# The effect of self-regulated feedback on acquisition and learning the overhand service skill of novice female athletes in volleyball

# Efecto del feedback autorregulado sobre la adquisición y el aprendizaje de la habilidad en el servicio de jugadoras noveles en voleibol

# O efeito de auto-regulação feedback sobre aquisição e aprender a habilidade de seu ponto de serviço de atletas do sexo feminino iniciante no voleibol

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**Abstract:** The purpose of the present research was to study the effect of self-regulated feedback on the acquisition and learning of the volleyball overhand service skill in novice female players 10-11 years old. Twenty-eight (28) novice female athletes aged 10-11 years old and with a 2-year training experience participated in this study. The female athletes were randomly divided into two groups, the experimental (n=14) and the control group (n=14). The athletes of both groups followed a five week training program with two units per week, which included drills for the learning of the service skill. The athletes of the experimental group were able to ask for feedback whenever they wished, while the athletes of the control group followed the program for learning the skill, taking feedback (knowledge of performance), whenever it was considered necessary by the coach. The results showed that there were significant differences between the two groups in learning the skill. Specifically, the experimental group was better at all the elements of the service skill, except for the throw of the ball, which apparently is due to lack of coordination of athletes at this age. It is suggested that coaches can use the self-regulated feedback, for better performance and learning and to develop athletes' internal cognitive processes.
**Key words:** self-regulated feedback, performance, learning, service skill, volleyball.

**Resumen:** El propósito de la presente investigación fue estudiar el efecto de realimentación autorregulado en la adquisición y el aprendizaje de la habilidad de servicio volado de voleibol en los jugadores novatos femenino 10-11 años de edad. Veintiocho 28 atletas de principiante de 10-11 años de edad y con una experiencia de entrenamiento de 2 años participaron en este estudio. Los atletas fueron divididos aleatoriamente en dos grupos, el experimentales (n = 14) y el grupo control (n = 14). Los atletas de ambos grupos siguieron un programa de entrenamiento de cinco semanas con dos unidades por semana, que incluye ejercicios para el aprendizaje de la habilidad de servicio. Los atletas del grupo experimental fueron capaces de solicitar retroalimentación siempre que quisieran, mientras los atletas del grupo control siguieron el programa para el aprendizaje de la habilidad, tomando información (conocimiento de resultados), siempre se ha considerado necesario por la entrenador. Los resultados mostraron que hubo diferencias significativas entre los dos grupos en el aprendizaje de la habilidad. En concreto, el grupo experimental fue mejor en todos los elementos de la habilidad de servicio, excepto el tiro de la bola, que al parecer es debido a la falta de coordinación de los atletas de esta edad. Se sugiere que entrenadores pueden utilizar la retroalimentación autorregulada, para mejor rendimiento y aprendizaje y para desarrollar procesos cognitivos internos de los atletas.
**Palabras clave:** realimentación autorregulado, rendimiento, aprendizaje, habilidades de servicio, voleibol.

**Resumo:** O objetivo da presente pesquisa foi estudar o efeito de autoregulação feedback sobre a aquisição e a aprendizagem da habilidade de voleibol serviço overhand em jogadoras de noviço 10-11 anos de idade. Vinte e oito 28 atletas do sexo feminino iniciante com 10-11 anos de idade e com uma experiência de formação de 2 anos participaram do estudo. As atletas foram divididas aleatoriamente em dois grupos, o experimentais (n = 14) e grupo controle (n = 14). Os atletas de ambos os grupos seguiram um programa de treinamento de cinco semanas com duas unidades por semana, que incluiu exercícios para a aprendizagem da habilidade serviço. Os atletas do grupo experimental foram capazes de pedir feedback sempre que quisessem, enquanto os atletas do grupo controle seguiram o programa para aprender a habilidade, levando o gabarito (conhecimento de desempenho), sempre que considerou necessário pela treinador. Os resultados mostraram que houve diferenças significativas entre os dois grupos em aprender a habilidade. Especificamente, o grupo experimental foi melhor em todos os elementos de habilidade o serviço, exceto para o arremesso da bola, que aparentemente é devido à falta de coordenação dos atletas nesta idade. Sugere-se que treinadores podem usar o feedback de autoregulação, para melhor desempenho e aprendizagem e para desenvolver processos cognitivos internos dos atletas.
**Palavras chave:** gabarito auto-regulada, desempenho, aprendizagem, habilidade de serviço, voleibol.

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The effect of self-regulated or self-controlled feedback on the acquisition and learning of open and closed skills is a field of study which has only recently started to concern researchers and therefore relevant research is limited. According to Schmidt, (1991) feedback comprises the information available to the person either during the movement or after its completion. The role of feedback in learning a motor skill and particular in learning several motor skills is crucial. The basic feedback forms are the intrinsic and the extrinsic ones, while the latter as augmented feedback is further divided in knowledge of performance and knowledge of result (Schmidt & Weisberg, 2009). Knowledge of performance is feedback related to the quality of the movement, while knowledge of results informs the trainee on the level s/he achieved the desired result or not. The way in which feedback can influence learning and ultimately the acquisition of a skill is complex and has not been fully explained yet, leaving open a broad field of study (Schmidt & Weisberg, 2009).

Several studies have been carried out (Goodman, 1998; Janelle, Kim, & Singer, 1995; Lewthaine, & Wulf, 2010; Todorov, Shadmehr, & Bizzi, 1997; Wulf, McConnel, Gartner & Scharz, 2002; Wu, & Magill, 2011) on different kinds of feedback and on their influence on motor learning. There were also researches that evaluated the learning through self-regulated feedback, in adults with Down syndrome (Chiviacowsky, Wulf, Machado, & Rydberg, 2012b) or in persons with Parkinson's disease-Chiviacowsky, Wulf, Lewthwaite, & Campos, 2012a). A very interesting type of augmented/external feedback broadly researched during the last twenty years and paving new paths in providing feedback is the self-regulated feedback, i.e. providing external feedback when the participant asks for it and not when the coach thinks it is necessary (Chiviacowsky & Wulf, 2002). The review of research already carried out leads to very interesting results, which show the advantages of self-regulated feedback for the athlete as his/her autonomy develops and the taking up of initiatives is facilitated while carrying out each skill (Ahmadi, Sabzi, Heirani, & Hasanvand, 2011; Bund & Wiemeyer, 2004; Carter & Patterson, 2012; Chen, Kaufman, & Jung 2001; Chiviacowsky & Wulf, 2002, 2005; Fairbrother, Laughlin, & Nguyen, 2012; Hadadi & Kheirjoo, 2012; Hemayattalab, Arabameri, Pourazar, Ardakani, & Kashefi, 2013; Janelle, Kim, & Singer, 1995; Sigrist, Rauter, & Wolf, 2001; Yoon, Yook, Suh, Lee, & Lee, 2013).

Recent studies concerning the benefits of self-regulated feedback are particularly interesting and strengthen the findings of former research (Chiviacowsky, 2014; Kaefer, Chiviacowsky, Meira, & Tani, 2014; Suewon, Ali, Kim, Kim, Choi, & Radio, 2014). In particular, Chiviacowsky (2014) carried out a research on whether self-regulated feedback programs have different effects on participants receiving feedback according to their good performance and on participants who could receive self-regulated feedback. The research results again showed that participants receiving self-regulated feedback had greater self-efficiency during the end of the practice and performed the skills more accurately during the retention test. Similarly, Kaefer et al. (2014) studied the effects of self-regulated feedback on learning sequentially synchronous motor skills in introvert and extrovert athletes. Here again the learning results for the groups receiving self-regulated feedback were much better in both categories. Studying the effect of providing self-regulated feedback in performing a serial motor skill in Taekwondo, Suewon et al. (2014) found positive correlations. In particular, learning and retention this skill require procedural, conscious and subconscious memory and thus this kind of feedback proved extremely beneficial as it activates deeper cognitive processes and boosts autonomy and the participants' motives. According to the authors, through self-regulated feedback information is assimilated actively by the participants, leading to better performance.

By referring to recent studies, Van der Kamp Duivenvoorden, Kok, and Van Hilvoorde, (2015) studied self-regulated feedback on motor learning and detected that motor skills and self-efficacy increase. Similarly, Grand et al. (2015) studied the extent to which participants choosing when to receive augmented feedback while practicing a motor skill had more learning motives in comparison to those not in controls of their feedback. Indeed, participants receiving self-controlled feedback had greater internal motivation and did better in maintenance tests than the control group. Lim et al. (2015) also reached these conclusions, by studying the efficacy of self-regulated feedback on a serial skill in taekwondo, stressing the best performance of the self-regulated group compared to the control group.

The advantages of self-regulated feedback can be described as follows: a) the active involvement of the participant in problem-solving strategies and the activation of deeper information processing procedures, b) direct motivation and finally c) more autonomy. Furthermore, this kind of extrinsic feedback fits the personal participant's needs better and leads to better learning results in the short as well as the long run. Needless to say, all above mentioned elements lead to better motor performance which is crucial especially in the competitive athletic sphere (Chiviacowsky & Wulf, 2002, Chiviacowsky & Wulf 2005; Chiviacowsky, Wulf, Laroque de Medeiros, Kaefer, & Wally 2008; Chiviacowsky, Wulf, Laroque de Medeiros, Kaefer, & Tani 2008; Hadadi & Kheirjoo, 2011; Chiviacowsky, Wulf, & Lawthwaite, 2012).

As already mentioned, providing self-regulated feedback in learning several motor skills has not been fully and adequately clarified, while the same applies for research on its effect in relation to competitive performance in a specific kind of sports as this would potentially lead to better

execution and hence better performance. Only Bokums, Meira, Neiva, Oliveira, & Maia, (2012) as well as Aiken, Fairbrother & Post (2012) focused on a certain kind of sports, having trainees carry out sports skills, proving that self-regulated feedback can indeed be beneficial to carrying out sports skills. Therefore it is crucial that studies focusing on a certain kind of sports be carried out. Moreover, in the abovementioned studies the external feedback provided was based on the knowledge of results, leaving questions regarding the efficiency of self-regulated knowledge of performance open. Finally, research carried out so far concentrates mainly on the results this kind of feedback has on learning in adults (apart from Chiviacowsky et al., 2008; Chiviacowsky et al., 2008), paying less attention to the potential advantages of its implementation on younger athletes.

Therefore, the purpose of the present research was to study the effect of self-regulated feedback on the acquisition and learning of the volleyball overhand service skill in novice female players 10-11 years old. For all the reasons stated above, the hypothesis that posed was that participants of experimental group (self-regulated feedback) will learn better the skill of service than the control group. Research results will be useful for volleyball coaches who train novice male and female athletes as a feedback form provided to trainees and make them more autonomous and independent since in this way they activate deeper cognitive processes and do not depend on their coaches' feedback.

## Method

### Participants

Participants were 28 novice female Volleyball athletes, 11 years old (M=10.96, SD=.43) and training experience of two years (*M*=1.98, *SD*=.63). The participants were assigned in two groups, experimental group (self-regulated feedback, n=14) and control group (verbal feedback by the coach, n=14) and they were taught the volleyball overhand service skill. The athletes participated in the experiment after having obtained written permission from their parents.

### Measures

Three measurements were taken. More specifically, the athletes were measured in the beginning in order to establish that all started at the same level of technique of service skill (pretest). After the completion of the intervention the final measurements were taken, to note the impact of the intervention on the players' performance in service skill (post-test). One week later, in which athletes didn't practice at all, the retention measurement was made, to establish whether the learned skill of the volleyball overhand service had been maintained

(retention test). All the measurements were taken in the volleyball court. In the first training unit, after the warm up, the participants performed a set of five trials (warm up in service). Afterwards, the evaluation test of service was conducted. The participants performed 10 attempts; while in the meantime, all the attempts of participants were videotaped. The instruction that was given to all participants before the attempts was: "*do the best you can...*". The video camera (Easy pix DVC5227) was placed 7m distance and in 45o angle on the right of each participant (if the participant used the left hand, the video camera was placed on the left, in the same distance and angle). The participants didn't know when exactly they were videotaped for avoiding changes on their behavior.

### Practice procedure

The duration of intervention was five weeks, for two times per week, (the same day and hour every week). The practice program was held on the first thirty minutes of the practice. During the practice intervention participants of both groups follow specific drills (four drills X10 services in each training session for improving the service technique). The content of practice was the same for participants of both groups, consisted of drills for the correct learning and execution of volleyball overhand service skill. The other practice contents were also the same for participants of both groups, in relation to content, volume and intensity of practice, but the only difference was that participants of each group were provided different kind of feedback. Participants of the experimental group (self-regulated feedback) followed the intervention program (gradually increasing difficulty of drills) for performance and learning the service skill. They ask feedback (for the elements of skill) from the coach, whenever they desire. Participants of the control group (verbal feedback) followed the practice program for performance and learning the overhand service skill, were provided verbal information feedback (knowledge of performance) by their coach every time he considered that they needed it.

### Instruments

Evaluation of technique

In order to evaluate the athletes' service skill, they were videotaped while executing 10 attempts. Two experts in volleyball (volleyball coaches) observed the video and they evaluated the athletes' performance in five technical elements of the skill. Intra and inter reliability of observers was checked (Kernodl & Carlton, 1992).

The instrument was used by Zubiaur, Ona & Delgado (1999), in their research of the effect of knowledge of performance and knowledge of results on volleyball service skill

learning. The observation instrument consists of four elements of technique and one for result. Each unit was analyzed apart and it was graded depending *ov* the quality of execution (2=for correct execution, 1= for minimum wrongs, 0= for the wrong execution). The total sum of these elements was the score of each participant in the service skill.

Starting position

1. The ball catching: (2= with the opposite hand of hitting, 1= with the two hands, 0= with the hand of hitting).
2. The catching of the ball before hitting: (2= between the chest and face, 1= between the thigh and chest, 0= under the thigh).
3. Foot position: (2= the same foot with the hitting hand, 1= the two feet open, 0= one foot –the same with the hitting hand –ahead and the other back). Perfect execution takes six points.

Throwing

1. The height of throwing: (2= about 30-40 cm over the head, 1= about 50 cm high over the head, 0= in the head high or lower).
2. The preparation of hitting hand: (2= direct up to the shoulder, 0= down to the shoulder). Perfect execution takes four points.

Hitting the ball

1. The height of ball before the hitting: (2=tall throwing up to the head, 1= low throwing, 0= low throwing right or left of the head).
2. The position of the palm of hitting hand: (2= the palm and the join of wrist are stiff, 1= the palm is semi flexible, 0=the palm is flexible).
3. Position of the other hand: (2= up to the shoulders' height, 1=on shoulder's height, 0= down of the shoulder). Perfect execution takes six points.

After hitting

1. The hands' movement: (2= the hand follow the ball and lands to the left knee, 1= the hand drop down next to the body, 0= the hand stop after hitting).
2. The position of the foot: (2= the right feet make a step ahead, 1= the feet do not move, 0= the left feet make a step). The perfect execution was four points.

The total sum of all points for each trial and for each element over 10 trials was the total score for service skill.

**Evaluation of the result**

The evaluation of the space accuracy (target, 2= was if the ball landed in the marked area, isosceles triangle, which started from the two corners of central line and reached one meter behind the attacking line, 1=the ball inside the court, but out of marked area, and 0= the ball in the net or out of the court). The perfect execution was scored two points. Therefore, in ten trials the perfect execution takes 20 points (2X10 trials).

**Observers' reliability**

The two observers have been volleyball athletes for ten years, students of volleyball faculty of department of sport science and they have also been juniors' volleyball coaches for three years. They were trained by the first author of study who was an expert coach in volleyball. During the evaluation the observers didn't know if the athletes were in the experiment or in the control group. The intra-observer's reliability test was assessed with the observation and recording in one day of ten athletes and the observation and recording of the same athletes on the following day by the same observer. No significant differences were found between the first and second tests, which assured that the coders were able to perform reliable coding with the observation tool (Potrac et al., 2007). The Inter observer's reliability using Cohen's k coefficient was 0.92 and Intra observer reliability was 0.91 and 0.93 respectively, indicates strong agreement.

**Questionnaire**

The participants at the end of the intervention program completed a questionnaire about the use of self-regulated feedback. The questions were about:
   a) *When do you ask feedback?* The athletes have to reply selecting one from five answers.
   b) *What do you believe that you manage to perform the service skill?* The athletes have to reply selecting from a scale 1-10 (from very well to very bad).
   c) *How sure you are that you could execute the service skill successfully?* The athletes have to reply selecting from a scale 1-10 (from very sure to not at all sure).
   d) *How do you enjoy yourself following the program for service skill learning?* The athletes have to reply selecting from a scale 1-10 (from very much to not at all).

In order to find out the frequency and the kind of feedback (for technique or for result, after correct or wrong executions) the participants asked feedback, a daily diary for each training session was held by the coach.

### Data analysis

SPSS for Windows 19.0 was used for the analysis of the results. Homogeneity of variance was obtained and independent samples t-test for checking the baseline groups' differences. Mauchly's test of Sphericity was not significant, which confirmed the appropriateness of the test. ANOVA *Repeated Measures* (2 group X 3 measures) analysis was used to check differences between groups.

## Results

The purpose of the present research was to study the effect of self-regulated feedback on the acquisition and learning of the volleyball overhand service skill in novice female players 10-11 years old.

### Baseline measurement

*T-test* analysis for Independent samples revealed that there were no significant differences in service skill technique between the groups for the baseline measure (*p = .498)* and for result (*p = .970)* which means that participants were started from the same level of learning. In table 1 and 2, are shown the means and standard deviations of groups in the baseline measurement.

**Table 1.** Means and standard deviations on the baseline measurement on the five elements in technique of two groups.

| Technique | N | M | SD | |
|---|---|---|---|---|
| Experimental (EG) | 25 | 14.94 | 2.79 | $T_{(50)=.683}$ |
| Control (CG) | 27 | 14.45 | 2.33 | *p>.498* |
| Total | 52 | 14.68 | 2.55 | |

**Table 2.** Means and standard deviations on the baseline measurement on the five elements in result of two groups.

| Result of service | | | | $T_{(50)=-.038}$ |
|---|---|---|---|---|
| Experimental (EG) | 25 | 3.24 | 2.06 | *p>.970* |
| Control (CG) | 27 | 3.26 | 1.53 | |
| Total | 52 | 3.25 | 1.8 | |

### The effect of intervention on performance of overhand service skill

The total sum of four elements was the score of technique in service skill. ANOVA *Repeated Measures* (2 group X 3 measures) analysis revealed significant "Group" X "Measurement" interaction ($F_{2,100 =}$ 15.628, $p < 0.01$, $\eta^2 = .238$), between the measurements (pre-test, post-test, retention test) and also revealed a significant "group" ($F_{1,50 =}$ 42.94, $p < 0.01$, $\eta^2 = .462$), and "measurement" effect ($F_{2,100 =}$ 20.245, $p < 0.01$, $\eta^2 = .288$). Analysing the interaction paired t-test analysis for the measurements were used.

The results indicated that participants of the EG (Self-regulated group) improved performance from pre (*M = 14.94, SD = 2.79*) to post-test (*M = 18.31, SD = 1.52*, $t_{(24)} = -5.71$, $p < .01$), from pre-test to the retention test (*M = 18.14, SD =1.74*, $t_{(24)} = .378$, $p < .01$) and from pre-test to retention test ($t_{(24)} = -4.50$, $p < .01$).

For the CG (control group) the participants improved performance from pre (*M = 14.45, SD = 2.33*, $t_{(26)} = -2.44$, $p < .01$) to post-test (*M = 15.55, SD = 1.55*) but there was a decrease in retention test (*M = 13.62, SD = 2.05*, $t_{(26)} = 1.66$, $p = .107$). Finally, the results indicated that participants of both groups improved service skill; however the EG (Self-regulated group) was better than the CG (control group) in the post and retention test.

**Table 3.** Means and standard deviations of elements in technique of overhand service in two groups.

| Groups | | Pre-test | | Post-test | | Retention test | |
|---|---|---|---|---|---|---|---|
| | N | M | SD | M | SD | M | SD |
| Experimental (EG) | 25 | 14.94 | 2.793 | 18.31 | 1.526 | 18.14 | 1.745 |
| Control (CG) | 27 | 14.45 | 2.338 | 15.66 | 1.555 | 13.62 | 2.052 |
| Total | 52 | 14.68 | 2.553 | 16.93 | 2.026 | 15.79 | 2.959 |

### The effect of intervention in the result of overhand service skill

The results of the research showed significant interaction between group and measurement ($F_{2.100 =}$ 13.176, $p < 0.05$, $\eta^2 = .209$), and also significant main effect of measurement ($F_{2.100 =}$ 24.63, $p < 0.05$, $\eta^2 = .330$), and group ($F_{1.50 =}$ 10.56, $p < 0.05$, $\eta^2 = .174$), that interpreted that the athletes of the experimental group have better scores in the result of overhand service.

Analysing the interaction paired t-test analysis for the measurements were used. The results indicated that participants of the EG (Self-regulated group) improved performance from pre (*M = 3.24, SD = 2.06*) to post-test (*M = 5.52, SD = 1.53*, $t_{(24)} = -4.95$, $p < .01$), from pre-test to the retention test (*M = 6.16, SD = 1.72*, $t_{(24)} = -6.006$, $p < .01$). For the CG (control group) the participants improved performance from pre (*M = 3.26, SD = 1.53*, $t_{(26)} = -4.08$, $p < .01$) to post-test (*M = 4.85,*

*SD* = 2.16) but there was no difference in retention test (*M* = 3.33, *SD* = 1.41, $t_{(26)}$ = -.258, *p* = .798). Finally, the results indicated that the participants of both groups improved service skill; however, the EG (Self-regulated group) was better than the CG (control group) in the post and retention test.

**Table 4.** Means and standard deviations in the result of overhand service in two groups.

| Groups | Pre-test | | | Post-test | | Retention test | |
|---|---|---|---|---|---|---|---|
| | N | *M* | SD | *M* | SD | *M* | SD |
| Experimental (EG) | 25 | 3.24 | 2.067 | 5.52 | 1.531 | 6.16 | 1.724 |
| Control (CG) | 27 | 3.26 | 1.534 | 4.85 | 2.161 | 3.33 | 1.414 |
| Total | 52 | 3.25 | 1.792 | 5.17 | 1.897 | 4.69 | 2.110 |

Daily diary

As it was reported previously, a diary was kept by the coach for each training to record the number of times that each athlete asked feedback from the coach and the kind of feedback (about the best or bad efforts). The data of diary showed that the athletes asked feedback from the coach only after they performed an error in their trial.

**Questions about the use of self-regulated feedback**

The first question was: *When did you ask feedback?* The athletes have to reply selecting a reply from the next answers. In table seven are presented the frequencies and percentages of answers of the athletes of the experimental group, about their beliefs for the intervention.

**Table 5.** Frequencies and percentages of the answers of athletes about their beliefs for the intervention.

| Questions | N | % |
|---|---|---|
| 1. Mainly after good trials | 4 | 16 |
| 2. Mainly after bad trials | 8 | 32 |
| 3. The same after good or bad trials | 3 | 12 |
| 4. By chance | 7 | 28 |
| 5. Nothing from the above answers | 3 | 12 |
| Total | 25 | 100 |

Most of the athletes (32%) replied "*after bad trials*", the 28% "*by chance*", and the 16% "*after good trials*".

## Discussion

This research aimed at studying the effect of self-regulated feedback on learning and maintaining the closed skill of topspin service (tennis) in volleyball in novice female athletes aged 11. In the beginning, the athletes tended to pose many questions regarding technique each time they carried out a new exercise, but after a while the required feedback form changed and became feedback on result. In addition, the request for feedback tended to decrease during this interventional program, while the fact that the athletes were able to understand when they had carried out an exercise wrong and asked for feedback from the trainer was striking; this was observed by Chiviacowsky et al., (2008) too. This observation is indicative of the fact that deeper cognitive processes are activated for the detection and correction of mistakes at this age which was also observed in this former research.

These results are in line with findings from former research such as those by Chiviacowsky et al., (2008) and Chiviacowsky et al., (2008), who are among the few researchers studying the advantages of self-regulated feedback on learning motor skills in school-age children (11 years old). The research findings contradict, however, many studies, according to which there was a tendency for trainees to ask for feedback after efforts they regarded as good/successful (Bokums, et al., 2012; Chiviacowsky, & Wulf, 2002; Chiviacowsky, & Wulf, 2005; Chiviacowsky, & Wulf, 2007; Chiviacowsky, et al., 2008a; Chiviacowsky et al., 2008b; Chiviacowsky et al., 2012; Drews, Chiviacowsky & Wulf, 2013; Ste-Marie, Vertes, Law, & Rymal, 2013). More specifically, no tendency to ask for feedback after a good effort, was observed, but questions were posed many times on technique after unsuccessful efforts, which shows that the young female athletes were able to detect their mistakes, which once again points out deeper cognitive processes and a greater athlete autonomy (Hansen, Pfeiffer, & Patterson, 2011; McCombs, 1989; McCombs & Whisler, 1989; Patterson, Carter, & Sanli, 2011).

## Conclusions

As far as the athletes' answers to the questionnaire on self-efficiency are concerned, they can be largely characterized as expected; according to them their ability to detect mistakes and ask for feedback for their correction was confirmed. Moreover, a weakness in evaluating their performance on learning the spin service skill due to their young age was observed as most

of them replied that they did fairly good despite the fact that at the end of the practice they managed to understand all key points of the skill. However, the fact that their confidence increased after the program is contradictory; the majority replied that they are able to carry out the service skill well/very well, a fact which again is interpreted by the increase in the feeling of self-efficiency that emerged during the interventional program.

According to the diary entries, each time the athletes practiced a new spin service technique, they asked mainly for performance feedback on an average of 6 out of 10 efforts. As they familiarized themselves with each exercise and gained more confidence, the demand for performance feedback declined while the demand for result feedback increased at a smaller scale (on an average of 3-4 out of 10 efforts). It should be noted that a tendency was observed not to ask for performance feedback, when an exercise was repeated in a next training unit which suggests learning transfer. Finally, it should be noted that the demand both for performance and for result feedback tended to decline during the interventional program which may be ascribed to the deeper ac-

tivation of cognitive processes and to the acquisition of the self-correction ability.

In conclusion, after ten training units comprising the interventional program of self-regulated feedback, it was established that the young female athletes had understood the basic key points of the spin service skill apart from throwing the ball correctly which obviously is due to the lack of hand-eye coordination in athletes at that age as this ability is not yet fully developed as in adults.

## Practical applications

This research can be practically applied in many ways. These are the following: Volleyball trainers can introduce self-regulated feedback in their training plans to activate early on deeper cognitive processes in athletes, strengthen their motivation and offer them meaningful and individualized guidance. Future research may focus in more detail on the psychological skills that develop with the use of self-regulated feedback (self-efficacy, self-confidence).

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