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TRANSFER OF DRIVING PERFORMANCE AS A FUNCTION OF TWO PRACTICE METHODS

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ABSTRACT

This research studied the transfer of driving performance from the range to the first hole of a golf course as a function of practicing a drill either in isolation of a playing context or in more of a playing context. The playing context group (n = 15) practiced the feet-together drill (a) with their pre- and post-shot routine, (b) while playing to three different targets and fairways, and (c) while being held accountable for the accuracy of their drives. The isolation group (n = 15) practiced the same drill without using their routines, or playing to different targets and fairways, or being held accountable for their driving accuracy. Both groups practiced the drill performing 45 driver swings per day over three successive days. The 45 swings were performed in the following order: (a) one full practice swing with feet together without driving a ball; (b) one full swing with feet together driving a ball; and (c) one full swing driving the ball with feet positioned as they usually are when playing. The male and female participants ranged in age from 18 to 22 years with an average handicap of 6.6. All participants were pre- and post-tested on the range on each of the three days. Ten minutes after the post-test on Day 3, all participants were also given a transfer test on the first tee of a golf course. Over the three days of practice both groups decreased their swing speed and ball speed, and reduced the club-head's angle of approach to the ball as well as the club-head face angle at impact. The group that practiced the drill in more of a playing context slightly improved their overall driving accuracy from the post-test on the range to the transfer test, but the group that practiced drill in isolation of the playing context experienced a significant decrement in accuracy. This finding is consistent with the prediction that transfer of training from the range to a golf course context is enhanced when students practice a drill more like they do when they play than in isolation of how they play.

Keywords: practice, transfer, golf, drills, learning

INTRODUCTION

Players at all skill levels practice drills to learn swing changes that will improve their play on the course. However, quite often what is not realized is that the way they practice a drill is as important for optimizing learning and the transfer of that learning as the drill they practice (Alpenfels & Christina, 2007; Christina & Alpenfels, 2002). Traditionally, teachers, coaches and players practice drills in isolation of the playing context (isolation method). With this method the drill is practiced first on the range in isolation of the things players typically do when they play such as using their pre- and post-shot routines, playing shots to different targets, or trying try to be as accurate as possible with each shot. Often drills are practiced using this method so that students can give their undivided attention to learning the swing changes being guided by the drill without being cognitively overloaded with having to think about other things to do while performing and learning from the drill. Some of the other things players do include using their pre- and post-shot routine, or playing shots to different targets, or making every shot count in terms of being as accurate as possible. Once the swing changes guided by the drill can be performed reasonably well, students should practice on the range to learn to combine the swing changes with other things that they ordinarily do when they play before they actually trying to combine them on a course. However, quite often the latter step is omitted and students try to transfer what they have learned from their practice of the drill in isolation of the playing context directly to their play on the course, which usually is less than effective.

An alternative practice method, which is less commonly used, is one in which drills are practiced more in a playing context. It is based on the long-known relationship between transfer of learning and similarity, which predicts that the greater the similarity between practice conditions on the range and playing conditions on the course, the greater the positive transfer of learning to the course. Advocates of this method argue that practice of a drill in combination with other things players do when they play leads to more effective transfer of learning from the range to the course than the isolation method (especially when step two of the isolation method is omitted) because it provides greater similarity between practice and playing conditions. Of course, advocates of the isolation method disagree. They argue that practicing a drill in more in a playing context would cognitively overload students with too much to do and think about, which would interfere with drill learning and produce less effective transfer from the range to the course than the isolation method. The purpose of this study was to test these opposing arguments for lower handicap players by comparing the effectiveness of these two methods of drill practice in relation to transfer of learning.

METHOD

Participants

Thirty experienced male (n = 25) and female (n = 5) students in the Professional Golf Management Program at Methodist University volunteered to participate in the study. Their

handicaps ranged from 1 to 15 (M = 6.6) and their ages ranged from18 to 22 years. Golfers were randomly assigned to one of two practice groups with the restriction that there be 15 participants in each group and they be balanced as much as possible in terms of gender and handicap.

Drill

The feet-together drill was used with the modification that the inside edge of the heels of feet be positioned about 6 inches apart during driver swings. This drill was used for four reasons. First, previous research (Alpenfels & Christina, 2004) had demonstrated that the drill was effective for making swing changes, especially in terms of improving swing path, launch angle, and number of hits on the center of the club face. Second, after the drill was explained and demonstrated, no further instruction was needed for the participants to effectively practice it. Thus, students could learn to make swing changes that were appropriate for them solely based on the movement feedback provided from performing the drill and seeing the outcome of their shots. Third, a variety of swing changes can be learned from practicing the drill such as changes in (a) hip and shoulder rotation (b) total body balance, (c) swing path, (d) launch angle, (e) number of center-face hits, and (f) control of swing speed to reduce "over-swinging." And fourth, the participants in the study had no previous experience using the drill.

Practice Groups

Participants in the isolation group practiced the drill independent of the playing context. They simply practiced the drill without using their pre- and post-shot routines. Moreover, they were not instructed to aim at or play to a target in the practice fairway and they were not held accountable for the accuracy of their drives. The other group practiced the drill more within a playing context. They practiced the drill in combination with their pre- and post-shot routines, while playing drives to targets in three different fairways, and were held accountable for the accuracy of their drives.

Study Design and Procedures

All participants began each of the three days of practice by warming-up as they typically do which included stretching, hitting some short and middle iron shots, and finishing with few practice swings with their own driver and then hitting five drives. After warming-up participants were pre-tested on the range using their own drivers to hit three drives. Participants were instructed to play each drive as though they were on a course engaged in medal play. Thus, they used their pre- and post-shot routines, played to a target in a simulated fairway on the range, and were held accountable for the accuracy of their drives.

Before taking swing measurements, participants took three practice swings in the testing environment to become familiar with the testing conditions. Then they hit three drives. Miss-hits, poor drives and drives involving equipment failures were repeated. Driver swing measurements were taken using the Titleist Performance Monitor and IClub Motion System (version 3.0). The accuracy of drives was recorded as follows: 1 = fairway; 2 = rough right or left; and 3 = beyond rough right or left; and 4 = miss-hit.

Following the pre-test, participants were given instructions on how to practice the drill according to the group to which they were randomly assigned. Three to six participants practiced at the same time while two instructors monitored them to be certain they were performing and practicing the drill as instructed. Instructors only gave feedback about how to perform and practice the drill. No other instruction, corrective feedback, or information about the study was given.

All participants practiced the feet-together drill in the following cycle of three: (a) one full practice swing performing the drill (without driving a ball) trying to learn from it; (b) one full swing driving a ball while performing the drill trying to learn from it; and (c) one full swing driving the ball while applying what they learned from the drill to their usual stance and set-up. This practice cycle was used because previous research (Alpenfels & Christina, 2007) had shown it to be a highly effective way to train to transfer swing changes learned from a drill to swings performed independent of the drill.

Each participant repeated this practice cycle of three 15 times with a two-minute rest break after the fifth and tenth time. This resulted in a total of 45 driver swings with 15 swings performed under each of the three conditions per day. The three days of practice produced a total of 135 driver swings with 45 swings performed under each of the three conditions.

After each cycle of three, participants in the isolation practice group recorded the trial completed with a check mark to keep track of how many trials they had completed. Those in the playing context group did the same thing except that instead of a check mark they recorded the accuracy of their drive when they were trying to apply what they learned from the drill to their usual stance and set-up (third part of the cycle of three).

About 10 minutes after participants completed their practice session each day, they were post-tested on the range. About 10 minutes after the post-test on the third day, participants were given a transfer test on the tee of the first hole of the Methodist University golf course. The post-test and the transfer test were the same as the pre-test, except that the transfer test was performed on the first hole of the golf course and the pre- and post-tests were performed in simulated golf course context.

RESULTS

The dependent measures analyzed by MANOVA included carry distance, swing speed, ball speed, launch angle, angle of approach, club-head face angle, club-head loft, swing path, hip and shoulder rotation, max-shoulder speed, X factor, max-X factor, and X-factor stretch. Since ordinal measurement was used to assess the overall accuracy of drives, a Chi Square test was used to analyze these frequency data. No significant differences ($p > .05$) between groups were found on the pre-test of Day 1 for any of the dependent measures. Thus, the two groups performed essentially the same on these measures at the onset of the study.

To determine if there were performance differences between groups over the three practice days a 2 x 4 (Groups x Days) MANOVA with repeated measures on the second factor was computed on the dependent measures taken on the Pre-test of Day 1 and Post-test of Days 1, 2 and 3. No significant effects were found for Groups or for the Groups x Days interaction ($p > .05$). However, a significant effect was found for Days (Wilks' Lambda F (24, 223.92) = 3.83, $p < .01$;

effect size = 27%). The univariate ANOVAs (using Greenhouse-Geisser df adjustments based on Mauchly's Test of Sphericity) revealed significant practice effects for ball speed (F (3, 84) = 4.95, p , < .01; effect size = 15%), swing speed (F (2.32, 64.99) = 15.45, p < .01; effect size = 36%), angle of approach (F (1.94, 54.31) = 9.56, p = .01; effect size = 25.5%), and club-head face angle (F (1.78, 49.83) = 5.95, p < .01; effect size = 17.5%). Post Hoc analyses revealed that (a) ball speed (BS) and swing speed (SS) decreased in mph from pre-test of Day 1(BS, M = 147.33; SS, M = 103.57) to post-tests of Days 3 (BS, M = 144.45; SS, M = 101.50); (b) angle of approach increased in degrees from pre-test of Day 1(M = -1.30) to post-test of Day 1 (M = -2.03), but then decreased on the post-test of Day 2 (M = .35) and finished on the post-test of Day 3 at M = -.06; and (c) there was no appreciable change in club-head face angle in degrees from pre-test (M = -3.18) to the post-test of Day 1 (M = -3.47), but it significantly decreased on the post-test of Day 2 (M = -2.41) and 3 (M =-.50). Thus, with practice both groups decreased their SS and BS and reduced the club-head's angle of approach to the ball as well as the club-head face angle.

Inspection of the driving accuracy data revealed that although the playing-context group hit the same number of drives in the fairway (24) on the pre-test as they did at the end of practice on the post-test of Day 3, they improved their driving accuracy by hitting eight fewer drives beyond the rough. The isolation group hit more drives in the fairway on the post-test of Day 3 (31) than they did on the pre-test (25) and hit four fewer drives in the rough and two fewer beyond the rough. However, the Chi-Square test indicated that the difference in driving accuracy between the groups was not significant (p > .05). Thus, both groups showed essentially the same improvement in overall driving accuracy as a result of practice.

To determine if the three days of drill practice under two different training conditions produced a transfer effect, a 2 x 2 (Groups x Transfer) MANOVA with repeated measures on the second factor was computed on the dependent measures taken from the post-test of Day 3 and the transfer test of Day 3. No significant effects were found (p < .05). The effect sizes for Groups, Transfer, and Groups x Transfer were 15.9%, 23% and 38.4%, respectively, which means that largest percentage the variance in the dependent measures can be accounted for by the interaction.

Although no appreciable difference in overall driving accuracy between groups was found on the post-test of Day 3, a significant difference (χ^2 (2, N = 90) = 8.44, p < .05; Yates correction for continuity, χ^2 (2, N = 90) = 6.50, p < .05) was found for overall driving accuracy between the two groups on the transfer test. Of the 45 drives hit, the playing-context group landed the fairway 25 times, in the rough 19 times and beyond the rough only once. The isolation group landed in the fairway 19 times, in the rough 16 times, and beyond the rough 10 times. It is interesting to note that overall accuracy improved slightly for the group that practiced more in a playing context from the post-test of Day 3 to the transfer test. Although this group hit only one more drive in the fairway on the transfer test, it reduced the number of drives that landed beyond the rough by six. Conversely, the overall accuracy substantially deteriorated on the transfer test for the group that practiced in isolation of the playing context. This group hit 12 fewer drives in the fairway, eight additional drives in the rough and four more drives beyond the rough on the transfer test. Thus, the playing-context group was able to maintain its overall driving accuracy on the transfer test and the isolation group was not.

DISCUSSION

It is not surprising that the two groups performed the essentially same on all the dependent measures taken because both groups practiced the same drill the same amount over the three days. Very likely, practicing the same drill made students' swings in both groups more alike than different. The only thing that could have caused a performance difference between the two groups was that one group practiced the feet-together drill in isolation of a playing context while the other group practiced the drill in more of a playing context. However, no evidence was found to indicate that the two practice conditions produced differential effects over the three days of training. Thus, no evidence was found to support the argument that practicing the drill in more of a playing context (i.e., in combination with the pre- and post shot routines; playing shots to different targets; and trying to be as accurate as possible on each shot) interfered with learning and driving performance. Indeed, if such interference occurred over the three days of practice, we didn't find it.

A significant difference between groups was found for overall driving accuracy on the transfer test, which took place on the first hole of the golf course. The group that practiced more in a playing context hit more fairways than the group that practiced in isolation of a playing context. And although the former group's drives hit the rough three more times than the latter group, it only hit one drive beyond the rough (unplayable, out of bounds or very difficult to play), whereas the isolation group hit 10. This finding is consistent with our (Christina & Alpenfels, 2002) previous prediction that greater transfer of training from the range to the golf course is likely to occur when students practice a drill more like they do when they play than when they practice a drill in isolation of the things they do when they play. Also, it is consistent with the effects found in the motor skills literature on practice, contextual interference, and transfer of learning (for reviews see e.g., Christina & Bjork, 1991; Rose & Christina, 2006, Chapters 9 & 12; Schmidt & Bjork, 1992).

It is interesting to note that the group that practiced the drill in isolation of the playing context was not able to maintain the level of overall driving accuracy they had achieved on Day 3 from the post-test on the range to the transfer test on the course. In fact, their overall driving accuracy became appreciably worse, whereas the accuracy of the group that practiced more in a playing context slightly improved. We suspect that this group's decline in driving accuracy was largely the result of not having the opportunity to practice the drill (or what was being learned from the drill) in combination with the things they usually do when they play (i.e., pre- and post-shot routine, playing to different targets, and shot accountability). When they were tested hitting drives on the course (transfer test), they had to combine these things (previous learning) with what they learned from practicing the feet-together drill (new learning) as they did on post-test of Day 3. However, the isolation group did not have the advantage of three days of practicing them in combination with the drill, whereas the group that practiced in more of a playing context did. Combining new learning with previous learning to produce successful performance (i.e., accurate driving) usually takes a considerable amount of practice for complex motor skills, which the isolation group did not have. In addition, both groups had to perform in an altered context (first hole of a golf course) on the transfer test. We speculate that practicing the drill in isolation of the playing context did not produce a level of learning that supported the transfer of driving accuracy

to an altered context. The resulting effect was a decrement in overall driving accuracy on the course for the group that practiced the drill in isolation of a playing context. Of course, further research is needed before the validity of our explanation can be ascertained. We certainly acknowledge that more research is needed not only to replicate this finding, but also to determine the extent to which (a) it can be generalized to higher handicap golfers as well as beginners, and (b) practicing in more of a playing context is appropriate for use with other drills.

APPLICATION

If the purpose of practice for lower-handicap golfers is to enhance the transfer of drill training from the range to play on a course, the drill should be practiced in more of a playing context on the range rather than in isolation of it using the cycle of three practice format (Alpenfels & Christina, 2007).

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