THE EFFECT OF DIFFERENT FEEDBACK METHODS ON BADMINTON SKILLS ACQUISITION AND RETENTION

Tzetzis G., & Votsis E.,

Aristotelian University of Thessaloniki

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Abstract

This experiment investigated the effects of three corrective feedback methods using information about the correct, the errors and a combination of the correct and the errors of the execution on the acquisition and retention of two badminton skills with different complexity. The participants of this study were 48 young athletes all boys, 10-14 years of age with 2-4 training experience. They were divided in three equal groups and they were all received instruction for two badminton skills with different complexity: a) backhand-short-serve (simple) and b) forehand-long-serve (complex). The three groups received different instructions for the two skills and a) the first group received instructional cues for the correct (C) execution of the performance b) the second group received instructional cues on errors (E) of the execution and c) the third group received instructions on errors and how to correct them (E-C). The training program lasted 12-practice units. There was a pre-test, and a post test after the end of the training program which lasted ten weeks, as well as a retention test, after two weeks which measured the result of their performance. A two way analysis of variance ANOVA (3 groups X 3 measures) with repeated measures on the last factor was used to analyse the effects of the three practice methods of corrective feedback for the two badminton skills on their result (R) scores of their skill performance. After the analysis of the data it was found that group (C) increased the result scores (R) for both skills. Group E increased the result (R) scores of the simple skill. Group E-C increased the result scores (R) of the complex skill. It was concluded that physical education teachers or coaches in order to improve learning in teaching skills to young participants, should take into account the complexity of the skills and use positive corrective feedback with information for the correct execution and how to correct it.

Key Words: corrective feedback, complexity, acquisition, result, badminton skills.

INTRODUCTION

There is universal agreement in the motor learning literature that feedback is a critical constituent of learning. Magill, (1993) asserted that when we choose to move, the conscious brain using a collection of controls the action learned movements. For the movement to progress successfully, the athlete requires information feedback (Schmidt & Lee, 1998). Some motor behavior researchers have stamped feedback as being the most important variable controlling performance and learning (Bilodeau & Bilodeau, 1961). Sage (1984) noted that research invariably indicates that feedback increases the rate of improvement on new tasks enhances performance on over-learned tasks and makes tasks more interesting.

Badminton is a sport that demands execution of complex skills with repetition and great intensity, especially at the competitive level. A performance of the correct technique is very important for athletes' success from the early stage of learning. Fitts and Posner (1967) asserted that at the early stage of learning feedback is necessary for the correct execution of the skills. The great variability of skills in badminton require a lot and different kind of abilities, which makes coaches' effort much more difficult (Capello & Gonzalez, 2003). Knowledge of performance (KP) is the feedback type most frequently used by coaches and teachers and it tends to focus on kinematic variants. Pangrazi, (1997) suggested that average persons and especially kids have a limited ability to acquire, store and recall detailed data on a specific task. Well-organised instructions improve learning process and performance. It is also mentioned that specific instructions contribute to better performance quality in skill acquisition (Swinnen, Schmidt, Nicholson & Sharino, 1990). A coach has to decide what is the most basic error and give feedback for correcting it. When a player has understood and applied the feedback information to correct the mistakes then the coach must proceed

to the next point in question (Schmidt, 1993). Corrective feedback has to be specific regarding execution and is crucial to both the current performance and the task repeatability.

There are many factors concerning the correct use of feedback that may have a positive or negative effect on the performance. A lot of research was conducted on the type of feedback that is more appropriate for skill acquisition. Some researchers connected the effect of the type of feedback with the complexity of the skills or the stage of learning of the participants. There is a controversy on the type of feedback that is more appropriate in different skills and Magill (1998) stated that this depend on the complexity of the skills and the learning stage of the athletes. Kernodle and Carlton (1992) asserted that if the participants are in the middle stage of learning knowledge of performance combined with instructions on errors is more effective method for complex skills.

Many motor skills can be learned without augmented feedback. However, athletes will learn many of these more quickly or perform them at a higher level if they receive augmented feedback during practice (Magill, 1998). Research evidences (Newell, Quinn, Sparrow and Walter, 1983) showed that people who receive knowledge of result (information's about the outcome of performing a skill) during the execution of simple skills (single-degree –of-freedom movement), continue to improve their performance comparing them with those who received only task-intrinsic feedback. Additionally, complex skills that require a person to acquire an appropriate multi-limp pattern of co-ordination, knowledge of performance (critical components of the co-ordination pattern) can speed up skill learning process (Kernodle, Johnson, & Arnold, 2001).

Different kind of teaching methods applicator in augmented feedback, primarily because of the different roles augmented feedback can play in the skill acquisition process. When the coach is giving error information, feedback is functioning in its informational role related to facilitating skill improvement. However, when the coach is telling to the player what he/she did correctly, feedback has a more motivational role. Lintern and Roscoe (1980) stated that error information is more effective for encouraging skill improvement, but whether this feedback should be about errors or about correct aspects of performance, depends on the goal of the information. The cues that describe the critical elements of performance have two different dimensions: a) instructional cues on how to correct the technique and b) instructional cues on errors of the execution. There is a controversial research on the role that feedback plays in different complexity skills at the different stages of learning. Magill (1998) asserted that instructions about correct and errors of the movement should be given to novices or to athletes at the early stage of learning and this information is less useful at the autonomous stage.

Most of the studies are conducted in laboratories and the results are sometimes insufficient and difficult to implement in sport situations. This experiment was a field study on two fundamental badminton skills with different complexity and increases the ecological validity of the study.

The purpose of this study was to investigate the effects of three corrective feedback methods using different instructions on the acquisition and retention of two badminton skills with different difficulty in terms of result, for young participants of 10-14 years of age with 2-4 years training experience.

Method

Sample

The participants of this study were 48 young athletes, all boys, 10-14 years of age (M=12.6, SD=0.5), with 2-4 years of practice experience (M=2.8, SD=0.4), who were randomly selected and assigned to three equal groups.

Procedure

All participants were pre-tested on the two badminton skills with different complexity (simple – complex) as follows: a) backhand short serve (simple), b) forehand long serve (complex). The two badminton skills were categorised as simple (backhand-short-serve) and complex (forehand-long-serve) according to the participation of the number and coordination of muscles and joints and also, the number of way of motions that can make a particular muscle unit to move in a particular way (Bernstein, 1967).

All groups practiced and received instructions 2 times a week, for 12 weeks. There was a warm-up and a rest period before and after the practice period. At the beginning of every training session a demonstration was performed by an elite player and the coach answered any questions about the technique of the two badminton skills. Every practice lasted approximately 60 min. All players practiced on five exercises for each skill (Partemian, 2003; Paup & Fernhall, 2000; Partemian, 1993), and each exercise lasted 3 min. The total duration of the exercises was 30 min and the last 15 min the participants played game without any instruction called as a free game. The instructor gave corrective feedback, 10 times on each badminton skill, in every training session.

The three groups followed the practice from the same coach but they were instructed by three different methods of corrective feedback. The first group (C)

received positive feedback and instructional cues on how to correct the technique (e.g. 'very good stroke but you have to hit the shuttle at a higher level'). The second group (E) received positive feedback and instructional cues on errors of the execution (e.g. 'very good stroke but don't hit the shuttle at a low level' – Descriptive feedback). The third group (E-C) received positive feedback and instructional cues on errors and directions on how to correct them (e.g. 'very good stroke but don't hit the shuttle at a low level'. You must hit it at the higher level' – Prescriptive feedback). Examples of the three different instructional methods are described on table 1.

---------- Insert Table 1 about here ----------

During the training program there was a video recording from a distance of 8m at an ankle of 45^{o} for checking coach instructions, players attitude and the correct application of the teaching methods. The most important point for correct execution of the technique was noted first and the less important later (Schmidt, 1991). A pre-test was conducted during the first week, followed by a post-test at the end of the acquisition period and a retention test two weeks later.

Test Description

The purpose of the French short serve test (figure 1) measured the participant's performance ability executing the backhand-short-serve. To the one side of the badminton court the athlete was standing on the service line. On the other side, in the middle of the court there were small circles, which they separated the double service area in small pieces. Each piece in the court was marked with the appropriate point (1,2,3,4,5 points). The athlete had to execute twelve backhand-short-serve and the ten best attempts were counted. The participants received the points according to where

the shuttle was landed. There was a tightrope over the net in a 20 cm distance. If the participants hit the shuttle over the tightrope they didn't take any point. The best score that a participant could win was 50. The reliability coefficient of the test was a=0.76. The test is presented in figure 1.

---------- Insert Figure 1 about here ----------

The Bobrich (1989) test for badminton observational rating scale for long serve (figure 2) was used to measure the participant's performance executing the forehand-long-serve. The athlete was standing on the one side of the badminton court. On the other side, the court was separated to four areas. Each area in the court was marked with the appropriate point (1,2,3,4 points). The athlete had to execute twelve forehand-long-serve and the ten best trials were counted. This test was scored according to where the shuttle was landed. During the execution of the skill a judge (high qualified coach) subjectively evaluated the appropriate height of the shuttle. Depended on the height of the shuttle the scoring one point when the shuttle was going close to net 2m≤, two points when the shuttle trajectory was >2m - ≤4m, three points when the shuttle trajectory was >4m - ≤6m and four points when the shuttle trajectory was ≥6m.

The scores from the landing of the shuttle and the trajectory were added and the mean was the score of this test. The best score was 40. The reliability coefficient was a=0.77. The test is presented in figure 2.

---------- Insert Figure 2 about here ----------

Training of the Instructors.

Prior to introducing the training programs, the instructor had specific directions on how to implement the instructional methods. Specifically, written directions were given for the identifications of errors, when to give information, what and how to say it (in what order). Specific written directions were also given on where to direct the attention of the participants. A pilot test with another group for four days before the test assured the understanding and the correct implementation of the methods by the instructor. Intra-judge reliability of the evaluator was examined by correlating two evaluations (test-retest reliability) of the same performance watching videotape.

Results

One-way ANOVAs' was used to analyse the initial differences of the pre-test scores for the three groups for each one of the two badminton skills. There were no significant main effects at the pretest scores for the backhand-short-serve skill ($F_{2,45}$=2.944, p>0.05) and the forehand-long-serve skill ($F_{2,45}$=1.269, p>0.05).

Two-way ANOVAs 3x3 (Groups X Measures) with repeated measures on the last factor were used to analyse the effects of the three corrective feedback methods on the result scores of each badminton skill. Whenever an overall significance difference was found a Sheffe post-hoc test was used to analyse the differences of the means.

Backhand-Short-Serve Skill

There was no significant interaction ($F_{4,90}$ = 1.098, p > 0.05), for the different measurement periods and the groups in terms of the result of the backhand-short-serve skill. There was a significant main effect ($F_{2,45}$ = 12.914, p < 0.05) among the three groups and a significant main effect ($F_{2,45}$ = 6.477, p < 0.05) among the measurement periods.

Result Scores

Group C. There was a significant ($F_{2,45} = 5.082$, $p < 0.05$) main effect among the three measurement periods in terms of result and the Sheffe post-hoc analysis revealed that the group C improved its score significantly from the pre-test (M = 22.75) to the post test (M = 29.56) and the retention test (M = 28.75). There was no significant ($F_{2,45} = 2.043$, $p > 0.05$) difference between the posttest and the retention test.

Group E. There was a significant ($F_{2,45} = 4.533$, $p < 0.05$) main effect among the three measurement periods in terms of result and the Sheffe post-hoc analysis revealed that the group E improved their scores significantly from the pre-test (M = 18.70) to the post test (M = 25.45) and the retention test (M = 26.10). There was no significant ($F_{2,45} = 0.986$, $p > 0.05$) difference between the posttest and the retention test.

Group E-C. There was no significant ($F_{2,45} = 0.081$, $p > 0.05$) main effect among the three measurement periods in terms of result and the Sheffe post-hoc analysis revealed that the group E-C didn't improve their scores significantly from the pre-test (M = 21.38) to the post test (M = 23.19) and the retention test (M = 23.25).

At the retention test, there was a significant ($F_{2,45} = 12.914$, $p < 0.05$) main effect among groups in terms of result. The Sheffe post-hoc analysis revealed that group C (M = 28.75) was statistically significant different from group E-C (M = 23.25). Group E (M = 26.10) was statistically significant different from group E-C, and there where no significant difference among groups C and E. The results of this analysis are depicted in figure 3.

---------- Insert Figure 3 about here ----------

Forehand-Long-Serve Skill

There was no significant interaction ($F_{4,90} = 1.586$, $p > 0.05$), for the different measurement periods and the groups in terms of the result of the forehand-long-serve skill. There was a significant main effect ($F_{2,45} = 3.549$, $p < 0.05$) among the three groups and a significant main effect ($F_{2,45} = 3.073$, $p < 0.05$) among the measurement periods.

Result Scores

Group C. There was significant ($F_{2,45} = 3.754$, $p < 0.05$) main effect among the three measurement periods in terms of result and the Sheffe post-hoc analysis revealed that the group C improved their scores from the pre-test (M = 33.75) to the post test (M = 38.06) and the retention test (M = 37.30). There was no significant ($F_{2,45} = 1.083$, $p > 0.05$) difference between the posttest and the retention test.

Group E. There was no significant ($F_{2,45} = 1.586$, $p > 0.05$) main effect among the three measurement periods in terms of result and the Sheffe post-hoc analysis revealed that the group E didn't improve their scores from the pre-test (M = 33.31) to the post test (M = 34.35) and the retention test (M = 33.75).

Group E-C. There was a significant ($F_{2,45} = 6.761$, $p < 0.05$) main effect among the three measurement periods in terms of result and the Sheffe post-hoc analysis revealed that the group E-C improved their scores from the pre-test (M = 32.90) to the post test (M = 36.00) and the retention test (M = 36.10). There was no significant ($F_{2,45} = 0.044$, $p > 0.05$) difference between the posttest and the retention test.

At the retention test, there was a significant ($F_{2,45} = 3.549$, $p < 0.05$) main effect among groups in terms of result. The Sheffe post-hoc analysis revealed that group C (M = 37.30) was not significantly different from group E-C (M = 36.10). Group C was significantly different from group E (M = 33.75) but there where no significantly

difference among groups E and E-C. The results of this analysis are depicted in Figure 4.

---------- Insert Figure 4 about here ----------

Discussion

The importance of providing useful information was noted by several researchers in the motor learning literature and Schmidt, (1991) and Smith and Thelen, (1993) suggested that motor learning is based on an increased efficiency of central and peripheral processes integrating multiple sources of sensory information. The main aim of the present study was to evaluate the effect of three different instructional methods of corrective feedback, on acquisition and retention of the result, of two badminton skills with different complexity, for youth participants in a sport setting. Several studies have shown that verbal instruction and rehearsal are important during the modeling of sequential motor skills by children (Weiss, 1983; Weiss & Klint, 1987).

From the findings of this research it can be concluded that positive feedback with instructions on how to correct the technique is beneficial for different kind of badminton skills for young players with 2-4 years training experience. The result scores were improved for both skills when participants received positive feedback and instructions on how to correct the technique (group C). Probably the cues for the correct execution focused the attention of the participants only on the correct aspects of the performance and improved learning. Magill (1998) and Wulf, Hoss and Prinz (1998) asserted that feedback that directs attention towards the external effects of the action facilitates skill improvement and motivate a person to continue practicing the

skill. Additionally, Schmidt and Lee (1999) suggested that this kind of feedback is useful and can improve performance only once they have learned the movement repertoire.

However, when athletes received positive feedback and instructions on errors (group E) of the execution, the result scores were improved only for the backhand-short-serve skill (simple). From the results of this study it was revealed that for participants of 2-4 years training experience, descriptive KP (critical cues on errors of the execution (E) was sufficient information only for the simple skill. Probably in simple skill, information about the error of the execution is enough and participants know how to correct them. Schmidt and Lee, (1999) suggested that the amount of information given depends on the stage of learning and people who are in the autonomous stage of learning, descriptive KP statement often is suffices.

On the other hand, the result scores of the group E-C (positive feedback and instructions on errors and directions on how to correct them) did not improve for the backhand-short-serve (simple) but improved for the complex skill (forehand-long-serve). It seems that very analytical and complicated instruction about the correct and the error may be redundant and unnecessary when people practise simple skills (Schmidt & Wulf, 1997). At the same time, when the skill is complex providing prescriptive KP statements is more helpful to improve the movement aspects of skill performance for the early or middle stage of learning (Kernodle & Carlton, 1992; Kernodle, Johnson & Arnold, 2001). Hodges and Franks (2002) supported that even though sometimes feedback seemed to convey little useful information in the early stage of acquisition for simple skills, it may possibly help refine the movement at a later stage.

Summarising, it seems that positive feedback with instructions on how to correct the technique is beneficial for badminton athletes for simple and complex skills. Additionally in simple skills feedback for the errors is enough information and participants probably know how to correct them. In complex skills feedback for the errors and how to correct them is more appropriate to improve the performance. The summary of the results of this study are summarised on table 2.

---------- Insert Table 2 about here ----------

Liu (2001) asserted that different opportunities of feedback produce different effects and that depends on the task goal specification. The task criterion specifies the appropriate information to be provided to the learner. Qualitative and quantitative feedback improve different aspects of the movement such as the result or the performance of the skill (Tzetzis, Kourtessis & Votsis, 2002). Siedentop (1991) suggested the ratio 4:1 between the correct or the error instructional cues of the execution. There must be one error information for every four correct instructional cues about technique. Also, Magill (1993) supported that a combination of error-based augmented feedback and information based on what was done correctly is most helpful. It takes the advantage roles of augmented feedback for motivating a person to continue practising the skill and facilitating skill improvement.

It is also important to note that the result scores retained from the acquisition phase to the retention phase since there was no decrease of the result scores. It seems that verbal instructions prescriptive or descriptive might have a long learning effect on performance.

This was a field study with real sport skills and it was attempted to have reliable and valid results. Delimitation of this study would be that the state of mind and the attention of the participants were not fully controlled. However, the real world setting results may reveal important information to coaches about the role of positive and corrective feedback methods in badminton skills learning. Research in real sport settings with different skills and sports or different participants' abilities is recommended. The tests must be as much more relative with the event. A test should be used only if it is valid, more reliable than the event and allows estimation of performance during their usual training. Then more reliable results will be available and they will depict the enhancement of the sport performance (Hopkins, Hawley, Burke, 1999).

Table 1. Different types of instructional methods for the three groups

Group A	Group B	Group C
Positive feedback and Instructional cues on how to correct the technique	Positive feedback and Instructional cues on errors of the execution	Positive feedback and Instructional cues on errors and directions on how to correct them
* Very good stroke, but you have to turn the body when you hit the shuttle. * Well done! Try the elbow to be closer to the head.	* Excellent stroke, but don't leave your body straight when you hit the shuttle. * That's good but don't do the stroke with the elbow away from the head.	* Very nice stroke, but don't be straight when you hit the shuttle. Try to turn the body at the motion. * Those strokes were a good one, but don't leave the elbow away from the head. As close as you can.

Table 2. Summarised results of the study

Groups	**Effect**	
	Backhand-Short-Serve (simple)	Forehand-Long-Serve (complex)
C	positive	positive
E	positive	neutral
E-C	neutral	positive

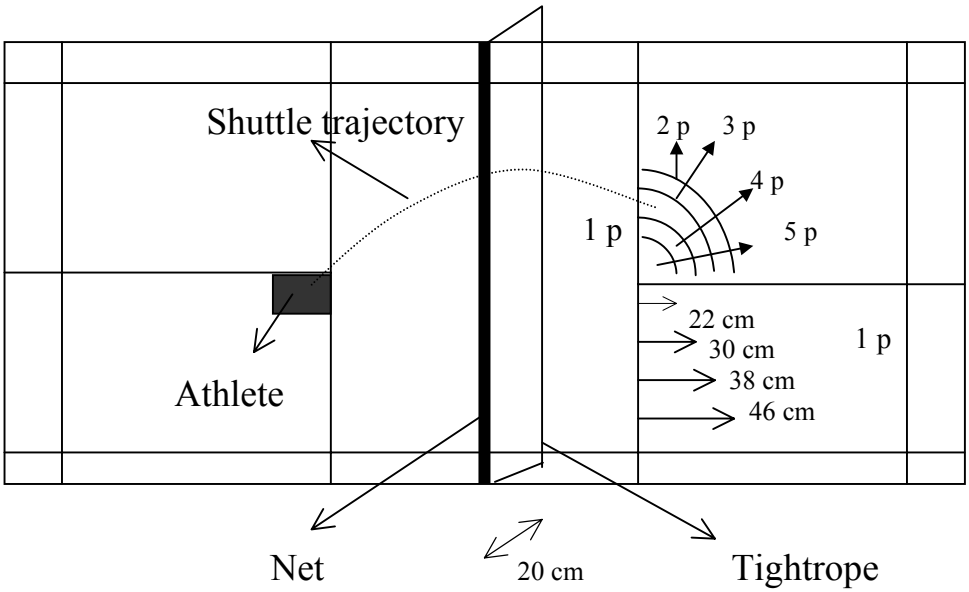

Figure 1. Setting of the test backhand short serve.

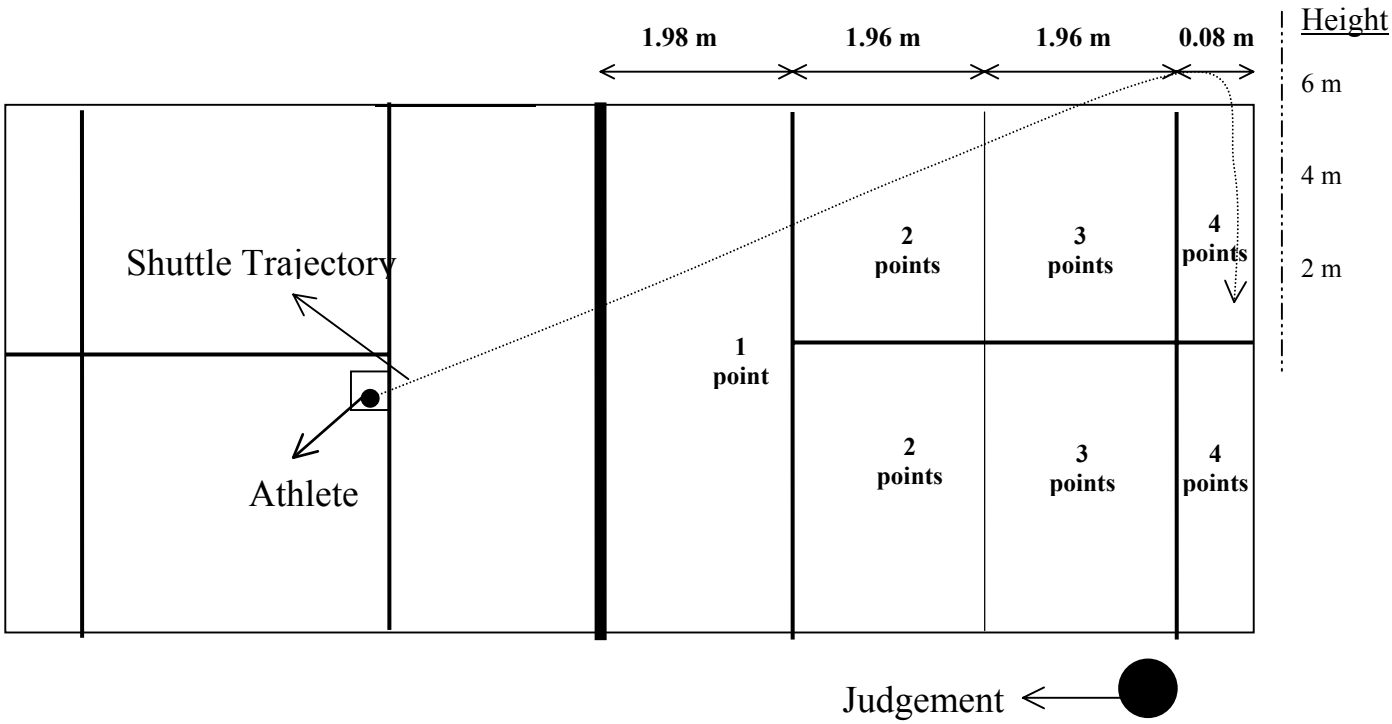

Figure 2. Settings of the test forehand long serve

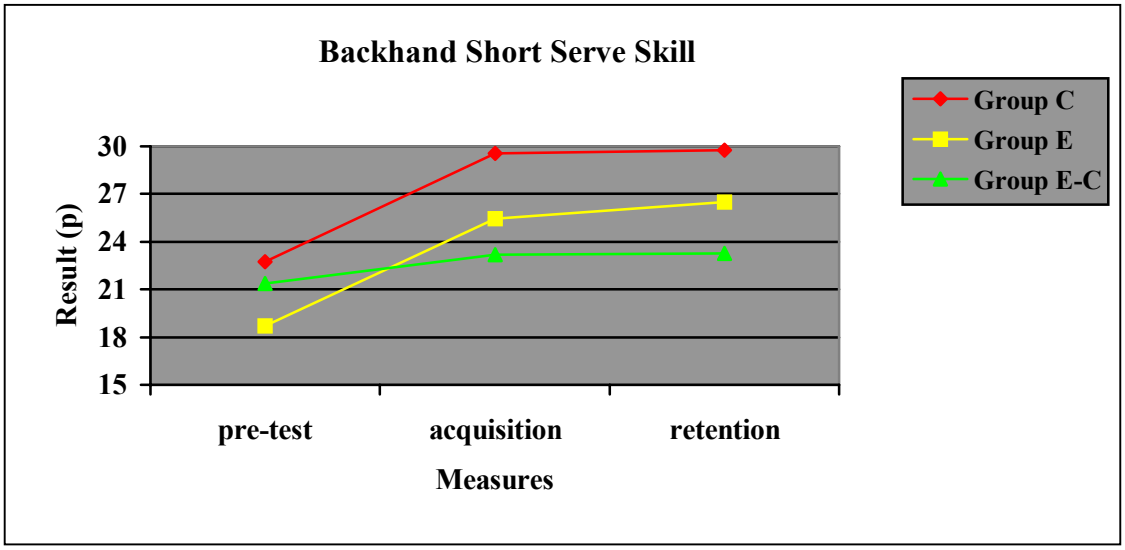

Figure 3. Result scores of the three groups for the three measurement periods of the backhand-short-serve skill.

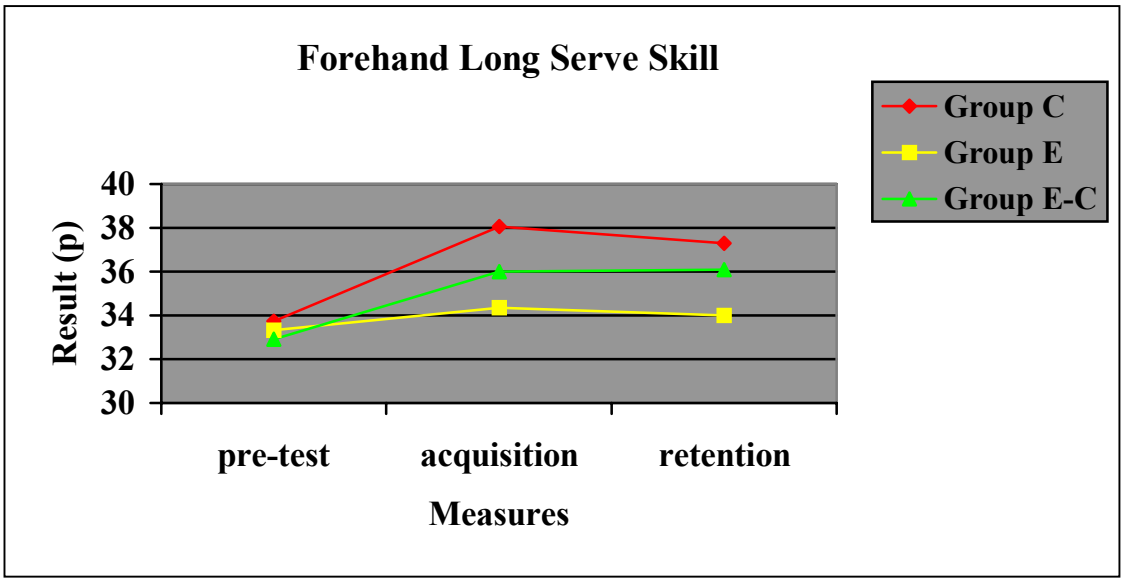

Figure 4. Result scores of the three groups for the three measurement periods of the forehand-long-serve skill.

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