THE EFFECTS OF VERBAL AND VISUAL FEEDBACK ON PERFORMANCE AND LEARNING FREESTYLE SWIMMING IN NOVICE SWIMMERS

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Original scientific paper
UDC: 797.21:159.922

Abstract:

The purpose of the present study was to investigate the effects of feedback on the freestyle swimming learning and performance of novice swimmers. Sixty male (M_{age}=18.7, SD=1.82) first year students were randomly assigned into four groups: self-modeling, expert-modeling, verbal, and control group. The intervention program lasted for seven weeks. Participants were evaluated in 25m freestyle swimming, with a pool buoy between their legs and breathing every three hands through a pre-test, a post-test and a retention test. The result revealed that self-modeling group was the most effective, in comparison with the other types of feedback, in terms of improvement of the technique in novice swimmers. There were no differences between the groups in the speed performance of 25m freestyle swimming. Overall, the present study provides valuable evidence for the effects of self-modeling on performance in freestyle swimming, and encourages research to further explore such effects between different types of feedback in real training conditions.

Key words: *verbal feedback, visual feedback, expert-modeling, self-modeling, swimming*

Introduction

Model observation or observational learning is considered to be one of the most important methods for learning skills or behaviors (Bandura, 1986; McCullagh, Weiss, & Ross, 1989). Model observation is defined as a process in which the observers try to imitate the skills presented by another individual (Mc CuIlagh, et al., 1989; Weiss, 1983). The main theoretical approach that explains the process of model observation is social learning (Bandura, 1986). According to Bandura, model observation is effective when the four sub-procedures of attention, retention, production, and motivation are activated. Through attention, the observers need to focus on important elements of a skill presented by a model. Then, observers need to retain the important details in their memory for later execution. Besides storing the information in memory, observers need to have the required physical ability to produce the modeled movement and have to be motivated to produce the observed skill. McCullagh and Weiss (2001), in their review on model observation, suggested that observation of models facilitated learning and performance of sport skills. Furthermore, other factors like observer's experience, gender, and age, as well as model's skill proficiency and social influences were also concerned to play an important role in the learning process. Finally, they suggested that two types of model observation had positive results in learning: observation of an expert model and self-observation of the athlete.

The information provided as feedback from an external source, such as a supervisor or expert, that influences performance of a skill is called augmented feedback. Augmented feedback, in which visual observation and verbal instruction are combined, leads to better execution of the movement in question in comparison to sole observation of the model (McCullagh & Little, 1989). Previous studies that tested efficacy of this type of feedback, indicated that visual observation had more positive effects on learning than verbal instruction in school children (McCullagh, Stiehl, & Weiss, 1990; Wiese-Bjornstal & Weiss, 1992) and in children who learned a timing sequence task (Kowalski & Sherrill, 1992; Meaney, 1994; Weiss, 1983) as well as in learning a dance skill consisting of five steps (Sawada, Mori, & Ishii 2002; Filippou, Bebetsos, Vernadakis, Zetou, & Derri, 2014). McCullagh and Caird (1990) noted that athletes who received verbal instruction, regardless of the type of visual information, executed skills more efficiently than those who did not receive any verbal instruction at all. In another study, the demonstration of an experienced model was more effective in primary school children than the demonstration of children's execution (self-observation of the athlete) of the skill of volleyball serving (Zetou, Fragouli, & Tzetzis, 1999). In contrast, self-observation of older female beach volleyball athletes proved better for the improvement of beach volleyball technical skills (Zetou, Kourtesis, Getsiou, & Michalopoulou, 2008; Zetou, Vernadakis, Bebetsos, & Makraki, 2012). It has to be noticed that simultaneous verbal instructions, which direct the attention of athletes to six key points of the skills, are crucial (Kernodle, Johnson, & Arnold, 2001). Maleki, Shafie, Nia, Zarghami, and Neisi (2010) demonstrated that feedback with model observation and simultaneous provision of verbal instructions improved learning of the skill of handstand, while feedback without verbal instructions did not showed results in skill learning.

In general, studies on model observation have demonstrated notable findings for short-term (performance phase) or long-term (learning or transfer phase) learning (Hayes, Hodges, Huys, & Williams, 2007; Vernadakis, Zetou, Avgerinos, Giannousi, & Kioumourtzoglou, 2006; Wulf, Raupach, & Pfeiffer, 2005; Zetou, et al., 1999). The tests used in these studies to evaluate the effect of model observation assessed results of a movement (Al-Abood, Davids, & Bennett, 2001), or dynamics or quality and coordination of a movement execution (Horn, Williams, & Scott, 2002). The latter study, which investigated model observation in the improvement of movement results, showed that bigger changes occurred in the movement dynamics than in its result. This effect was bigger for adults than for children, while the effect on the result of the movement was greater for children than for adults (Ashford, Bennett, & Davids, 2006). Recently, the effects of model observation (Clark & Ste-Marie, 2007; Ste-Marie, Rymal, Vertes, & Martini, 2011) have been linked to the self-regulation theory (Zimmerman, 2000). The theory claims that model observation is not only supportive to new skills acquisition, but also initiates changes in self-satisfaction, self-reaction and inner interest for the skill about to be learned, especially in children (Clark & Ste-Marie, 2007). Also, model observation in competitive situations, combined with self-regulating strategies, such as strategic design and self-evaluation (Rymal, Martini, Ste-Marie, 2010; Ste-Marie, Rymal, Vertes, & Martini, 2011) had positive results.

The type of model (novice or expert) is a key factor that can influence the learners' skill performance. According to the model type, McPherson and Bull (2003) did not find any differences to performance or psychological benefits for the athletes of the teams that were observing either a novice or an expert model. Both experimental groups performed better than the control group. In terms of the type of observation, it is expected that self-observation is more efficient compared to model observation. While some studies showed positive results in self-modeling observation through the use of video (Clark & Ste-Marie, 2007; Onate, Guskiewic, Marshall, Giuliani, Yu, & Garrett, 2005; Van Wieringen, Emmen, Bootsma, Hoogesteger, & Whiting, 1989), one study found that self-modeling observation was less effective (Zetou, et al., 1999), while Emmen, Wesseling, Bootsma, Whiting, and Van Wieringen, (1985) did not find any differences between self-modeling observation and other types of models observation. From the aforementioned studies it can be inferred that there are some common elements that could explain which model type is most effective, when self-modeling observation is compared to other types of models observation. Ashford et al. (2006) hypothesized that characteristics of a skill (open or closed skill) could modify benefits of observation and concluded that self-modeling observation using video footages was more effective than other types of model observation in discrete skill learning, such as landing from a jump in basketball (Onate, et al., 2005), serving in volleyball (VanWieringen, et al., 1989), but also in continuous skill learning, such as swimming (Clark & Ste-Marie, 2007; Starek & McCullagh, 1999; Zetou, Vernadakis, & Bebetsos, 2014). Thus, some other variables must be taken into consideration in order to determine which kind of model observation would be more effective. Consequently, the factors of age, but also of experience of observers are the ones that have a different effect on the type of model observation (expert model or self-observation). From the results of the review studies it can be inferred that younger athletes benefit more from the expert model observation because they try to imitate the movement, while older athletes or more experienced ones benefit more from self-observation. Ste-Marie, Clark, and Latimer (2002) suggested that the appropriate timing to deliver verbal instructions to children is before or after demonstration since children have limited attention span and processing. Janelle, Champenoy, Coombes, and Mousseau, (2003) used a new technique in demonstrations with positive results; they inserted darts into a video image to mark the points which the observers needed to pay more attention to.

In a recent review, Ste-Marie, Law, Rymal, Hall, and McCullagh (2012), attempted to provide some instructions to researchers for model observation aiming performance and skill learning. Before an experiment or intervention planning, the researchers should answer to the following questions: "What?" (what kind of observation: live or videotaped model), "Who?" (the type of a model: expert or still learning model), "Why?" (the aim of the observation: performance or learning skill improvement), "Where?" (the place of intervention: laboratory environment or real practice environment), "When?" (in what moment will the demonstration be presented and how many times). They have suggested that researchers must first evaluate both athletes' and skill's characteristics and define what they expect from the result of the intervention and afterwards, to decide on the type of model, what the learners will observe exactly and if the observation will be accompanied by instruction, when will the observation take place and how will observers acquire information from the observation.

The aim of the study was to investigate the effect of different kinds of feedback (observation of an expert model combined with verbal instructions in key points vs. self-monitoring observation with an emphasis on key points vs. only verbal instructions in key points in real training conditions) on performance (25-meter freestyle swimming) and technique learning (hands/breathing) of novice swimmers in freestyle swimming. It was therefore hypothesized that the groups of visual and verbal feedback will perform better compared to verbal feedback and control groups.

Method

Participants

Sixty male first year students with no prior experience in competitive swimming (M_{age}=18.7, *SD*=1.82), were randomly assigned to three experimental (Self-Modeling – SM, Expert-Modeling – EM, and Verbal – V group) and one control group (C). Students who were active swimmers did not participate in the study. Before participating in this study, all students were fully informed about the protocol and their written consent was obtained before testing.

Design and procedure

The duration of the intervention was seven weeks. Students participated in a 40-minute training program session once a week on the same day and hour. The training program was identical for all participants and consisted of drills aimed at the correct execution of hand movements in freestyle stroke and proper position of the head and whole body during breathing. The participants of each group were given a different type of feedback on their performance.

The participants of SM group with verbal cues (SM, n=15) observed video footage of their own executions and the coach simultaneously provided them with verbal instructional cues (key words for the main elements of the skill, instructing them what to do). The students were videotaped while practicing and at the beginning of every practice session each student observed the video of his previous efforts for two seconds while the coach simultaneously pointed to the main elements (technique) of the skill. After the observation, the student returned to practice. The same procedure was repeated in the middle of the practice session.

The participants of the EM group with verbal cues (EM, n=16) were provided with feedback in the form of expert modeling observation from an expert swimmer and simultaneously with verbal instructional cues (key words for the main elements of the skill explaining what the model did). Four participants observed the video for two seconds at the beginning and in the middle of the practice session and then they returned to practice.

The participants of the verbal group (V, n=14) were only given verbal instructional cues for the main elements of the skill. More specifically, at the beginning and in the middle of every practice session they were for two minutes, provided with feedback, concerning the five main elements of hand technique of the freestyle swimming skill.

The participants of control group (CG, n=15) were given a traditional verbal feedback consisting of a summary of knowledge-of-performance feedback.

Verbal instructional cues were identical for all experimental groups and also were the same as the qualitative evaluation: 1=entry of the hand (extend the arm from the shoulder directly ahead and place it in the water in front of the head), 2= the palm on the side (the palm should face the bottom of the pool with the wrist slightly higher than fingertips and the elbow higher than the wrist on the side); 3=breathing (the head should be cocked forward about 45 degrees); 4=rebound (the elbow high, above the hand in the pulling phase of the stroke as in the recovery phase), 5=catch and pull over (catch the water and begin an underwater pull).

Apparatus

For the purpose of video recording, a digital video camera SONY was used. For the video footage observation, a portable personal computer with 20'' monitor was used. The students carried a "pull buoy" between their thighs, when they practiced and tested the skill. Furthermore, a stopwatch was used for the time evaluation and also a temperature thermometer to ensure stable water temperature conditions across all measurements.

Evaluation procedure

All practice sessions and measurements took place in the university swimming pool. Participants were evaluated in freestyle swimming at the beginning and end of the intervention and also two weeks after the post-test without practice (retention test). More specifically, participants were evaluated in the skill "hands in freestyle swimming with a pull buoy between their thighs and breathing every three hands" over 25 m distance, with a startup inside the pool. The video camera was placed within 6 m of distance and at a 45° angle from the participant, and followed the participant consistently in terms of distance and angle. The data recordings were evaluated by two observers (two swimming coaches).

Evaluation of skill (technique) quality

Ten of the videotaped trials (from the 5th to 15th) were observed and evaluated by two expert observers. Five elements of skill were qualitatively analyzed: 1=entry of the hand (extend the arm from the shoulder directly ahead and place it in the water in front of the head), 2= the palm on the side (the palm should face the bottom of the pool with the wrist slightly higher than fingertips and the elbow higher than the wrist on the side); 3=breathing (the head should be cocked forward about 45 degrees); 4=rebound (the elbow high, above the hand in the pulling phase of the stroke as in the recovery phase), 5=catch and pull over (catch the water and begin an underwater pull).

The rating was 1 for correct execution of every element and 0 for incorrect execution. The best mark for each participant could be 50, that is, the sum of ten trials plus the sum of score for five elements (5 elements x 10 trials).

Speed evaluation

For the speed evaluation, participants were measured in 25 m freestyle swimming starting inside the pool and their times were recorded at the beginning and end of the intervention.

Reliability of observers

Videotapes of all participants' acquisition and retention trials were evaluated individually by two observers (swimming coaches) who undergone a training session delivered by the lead researcher on how to rate students' performance. The observers were not involved in any way in the testing and were thus blind to the experimental conditions. Each participant was anonymous to the observers, identified by a number. The observers reached an inter-observer agreement percentage of 90% prior to data collection, which was calculated through the procedures described by Kazdin (1982). The following formula was used to compute the inter-observer agreement percentage (%): Interobserver Agreement % = Agreements/Agreements+Disagreements x 100.

Inter-observer agreement checks were also conducted during data collection. Agreement percentage was .88 or higher on each occasion. On each test session the observers simultaneously recorded the performance scores, together with the instructor, for one randomly selected participant. This inter-observer agreement checks, calculated as before, yielded ratings consistently at or above 90%. The test performance scores were determined by the total score accumulated during the required 10 trials.

Research design

The research design of the present study was factorial in the form of 4x3. More specifically, there were four independent variables, "the four groups" (the three experimental groups following different methods of feedback and the control group with the traditional teaching method) and "the measurements" (the pre-and post-intervention tests and the retention test). The dependent variables were the participants' performance scores on the technique of the swimming freestyle given by the observers and their scores on the speed time measurement of 25 m freestyle swimming with a pull buoy between their thighs.

Statistics

Prior to the repeated measures analysis of variance, distribution normality was tested by Kolmogorov-Smirnov test (K-S test) as well as homogeneity of variance using Bartlett test. Tests resulted in a non-significant value ($p<.05$), which indicated that the data did not differ significantly from the multivariate normality of variables, thus parametric tests could be applied. Each analysis of ANOVA of repeated measures was completed by the Bonfferoni *post-hoc* test.

Results

Preliminary analyses

The aim of the pre-test analysis was to compare the baseline scores of participants before training intervention. Thus, one way-ANOVA was performed on the pre-test values. The results revealed that there were no statistically significant differences between the groups in the pre-test in technical performance ($p=.208$) nor in the 25 m speed swimming scores ($p=.170$).

Main analyses

Repeated measures analysis of variance revealed that there was a significant main effect of measurement ($F_{2,112}=358.97$, partial $\eta^2=0.865$, $p=.000$) in freestyle swimming. The within subjects contrast analysis revealed that there were significant differences between the pre-test and post-test scores and between the pre-test and retention

Table 1. Means and standard deviations of the groups in three measurements of the hands technique in freestyle swimming

Measurement	Groups	N	Means	SD
Pre-test	Self-modeling	16	21.69	3.96
	Expert model	15	22.20	2.57
	Verbal cues	14	20.07	3.22
	Control	15	22.73	3.26
	Total	60	21.70	3.36
Post-test	Self-modeling	16	40.63	4.53
	Expert model	15	35.27	2.49
	Verbal cues	14	31.71	3.73
	Control	15	25.60	3.18
	Total	60	33.45	6.58
Retention- test	Self-modeling	16	42.00	3.26
	Expert model	15	36.93	2.43
	Verbal cues	14	33.43	2.06
	Control	15	24.60	2.89
	Total	60	34.38	6.99

scores for the three experimental groups in the freestyle swimming technique. Paired samples *t*-test revealed significant differences from pre- to post-test (t_{15}=-11.812, p=.000) and pre- to retention test (t_{15}=-15.256, p=.000) and post-test to retention test (t_{15}=-1.856, p=.001) for the SMG group. Significant differences were found from pre- to post-test (t_{14}=-15.213, p=.000) and pre-test to retention test (t_{14}=-21.686, p=.000) and from post-test to retention test (t_{14}=-3.190, p=.007) for the EMG group. Significant differences were also found from pre- to post-test (t_{13}=-8.405, p=.000) and pre-test to retention test (t_{13}=-12.897, p=.000) and from post-test to retention test (t_{13}=-2.511, p=.026) for the VCG group. However, there were no significant differences from pre- to post-test (t_{14}=-2.729, p=.056), pre-test to retention test (t_{14}=-1.777, p=.097), or from post-test to retention test (t_{14}=1.111, p=.285) for the control group. There was also the significant main effect of group ($F_{3.56}$= 61.848, partial η^2=0.768, p=.000) and interaction effect between the group and the measurement ($F_{6.112}$=33.090, partial η^2=0.639, p=.000).

Post-hoc Bonferroni revealed significant mean differences in the performance scores of freestyle swimming between the students of SMG (M=40.63) and EMG (M=35.27), then between the students of VCG (M=31.71) and the members of control group (M=25.60). The results were same for the retention test as well; the members of SMG were better than the students of other three groups. The mean scores and standard deviations of each group across the three measurements are presented in Table 1.

Speed performance

Repeated measures analysis of variance revealed that there was the significant main effect of measurement ($F_{1.56}$=317.073, partial η^2=0.850, p=.000) in the speed scores of freestyle swimming. The within-subjects contrast analysis revealed that there were significant differences between the pre-test and post-test scores and between the pre-test and retention test scores for the three experimental groups on the decision making. Paired samples *t*-test revealed the significant differences from pre- to post-test (t_{15}=16.147, p=.000) for SMG, the significant difference from pre- to post-test (t_{14}=7.922, p=.000) for EMG, and the significant differences from pre- to post-test (t_{13}=3.924, p=.000) for VCG. Also, the significant difference was found from pre- to post-test (t_{14}=6.881, p=.000) for the control group. No significant main effect of group ($F_{3.56}$=1.898, partial η^2=0.092, p=.092) was obtained, but there was an interaction effect between the group and the measurement ($F_{3.56}$=71.217, partial η^2=0.792, p=.000).

Post-hoc Bonferroni revealed that there were no significant mean differences in the *speed score of freestyle swimming* between the members of SMG (M=21.77), EMG (M=20.96), VCG (M=22.93) and control group (M=24.42). The mean scores and standard deviations of each group across the three measurements are presented in Table 2.

Table 2. Means and standard deviations of groups in 25 m speed performance score on two measurements

		Pre-test		Post-test	
Groups	**N**	**M**	**SD**	**M**	**SD**
Self-modeling	16	23.73	2.77	21.77	2.89
Expert model	15	21.86	2.16	20.96	2.16
Verbal cues	14	23.25	4.97	22.93	4.93
Control	15	24.65	4.01	24.42	4.02
Total	60	23.38	3.65	22.50	3.76

Discussion and conclusions

The aim of the present study was to investigate the effects of different types of feedback on performance and learning of the technique (hands/breathing) of novices in freestyle swimming. According to the results of the present study, the members of SMG significantly improved their technical execution of the skill "25m freestyle swimming, with a pool buoy between the thighs and contralateral breathing every three hands", followed by the students of EMG. The participants of the group that received only verbal feedback through the use of keywords seem to least improve their swimming technique compared to all intervention groups. The members of the control group, who received only the traditional method of teaching by their teacher, had the least improvement of all the groups. It seems that the students of the group that executed the standard practice were interrupted to observe their previous effort and to recognize their mistakes. Consequently, the students of the group that observed an expert swimmer and who recognized the main points that require their focus and attention improved their skill to a greater extent compared to the athletes of the group that received only verbal feedback. The students of the third group, who received only verbal feedback on five key points, improved the least. Finally, the students of the control group did not receive any extra information from their teacher (traditional teaching) and that constrained their learning progress compared to the other groups of students. Thus, firstly, the method of self-modeling observation and, secondly, the expert model observation, where the observed students also recognized, with the assistance from their coach, the most important elements of the skill, seem to be the most appropriate methods (with the SM method being the most effective) to be applied to novice athletes.

The results of the retention test were similar, so that it could be determined whether and to what extent the improvement of the novice athletes of each group was permanent, that is, whether there was retention and, consequently, did the intervention have learning effects. The importance of the retention test, conducted in this study as well, determines whether a teaching method is effective and does it have continuity in learning the kinetic information; it is also a way of assessing individual teaching skills of each coach-teacher.

Thus, the results of the present study showed that there was a downward trend in all the three intervention groups, as well as in the control group, but not lower than that of the final test. So, all the groups retained their performance (learned skill), which was expected since they had been practicing for seven weeks. Consequently, the students of all four groups had gains in performance and in learning as a result of practice, but the SM method was proved to be the most effective, followed by the method of EM, and V method; the least effective teaching method was the traditional one with a summary feedback. However, one can assume that learning of adult novices profited to a greater degree from observing themselves performings, but also from listening and reflecting on the elements they should pay attention to in order to avoid mistakes. On the other hand, if novices were young, they would probably be benefited more by observing an expert model, as they would try to imitate a proper pattern. Thus, this study comes to the conclusion that self-modeling observation, as a source of feedback, is more effective in adult novices than observation of an expert model plus audio feedback, but also more effective compared to the traditional method of teaching (Bebetsos, 2015). The results of the current study coincide with the results of other studies such as that of Law and Ste-Marie (2005), who experimented the self-modeling effect in figure skating jump performance. Also, Zetou, Tzetzis, Vernadakis, and Kioumourtzoglou (2002) revealed that children of expert-modeling group were more effective compared to self-modeling group in an intervention aimed at teaching volleyball skills.

Nevertheless, there is a debate about the effectiveness of audiovisual feedback using audiovisual material compared to the traditional teaching. For example, Rikli and Smith (1980) supported the notion that providing feedback via visual material was not very effective in experienced athletes. Other researchers reinforced this opinion and stressed that this source of feedback was overestimated (Emmen, et al. 1985; Van Wieringen, et al., 1989). Recent studies compared effectiveness of two teaching methods using high school students (the first and second grades), that is the traditional method and teaching method using a computer, in learning the skill of setting in volleyball (Vernadakis, Zetou, Antoniou, & Kioumourtzoglou, 2002), physical education contents (Bebetsos & Antoniou, 2008; Antoniou, Gourgoulis, Trikas, Mavridis, & Bebetsos, 2003), and basketball shooting skill (Vernadakis, Antoniou, Zetou & Kioumourtzoglou, 2004) and found that multimedia technology was not superior nor inferior to the traditional teaching; it was equally effective.

The results of our study confirmed the original hypotheses. Visual feedback, combined with audio feedback, that is, verbal instructions to focus on particular points of the learned skill, proved to be more effective than verbal feedback and traditional teaching. Many researchers claim that using verbal cues is very effective, especially for very young children that attempt to learn a new kinetic pattern, especially when verbal cues are linked to practice. In a relevant study, Mohnsen and Tomson (1997), who studied the use of audiovisual media and how they can help improve learning, demonstrated that it was advisable to videotape technical performance of each athlete and then to reflect and analyze it in order to correct any mistakes (Weis, & Klint, 1987; Mc Cullagh, et al., 1990).

As for the effect of different methods of feedback on improving speed performance of students, the results of the study showed that there were differences between the tests, but there were no difference between the groups, which mean that all groups improved their time with practice. This can be attributed to the fact that performance is a multi-factor issue (genetic factors, physical condition, athletes' personality, cognitive skills, etc.), where technique is but a single piece of the puzzle of performance. In this particular case, we cannot claim improvement in technique and, as a result, improvement of the speed time. The method of self-modeling observation and, generally, the audiovisual feedback methods are greatly accepted in the field of coaching. The means technology can offer to coaching today are numerous, easy to use and easily accessible (Giannousi, Vernadakis, Derri, Antoniou, & Kioumourtzoglou, 2014; Vernadakis, Derri, Tsitskari, Antoniou, 2014; Vernadakis, Giannousi, Tsitskari, Antoniou, & Kioumourtzoglou, 2012). Besides, sport coaching is in a constant search for methods that can easily be applied on the training premises (such as swimming pools, courts, tracks) and that can be effective (Bebetsos & Theodorakis, 2003; Bebetsos, Antoniou, Kouli, & Trikas, 2004). A lot of studies suggest that self-modeling observation could be applied to both individual and team sports for the improvement of both simple and complex skills. Besides, the evidence existing in the relevant literature is that using audiovisual feedback improves athletes' performance.

Further research should be done with younger age participants (8-10 year) because within that age span children begin to practice sports and learn sports skills. The same design could be applied to three age categories (6-10, 11-16 and 17 and over) in order to determine which method of feedback/instruction would be most appropriate for each age category. This same design could possibly be done without practice intervention to determine the effect of the kind of model without the effect of practice. For older athletes, instead of observing a model, they could observe their own kinetic analysis and recognize important points of the skill using darts. Additionally, since nowadays computers are used extensively, a computer could utilized with, using appropriate programs to create models, which would look like athletes (age, sex, character, parental intervention, even facial characteristics) so as to have better results in skill learning, of course, always combined with practice (Bebetsos, Zetou, & Antoniou, 2014; Vernadakis, Kouli, Tsitskari, Gioftsidou, & Antoniou, 2014; Vernadakis, Papastergiou, Zetou, Antoniou, 2015).

In conclusion, the combination of visual and audio feedback and, more specifically, the method of self-modeling observation, may be the most effective way to learn new skills and also to improve performance in general. It is another useful tool for coaches and Physical Education teachers.

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Submitted: October 31, 2015
Accepted: August 2, 2016

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