

Effect of Goal Setting on Psychological State and Swimming Performance in Competitive Swimming

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ABSTRACT

The aim of this study was to study the effect of setting a personal goal to achieve on psychological parameters (cognitive anxiety, somatic anxiety and self-confidence) and on the chronometric performance of 50m butterfly in young swimmers. aged between 12 and 13 years old during the 2019/2020 sports season. The population was divided into three groups, the first group1 (G1) underwent competition preparation without a set goal (method1), the second group2 (G2) was oriented towards a vague goal "Do your best" (method2), whereas, the third group was asked to respond to a difficult-to-achieve goal according to a goal-setting interval (GBI) (method3). The results indicate that method 1 and method 3 increased the level of cognitive and somatic anxiety in swimmers in these two groups ($p < 0.05$). Furthermore, the self-confidence score was low in group 1 compared to the other two groups. Our results also show that chronometric performance was improved ($p < 0.05$) better by method 3 than by method 2, while performance remained unchanged in group 1. The difficult goal setting by IFB improved the chronometric performance, but at the same time increased the values of cognitive and somatic anxiety, for this reason the mental trainers and the technical staff were invited to develop associated mental preparation models to this method of goal setting to help swimmers psychologically.

Keywords: goal setting, cognitive anxiety, somatic anxiety, self-confidence

INTRODUCTION

The early adolescent phase (12-13 years old) constitutes a very important period in the training process of young swimmers. However, studies have shown that to reach an elite level, the swimmer must train approximately ten years or 10,000 hours. Indeed, young swimmers train in and out of the water with a training volume of between 10-15 hours per week depending on the level of individual performance (Vitor et al, 2010; Sharp et al, 2000). In this context, the development of physical condition in young swimmers depends on the improvement of

different physical qualities, namely: endurance, resistance and speed in and out of the water, in addition agility, balance, coordination, muscular strength and flexibility (Billat, 2017; Cazorla et al, 1985; Weineck et al, 1992). Likewise, swimming parameters are among the fundamental factors to develop to achieve optimal performance. Likewise, young swimmers (12-13 years old) participate in competitions from 50m to 800m. For this reason, training with its different aspects (frequency, volume, intensity, etc.) and competition have effects on the psychological and social state of the swimmer.

However, several authors have studied and analyzed the psychological state in amateur and competitive athletes (Leonardo et al, 2017; Flatt et al, 2016; Elbe et al, 2015; Kennedy et al, 2013). Vacher et al, 2018 studied the trajectories of swimmers in terms of psychological parameters (recovery from general and sport-specific stress) and physiological parameters (cardiac variability) during 3 months of training after the national competition in national swimmers aged 18 and over.

Flatt et al, 2016 assessed the cardiac parasympathetic pathway and psychological responses during a competition preparation period. These authors indicated that swimmers' sensations can be monitored during this training phase with a brief questionnaire on well-being derived from a Smartphone application in sprint swimmers aged 21 ± 1.6 years.

However, Elbe et al, 2016 had indicated that a 12-week training program with increased intensity and decreased volume could decrease general stress and increase recovery levels, whereas sport-specific stress and sport-specific recovery remained unchanged in elderly elite swimmers (18.27 ± 2.80 years).

In the same context, Kennedy et al, 2013 analyzed the factors influencing the fatigue status in Canadian university swimmers, moreover, psychological parameters (stress, mental fatigue) and physiological parameters (heart rate, energy level) were processed in the form of quantitative and qualitative data, these authors demonstrated that after intensive training and the depression phase, the values of heart rate, form and energy level were improved, while, flexibility of a training program could positively influence the state of fatigue in swimmers. However, Taylor et al, 1997 studied the effect of a training program with an increase in volume on sleep quality, psychological and other physiological parameters.

The anxiety factor is one of the factors that has been studied by several authors in athletes. Recent investigation developed by Athanasios et al, 2019 had studied the relationship between psychophysiological parameters and performance in swimmers with different training levels. Measurements included state of anxiety, rate of perceived effort, muscle oxygenation of the legs, heart rate and vertical jump capacity in relation to a 50m test at maximum speed in breaststroke swimming.

However, Leonardo et al, 2017 had studied the relationship between anxiety and heart rate variability during the Brazilian national competition, thirty minutes before the 400 m freestyle, the athletes answered the questionnaire on the inventory of competitive anxiety (CSAI-2R). These authors indicated that there is a relationship between cognitive anxiety and summative anxiety with heart rate in swimmers aged between 15 and 16 years old. On the other hand, Hauton et al, 2013 studied the relationships between anxiety symptoms, self-esteem and

performance in elite swimmers aged between 21 and 22 years old, this study explained the effect of anxiety on sports performance, and the techniques used by swimmers to control the state of anxiety. In another investigation, Lemon et al, 2007 examined the relationship between pre-competitive, subjective and objective anxiety (related to cognitive state) with competitive performance in young, aged swimmers. between 12 and 13 years old. The study partially supported the self-serving bias hypothesis; winners used the ego-enhancing attribution strategy, but losers did not use an ego-protecting attribution style.

Young swimmers, with the help of the coach, set goals to achieve during the competition; to our knowledge, investigations studying the effects of setting a goal to achieve on psychometric and physical parameters in young swimmers remained very weak.

For this, our objective was to study the influence of setting a goal to achieve on psychological state (cognitive anxiety, somatic anxiety and self-confidence) and chronometric performance in 50m Butterfly in young people. swimmers aged between 12 and 13 years old during the 2018/2019 season.

Hypothesis: based on the fact that the high difficulty of the objectives set to achieve could increase the pre-competitive anxiety score in young swimmers and improve the chronometric performance of 50m butterfly.

MATERIALS AND METHODS

Participants

Thirty national swimmers (Boys: $n = 17$; Girls: $n = 13$) (Table 1), belonging to the Tunisian swimming club, participated in this study. In this randomized controlled trial, swimmers were divided into three groups and were subjected to the same training conditions during three successive sporting seasons. First group (G1, $n = 10$) was asked to manage very difficult goals, second group (G2, $n = 10$) was asked to manage easy and vague goals, and the third group (G3, $n = 10$) was a control group without objective. Furthermore, the setting of objectives to be achieved were established by the team's technical staff.

Experimental Protocol

During the pre-competitive phase (two weeks before the competition), we first measured the anthropometric parameters (height; body mass; body mass index and wingspan). Subsequently, we randomly divided the population into three groups and set the personal objective to be achieved for each swimmer according to the group which belongs except the swimmers of (G1) who followed the preparation for the competition without an objective to achieve, and each G2 and G3 athlete was asked to direct all efforts and physical and mental abilities to achieve the goals set on the day of the competition. However, G2 and G3 swimmers were informed of these objectives to be achieved 2 weeks before the competition (during the pre-competitive phase)

All the swimmers from 3 groups having undergone two evaluations of the 50m butterfly chronometric performance, the first (Test) was established two weeks before the competition (during the pre-competitive phase) and before setting the objectives to be achieved, while, the second evaluation (Retest) was established on the day of the competition. Whereas, psychological parameters were assessed 1 hour before the competition.

Table 1: Anthropometric measurements of the population (mean $\pm$ standard deviation).

	GROUP 1	GROUP 2	GROUP 3
AGE (ANS)	11,9 $\pm$ 0,8	12,1 $\pm$ 0,7	11,7 $\pm$ 1,0
SIZE (CM)	151,9 $\pm$ 9,0	157,3 $\pm$ 14	155,3 $\pm$ 12
MASS (KG)	47,9 $\pm$ 7,0	49,3 $\pm$ 4,0	48,5 $\pm$ 2,0
IMC (CM)	18,6 $\pm$ 2,4	17,8 $\pm$ 1,1	18,2 $\pm$ 2,6
WINGSPAN (CM)	153,8 $\pm$ 5,0	160,5 $\pm$ 15	159,2 $\pm$ 12

The Parameters Measured - The Tests

Anthropometric Parameters:

Anthropometric parameters were measured using a standard anthropometric kit:

- The size t (in meters) was measured using a measuring rod graduated in centimeters to the nearest 0.1 cm.
- The weight p (in kilograms) was measured by a scale (personal scale) with an accuracy of 0.1 kg.
- Body mass index: BMI (kg.m^{-2}) = $p.t^{-2}$
- The wingspan was measured using a tape measure with an accuracy of 0.1 cm.

Chronometric Performance Tests:

On the day of the competition and after the warm-up, the participant must place themselves on the starting block, at the signal the swimmer begins the race with a diving start. All swimmers are informed that it is forbidden to pass the distance of 15m in casting either after the diving start or after the turns, likewise it is forbidden to touch the water lines, to lean on the bottom of the pool, and finally it is obligatory to touch the wall after each turn and at the end of the race. The participant performed the 50m (2*25m non-stop) butterfly test with maximum speed.

To evaluate the timing performances, the timekeepers are placed at the finish of the race to take the times achieved using digital sports stopwatches (Casio HS 80 TW-1).

Anxiety:

The assessment of anxiety was established by a CSAI-2R questionnaire (Cox et al, 2003), it is a revised version of the original CSAI-2 questionnaire (Martens et al, 1990). The 17-item CSAI-2R questionnaire is divided into three blocks, the first aims to assess cognitive anxiety, it is composed of 5 items with an intensity between 5 and 20. However, somatic anxiety evolves in the second block with 7 elements and an intensity between 7 and 28. While, self-confidence evolves during a third block by 5 elements and an intensity between 5 and 20. The swimmer was asked to answer the questionnaire, their response is evaluated on a four-point scale, (1) "Not at all", "(2)", "A little", (3) "Moderately" and (4). "Alright." In the present study we used the French version which was validated by Martinent et al, 2010, this version has psychometric properties consistent with the English version. The score for each block was obtained by adding the sum, dividing by the number of elements and multiplying it by 10.

Goal Setting Protocol:

The setting of objectives to be achieved was established by the club's technical staff during the pre-competitive phase. In addition, all G2 and G3 swimmers were informed 2 weeks before the

competition to direct all these mental and physical efforts to achieve the goal set on the day of the competition.

- Group 1: method 1: follow the training during the pre-competitive phase without any goal being set
- Group2: method2: the technical staff set a vague and non-specific goal to achieve for all swimmers in the “do your best” group
- Group3: method3: the technical staff set specific and difficult but realistic goals, they established a model of the “goal setting interval” (IFB) which was proposed by O'Block and Evants, 1984. This model consists of to determine the goal to be achieved during a competition by an interval of performances. However, the development of this interval involves 5 points to be determined:
 - A: represents the average of the athlete's 5 best performances.
 - B: represents the best performance of the last five performances, it is the lower limit of the goal setting interval
 - C: represents the difference between the average of the athlete's 5 best performances (A) and the best performance of the last five performances (B), knowing that the performance is a time, therefore $C = A - B$.
 - D: represents the average point of the interval, knowing that the performance is a time, therefore $D = B - C$
 - E: represents the upper limit of the interval, knowing that the performance is a time, $E = D - C$

Example of a Goal Setting Interval:

A swimmer from group 3 (G3) achieved the following five performances during the last three months before the 50m butterfly competition (in second):

“1”: 29.14; “2”: 29.57; “3”: 30.36; “4”: 31.24; “5”:30.54

Statistical Procedure

Data analyzes were performed using SPSS version 22 for Windows (SPSS Inc, Chicago, IL, USA). Values are presented as mean $\pm$ SD. Normality of the data sets was checked using the Kolmogorov-Smirnov test, compound symmetry was tested using the Mauchly test. Double-factor repeated measures analysis of variance (groups, time) was used to determine the interaction (groups: G1, G2 and G3 x Time: Test and Retest) and to determine the difference after the intervention period (between Test and Retest) of all dependent variables. Statistical significance was set at $p < 0.05$.

RESULTS

Table 2: The mean values of psychometric parameter scores (mean $\pm$ standard deviation).

	Group 1	Group 2	Group 3
Cognitive anxiety	16,8 $\pm$ 1,23†**	11,7 $\pm$ 1,9 ∞ **	17,5 $\pm$ 1,18
Somatic anxiety	22,10 $\pm$ 2,03†**	13,8 $\pm$ 1,03 ∞ **	21,6 $\pm$ 1,84
Self-Confidence	12,9 $\pm$ 1,66‡*	14,4 $\pm$ 1,9†*	14,5 $\pm$ 1,18

†: Group1 to Group2; ‡: Groupe1 to Groupe3; ∞ : Groupe2 to Groupe3; *: $p < 0,05$; **: $p < 0,01$

Table 3: Mean values of 50m butterfly (mean $\pm$ standard deviation)

	50-m swimming performance	
	TEST	POSTTEST
Group1	33,35 $\pm$ 1,64	32,54 $\pm$ 1,43
Group2	33,84 $\pm$ 1,13	32,84 $\pm$ 0,03†*
Group3	33,92 $\pm$ 2,28	31,42 $\pm$ 1,07†**

†: Test to posttest; *: p <0,05; **: p <0,01

DISCUSSION

The objective of this investigation was to study the effect of setting a personal goal to be achieved during the competition on the state of cognitive anxiety, somatic anxiety and pre-competitive self-confidence and chronometric performance. in 50m Butterfly among young swimmers aged between 12 and 13 years old during the 2018/2019 sporting season.

The Relationship Between Goal Setting and Psychometric Parameters

According to the data of our investigation, we observed that the cognitive anxiety score in group 1 and group 3 was higher than in group 2 with a significance of p = 0.000 of G1 compared to G2, and of G3 compared to compared to G2. As a result, setting difficult goals in group 3, or the absence of a goal to achieve in group 1, would increase the cognitive anxiety score than a vague "do your best" goal. The high cognitive anxiety score in group 3 can be explained by the difficulty of the challenge imposed on the swimmers, while this increase in group 1 can be explained by the state of worry and doubt caused by the absence of a goal to achieve. In the same context Jones et al, 2010 indicated that setting a difficult goal could increase the level of cognitive anxiety (p < 0.05) compared to other easy-to-achieve goals, during an investigation which studies the relationship between goal setting, anxiety and performance. Furthermore, another study carried out by Williams et al, 1997 had indicated that the athlete is involved in the aim of achieving more than the level of anxiety is lower, therefore, the increase in the difficulty of the goal to be achieved must be accepted by the swimmer to avoid a sharp increase in cognitive anxiety.

Our assessment also showed that the somatic anxiety score was higher in group 1 and group 3 than in group 2 with a significance p = 0.000 of G1 compared to G2, and of G3 compared to G2. Furthermore, the physical and mental efforts that are involved in group3 to achieve a performance belonging to the goal setting interval (IFB) may be the causes of the increased level of somatic anxiety in swimmers of this group. group, while, the absence of the orientation of physical efforts, perhaps an element which disrupts the state of somatic anxiety in the swimmers of the group1, these results agree with the study developed by Williams et al , 1997, where the authors showed that the lack of involvement in a task increases the level of somatic anxiety in athletes, likewise, the setting of a difficult goal leads to an increase in anxiety score somatic.

In our results, we also noticed that the self-confidence score was lower in group 1 compared to group 2 and group 3 with a significance of p = 0.03 of G1 compared to G3 and p = 0 .02 of G2 compared to G1. However, a vague goal of "do your best" could allow the swimmer in group 2 to aspire to achieve a very high performance, this thought may be the cause of the increase in self-confidence scores among swimmers in this group. While, the fear of failure to achieve the

set goal may decrease self-confidence in group3 swimmers, similarly, the lack of understanding of the demands and objectives to be achieved during the competition may be a factor that decreases self-confidence in group1 swimmers. Furthermore, Jones et al, 1997 showed that a vague objective “do your best” could increase self-confidence, while a difficult objective reduces the self-confidence score in athletes.

The Relationship Between Goal Setting and 50m Butterfly Performance

It was noted that the chronometric performance of 50mpapillon was improved in group 3 better than in group 2, while this performance remained unchanged in group 1, as a result, a highly significant improvement was recorded in group 3 between Test and the Retest ($p = 0.006$; -2.5sec; 7.83%), and a significant improvement in group 2 between Test and Retest ($p = 0.03$; -1sec; 3.24%), while the result was no significant in group 1 ($p = 0.26$).

The performance target set by the goal setting interval (GBI) could activate and direct the physical and mental abilities to meet the demands of the goal to be achieved during the competition better than a vague "do" goal. your best", likewise, the lack of setting a personal goal to achieve does not direct swimmers to optimize time performance. Our results confirm the theory of goal setting (Locke and Lathman, 1990; 1994) that “specific and difficult goals lead to better performance than easy or vague goals such as (do your best)”

In the same context, a study developed by Sarrazion and Famose, 2003 consisting of climbing by varying the difficulty and the specificity of the objectives to be achieved for each exercise, these authors indicated that as the difficulty increases, performance increases.

The importance of setting a personal goal was also studied by Simões et al, 2012, these authors indicated in a two-year longitudinal study that the group which trained the entire season with fixed objectives to achieve presents performances better than the group which trains without objectives to be achieved among elite swimmers aged between 14 and 20 years. On the other hand, Theodorakis, 1995 had shown in an investigation where the swimmer was asked to perform series of 10 min swims, that the effectiveness of setting a personal goal to achieve was affected by past performance, as well as by the sense of self-efficacy and satisfaction among collegiate swimmers.

CONCLUSION

Psychometric parameters (cognitive and somatic anxiety and self-confidence) and physical (timed performance in 50m butterfly) in young swimmers aged between 12 and 13 years old during the 2018/2019 sports season.

Our results show that method 3 for a difficult goal to achieve presented by a goal setting interval (IFB) and method 1 (without a fixed goal to achieve) increased the level of cognitive and somatic anxiety in swimmers before the competition compared to method2 (a vague “do your best” goal) which presented low anxiety values. However, self-confidence was lower in group 1 “training without set goals” than in the other two groups (setting a goal to achieve).

Furthermore, the chronometric performance of 50m butterfly was improved better after setting a difficult goal than a vague goal, while this performance remained unchanged in group 1 (without goal). For this, we noted that a difficult and realistic goal by an IFB could better guide

and activate the physical and mental capacities of swimmers to achieve better performances, as well as the increase in the level of cognitive and somatic anxiety after the goal setting method³ requires psychological intervention by the swim team's mental coach to manage anxiety and increase self-confidence in swimmers.

Limit of the study. In this study, the number of subjects in both groups may also be a limitation of this study. The problem also arises from the difference in the lifestyle of young swimmers during the pre-competitive phase which can influence the results.

Perspective: the method of setting a difficult goal by IFB improved the chronometric performance, but at the same time increased the values of cognitive and somatic anxiety, for this purpose mental preparation models can be developed in future studies to better help swimmers psychologically.

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