ISSN 0126-1969

Volume 29, Nomor 03, Desember 2004

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Forum Pendidikan	Vol 29	No. 03	Hlm. 207 - 318	Padang Desember 2004	ISSN 0126-1969

FORUM PENDIDIKAN

Volume 29, Nomor 03, Desember 2004

Penerbit:
Universitas Negeri Padang Press

Alamat Redaksi:
Lantai III Gedung Rektorat UNP
Kampus UNP Air Tawar Padang
Telp. (0751) 51260
Terbit Sekali Empat Bulan
April, Agustus, Desember)
Terakreditasi
Kpts. Ditjen Dikti Depdiknas
No. 23a/DIKTI/Kep/2004
Tanggal 4 Juni 2004

ISI NOMOR INI

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COMBINED METHODS OF PHYSICAL PRACTICE (PP), KNOWLEDGE OF RESULTS (KR) AND MENTAL PRACTICE (MP) ON THE LEARNING OF A MOTOR SKILL

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Abstrak

Artikel ini didasarkan atas hasil penelitian pada mahasiswa yang mengikuti perkuliahan Bola basket Dasar pada Fakultas Pendidikan Olahraga dan Kesehatan, Padang. Tujuan penelitian adalah untuk mengetahui perbedaan hasil pembelajaran tembakan bola basket yang memakai metode berlatih, metode gabungan berlatih + panduan keberhasilan (PK), dan metode gabungan berlatih + PK + berlatih dengan pikiran (BdP). Hasil penelitian menunjukkan bahwa hipothesa nol ditolak.

Kata kunci: *Tembakan satu tangan, tembakan bebas, bola basket, panduan keberhasilan/knowledge of results (PK/KR), berlatih dengan pikiran/mental practice (BdP/MP).*

Introduction

Learning a motor skill is a complex process and achieving a high level of any particular motor skill can take years of training and practice (Grouios, 1992; Magill, 1994a). Most researchers agree that learners will progress through three stages in the learning of motor skills (Bueckers & Magill, 1995; Schmidt, 1988).

One of the goals for teachers and coaches is to facilitate this learning process so that passage from novice to expert can be made at a faster rate. It is essential that teacher, in order to facilitate the learning process, communicate effectively to learners at all stages.

The literature concerning motor learning reveals that there are number of methods and strategies used to enhance learning as well as

performance (Magill, 1994a; Schmidt, 1988). Two of the methods which can assist teachers and coaches in the teaching of motor skills to improve performance are known as knowledge of results (KR) and mental practice (MP). In this study a combination of physical practice (PP) with KR, and PP with both KR and MP were applied to the teaching of the basketball free throw using the one handed set shot technique.

Basketball is one of the practical subject taught to physical education students at the Faculty of Physical Education and Health Padang. One of the problems with this subject is how to enhance learning as well as performance of the students. Past methods of teaching experience of the one handed set shot technique have resulted in unsatisfactory performance. Therefore, it is necessary to improve or reform the methods used.

One of the basic and most important skills of basketball which must be mastered by every basketball player is free throw shooting. There are variety of ways to perform the free throw in basketball. One of these shots, the most common method, is the one handed set shot. Hay (1985) suggests that set shot is the logical technique to be learned first.

Many researchers explained that when an individual learns a new task or motor skill, he or she passes through a number of stages in the way it is performed. These stages are characterized by factors that occur at the beginning, middle, and final phases of skill development. These three stages are labeled consecutively as early or cognitive phase, intermediate or associative phase, and final or autonomous phase (Buekers & Magill, 1995; Magill, 1985; Rink, 1985; Sage, 1984; Schmidt,1975a).

One of the physical education teacher's main role is to be directly involved in helping others learn skills. Inherent in this role is the need to determine whether or not learning is taking place. Rink (1985) explained that learning itself is a phenomenon that is not directly observable. Learning can only be inferred from a learner's behaviour or performance since performane is observable, whereas learning per se is not. As a result, learning must be inferred on the basis of perfomance measures that posses certain characteristics. For example, scores should change over time as a result of practice and those scores should reflect improvement and also, as a result of practice,

performance should become less variable from day to day or trial to trial.

When learning motor skills, information must be processed by the learner. In the performance of each motor skill, an individual must gather information from different source (visual, verbal, and kinesthetic), make decisions about that information, and select a response that is deemed most appropriate for the situation.As learners progress through the stages of learning, they increase their capabiltiy for detecting their own errors and for making the appropriate adjustments to correct them. That is, the expert is capable of using the information provided be the sensory systems to perform the skill successfully, whereas novices are sometimes unaware or unable to use the information provided by the sensory systems. As a result, they use external information that enhances the sensory information to guide their actions (Buckers & Magill, 1995).

It is clear that feedback is an important aspect in general learning as well as in the learning of motor skills. Marteniuk (1976) explained that feedback is a general, all inclusive term concerning the information given to the learners about the performance of a skill while they are performing or after the skill is completed. This information is received through any one or combination of the sensory systems. Similarly, Newell, Carlton, and Antoniou (1990), and Silverman (1994) concluded that this kind of information can be categorized into the frames that relates to the action, that is presented prior to, during, and after actions. Furthermore, Magill (1985) explained that the term knowledge of results (KR) is often used synonymously and interchangeably with the term feedback. In fact, KR has been viewed as the single most powerful variable governing the acquisition of skills (Adams, 1971, Mc Cullagh & Little, 1990; Rink, 1985; Schmidt, 1975b; Sparrow & Summers, 1992).

Research findings have supported the importance of KR both as learning variable (Reeve, Dornier & Weeks, 1990; Schmidt & Young, 1991) and as a performance variable (Schmidt et al, 1989; Schmidt & Young 1991). That is, when KR is available, most individuals will master a given task. In other words, KR is necessary for learning to occur (Kernodle & Carlton, 1992; Magill, 1994b).

Mental activity, mental practice, mental training, and ideomotor training as means to improve the learning and performance of motor skills has been defined by many authors. This activity has been

recognized and, in fact, well documented as assisting the improvement of learning and performance (Grouios,1992; Hinshaw, 1991; Murphy, 1990; Zervas, 1986). These terms are also referred or connected to other terminologies such as simulation of motor behavior (Decety & Ingvar, 1990), mental rehearsal, symbolic rehearsal, cognitive rehearsal, covert rehearsal, imaginary or imagery practice, implicit practice, conceptualization, visualization, visio-motor training (Zervas,1986). Among these terms, Zervas (1986) explained that "mental practice" is mostly used by the USA authors whereas "mental training" and "ideo-motor training" are preferred by European authors.

Generally, all of these terms deal with some kind of "mental activity" without any observable movement. It has been suggested that mental images can be understood as products of the brain's information processing capacity (Hecker & Kaczor, 1988). Mental practice has been defined as the covert rehearsal of a physical skill in the absence of covert muscular movements (Wulf, Gernost & Choi, 1995). Therefore, individuals are involved in mental practice when they are imaging a skill or part of a skill, that is about to be performed.

Methodology

The design used the Pretest – Posttest Control Group Design (Gay, 1996). The subjects in this study were students from the the Faculty of Physical Education and Health Padang undertaking a beginning unit of basketball. There were 50 students (N = 50) in these classes. The first class had 16 students, the second class had 17 students, and the third class had 17 students.

These classes were randomly chosen into group 1, group 2, and group 3. Furthermore, these goups were randomly assigned to each of the following three groups:

A control group	(PP)
A treatment group 1	(PP + KR)
A treatment group 2	(PP + KR + MP)

Some students in the groups withdrew from classes during the treatment period. One students withdrew from the control group, two students withdrew from the treatment group 1, and two students withdrew from the treatment group 2. As a result, they were 45 students (N = 45) or every group had 15 students.

The design used a Pretest – Posttest Control Group Design. This was a true experimental design (Gay, 1996). This design will control most of variables concerned with both internal and external invalidity, except for the interaction of testing and treatment (Campbell & Stanley, 1963; Gay, 1996).

All testing took place on a standard basketball court using standard, approved equipment. In order to collect the data, tests on the free throw in the basketball were employed using the one handed set shot. This test is considered to be a valid measure of the free throw ability of players in basketball. This test has face validity (Burn, 1995; Gay, 1996) or logical validity (Thomas & Nelson,1985). The rating system explained by Wallace and Hagler (1979) had been employed in the study but with some modification. The modification is for the third, fourth, fifth, and sixth steps of the rating system (Marzuki, 1997).

In this study, the independent variables are KR and MP, whereas, the dependent variable is the performance of the basketball free throw using the one handed set shot. This study took place over of six weeks with each meeting lasting appoximately of 100 minutes.

Results

Following the practicing of the basketball free throw using the one handed set shot for both dependent and independent variables, it was found that all groups improved during this period. Comparisons were made on the pre-test and post-test scores to determine whether they had improved similarly. Table 1 depicts the performance of the group scores during the pre-test to post-test.

Anova confirmed that there were significant differences between the groups, $F(3.28) = 12.921$, $p < .0001$). The null hypothesis was, therefore, rejected as it indicated that the experimental groups had improved signifantly.

Table 1 Performance of the Group Scores
(N = 15 for each group)

Group	Test	Mean	SD	F	P
Control	Pre	31.200	3.278	12.921	<.0001
Control	Post	34.600	6.406		
Experiment 1	Pre	31.133	4.307		
Experiment 1	Post	39.600	4.239		
Experiment 2	Pre	30.933	4.044		
Experiment 2	Post	39.800	4.313		

In order to see the most significant difference between groups, comparisons were conducted at .05 significance level. Table 2 reveals the highest significance in improvement between the groups.

Table 2 Comparisons of Significance Level
(N = 15 for each group)

Group	Mean Diff	P	Sig at .05
CPre, Ex1 Post	- 8.400	0004	Significant
CPre, Ex2 Post	- 8.600	0002	Significant
Ex1 Post, Ex1 Pre	8.467	0003	Significant
Ex1 Post, Ex2 Pre	8.667	0002	Significant
Ex1 Pre, Ex2 Post	- 8.667	0002	Significant
Ex2 Post, Ex2 Pre	8.867	0001	Significant

Table 2 reveals that the experimental group 2 had the most significant difference among the groups (Ex2 Post, Ex2 Pre, P = .0001). Table 2 also shows that the experimental group 2 had improved slightly more than the experimental group 1 (Ex2 Post, C Pre, (P = .0002) < Ex1 Post, C Pre, (P = .0004). This improvement in the experimental group 2 is also reflected in each of the experimental groups (Ex2 Post, Ex2 Pre, (P = .0001) < Ex1 Post, Ex1 Pre (P = .0003. The improvement of each group between the pre-test and post-test can be seen clearly in figure 1.

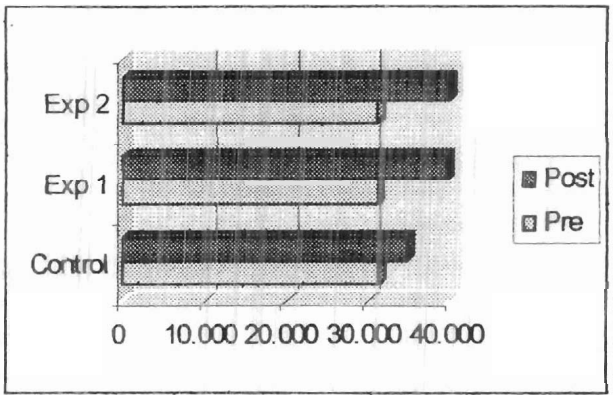

Figure 1 The Groups' Improvement between the Pre and Post-Tests

Figure 1, on the one hand, shows clearly that both the experimental group 1 (Practice + KR) and experimental group 2 (Practice + KR + MP) significantly improved in contrast to the control group. On the other hand, the experimental group 2 (Practice + KR + MP) improved slightly more than the experimental group 1 (Practice + KR).

Discussions

The purpose of this study was to examine the effects of using different methods of either physical practice (PP), physical practice and Knowledge of Results (PP + KR), and physical practice combined with both KR and mental practice (MP) (PP + KR + MP) on the performance of basketball free throw using the one handed set shot. It was hypothesized that there would be no difference between PP and PP + KR, or PP, PP + KR and PP + KR + MP to the performance of dependent variable.

The results of this study indicate that the null hypothesis was rejected. The treatment condition showed a significant differential improvement between pre and post-test. An analysis of performance differences between the PP group and the combined PP + KR indicates that the experimental group 1 (PP + KR) was more effective than the control group (PP). It is clear that learning the basketball free throw using the one handed set shot technique is enhanced when KR is provided to the learners. Information given as KR is considered to be the basis of error correction on the next trial which in turn can lead to

motivate learners to keep moving toward the goal and to a more effective performance as practice progress (Adams, 1987; Marteniuk, 1986; Travlos & Pratt, 1995; Winstein & Schmidt, 1990). This study, then, reveals additional evidence for the power of KR for learning a motor skill (Adams, 1971; Kernodle & Carlton, 1992; Lee, White & Carnahan, 1990; Magill,1994b; Mc Cullagh & Little,1990; Schmidt, 1975b; Schmidt & Young, 1991; Sparrow & Summer, 1992). It appears that providing KR is both beneficial and necessary for skill learning. "It is very difficult not to pay attention to KR in many motor learning tasks" (Lee et al., 1990: 207)

Practice seems to lead to consistent performance (Ziegler, 1987). In the present study, even though KR as a basis of error correction was not given to the control group, the subjects still could detect their own errors. That is, they gathered information from visual, kinesthetic, and audio sources. Since the present study was conducted outside the laboratory, it could not fully control the information received from other sources. This particularly affected the subjects in the control group as they observed information coming from friends or peers while they were practicing the skill. Ryan, Blakeslee & Furst (1986) explained that many behaviors are learned by observing others, ending up with a rugged estimation of the modeled behavior. It has been considered that modeling is one of the most effective means whereby individuals learn a variety of skills behavior, attitudes, and values (Weiss,1983). In light of this, the students developed a rough estimation of the actions demonstrated by another learner. It has also been shown that subjects might even be able to get a rugged estimation of "how hard", or "how easy", "how fast" or "how slow" an action is performed (Ryan et al., 1986).

The previous treatment, PP + KR, indicated the positive role of KR as a basis of error correction for developing an appropriate response on the next attempt. The addition of MP to the experimental group 2, PP + KR + MP, was predicted to produce the significant improvement over the control group and a slightly better performance than the experimental group 1. Mental practice has been theorized not only to play a key role in the planning and implementation of action but also to enable the construction of movement pattern in a continuous process of striving for perfection (Issac & Marks,, 1994). It has also been indicated that skill can be acquired or refined through MP (Mc Kay, 1981). Furthermore, Mc Kay (1981) hypothesized that

imagery affecting the higher order mental nodes in the central nervous system has a priming effect on the muscular movement nodes:

> *"Activating the lowest level movement nodes results in muscle movement, but activating a higher level node primes or partially activates the subordinates nodes connected to it, and this priming effects remains subtreshold until the triggering mechanism is applied. Only the mental nodes are activated during physical practice. Response time in the mental practice condition therefore measures in part the time to activate the mental nodes. ... As a consequence of a faster rate of priming, practiced or repeatedly activated nodes at any level in the system can be speeded up as a function of high level practice. This explains why mental practice have equivalent effects" (Mc Kay, 1981 : 281).*

Conclusions and Implications

This research was designed to evaluate the effects of PP + KR + M on the learning of the basketball free throw using the one handed set shot technique. Physical practice and KR significantly improved the performance of the skill. The KR given was effective and meaningful, that is, subjects understood clearly the correction provided to a specific part of a response and then, practiced this information appropriately in the following trial.

The study revealed that the addition of MP to the variable of PP + KR has a significant increase on the performance of the task. Therefore, the procedures treated in this study can be applied to learners beginning the basketball free throw.

It is suggested that further study needs to be conducted in laboratory conditions to investigate the relation of KR followed by MP to the function of perceptual trace (Adams, 1971) or recognition schema/schemata (Schmidt, 1975b).

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