The Importance of Feedback in Improving Freestyle Swimming Performance in Children

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Abstract

Increasing the sports longevity of children and juniors is considered to be the "supreme goal" in the first stage of their training, with the aim of increasing the efficiency of the activity, which is desired by all specialists.

Following the studies carried out by the specialists in the field, it was found that in order to achieve remarkable results in higher age categories, respectively, youth and seniors, the selection for swimming must be lowered to the age of preschoolers, a fact hat ensures an optimal training period.

Considering the complexity and accelerated pace of the learning process among children, we approached this theme with the aim of capitalizing on the visual, auditory, kinesthetic feedback in learning by monitoring the technical executions of each subject to research following the application of an own strategy of learning and strengthening the freestyle stroke (crawl) in swimming.

Feedback is the way of verbal and/or non-verbal communication of a person or a group regarding the behavior and the way it can affect us. At the same time, it plays an important role in identifying behaviors that can be followed and carried out, taking into account two necessary aspects: on the one hand, the positive effects produced, and on the other hand, the modification and change of those behaviors depending on the negative impact which he exercises.

By consolidating the technical executions, as well as by performing some exercises on medium and long distances, performed with medium intensity, but also short sprints (15-25m) with the aim of correcting the technique under conditions of sustained effort, progress has been recorded to -4.61 sec. between initial and final testing.

Keywords*: swimming, feedback, children, freestyle technique, progress.*

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1. Introduction

Compared to the description of other areas, the sphere of knowledge and child development is constantly expanding. If over time a great emphasis was placed on the discovery of certain knowledge in areas such as physiology, biochemistry, anatomy, medicine, human behavior sciences, nowadays scientists have turned their attention to the discovery of the child and his role in society. One of the reasons why the issue of childhood and child development did not concern the sphere of interest of specialists is the lack of information.

Nowadays, if we talk about swimming, we refer to a sport with a fascinating evolution. A sport that, in order to be successful, in addition to talent, requires strong doses of perseverance, will, motivation and determination. Swimming has always occupied a special place among the sports branches, due to the spectacle it offers, due to the competition that is constantly growing, where new records are being recorded, more and more frequently, in national and international competitions.

Following the studies carried out by the specialists in the field, it was found that in order to achieve remarkable results in higher age categories, respectively, youth and seniors, the selection for swimming must be lowered to the age of preschoolers, a fact that ensures an optimal training period.

As Alexe (1993) states, for the achievement of the above-mentioned tasks, between the training of children, juniors and seniors, the need for a close connection, continuity and organic interdependence appears more and more obvious. The selection of a preschooler, followed by the growth and development of a junior champion, and finally, the transformation into a true European, world-class swimmer, constitutes a remarkable work of creation, an entire instructive-educational process, which is based on respecting the particularities of age and gender, of the morphological, functional and psychological particularities of the organism which is growing.

Feedback is a way of evaluating the response of others following our actions and words. When we enter in a new environment, interacting with new people, we rely on the feedback that is created between us and others to

find out what works and what doesn't. Regarding the transmission of information, by recording the feedback of each child, we understand the answers that he transmits following the instruction provided.

The freestyle stroke, or crawl movement, occupies an important place during swimming training. It is also the fastest stroke in swimming events, thus generating the most research.

2. Topic addressed

As the studies about the child have gained momentum, there is an evolution in the manner of its growth and development, an improved attitude of society regarding the birth of children and raising them, as well as the importance of their place both in the family and in society.

From the study of the specialized literature, regarding the development of the child, it emerges, almost unanimously, the idea according to which the main starting point of everything that the child learns in the first years of life and, then, one of the important reference points for "learning to become a durable and transferable one, it starts from the child's body and emotions" (Gravel S., Tremblay J., 2004).

Learning by discovering his own body, the daily bodily experiences that the child goes through lead to mastering his own body and to its desirable and constructive use, in the most diverse situations. Gradually, he will move on to the discovery of the environment around him: physical, in the first instance, then, affective and, finally, social. (Piaget J., Inhelder B. 2005) This evolutionary process will constitute the foundation of his psychic development (affective and intellectual).

Nowadays, if we talk about swimming, we refer to a sport with a fascinating evolution. A sport in which, in order to be successful, in addition to talent, strong doses of perseverance, will, motivation and determination are needed. Swimming has always occupied a special place among the sports branches, due to the spectacle it offers, due to the competition that is constantly growing, where new records are being recorded, more and more frequently, in national and international competitions.

In swimming, as sport, for example, largely under the influence of the Australian and American experience from the 1950s, the idea crystallized according to which training in this sports branch should be started at the age of 6-8 (Platonov, 2015, p. 230).

It is known that a child is not a miniature adult, therefore, it needs to be treated differently in the training process (Hahn E., 1996). Thus, it is necessary for the coach-teacher to acquire in-depth knowledge about each stage of the child's development and growth, with the rules specific to the particularities of age. In children, the need for movement is, in fact, a necessity for physical, mental and motor development, and this is manifested by their desire to swim, jump, slide, throw themselves, either spontaneously or organized.

Swimming tones the muscles and improves the functions of the nervous system, decreases the feeling of heaviness of the body, regulates breathing movements and heartbeats, relaxes and combats muscle contractions (Tanaka H., 2009), which means that there is no pain in the execution of the movements, to be done easily, accelerates energy metabolism and activates venous circulation in the limbs.

Although there are numerous studies that mention the optimal age to start swimming, due to the requirements and the accelerated pace of completing the initial stage, which is constantly changing, coaches want to achieve notable performances from these young ages, a fact that demonstrates that many among the reactions, the responses of the child, who is in full growth and development process, are not taken into account. Thus, we proposed recording the results following the initial and final testing of the subjects, performing their comparative analysis and tracking whether or not there is progress from a statistical point of view.

In order to become a successful swimmer, it is recommended to work gradually, step by step. According to the statement of Bompa (2003), working carefully in all echelons of training over a period of 7-9 years of systematic training, well programmed starting from the childhood years, from 6-7 years, related to the observance of biological requirements, psycho-pedagogical, the possibility is created that at the above-mentioned ages, against the background of a solid multilateral physical training, superior

health indices and a degree of technical mastery, to reach world performances, some incredibly achieved a few years ago.

Regarding the transmission of information, by recording the feedback of each child, we understand the answer that he transmits following the instruction provided. We will follow and record the subjects' feedback following the information received, in the role of receivers.

Feedback is the domain of verbal and/or non-verbal communication of a person or a group in terms of behavior and how it cannot affect (Tulgan B., 1999). Studies show that it contains a perceptual component (what I observe in the other's behavior) and an emotional component (the feelings and experiences caused by the observed behavior). At the same time, it plays an important role in detecting behaviors that can be followed and carried out, taking into account two necessary aspects: on the one hand, positive effects produced, and on the other hand, the modification and change of those behaviors depending on the negative impact which he exercises.

A careful reflection on this topic is brought by Zeus and Skiffington (2000). They define feedback as "what we do when we give our opinion or when we evaluate someone's behavior or performance. It is any communication that provides information to another person about our perception of them and how their behavior affects us.".

Giannousi, Mountaki, and Kioumourtzoglou (2017) investigated the effects of different types of feedback on the performance and learning of the freestyle technique at the novice level. They concluded that the combination of visual and auditory feedback (audio-feedback), and more specifically the self-modeling, observational method, can be the most effective way to learn new skills and also, to improve overall performance.

As stated by Barbosa et al. (2010), the biophysical determinants of swimming performance represent one of the most attractive topics in swimming science.

According to McLeod (2010), even a strong, well-designed house will eventually collapse if the foundation is weak. In other words, a solid technical foundation created from the first years of activity in the pool, from childhood, ensures the support of future performance among cadets, juniors and seniors. Increasing the sporting longevity of children and juniors is

considered to be the ultimate objective in the first stage of their training, with the aim of increasing the efficiency of the activity, deliberately pursued by all specialists.

The crawl, or free movement, occupies an important place during swimming training. It is also the fastest procedure in swimming events, thus generating the most research.

When the hand enters the water, it is followed by its joint and the elbow, the arm being extended in the initial position of the propulsive phase (Figure 1). The upward rotation of the shoulder blade allows the swimmer to adopt an elongated position in the water. From this phase, the first part of the propulsive phase begins with the arm entering the water.

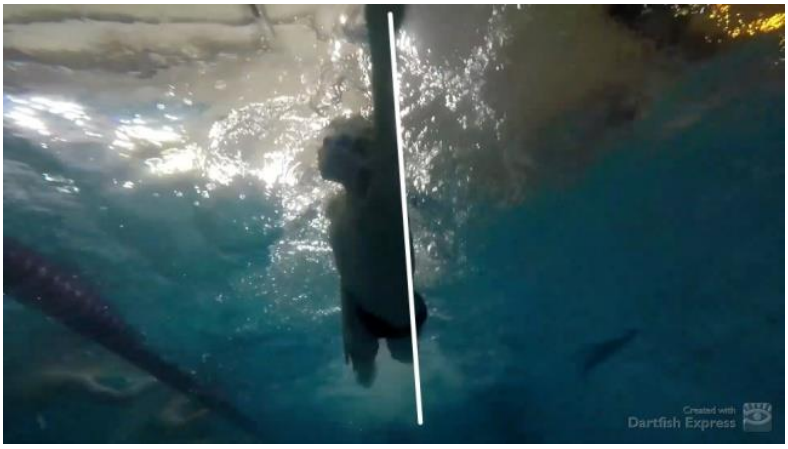

Figure 1. The body position on the water

The most important, even fundamental, component in swimming, valid for all procedures, is the body position on the water (streamline). This has the role of considerably reducing the frictional force through an efficient sliding at the water level, being determined by two components:

a) head position – the head represents the segment that determines the position of the whole body. The gaze is directed forward, down. If the position of the head is too high on the water, it would mean changing the position of the feet far below the water level, which would lead to a forward movement with a high degree of difficulty (Figure 2).

Figure 2. Incorrect head position

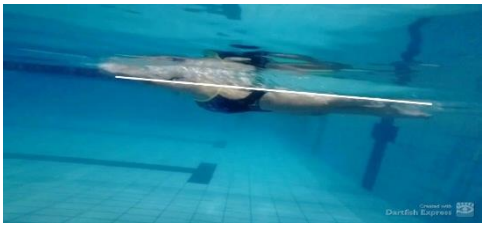

Figure 3. Correct head position

b) hip position – is interconnected with head position because one leads to the other. So by maintaining a correct head position, in alignment with the spine and hips, there will be no slowness or feeling of weight on the water.

The next element is the water capture phase. This includes the entry of the hand and fingers into the water as the first element in the catching phase. Thus, the hand pierces the water with the middle finger, 12-18 cm away from the shoulder, forming an angle of 45°, followed by the extension of the arm into the water, at which point the chest begins to open.

At the elbow, the flexors begin to contract at the beginning of the catch phase, gradually bringing the elbow from full extension to a flexed position of approximately 30°. The most important part is the EVF (Early Vertical Forearm, in translation). This EVF means that, as soon as the fingertips pierce the water, they follow their lead to the bottom of the pool, during which the forearm becomes as vertical as possible, so that the palm (hand) has the role of a shovel. Thus, the third element of the propulsive phase is traction, or pushing, which involves not only the hand, but also the entire forearm. Once traction is initiated, the propulsion phase follows which will pull the body forward, while the body rotation phase occurs.

All these elements constitute the aquatic path of the arms, propulsive, from the overall structure of the action of the arms. In addition to the water path, the structure of the stroke also includes an aerial path, the return, which has the role of preparing a new movement cycle.

The role of the arms is to propel the swimmer's body with a predominantly lateral, vertical movement, the propulsion being thus dominated by the bearing force and not by the resistant one. (Vasile L., Balan V., 2021).

When a water path and an air path are made with each arm, it means that one arm cycle has been completed. Thus, in freestyle the arms work alternately cyclically, in the idea that when one arm rows, the other returns through the air.

Footwork, also called kicks or beats, facilitates propulsion through the water by maintaining body balance and lateral alignment, allowing the athlete to rise above the water.

Just like the movements of the arms, the kick movements can be divided into the propulsive (descending) phase, with the role of lifting, and the passive (ascending) phase, with the role of overcoming the inertia of the downward blow, by changing the direction of movement upwards, with minimal costs energy; they are also called "downbeat", respectively "upbeat".

In the specialized literature, the coordination of six kicks per arm cycle can be found, but recent studies show that this type of coordination is only "a myth that should have been dispelled with the first underwater footage". In this sense, the researchers believe that the actual movement is composed of four strokes per arm cycle, the main role of the legs being to ensure the balance of the body and not propulsion.

Hattie and Timperley (2007) noted that feedback is one of the most powerful influences on learning and acquisition, but this impact can be either positive or negative. Its importance is frequently mentioned in articles on learning and teaching, but surprisingly, there are few recent studies that have systematically investigated its meaning. Through their study, the authors showed that although feedback is among the major influences, the type of feedback and how it is delivered can be extremely effective in the training process.

Our work aims to detect these behaviors - responses of the subjects subjected to research following the stimuli applied in the process of learning and assimilation of technical executions in the free process. The research is based on the circular exchange of information (visual, auditory, sensory, kinesthetic) between at least two parties: the coach - the subjects.

In other words, we can think of feedback as a way of evaluating the response of others following our actions and words. When we enter in a new

environment, interacting with new people, we rely on the feedback that is created between us and others to find out what works and what doesn't. Regarding the transmission of information, by recording the feedback of each child, we understand the answers that he transmits following the instruction provided.

According to Mooney et al. (2016), methods based on video footage are the most frequently used, highlighting a percentage of 70% among coaches who use this method in their training plans, the attention being focused on the qualitative part and not on the quantitative one. Barriers to the widespread use of quantitative biomechanical analysis in elite swimming settings were explored. Constraints include time, cost and resource availability, while other circumstances such as sources of swimming performance information, analysis and control of service delivery are discussed, with particular emphasis on video-based methods and emerging sensor-based technologies.

2.1. Study Design and Subjects

Considering the complexity and accelerated pace of the learning process among children, we approached this theme with the aim of capitalizing on the visual, auditory, kinesthetic feedback in learning by monitoring the technical executions of each subject subject to research following the application of an own strategy of learning and consolidating the technical procedures for swimming.

2.2. Research subjects

We brought together the members of the *"perspective group"* made up of 30 children who show skills for practicing swimming. *(the group was formed on the basis of the results obtained by participating in a contest/trial based on the establishment of criteria for access/selection in the respective group).*

2.3. Research methods

Scientific documentation, observation, experiment, statistical-mathematical methods.

The present study covered a period of four months of training. Thus, 16 weeks of training were completed, structured in 48 specific training sessions, with a duration of 1 hour 30 minutes each, which adds up to a total of 72 hours of actual training (in the water), carried out in three weekly sessions, on Tuesdays, Thursdays and Fridays, between 15:30 and 17:00.

During this stage, we carried out two checks, initial and final. After completing the initial verification, from January, we introduced the weekly viewing of videos focused on the technical execution of the movements in the free process. More precisely, we allocated 30 minutes to Friday, during which the subjects were subjected to the visualization of their own technical executions compared to the technical executions demonstrated by world-class swimmers. From a structural point of view, each week of the 16 training sessions corresponded to one element from the free technical procedure, in order to analyze the movements, tractions, body segments positions, entry and exit points of the upper limbs in and out of the water, leg movements . Thus, in addition to the 72 hours of specific training, in the water, we recorded a total of 8 hours allocated to visual images.

An integral part of the training of small athletes, table no. 1 describes a microcycle of their training process.

Table 1. Microcycle of their training process

Day	Exercices	Dura-tion	Pause	Description	Observation
Tuesday	➢ Warm-up: 250m invers IM	5′		100m freestyle/75m breaststroke/50m backstroke/25m butterfly	
	➢ Technique : 20 x 25m Freestyle	20′	Pl. = 1′	#2: freestyle kick with arms stretched forward, hands resting on the water, without support, head in the water; #2: free kick with arms outstretched by the body, twisting the body with the shoulder above the water (6 kicks on each side); #2: 6 right-side free kick, 6 left-side free kick, 3 strong free strokes; #2: free kick holding the board under the water with right arm extended above water (out of water), lateral breathing after each 6 kick moves;	The exercise is performed with fins. Pay attention to the body position on the surface of the water during all exercises.

Day	Exercices	Dura-tion	Pause	Description	Observation
				#2: the same exercise, the left arm keeps the board under the water, the right arm is held above it; #2: the left arm is fixed stretched on the water forward, only the right one works (emphasis on the trajectory of the arm underwater); #2: the same exercise, the right arm sits, the left arm works; #2: scoring the water in three areas: near the leg, in the armpit area (bending the elbow, raising the shoulder above the water) and above de head (at the point where the palm enters in the water for the catching phase); #2: freestyle with head above the water; #1: free with scraped fingers; #1: free with closed fist.	
	➢ Basic set: 10 x 50m Backstroke	15′	Pl. = 1′30	Descending #1 to #5	Aim to rotate the torso to allow each shoulder to rise above the water.
	➢ 16 x 25m	10-11′	P. = 15-20″	#25m underwater butterfly kick #25m breaststroke pull with butterfly kick	With fins.
	➢ Cool down: 150m swimming	3-4′		25m freestyle/25m backstroke	
Thursday	➢ Warm-up: 4 x 50m Backstroke	6′	Pl. = 1′30″	#1: 25m - 2x right arm + 2x left arm/25m backstroke #2: 25m slide one arm extended by the body, the other extended by the head, 6 kicks, switch.	
	200m backstroke kick	5′		#25m arms by the body, torso twist keeping the shoulder above the waterfor 6 kicks, switch / #25m arms overhead (streamline position)	
	2 x 25m Backstroke	2′	Pl. = 1′	Maximum speed.	Speed of execution, the movement of the arms and legs, as well as the recorded time track.

Day	Exercices	Dura-tion	Pause	Description	Observation
Friday	➢ Basic set: 4 x (2 x 50m butterfly kick + 4 x 25m butterfly)	20′	Pl.50m = 1′ Pl.25m = 40′′	With fins. The butterfly kick are performed at a fast pace, emphasis on the force of the water stroke.	
	➢ 5 x 20′′ freestyle kick	2′40′′	P. = 20′′	It is performed in a vertical position with the palms above the water.	Body kept in a straight line.
	➢ Cool down: 500m înot	8′		#100m: 75m double backstroke/ 25m breaststroke pull with free kick #100m: 75m back/25m free	
	Viewing - analyzing the technical videos in the freestyle stroke	30′		• Head position; • breathing; • Propulsive phase); • Passive phase; • Body sliding.	
	➢ Warm-up: 10 x 50m	15′	Pl. = 1′30′′	#1: 50m free #2: 50m back	
	➢ Basic set: 8 x 25m freestyle pull 8 x 25m freestyle kick	6′ 6′	Pl. = 45′′ Pl. = 45′′	#1: free with head above the water; #2: free with breathing at 3 strokes; #3: 12,5m maximum speed /12,5m moderate; #4: 12,5 moderate/12,5m maximum speed; #1 - #4: 12,5m maximum speed/ 12,5m moderate; #5 - #8: 12,5m moderate/12,5m maximum speed.	Torso rotation. Sliding on water. Arm frequency. Maintaining an equal number of strokes throughout the exercise.
	➢ Cool down : 3 x 200m	12′	Pl. = 4′	150m Craul (50m controlled swim/ 50m constructed swim – from slow to fast/50m long strokes) + 50m double backstroke	The first and last 5m of the second 50m do not breathe.

At the end of this stage, we organized a test at the club level to test the subjects following the completed training period. For us, it was the final test in the research we carried out. As it emerged from the statistical results of the present study, we can note the registration of considerable progress in the results throughout the four months of training.

Table 2. Statistical description of the results obtained

	Mean	N	Std. Deviation	Std. Error Mean	Std. Error Mean	Mini-mum	Maxi-mum	Variance
Initial testing	**46.82**	**30**	**1.72**	**0.31**	**0.31**	**44.21**	**49.81**	**2.980**
Final Testing	**42.21**	**30**	**2.12**	**0.38**	**0.38**	**38.73**	**45.53**	**4.521**

This analysis involves a comparison between the initial time, I.T., of testing, and the end of the study (F.T.). Average results show improvements in terms of recorded times of 4.61sec. between the two tests (I.T.=46.82sec and F.T.=42.21sec), which means increasing efficiency and improving technique execution.

Table 3. Statistical correlations of the results in the 50m Freestyle

			Significance	
Pair 1	**N**	**Correlation**	**One-Sided p**	**Two-Sided p**
I.T. – F.T.	30	0.887	<0.001	<0.001

Table 3 indicates the extent to which the two tests are correlated. The differences between the two phases of testing are significant for the test in 50m Freestyle applied event, the coefficient of 0.887 indicating a significant strong correlation (sig.<0.001). The following table highlights the fact that both the one-sided significance level (one sided p) and the two-sided significance level (two sided p) indicate the existence of a significant difference between the two measurements (I.T. and F.T.), the value of the significance indicator being less than 0.001 for all variables.

Table 4. The T Test results in the 50m Free

	Paired Differences							Significance	
			Std.	95% Confidence Interval					
		Std.	Error	of the Difference				One-	Two-
	Mean	Dev.	Mean	Lower	Upper	t	df	Sided p	Sided p
I.T. – F.T.	4.60	0.99	0.18	4.23	4.97	25.36	29	<.001	<.001

The size of the effect, or its magnitude, was calculated using the *Cohen's d* value, whose interpretation is as follows: around 0.20 – the effect is low,

0.50 means the effect is medium and above 0.80 symbolizes a strong effect. The method shows the effectiveness of the training program in order to improve analyzed performances in the freestyle and the impact it produced on the children participating in the study.

Table 5. The effect size of training program

				Point	95% Confidence Interval	
			Standardizer[a]	Estimate	Lower	Upper
1	I.T. – F.T.	Cohen's d	0.99	4.63	3.38	5.86
		Hedges' correction	1.02	4.51	3.3	5.71

The effect on the 50m Free trial is very strong (0.99), exceeding the value of 0.80 and demonstrating that, following the training program focused on improving technical training in relation with the provision of feedback, the children substantially improved their recorded results in the 50m Free event at the end of the four months.

The results in table 5. Demonstrate that our study had an impact on children's progress, the size of the effect being remarkable following the recorded times.

3. Discussion and Conclusion

Following the aspects followed in the specialized literature and presented in this report, it was found that in order to achieve remarkable results in higher age categories, respectively, youth and seniors, the selection for swimming must be lowered to the age of preschoolers, a fact that ensures an optimal period of training.

By consolidating the technical executions, as well as by performing some exercises on medium and long distances, performed with medium intensity, but also short sprints (15-25m) with the aim of correcting the technique under conditions of sustained effort, progress has been recorded to -4.61 sec. between initial and final testing.

Learning technical procedures requires a well-defined set of skills. According to the experts in the field, swimming is a sport in which, in order

to succeed, it is necessary to combine the knowledge of several sciences: medicine, anatomy, biology, physics, chemistry.

In order to create a solid foundation, in which communication is at the top of the hierarchy and which, subsequently, generates a solid coach-athlete relationship, feedback must be provided by both parties.

The checks carried out during the January-April preparation stage, the recorded results, represent useful data for training that also allow the athletes to know their progress and to be able to relate to the objectives pursued; this test constitute the essential part of this research.

By means of the training model applied in the January - April period, the following progress was recorded:

- ✓ In the 50m freestyle test there was a progress of 4.61 seconds recorded at the end of the training stage. If initially, the group recorded an average of 46.82 seconds, at the final testing, the average was substantially improved, resulting in 42.21 seconds.

The proposed training plan contributed to the improvement of the children's results, the differences between the initial testing and the final testing being significant.

Because of these results, we can appreciate that following the involvement of feedback in the children's training program and its monitoring, considerable progress can be registered among children and, at the same time, solid foundations of a technical training that can ensure longevity can be established in performance activity.

Our study supports the idea that in order to achieve remarkable results in higher age categories, namely youth and seniors, the selection for swimming should be lowered to the age of preschoolers, which ensures an optimal training period. The complexity of this sport is given by its own characteristics, and its practice starting from the childhood years, from 6-7 years old, through a well-programmed process in relation to the observance of the biological, psycho-pedagogical requirements, creates the possibility that from the above-mentioned ages, against the background of a solid multilateral physical training, superior health indices and a degree of technical mastery, to reach world performances over time.

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