significantly either with respect to percentage of possible points or percentage of hits-on-target. Post tests were

TABLE 10

Summary of One-Way Analysis of Variance of Post-Test Percentage of Possible Points at Training Distance of 25 Yards

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Group | 0.001 | 1 | 0.001 | 0.02 NS |
| Ss within group | 1.33 | 20 | 0.07 | |

TABLE 11

Summary of One-Way Analysis of Variance of Post-Test Percentage of Hits-on-Target at Training Distance of 25 Yards

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Group | 0.26 | 1 | 0.26 | 1.16 NS |
| Ss within group | 4.47 | 20 | 0.22 | |

TABLE 12

Summary of One-Way Analysis of Variance of Post-Test Percentage of Possible Points at Non-Training Distance of 30 Yards

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Group | 0.14 | 1 | 0.14 | 2.16 NS |
| Ss within group | 1.25 | 20 | 0.06 | |

TABLE 13

Summary of One-Way Analysis of Variance of Post-Test Percentage of Hits-on-Target at Non-Training Distance of 30 Yards

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Group | 0.23 | 1 | 0.23 | 1.33 NS |
| Ss within group | 3.43 | 20 | 0.17 | |

TABLE 14

Summary of One-Way Analysis of Variance of Post-Test Judges' Rating Scores on Subject Form while Shooting Archery

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Group | 0.28 | 1 | 0.28 | 0.06 NS |
| Ss within group | 98.55 | 20 | 4.93 | |

TABLE 15

Summary of One-Way Analysis of Variance of Post-Test Scores on Written Knowledge Test

| Source | SS | df | MS | F |
|---|---|---|---|---|
| Group | 8.91 | 1 | 8.91 | 0.60 NS |
| Ss within group | 299.45 | 20 | 14.97 | |

thus in general agreement with the finding of no significant differences as a result of the training by the two instructional conditions.

Though overall performances between the two groups failed to differ, it was thought that more subtle aspects of performance, such as form, might. Each subject was therefore rated by two judges (neither of whom were familiar with the purposes of the present study) using a three-point rating scale on seven different categories considered to contribute to good form. The mean score between the two judges was calculated for each subject of the two experimental conditions. Inter-observer agreement, however, was so low ($\underline{r} = 0.31$) that comparisons between shooting form for subjects in the two instructional conditions was all but impossible. A one-way ANOVA (see Table 14) revealed that the two groups, in fact, did not differ significantly ($\underline{F} = 0.06$; $\underline{df} = 1,20$; $\underline{p} \geq 0.05$).

A final post-test dependent measure consisted of scores on a written test including questions about the steps in shooting archery, general procedures, and corrections to be made for common errors. Performances on the written test also failed to differ significantly between groups as summarized in Table 15.

Unit Value of Instructions

The results of the present study have shown that in terms of actual performance (percentage of possible points and hits-on-target, archery form, and written knowledge) no significant differences were obtained as a function of the type of instruction presented (i.e., whether presented to a group as a whole, or to individual members within the group setting). These results, however, have all dealt primarily with those aspects of the instruction related to the learner. While the two instructional methods failed to produce performances which were significantly different from one another, the question remains as to the instructional efficiency of each in producing these performances. With this in mind, the data were further analyzed from a pedagogical perspective. Specifically, this analysis sought to determine the relative unit value of instructions presented under each of the two instructional conditions.

First, the number of instructions presented under each experimental condition was determined. For the individual condition, the absolute number of individual instructions was determined. The total number of instructions was 146 in the individual instructional condition. This yields a daily mean of 9.13 and a mean number of instructions per subject of 13.2 over the course of 16 instructional sessions. The daily mean number of instructions per subject is 0.83.

Two alternative methods were available for determining the number of instructions for the group instructional condition. First, it might be assumed that each individual within the group condition fully attended to each instruction presented to the group as a whole. Therefore, the total number of instructions presented to the group condition would equal the sum of the number of instructions presented daily to the group multiplied by the number of individuals present daily in the group. In making this inflated assumption, the sum of the number of instructions presented times the number of subjects present yields a sum of 1,215 instructions with a daily mean of 75.94. The mean number of instructions presented per subject over the course of training is 110.45. The daily mean of instructions per subject in the group instructional condition is 7.69.

Assuming, for the moment, that this assumption is valid, a statistical comparison (see Table 16) revealed a highly significant interaction between groups x blocks, indicating that the number of instructions varied over time between the two groups ($\underline{F} = 89.74$; $\underline{df} = 3,60$; $\underline{p} \leq 0.01$). In the group instructional condition, significantly more instructions were given over time than in the individual instructional condition where a relatively stable frequency of instructions was given. Over the entire experiment, the group instructional condition received significantly more instructions than the

TABLE 16

Summary of the Analysis of Variance of Differential Number of Instructions Presented per Subject per Group

| Source | SS | df | MS | F | |
|---|---|---|---|---|---|
| Group | 1024.29 | 1 | 1024.29 | 19.75 | * † |
| Blocks | 155.70 | 3 | 51.90 | 91.19 | ** |
| Ss within group | 16.63 | 20 | 0.83 | 1.46 | NS |
| Group x blocks | 153.22 | 3 | 51.07 | 89.74 | ** |
| Ss x blocks within group | 34.15 | 60 | 0.57 | | |

† Indicates use of a Quasi F ratio (F')

* $p \leq 0.05$

** $p \leq 0.01$

individual condition ($F'$ = 19.75; $df$ = 1,3; $p \leq 0.05$). Given the equivalent performances of the two instructional conditions, this finding would argue strongly for the superiority of individualized instruction since the teacher had to give fewer instructions in the individual instructional condition to achieve the same results. (Mean number of instructions for the group instructional condition was 7.74; whereas, the mean number of instructions for the individual instructional condition was 0.92.)

In submitting these data to an analysis of variance, the unit value of instructions was calculated by dividing the total number of points earned per subject per block by the number of instructions presented per subject per block . . . plus one. It was necessary to include the "plus one" in the denominator as there were blocks in which some subjects received no individual instructions. The addition of the single unit allowed for computation while maintaining the ordinal relationship between the number of instructions given. Table 17 shows that the unit value of instruction was significantly greater for the individual condition ($F'$ = 10.41; $df$ = 1,60; $p \leq 0.01$).

There is, however, no way of determining to what extent each individual within the group instructional condition actually attended to each instruction presented to the group as a whole. An alternative, and seemingly more

TABLE 17

Summary of the Analysis of Variance Comparing Unit Value of Instructions

| Source | SS | df | MS | F | |
|---|---|---|---|---|---|
| Group | 365983.80 | 1 | 365983.80 | 10.41 | * † |
| Blocks | 53632.77 | 3 | 17877.59 | 2.28 | NS |
| Ss within group | 320701.30 | 20 | 16935.06 | 2.04 | * |
| Group x blocks | 59631.54 | 3 | 19877.18 | 2.53 | NS |
| Ss x blocks within group | 470934.60 | 60 | 7848.91 | | |

† Indicates use of a Quasi F ratio (F')

* $p \leq 0.05$

logical, way of determining the unit value of instructions would be to count only the absolute number of instructions presented under each of the two conditions. Recording instructions in this manner, the mean number of instructions presented daily to the group instructional condition was 7.69 and 9.13 for the individual instructional condition. The mean number of instructions per subject was 11.18 in the group instructional condition and 13.2 in the individual instructional condition.

To obtain a numerical index for unit value of instructions, the total points earned per subject per block was divided by the total number of instructions presented per subject per block. If a subject shot fewer than six arrows, that subject's scores were prorated to yield daily scores as if six arrows had been shot. These data are summarized in Table 18.

In Figure 3, the unit value of instructions for the group instructional condition is plotted and represented by the closed circles; the unit value of instructions for the individual instructional condition is plotted and represented by the open circles. During the early stages of training, the group instructional condition appears to be favored. Whereas, in the later stages of training the individual instructional condition appears to be favored.

Expressing the unit value indices in terms of a ratio yielded a fraction reflecting the relative value of

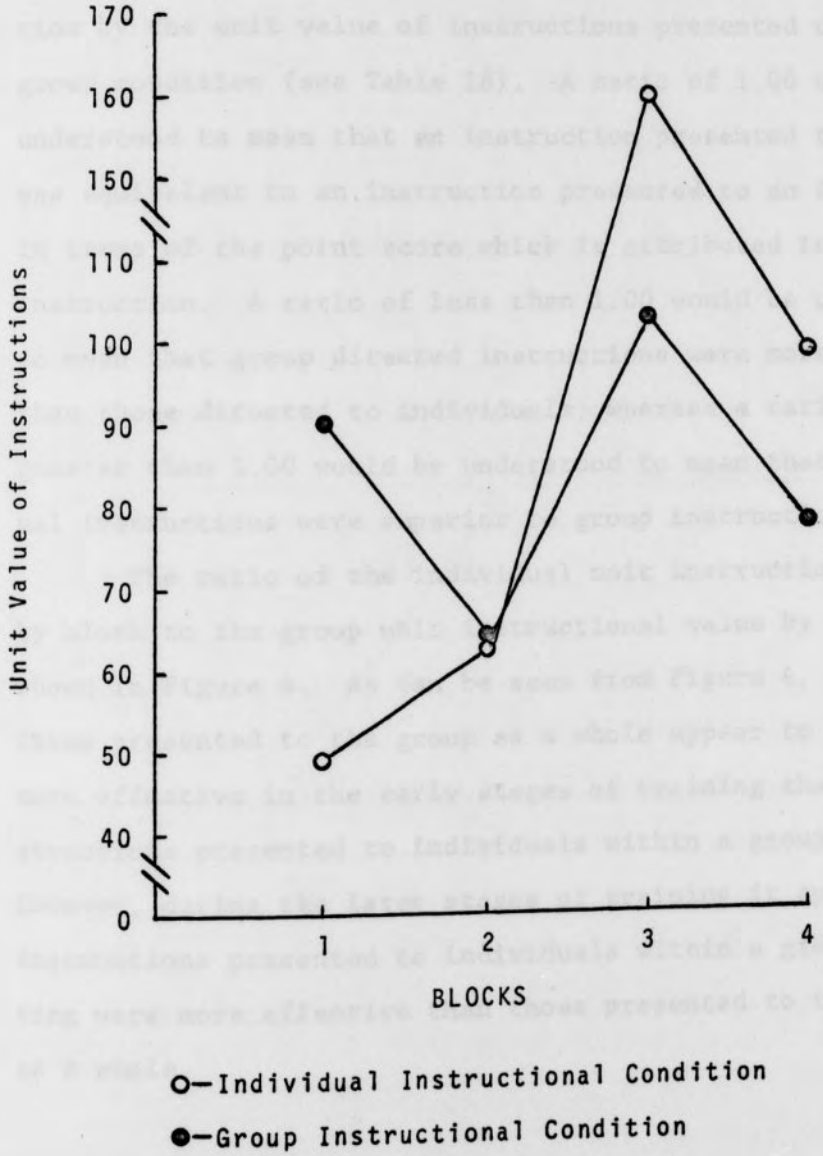
TABLE 18

Summary of Data for Construction of Ratio Value in Analysis of Unit Value of Instructions

| | | Total Points | Absolute Number of Instructions | Unit Value | Ratio of Individual to Group |
|---|---|---|---|---|---|
| Block 1 | Group Condition | 1354 | 15 | 90.27 | .54 |
| | Individual Condition | 1769 | 36 | 49.14 | |
| Block 2 | Group Condition | 2011 | 31 | 64.87 | .97 |
| | Individual Condition | 2825 | 45 | 62.78 | |
| Block 3 | Group Condition | 3319 | 32 | 103.72 | 1.55 |
| | Individual Condition | 3858 | 24 | 160.75 | |
| Block 4 | Group Condition | 3512 | 45 | 78.04 | 1.27 |
| | Individual Condition | 4077 | 41 | 99.44 | |

Figure 3

Unit Value of Instructions: Group and Individual Instructional Conditions

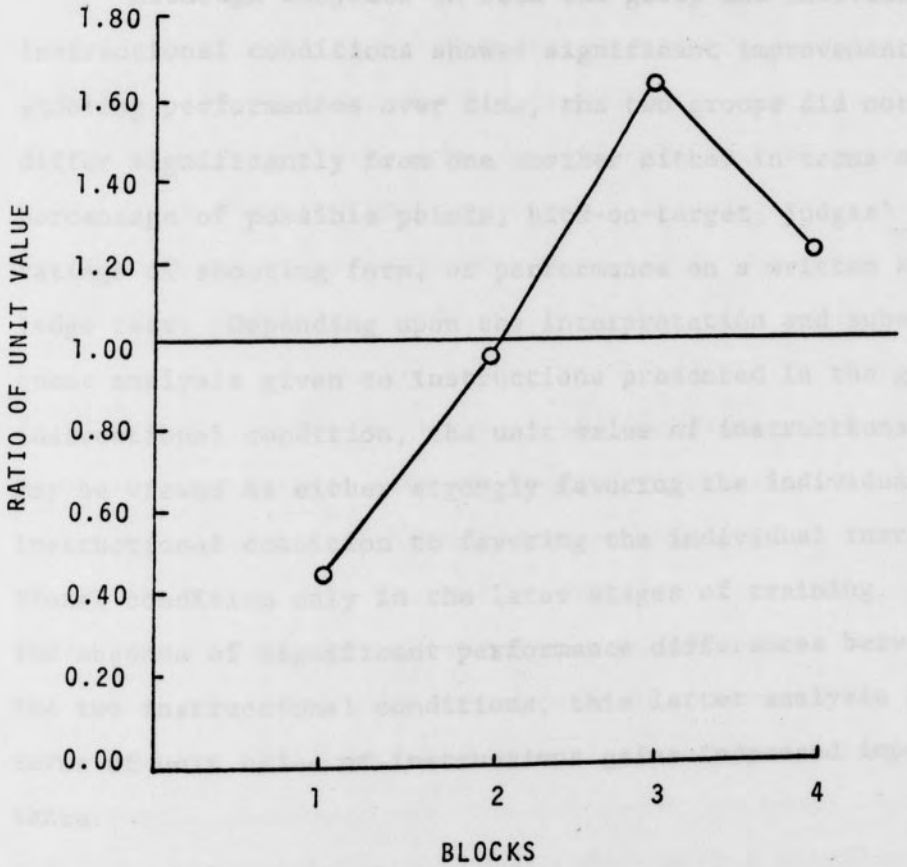


instructions presented under each of the two experimental conditions. The ratio was formed by dividing the unit value of instructions presented under the individual condition by the unit value of instructions presented under the group condition (see Table 18). A ratio of 1.00 would be understood to mean that an instruction presented to a group was equivalent to an instruction presented to an individual in terms of the point score which is attributed to that instruction. A ratio of less than 1.00 would be understood to mean that group directed instructions were more effective than those directed to individuals; whereas a ratio of greater than 1.00 would be understood to mean that individual instructions were superior to group instructions.

The ratio of the individual unit instructional value by block to the group unit instructional value by block is shown in Figure 4. As can be seen from Figure 4, instructions presented to the group as a whole appear to have been more effective in the early stages of training than instructions presented to individuals within a group setting. However, during the later stages of training it appears that instructions presented to individuals within a group setting were more effective than those presented to the group as a whole.

Figure 4

Ratio of Individual Unit Value of Instructions to Group Unit Value of Instructions



# CHAPTER IV
# DISCUSSION

## Summary of Results

Although subjects in both the group and individual instructional conditions showed significant improvement in shooting performances over time, the two groups did not differ significantly from one another either in terms of percentage of possible points, hits-on-target, judges' ratings of shooting form, or performance on a written knowledge test. Depending upon the interpretation and subsequent analysis given to instructions presented in the group instructional condition, the unit value of instructions may be viewed as either strongly favoring the individual instructional condition to favoring the individual instructional condition only in the later stages of training. In the absence of significant performance differences between the two instructional conditions, this latter analysis in terms of unit value of instructions gains increased importance.

## Analysis of Teacher's Instructional Behaviors

Formal observation and analysis of the teacher's instructional behaviors indicated that the criteria were met for operationally distinguishing the two experimental

conditions. That is to say, greater than 90 percent of all instructions directed to the group instructional condition were directed to the group as a whole; whereas in the individual instructional condition, more than 90 percent of all instructions were directed toward individuals. However, observations made daily but not formally recorded revealed that although the teacher met the operational definitions stated in the criteria for the experimental conditions, some of her more subtle behaviors in fact made the two instructional conditions quite homogeneous. Although the criteria for the experimental conditions were met in the group instructional condition, individuals within this condition were also able to receive rather specific individualized instruction as a result of the following teacher behaviors. On several occasions, when an individual was observed to be having considerable difficulty but perhaps not one common to the entire group, the instructor would use this individual to demonstrate to the entire group. At such time, the other members of the group were asked to analyze the problem of the demonstrating individual and to make suggestions for skill improvement. Consequently, the criterion for group instruction was maintained while an individual with a specific skill problem needing correction was given rather specific individualized assistance.

In addition, the teacher was observed to make corrections of similar errors within both experimental conditions

on a given day, the difference being primarily the manner in which the instructions were delivered rather than an additional difference being concerned with the content of the corrections. It was assumed in setting up the study that the teacher's instructional behaviors would differ between groups as to content as well as to whom the instruction was presented. That is to say, instructions presented to individuals would be specific to the individual and errors made by the individual; whereas instructions presented to the group be directed toward common errors of the group without being specifically aimed at a single individual within the group. However, the assumption appears to have been in error, since the teacher was observed to make similar corrections of similar errors in both experimental conditions.

Furthermore, substantiation is given to the similarity of teacher behavior in both groups by the analysis of the frequency of different instructional categories. Although the category of verbal prompt occurred significantly more than any other single category, there was no statistically significant difference between the two experimental conditions. Similar findings were evidenced for the frequency of the total of the instructional categories. Thus, although operational criteria defining the two different instructional conditions were satisfied, marked similarities

across both conditions in terms of teacher behaviors may in part account for the failure of the two conditions to differ significantly.

Considering the matter of similarity of teacher instructional behaviors leads to the conclusion that instruction directed to an individual does not necessitate individualization of instruction, particularly with respect to the relevance of the information or the involvement of the learner. This study was designed to consider only to whom the instruction was delivered. One other plausible explanation for the failure of the two instructional conditions to differentially affect student performance would be that the teacher did not discriminate between the two conditions other than in the manner (that is, to whom) instruction was presented. In other words, the instructions presented were not more relevant to individuals within the individual condition than perhaps they were to individuals within the group condition. In addition, there did not appear to be any significant difference in the amount of learner involvement initiated by the teacher between the two groups. In general, there appears to have been an overall failure on the part of the teacher to individualize instructions. Consequently, both experimental conditions received essentially the same instructional treatment. The groups differed only in the manner (that is, to whom) instructions were

presented. Had individualization of instruction occurred, then perhaps the performance data would have favored individualized instruction, as suggested by previous literature.

Having considered some of the most apparent factors thought to have affected the teacher's performance in the present study and the manner in which these factors might have affected the study's outcome, the discussion will now turn to a further consideration of the importance of the unit value of instructions presented under the two experimental conditions.

Unit Value of Instructions

In considering the more conservative analysis of unit value of instruction, it was noted that in the initial stages of training, the group instructional condition was favored, whereas in the later stages of training the overall number of points per instruction began to favor the individual instructional condition. One possible explanation might be that in the initial stages of instruction errors are being made which are common to all members of the group. Within the group instructional condition, the teacher is making corrections which are relevant to the majority of the members of the group. However as training proceeds, errors become more varied and individualized due to the increasing degree of complexity of the responses being acquired and due also to

the fact that individual students are likely to be at different skill levels. Instructions then which are directed at individual errors would be expected to be of more value.

Problems Encountered in the Conduct of the Study

The greatest problem in interpreting the data from this study was in the determination of how to measure the effectiveness of the instruction directed to the group as a whole. An inflated measure seemed to result from the assumption that each individual received each instruction presented. Although conditions were established to encourage this, it seems most unlikely that each instruction within the group instructional condition was equally attended to by each individual subject. And even if the instructions were equally attended to by each individual within the group, it is even more difficult to determine to what extent the instruction was effective in altering the subsequent performance of that individual. In making these assumptions about the group instructional condition, the analysis showed the unit value of instructions to greatly favor the individual instructional condition.

If, however, the more conservative method of determining the effectiveness of an instruction for the group instructional condition is assumed (i.e., by counting the absolute number of instructions presented to the group as a whole), then the unit value of instructions favors the

group in the initial stages of training and the individual instructional condition in the later stages of training. While specific student errors were not noted and recorded in the present study, this conclusion seems consistent with the assumption previously discussed concerning the elimination of common and individualized errors over the course of training.

Implications for Further Research

Future studies dealing with the relative effectiveness of group versus individualized instructional methods must first deal with the whole area of attentional factors operating in group instructional settings, and specifically with the quantification of the degree to which individual instructions are attended to by members of a group.

Another area which would need attention based on the results of the present study is the training of teachers in the effective individualization of instruction. While the teacher in the present study was successful in complying with the operational criteria defining the two instructional conditions, observations demonstrated that her instructions did not differ for the two groups in terms of content. The present study suggests that training in how to individualize instruction may be necessary before performance differences can reasonably be expected. Factors which might profitably be included in such training would be (a) task analysis

(i.e., knowledge of the component parts of the skills being taught, (b) shaping (i.e., the ability to know how to structure the sequence of the skills to be learned), (c) observation and evaluation of skill performances, and (d) the ability to provide prompts while maintaining the level of responding.

In considering studies of individualized instruction, the effect of group size may become an important factor. For instance, what is the effect of group size upon the rate of learning of an individual within the group? What effect does group size have upon the performance of the teacher? Does group size differentially affect performance as a function of the degree of complexity of the performance being acquired?

The present study indicates a strong need for evaluating the effects of instructional variables upon skill acquisition as a function of the increasing degree of complexity of the task. In the analysis of the present data, it was found that individualizing instruction was advantageous (in terms of unit instructional value) during the later stages of training. The interaction between the particular method of instruction chosen (in this case, group or individual) and the various stages of training was assumed to be due to the manner in which different methods operate upon different classes of errors (i.e.,

common versus individualized). Validation of such an assumption however is dependent upon first identifying errors of each class and then demonstrating that each is affected in some systematic manner by the experimental manipulations. Only then can the findings of the present study be profitably extended to the analysis of the effectiveness of group versus individualized methods in the acquisition of more complex skills.

## Conclusion

In current educational designs individualization of instruction is often established as a goal. However in terms of optimal educational efficiency and learner performance, the present study suggests that the choice of individual versus group instructional strategies must include a thorough consideration of such factors as (a) the ability of the instructor to effectively individualize instruction, (b) commonality of errors at beginning skill levels and the diversity of errors at later skill levels, and (c) an understanding of the different levels of complexity for the particular skill being taught. On the basis of the present study, this last factor may be expected to interact significantly over the course of training with the particular method of instruction chosen. Identification of the conditions under which such an interaction is to be predicted remains an empirical question.

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APPENDIX A

Observation Code Sheet of Recipient of Instructional Behaviors *

Observer _____ Reliability Checker _____

Session # _____ Date _____ Time _____ Total Obs. Time _____

| Instructional Categories | Interval / Amt. time / Group | A(Gr) | B(Ind.) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Verbal Prompt | Ind. (Recep.) | | 6 | 7 | 10 | 12 | 13 | 14 | 15 |
| | | | 17 | 18 | 20 | 21 | 22 | 23 | |
| | Group (Recep.) | | | | | | | | |
| Phsyical Prompt | Ind. | | 6 | 7 | 10 | 12 | 13 | 14 | 15 |
| | | | 17 | 18 | 20 | 21 | 22 | 23 | |
| | Group | | | | | | | | |
| Modeled Prompt | Ind. | | 6 | 7 | 10 | 12 | 13 | 14 | 15 |
| | | | 17 | 18 | 20 | 21 | 22 | 23 | |
| | Group | | | | | | | | |
| Positive Conseq. | Ind. | | 6 | 7 | 10 | 12 | 13 | 14 | 15 |
| | | | 17 | 18 | 20 | 21 | 22 | 23 | |
| | Group | | | | | | | | |
| Negative Conseq. | Ind. | | 6 | 7 | 10 | 12 | 13 | 14 | 15 |
| | | | 17 | 18 | 20 | 21 | 22 | 23 | |
| | Group | | | | | | | | |

*Intervals for recording were repeated twice under each condition on the actual coding sheet used in the study.

Key to Code:

**PROMPT**: Occurs BEFORE response of student; gives relevant information; serves as a reminder to student; has cueing or signaling properties.

**VERBAL**: Comment spoken aloud so that observer can hear, any verbal instruction; e.g., "Hold your bow steady," "Lift your elbow," "Take time to aim," etc.

**PHYSICAL**: Bodily contact between student and teacher which gives information to the student about the skill; e.g., lifts elbow to more elevated position.

**MODELED**: Includes modeled or physical demonstration; may be performed by teacher or by a student upon teacher's request; e.g., demonstration of correct grip.

**CONSEQUENCE**: Occurs AFTER response of student; may have either or both motivational and informational properties related to previous response of student.

**POSITIVE**: Purpose to praise or encourage student by making "pleasant" statements; e.g., "That's good," "Keep working," etc.

**NEGATIVE**: Purpose to criticize or discourage student responding by making "unpleasant" statements; e.g., "That's not very good," "How about trying?", etc.

APPENDIX B

Summary Sheet of Instructional Behaviors

Observer _____ Reliability Checker _____

Session # _____ Date _____ Time _____ Total Obs. Time _____

| Instructional Categories | Recipient | Condition A | | | Condition B | | |
|---|---|---|---|---|---|---|---|
| | | Freq. of Inst. Cat. | Freq. to Recip. | % | Freq. of Inst. Cat. | Freq. to Recip. | % |
| Verbal Prompt | Ind. | | | | | | |
| | Group | | | | | | |
| Physical Prompt | Ind. | | | | | | |
| | Group | | | | | | |
| Modeled Prompt | Ind. | | | | | | |
| | Group | | | | | | |
| Positive Conseq. | Ind. | | | | | | |
| | Group | | | | | | |

APPENDIX B (Cont.)

| Instructional Categories | Recipient | Condition A | | | Condition B | | |
|---|---|---|---|---|---|---|---|
| | | Freq. of Inst. Cat | Freq. to Recip. | % | Freq. of Inst. Cat | Freq. to Recip. | % |
| Negative Conseq. | Ind. | | | | | | |
| | Group | | | | | | |
| Total | Ind. | | | | | | |
| | Group | | | | | | |

APPENDIX C

Students' Daily Score Record

Student Signature _____ Session # _____ Date _____

| | 1 | 2 | 3 | 4 | 5 | 6 | # shot | # hit | % hit | total score | poss. score | % score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| End 1 | | | | | | | | | | | | |
| End 2 | | | | | | | | | | | | |
| End 3 | | | | | | | | | | | | |
| End 4 | | | | | | | | | | | | |
| End 5 | | | | | | | | | | | | |
| End 6 | | | | | | | | | | | | |
| Total | | | | | | | | | | | | |

APPENDIX D

Judges' Rating Scale

| | 3 Very Acceptable | 2 Acceptable | 1 Unacceptable |
|---|---|---|---|
| Stance | feet parallel, straddling firing line, body in line with target | stance open or closed hips and/or shoulders in line with target | archer tends to face target--no body part in line with target |
| Nock | Index finger & next finger hold arrow on nock, arrow inserted pile first above arrow rest, between string & bow to nocking point, cock feather away from bow | arrow held by nock between index finger & thumb, placed on string by sliding arrow pile first between string and bow | arrow grasped by fletching or below, lifted over string to nocking point |
| Address | looks to target & maintains eye contact with target, brings bow up to eye level | looks to target, back down to bow, back to target while drawing | maintains eye contact with bow, eyes follow bow up to point of aim |
| Draw | bow is drawn (pushed & pulled) in one smooth action from bow side up to point of aim | bow is raised slightly prior to beginning of draw | bow is raised to vertical position prior to draw |
| Anchor | anchors at jaw or chin & maintains anchor through follow-through | anchors at jaw or chin but fails to maintain anchor afterrelease | fails to anchor at any point around chin or jaw |
| Release | holds anchor, relaxes hand to release | flies on release | plucks on release |
| Follow-thru | maintains position at release until arrow strikes target | maintains position at release for short while | changes position immediately upon release |

| Student | Stance | Nock | Address | Draw | Anchor | Release | Follow-thru |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

# APPENDIX E

## Written Knowledge Test

(Note: Answers to Sections I-III shown in parentheses; Section IV, by asterisk)

1. Shooting Sequence: Please arrange the following shooting steps in proper sequence.

| | |
|---|---|
| A. Stance (1) | E. Aim (5) |
| B. Anchor (4) | F. Follow-Through (7) |
| C. Draw (3) | G. Release (6) |
| D. Nock (2) | |

II. True-False

8. If all of an archer's arrows go low, the archer should move his point of aim. (True)
9. At full draw, the cock feather should be away from the bow. (False)
10. Tilting the bow to the right causes the arrow to go to the right. (True)
11. If your arrows go consistently low, move your point of aim up. (True)
12. It is not necessary to hold the follow-through position as it has no effect on the flight of the arrow. (False)

III. Common Errors: The following are common errors in shooting. The possible answers are the directions an arrow may take when an error is committed. Indicate the appropriate arrow direction.

A. High B. Low C. Right D. Left

13. Third finger not on the string. (A)
14. Flinching the bow arm. (D)
15. Squeezing the arrow. (D)
16. Hunching the bow shoulder. (C)
17. Dropping the bow arm on release. (B)
18. Plucking the string on release. (C)
19. Arrow nocked low. (A)
20. Tilting the bow to the left. (D)
21. Failure to anchor under chin. (A)
22. Creeping. (B)
23. Failure to come to a full draw. (B)
24. Elbow of draw arm lowered on release. (B)

25. Aiming with nondominant eye. (D)
26. Releasing while string is away from face. (D)
27. Failure to anchor under jaw. (A)

IV. Multiple Choice:

28. By what part does an archer pick up an arrow?

a. feathers
*b. nock
c. crest
d. shaft

29. What is the term used to denote putting oneself in position to shoot?

*a. stance
b. approaching the line
c. addressing the target
d. readiness

30. What is the fourth step in shooting?

a. release
b. aim
c. nock
*d. anchor

31. What should one do when removing arrows from the target?

a. place one hand on the target, the other hand on the shaft of the arrow.
b. make sure no one is immediately in front of the target.
c. call out the score of the arrow being removed.
*d. all of the above.

32. Which end would be most characteristic of consistent form?

a. six in white
b. six off target
c. six scattered on target
*d. six in lower right portion of the target

33. How would a freestyle archer adjust his sight if his arrows were low and left?

a. higher and towards bow
b. higher and away from bow
c. lower and towards bow
*d. lower and away from bow

34. An archer's arrows are grouped at 4 o'clock. Why is this an important accomplishment?

a. consistency is very important in archery
*b. grouping shows that the shooter has established consistent form in shooting.
c. only a small adjustment needs to be made with his/her point of aim for him/her to group his/her arrows in the gold.
d. grouping shows that the archer is releasing each arrow the same way.

35. If you were teaching a beginner, which mistake would you correct first?

a. titled head
*b. hyperextended elbow
c. poor chin anchor
d. improper grip

36. Which of the following would be most likely to cause an arrow to go high?

*a. anchoring while the mouth is open
b. a head-on wind
c. creeping
d. sight placed too high

37. Why is holding an important part of shooting?

*a. it gives the bow arm a chance to become steady.
b. it will help reduce fatigue.
c. it helps the muscles increase in tension.
d. it gives the shooter time to "get set."

38. Which is the best position for the three fingers to grasp the string?

a. the first joint for all three.
b. first joint for index and middle finger and near the end for the third.
*c. as far to the ends as possible for all three.
d. above the first joint for all three.

39. In nocking

a. the cock feather should be on the bottom
b. the index finger is held around the bow
c. the back of the left hand should be sideways
*d. the arrow should be perpendicular to the bowstring

40. In releasing the string

*a. relax the string hand
b. move the string hand to the side
c. slightly tense fingers of string hand
d. drop bow arm slightly

41. Keep the bow arm elbow

a. straight and down to give stability
b. straight and out to give stability
c. bent and down to avoid hitting it
*d. bent and out to avoid hitting it

42. Holding means keeping

*a. an arrow at full draw while aiming
b. the follow through position after shooting
c. the wrist in the traditional grip
d. the wrist in the extended grip

43. Which best describes the proper way to address the target?

a. standing on shooting line facing the target
*b. astride the shooting line and looking toward the target
c. standing with feet together, shoulder toward target
d. astride shooting line with body toward target

44. How is the bow held when nocking the arrow?

*a. parallel to the group
b. perpendicular to the ground
c. in shooting position
d. in the opposite hand

45. What fingers are used to draw the bow?

*a. thumb and index
b. index, second, and middle
c. second and third
d. all four

46. In shooting long distances, where should the point of aim be?

*a. well above the target
b. on or near the target
c. in front of the target
d. at the bull's eye

47. Which statement is best applied to the anchor point?

*a. it must be consistent
b. it is constantly changing
c. it determines the distance the arrow travels
d. it varies with the individual

48. When should an archer remove his/her hand from the anchor point?

a. when the arrow is released
*b. when the arrow hits the target
c. when the arrow is on its way
d. when the draw is completed

APPENDIX F

Mean Scores of Performance Measures

| Daily Repeated Measures | Block Means: Group Condition $B_1$ | $B_2$ | $B_3$ | $B_4$ | Individual Condition $B_1$ | $B_2$ | $B_3$ | $B_4$ |
|---|---|---|---|---|---|---|---|---|
| Percent Possible Score | 19.7 | 20.2 | 27.7 | 33.9 | 21.5 | 28.2 | 34.2 | 38.1 |
| Percent Hits-On-Target | 39.0 | 51.9 | 56.7 | 70.9 | 46.9 | 57.5 | 67.3 | 76.1 |

| Post-Test Measures | Means: Group Condition | Individual Condition |
|---|---|---|
| Percent Poss. Score (25 yds) | 20.4 | 19.8 |
| Percent Hits-On-Target (25 yds) | 52.8 | 42.0 |
| Percent Poss. Score (30 yds) | 15.2 | 10.0 |
| Percent Hits-On-Target (30 yds) | 34.1 | 24.8 |
| Judges' Rating | 16.09 | 16.32 |
| Written Knowledge Test | 25.91 | 24.64 |