

Do Structures of Practice and Knowledge of Results Influence Learning and Performance?

Nicky Lumb

University of the West of England, Bristol, United Kingdom

Purpose:

Great practice is the key to outstanding play (Guadagnoli, 2009), yet despite the importance of efficient, and well-planned practice, research has generally neglected this vital area. The purpose of the quantitative investigations were to examine:

1. The retention effect of participation in practice sessions integrating blocked, serial and random practice compared to sessions involving just blocked practice.
2. The retention effect of combining blocked, serial and random practice with immediate additional knowledge of results (KR) in the form of the ball's landing distance compared to sessions where no additional KR was given.

Methods:

24 male participants (PGA Golf Professionals) aged between 23 and 41 were divided into 4 groups (6 players in each group).

Group 1 (Full KR) engaged in blocked, serial and random practice and when every ball landed participants were told the shot's landing distance. Group 2 (10ft KR) engaged in blocked, serial and random practice and when every ball landed participants were told if the ball landed within 10 feet of the target. Group 3 (Std KR) engaged in blocked, serial and random practice, and participants received no additional KR. Group 4 (Control) participants only engaged in blocked practice and received no additional KR.

The practice intervention involved a 10 ball Pre-test to random distances; 5 x 100 ball practice sessions; 10 ball Mid-test to random distances; 5 x 100 ball practice sessions; 2 day rest; 10 ball Post-test to random distances. Every shot was measured using a Flight Scope X2 Launch Monitor.

Results:

Descriptive data of the pre, mid and retention test results between the groups indicate that at pre-test, there were minimal differences between the four groups, with pre-test scores for the full KR group; $M = 1.83$ ($SD = 0.98$), 10ft KR group $M = 1.50$ ($SD = 1.38$), Std KR group $M = 1.67$ ($SD = 1.21$), and control group $M = 1.83$ ($SD = 0.75$).

Mid-test scores show a difference of one shot between the full KR group $M = 5.17$ ($SD = 0.75$) and the 10ft KR condition $M = 4.17$ ($SD = 1.60$), with another shot difference evident between the Std KR $M = 3.33$ ($SD = 0.52$) and the control group $M = 1.83$ ($SD = 0.75$). In addition, there was a three shot difference between the best performing full KR group ($M = 5.17$) and the least accurate control group ($M = 1.83$).

Retention test scores show further disparities with the full KR condition $M = 7.17$ ($SD = 0.98$) outperforming the other groups; 10ft KR, $M = 5.83$ ($SD = 1.83$), Std KR $M = 4.67$ ($SD = 1.03$), and Control $M = 2.83$, ($SD = 0.41$).

Repeated measures analysis of variance (ANOVA) with one dependent variable (number of shots to 10ft) and 4 levels of the independent variable (level of KR each of the 4 groups received) determined a main effect by group: ($F(2, 6)=109.224$, $p=.000$, $\eta^2=.845$). Further analyses signified a main effect between the groups by time ($F(2, 6)=8.994$, $p=.000$, $\eta^2=.574$) with Bonferroni post-hoc tests showing the following results in the pre, mid & retention tests:

Groups	t-test	Degrees of Freedom	P Value
Full KR v 10 feet KR			
Pre-Test	0.482	10	0.640
Mid-Test	1.384	10	0.197
Retention Test	1.569	10	0.148

Full KR v Std KR

Pre-Test	0.262	10	0.799
Mid-Test	4.919	10	0.001*
Retention Test	4.294	10	0.002*

Full KR v Control

Pre-Test	0.000	10	1.000
Mid-Test	7.67	10	0.000*
Retention Test	9.971	10	0.000*

10 feet KR v Std KR

Pre-Test	-0.222	10	0.828
Mid-Test	1.213	10	0.253
Retention Test	1.357	10	0.205

10 feet KR v Control

Pre-Test	-0.52	10	0.614
Mid-Test	3.229	10	0.009*
Retention Test	3.909	10	0.003*

Std KR v Control

Pre-Test	0.286	10	0.780
Mid-Test	4.025	10	0.002*
Retention Test	4.044	10	0.002*

Discussion:

1. The Structure of Practice

Repeated measures analyses of variance (ANOVA) showed significant differences between the Std KR group and Control group in both the mid and post-tests. This suggests if practices are serialized and randomized players have to process tasks at a deeper level (Schmidt, 1991) by generating a new action plan (Lee & Magill, 1985) for the next shot. This can reduce performance during practice but increases learning which was evident in the practice results and retention tests.

2. The Effects of Different Levels of Knowledge of Results

Repeated measures analyses of variance (ANOVA) showed significant differences between the Full KR group and the groups that did not receive additional KR at mid-test and post-test. This suggests additional KR after every shot improves players' sensory qualities and enables them to make precise adjustments to their movements (Schmidt, 2003). This helps players to execute their shots with greater accuracy more often and improves their long-term learning.

Practical Application/ Clinical Relevance:

The results suggest that the composition of practice and feedback (KR) can impact upon the retention of motor skills, and practice regimes should combine blocked, serial and random practices with precise and immediate feedback. This is likely to accelerate players learning and lead to faster, more efficient skill acquisition. This should enhance players on course performances, lead to lower scores and result in greater competition success.

References:

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