The Effects of Three Styles of Teaching on University Students' Motor Performance

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The effects of three teaching styles (command, practice, and reciprocal) from Mosston's Spectrum of Teaching Styles were investigated in terms of motor skill acquisition and retention of a selected shooting task. University students (N=135) enrolled in nine riflery classes were randomly assigned by class to one of three treatment groups. A 3x6 (Teaching styles x Sets of trials) ANCOVA, with repeated measures on the last factor and pretest performance as the covariate, revealed a significant group-by-trials interaction. Command and practice styles were significantly superior to the reciprocal style in terms of skill acquisition and retention. Discussion addresses not only previous research on Mosston's styles but also the research in teacher effectiveness and selected motor-learning constructs.

There are many conceptual frameworks that have attempted to describe and organize the processes involved in teaching (Briggs, 1977; Dick & Carey, 1978, 1985; Flanders, 1970; Gagne, 1977; Joyce & Weil, 1972; Mosston, 1966, 1972; Mosston & Ashworth, 1986; Wessel & Kelly, 1986). The value of such frameworks is threefold: (a) to assist teachers by giving them a structure from which to build their unit and lessons plans, (b) to assist researchers by providing a model to aid in designing and conducting systematic inquiry, and (c) to assist supervisors in providing feedback to teachers.

In addition to these conceptual frameworks, there also exists a body of literature related to the instructional effectiveness of teachers. The frameworks and effective teaching behaviors cannot be viewed separately as both contribute to the teaching and learning environment. Based on research from the last 20 years, there is clear evidence that the skills of effective teachers differ from those of ineffective teachers (Brophy, 1982). Within physical education, the process-product research has provided specific teaching behaviors associated with student achievement: (a) high percentage of class time devoted to content; (b) appropriate and considerable practice; (c) successful practice; (d) high expectations of students; (e) minimal wait, transition, and management time; (f) student accountability; (g) supportive learning environment; and (h) direct instruction (task-oriented, clear statement of goals, demonstration and explanation of task, teacher-controlled, closely monitored, immediate and task-related feedback) (Ashy,

In Mosston’s framework, the Spectrum of Teaching Styles, many of the behaviors that differentiate effective from ineffective teachers are interwoven into the teaching styles. For example, direct instruction, which is described as task-oriented and teacher-controlled, is closely akin to Mosston’s command style and similar to the practice style.

The Spectrum of Teaching Styles has been widely employed and has undergone a series of refinements since its conception in the mid 1950s (Goldberger, Gerney, & Chamberlain, 1982; Mosston & Ashworth, 1986). Briefly, Mosston’s framework can be described as a series of decisions related to the teaching-learning process. These decisions are made by the teacher, the student, or some combination of the two. The decision makers change along a continuum from Style A (command style), where the teacher makes all the decisions, to Style J (self-teaching style), where the student makes all the decisions. Mosston organized decisions regarding the teaching-learning process into three sets: (a) preimpact (before instruction occurs, related to planning decisions), (b) impact (during the instruction, related to execution decisions), and (c) postimpact (after instruction, related to assessment decisions) (Harrison & Blakemore, 1990). Thus far, 10 teaching styles have emerged as a result of this decision-making chain. For a more complete discussion of the 10 styles and the role of decision making, see Mosston and Ashworth (1986).

Much of the research that has utilized the Spectrum of Teaching Styles in process-product research paradigms was the result of projects and doctoral dissertations in the 1970s (Bryant, 1974; Chamberlain, 1979; Dougherty, 1970; Gerney, 1979; Virgilio, 1979). For the most part, these studies yielded inconclusive findings regarding the link between selected styles of teaching and students’ performance (Goldberger, personal communication, June 5, 1990). Goldberger et al. (1982) identified a list of common concerns that may have contributed to these findings:

1. the length and distribution of training was insufficient to produce meaningful results; (2) styles theoretically parsimonious were hypothesized to have widely disparate results; (3) often the investigators did not fully appreciate the theoretical intricacies of the styles under scrutiny and, as a consequence, the treatments lacked fidelity between theory and implementation; (4) the dependent measures lacked reliability; (5) the same teacher, who was often the investigator, taught only one intact group per treatment; (6) extraneous variables, known to interact with teacher behavior variables, were not systematically controlled. (p. 117)

Goldberger (1983) reported the results of three studies that investigated the effects of three styles (Style B—practice, Style C—reciprocal, and Style E—inclusion) on the psychomotor performance and social development of fifth-grade children. Results indicated that (a) all three styles facilitated learning a motor task, (b) Style B produced the highest motor skill attainment, and (c) Style C enhanced short-term social development in terms of increased social interaction with peers. In contrast to the findings of the projects and dissertations of the
1970s, which were for the most part inconclusive, this series of studies provided clear evidence that "data-based linkages can be established between selected teaching styles and specific learning outcomes" (Goldberger, 1983, p. 222).

Therefore, with the exceptions of Goldberger's (1983, Goldberger et al., 1982) work and a small group of projects and dissertations, limited research has been conducted on the impact of Mosston's teaching styles on motor skill acquisition and retention in field settings.

Based on Goldberger et al.'s (1982) list of common concerns, the present study was designed to (a) use a dependent variable that was deemed reliable and valid (e.g., a riflery score), (b) systematically control selected teacher-behavior variables (e.g., feedback, practice time) known to affect student performance, (c) use the same teacher for all intact groups in order to ensure consistency of instruction among classes, (d) apply a validation technique to the task sheet, (e) have students verify their assigned treatment protocols (teaching styles), (f) utilize a field-based setting, and (g) apply a retention phase to the experiment so that short-term learning could be addressed.

The purpose of this study was to investigate the effects of three teaching styles (Style A—command, Style B—practice, and Style C—reciprocal) on the acquisition and retention of a shooting task.

Method

Subjects

One hundred and thirty-five university students, ranging in age from 18 to 23 years and enrolled in one of nine riflery classes, were subjects for this study. Each class was randomly assigned to one of three treatment conditions (command, practice, and reciprocal), which resulted in three classes per treatment. There were 27 males and 18 females in the command group, 26 males and 19 females in the practice group, and 27 males and 18 females in the reciprocal group.

Although the subjects agreed to participate in the study at the outset, none were informed about the exact nature of the study until after the data were collected. Subjects were debriefed and given the option of having their shooting scores withdrawn from the data set after the data were collected.

All but 6 subjects, 2 in each condition, were right-handed. Several subjects wore corrective lenses: 2 in the command group, 2 in the practice group, and 1 in the reciprocal group. All subjects were screened for contralateral eye-hand dominance as this condition has a detrimental effect on shooting performance (Daniels & Landers, 1981; Porac & Coren, 1976). No one was disqualified due to this condition. None of the subjects reported having previous experience shooting in the kneeling position.

One instructor, knowledgeable in position shooting and who had received training in the teaching styles, taught all nine classes. Standardized lesson plans and practice schedules were followed to ensure that all classes received the same content and practice opportunity.

Context and Task

This field-based study was conducted using university students in a class setting. The participating subjects were students in riflery classes in the basic
physical education program. Christina (1989) recommended that researchers collect data in applied settings as these findings could be more readily utilized by practitioners. The integrity of the teaching-learning environment was maintained, and the only variation was the application of the three teaching styles selected for study. The subjects shot from the kneeling position as prescribed by the *Basic Smallbore Rifle Guide* (1985).

**Equipment and Scoring**

The rifles used in this study were Model 54 Anschutz Savage smallbore target rifles with competition stocks. Additional shooting equipment consisted of canvas shooting jackets, slings, shooting gloves, kneeling rolls, and ear protectors. Telescopes, positioned behind each shooting station, were used to sight-in the rifles and provide knowledge of results (KR) feedback. The targets were 11-bull Conventional Targets (A-17), approved by the National Rifle Association. The range was a 4-point, 50-foot indoor facility.

Shooting scores, the dependent measure, were based on accuracy. Scores were obtained by measuring the closeness of each shot to the center of the target. The total shooting score was a composite of five shots (each shot being worth 10 points). For a more complete discussion of the scoring procedure for the A-17 target, see Boyce (1990a).

**Procedures**

*Task Sheet.* A task sheet for the kneeling position was developed and validated. Prior to the study, a list of the most frequently occurring mistakes of beginning shooters in the kneeling position was compiled. That list was then compared to the characteristics of the kneeling position found in the *Basic Smallbore Rifle Guide* (1985). By combining these two sources, a list of 12 characteristics of the kneeling position was devised.

Concurrent validity was calculated by comparing the shooting scores of a pilot study (N=45) to their scores on the task sheet across five sets of shooting trials. A correlation coefficient of $r(225)=.69, p<.0001$, fell within the moderately high range of .60 to .79 (Safrit, 1990). Because the task sheet only covered positional characteristics and could not address the actual steadiness of the shooting position, the moderately high coefficient was deemed acceptable for the purposes of this study.

*Verification of Protocol.* The subjects provided verification of protocol by answering questions that identified the decision makers during the application of the command, practice, and reciprocal styles. The questionnaire, based upon Mosston and Ashworth’s (1986) “Anatomy of the Style,” also elicited the subjects’ reactions to the particular styles they were exposed to during the course of the research. (This questionnaire is available upon request to the author.)

*Description of the Teaching Styles.* Mosston and Ashworth (1986) pointed out that Styles A–J have been identified as landmark styles due to the exactness of their nature and mutual exclusiveness related to decisions and decision makers. However, sometimes the situation in the gymnasium, not the style, dictates who makes selected decisions. When this occurs, adjustments made to the decisions fall under the “canopy” of A or B depending on the proximity to the particular landmark style. . . . For example, a common condition in gymnastics is that
the location of an apparatus determines the location of the activity; therefore, when style B is used, the learner does not make a location decision. (Mosston & Ashworth, 1986, p. 237)

The differences among command, practice, and reciprocal styles involve a shifting of decision makers from teacher to learner (from command to practice) and from learner to doer (from practice to reciprocal) during the impact set. The shift in decision makers occurs in nine categories: (a) posture, (b) location, (c) order of tasks, (d) starting time per task, (e) pace and rhythm, (f) stopping time per task, (g) interval, (h) attire and appearance, and (i) initiating questions for clarification (Mosston & Ashworth, 1986). Of the nine categories, the decision related to posture was not shifted to the learner or doer because posture (i.e., the kneeling position) was "a part of the subject matter" (Mosston & Ashworth, 1986, p. 39). In addition, the decision of location was not given to the learner or doer due to safety considerations. However, the remaining seven categories followed the guidelines established by Mosston and Ashworth (1986).

The present study used a single task, with subjects arranged in groups of four. Therefore, the decision regarding the order of tasks was changed to the subjects’ deciding their own order (who would go first, second, etc.). In addition, decisions about the starting time per task were changed to the starting time of each subject within the group performing the task.

The following is a brief description of the three styles utilized in this investigation, including deviations (which fell under the canopy) from the styles. For a more detailed explanation of these three styles, see Mosston and Ashworth (1986).

Style A (command) is characterized by all decisions, from preimpact through postimpact, being made by the teacher. Because stopping a group of shooters in the middle of a shooting sequence is unwise from a safety standpoint, the instructor delivered group knowledge of performance (KP) and reinstruction between shooting relays (when one group of subjects finished shooting and before the next group began firing).

Style B (practice) offers the learner an opportunity to make some impact decisions without infringing upon high on-task time. The teacher still makes all the preimpact and postimpact decisions, but the learner, under the guidance of the teacher, makes selected impact decisions (e.g., the shooting order of the subjects within each group). This style allows for some individualization of instruction. The instructor delivered KP on positional characteristics. The KP was systematically provided twice during each set of trials (a set of trials consisted of eight shots: three for warm-up and sighting and five for score). For the purposes of this study, the task sheet was used to remind students of the proper technique.

Style C (reciprocal) is similar to the practice style regarding the impact decisions. The primary difference between the two styles is the element of assessment (a postimpact decision). In Style C, the assessment was delivered by a designated partner (student observer), who applied the task sheet and delivered KP feedback to the shooter after every shot. Further, the teacher’s role changed because the teacher did not confer directly with the individual student but with the student’s partner. However, the instructor still explained and initially demonstrated the kneeling task prior to the partner’s application of the task sheet.

Design. Prior to the shooting task in the kneeling position, all subjects received 3 weeks of shooting instruction and practice in the prone position as well as a safety
orientation. The prone shooting task functioned as an orienting task preceding the experimental (kneeling) task. During the orienting task, all subjects were trained under a combination of command, practice, and reciprocal styles (without the benefit of a task sheet), with the command style receiving the greatest emphasis.

All subjects were pretested on the kneeling shooting task. Standardized instructions, a safety orientation, and a demonstration of the kneeling position were given prior to the pretest. Information on KR and KP was withheld during this phase. Following the collection of the pretest data, the appropriate teaching styles were imposed.

The data-collection protocol included seven sets of trials: (a) one set of pretest trials, (b) five sets of skill-acquisition trials, and (c) one set of retention trials. A set of trials consisted of three shots for warm-up and sighting and five shots for score. Subjects in all three conditions fired a total of 35 shots for score plus sighting and warm-up shots. The pretest and acquisition sets of trials spanned 3 weeks, 2 days per week. A set of retention trials ensued 7 days following the last set of acquisition trials. The highest possible score on the target for one set of trials was 50 points (10 points per shot).

The provision of KR feedback (e.g., the score and location of each shot) to subjects in Styles A, B, and C was delivered to the shooter after each shot by a student with a telescope located behind each shooting station. Normally, KR can be determined by the performer through a visual source (e.g., seeing the basketball go in the basket). However, in target shooting the shooter cannot see where the shot hit the target. In addition, subjects were also given terminal KR feedback, which consisted of a total shooting score, following the completion of each set of acquisition trials.

The researcher’s decision to deliver KR uniformly across the three teaching styles was based on feasibility. As previously described, the subjects in the command group received group KP feedback between relays; if the instructor would have been required to deliver the KR, this would have resulted in 32 KR (4×8, Shooters × Shots) feedback instances in addition to the eight observations of KP feedback. A similar situation would have occurred in the practice group. Therefore, the delivery of KR feedback was deemed not feasible, and KR was delivered uniformly across all three teaching styles.

Performance scores were recorded for all sets of trials. Opportunity for practice and weapon usage was standardized. All subjects were encouraged to give their best effort on the shooting task regardless of the condition applied. For motivation, subjects were informed that their shooting performance would count toward their grades. The research protocol outlined in the present study is similar to the one applied in Boyce (1990a).

The pretest, acquisition, and retention sets of trials were analyzed in a 3×6 (Teaching styles × Sets of trials) ANCOVA, with repeated measures on the last factor and pretest performance as the covariate. Follow-up procedures included simple main-effects tests and Tukey’s Honestly Significant Difference (HSD) post hoc procedure (Hays, 1981).

Results

Skill Performance

To test the effects of the three teaching styles upon shooting performance, a 3×6 (Styles × Sets of trials) ANCOVA, with repeated measures on the last factor
and pretest performance as the covariate, was computed. A multivariate $F$ test utilizing Wilks's lambda was applied to the interaction. Main effects were tested using a univariate $F$ test, which required certain assumptions about the variance-covariance matrix in the repeated-measures design (Norusis, 1988). Further, when the symmetry conditions were violated as determined by Mauchly's test of sphericity, the Greenhouse-Geisser epsilon was used to adjust the degrees of freedom. This epsilon was applied when both the obtained $F$ value and the sphericity test were significant.

There was a significant styles-by-trials interaction, $F(10,256)=2.68, p<.01$. When group means were examined across the six sets of trials, they did not appear to follow the same skill acquisition and retention patterns (see Figure 1 and Table 1). Simple main effects were tested using one-way ANOVAs and Tukey's HSD post hoc procedure. Simple main effects for each teaching style revealed that the command, $F(5,220)=14.25, p<.001$, practice, $F(5,220)=15.73, p<.001$, and reciprocal, $F(5,220)=2.31, p<.05$, styles facilitated significant skill improvement across the six sets of trials.

Differences among the three styles at each trial were also computed using one-way ANOVAs and Tukey's HSD post hoc procedure. The findings revealed nonsignificant differences at Sets 1, 2, and 3, but at the fourth set of trials, a simple main-effects test revealed a significant difference, $F(2,132)=9.14, p<.001$. When Tukey's HSD post hoc procedure was applied, the command and practice styles were significantly superior to the reciprocal style at the $p<.05$ level. Similarly, at the fifth set of trials, a significant difference was revealed, $F(2,132)=9.04, p<.001$, and Tukey's HSD post hoc procedure indicated that the command and practice styles were significantly superior to the reciprocal style at the $p<.05$ level.

![Figure 1](image_url)  
Figure 1 — Teaching-style groups across the seven sets of trials (shooting scores of 0 to 50 points). Means are adjusted on the pretest covariate.
Table 1

Adjusted Mean Performance Scores and Standard Deviations Across Treatment Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pretest</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Command</td>
<td>23.53</td>
<td>7.25</td>
<td>32.05</td>
<td>8.06</td>
<td>36.78</td>
<td>6.29</td>
<td>36.31</td>
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<tr>
<td>Practice</td>
<td>24.16</td>
<td>9.51</td>
<td>30.12</td>
<td>8.81</td>
<td>34.18</td>
<td>5.79</td>
<td>36.16</td>
</tr>
<tr>
<td>Reciprocal</td>
<td>22.98</td>
<td>11.45</td>
<td>31.99</td>
<td>7.92</td>
<td>35.01</td>
<td>6.96</td>
<td>33.85</td>
</tr>
</tbody>
</table>

Note. Total score possible per set was 50 points. The pretest was the covariate. Standard deviations were not adjusted. N = 45 per group.
During the retention set, a simple main-effects test revealed a significant difference, $F(2,132)=6.53$, $p<.005$, and when Tukey's HSD post hoc procedure was applied, the command and practice styles were significantly superior to the reciprocal style at the $p<.05$ level.

A main effect for teaching styles was significant, $F(2,131)=6.29$, $p<.003$, indicating that the treatment had a different effect upon overall shooting performance. The command style had the highest adjusted mean ($M=36.86$), followed by the practice style ($M=35.68$), and the lowest adjusted mean was exhibited by the reciprocal style ($M=33.88$).

Further, a main effect for trials and the sphericity-test finding were significant, and degrees of freedom were adjusted, $F(4,580)=23.11$, $p<.0001$. Differences among trial means were tested using Tukey's HSD post hoc procedure, which indicated that groups improved significantly over the six sets of trials.

Verification of Protocol

The results of the verification of protocol varied according to the style group, who supplied the verification data. The verification scores were calculated by scoring each student's answers to Questions 1-15 and computing group averages. The command group reported the highest average verification score of 97%. The average score for students in the reciprocal style was 90%. The practice-group yielded an average score of 87%. In addition, the questionnaire posed 3 open-ended questions that sought students' reactions to the styles imposed during the five sets of acquisition trials. These responses were recorded and tallied and will be addressed in the discussion section as they assist in the interpretation of the research findings.

Discussion

This study investigated the effects of three selected teaching styles on the acquisition and retention of a shooting task. Because practice time was held constant across the three groups and opportunity for outside practice was minimized due to the uniqueness of the task, the research findings cannot be attributed to variation in practice opportunity. Therefore, other reasons must be offered for these findings.

When a significant main effect for trials was revealed, Tukey's post hoc procedure indicated that as trials progressed, the performance scores increased. This improvement in performance scores was attributed to a practice effect.

A significant interaction effect between groups and sets of trials indicated that differing skill-acquisition and retention patterns existed among the three teaching-style groups. A follow-up test that examined individual teaching styles across the six sets of trials indicated that all three styles facilitated motor skill acquisition and retention. This finding was supported by the research on teacher effectiveness because many of these effective behaviors (e.g., student accountability for learning, considerable practice opportunity, initial teacher explanation and demonstration of task, immediate and task-related feedback) were inherent in the present study across all three treatment groups. Further, when the groups were examined at each set of trials, the findings revealed that the command and
practice styles were significantly superior to the reciprocal style at the fourth, fifth, and retention trials.

Goldberger’s (1983) research revealed that the practice-style group had higher posttest scores when compared to the reciprocal style. Although these two groups did not differ significantly in Goldberger’s (1983) work, these findings suggest support for the results of the present study. However, the subjects in Goldberger’s (1983, Goldberger et al., 1982) studies were fifth graders, and caution must be exercised when comparing university students and fifth graders as the two age groups are at different developmental levels.

In addition, research related to direct instruction also supports these findings as both the command and practice styles contain similar elements regarding direct instruction (e.g., teacher control, clarity of task expectations, demonstrations and explanations, immediate and task-related feedback). Research on direct instruction revealed that when the goal of instruction was the acquisition of a basic skill, then the direct teaching style was superior to learner-centered instruction (e.g., reciprocal style) where students instructed one another (Brophy, 1982; Gage, 1978; Graham & Heimerer, 1981; Oliver, 1983).

From the results of the follow-up tests that examined groups at each trial, it appears that the reciprocal style did not elicit the same high skill performance as the command and practice styles. From a teaching-learning perspective, one might surmise that the immediate, formative KP feedback provided by a peer in the reciprocal style would enhance closed-skill acquisition, especially if students were in a beginning stage.

The answer to this puzzle was provided, in part, by the subjects’ responses to the open-ended questions in the questionnaire. The students in the reciprocal group wanted to know why the teacher only spoke to the partner and not directly to the shooter. Almost half of these students (42%) reported that the task sheet was helpful but that their partners didn’t know anything more about the kneeling position than they did. Perhaps these students wanted to receive information directly from the instructor, and when they only received information from the partner, maybe it was not valued.

Apart from the students’ comments, some additional explanations can be offered for the students’ inferior performance under the reciprocal condition. It is possible that the constant KP feedback (after every shot) on the positional characteristics actually interfered with shooting performance in three possible ways. First, an “audience effect” may have occurred, and students may have turned in poorer scores as a result of too much attention. Second, partner feedback was KP, not KR. Perhaps the shooter was not interested in this type of process-related KP, and KP may have actually interfered with the processing of KR (especially as the shooter was firing for points). However, the role of KP over KR in the acquisition of closed motor skills has been demonstrated in the literature (Del Rey, 1972; Gentile, 1972; Robb, 1968; Wallace & Hagler, 1979).

Third, the KP feedback after every trial may have caused dependence on the partner’s feedback, detracting from learning by limiting the subjects’ utilization of their internal sensory-feedback systems for error detection and correction (Ho & Shea, 1978; Weinstein, 1987). Further, Schmidt (1988) cited the “guidance hypothesis,” which stated that learners who received feedback from partners on task performance may not process the task at a level that strengthens learning. This hypothesis regarding the dependence upon the partner’s feedback could
possibly be attributed to the reciprocal group’s lesser performance during the retention trials.

In the command-style group, over 50% reported that although they knew that their shooting scores improved, they disliked the way the class was taught. They disliked the public nature of the group KP feedback (even though students were not singled out) and having to stop between relays for KP feedback and reinstruction when “a few people were having problems.” This reaction was probably magnified as these students were exposed to a combination of command, practice, and reciprocal styles during the prone shooting task (the orienting task), which preceded the kneeling unit.

In retrospect, the researcher cannot question the performance results of the command group. This method has been widely used in high-risk military settings. However, the choice of teaching styles depends on the desired learning outcome (e.g., skill performance, social); certain teaching styles may yield results (e.g., a shooting score) that can be immediately and quantitatively measured. From the results of this study, it appears that if a teacher wants to elicit skill improvement and short-term learning in a task that is closed and target-oriented, then the command or practice style might be an appropriate choice. However, a different type of motor skill (e.g., open skill) may benefit from other types of instructional strategies and styles. The effectiveness of a selected instructional strategy and/or style may be dependent not only on the type of skill but also on the age and/or background (e.g., socioeconomic status) of the learner.

References


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