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The comparison of Imagery ability in elite, sub-elite and non-elite swimmers

Comparación de la habilidad de Visualización Mental de los atletas de Elite, Sub-Elite y No-Elite en la Natación

Comparação entre praticantes de Elite, Sub-Elite e Não-Elite na habilidade de Imagery em praticantes de Natação

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ABSTRACT

The ability to generate and control mental images is present in all of us, but it differs from person to person. Therefore, it is important to understand that imagery ability can be changed through training and experimentation, it is not a fixed ability. The aim of this study is to compare imagery ability in elite, sub-elite and non-elite athletes in a sport which involves closed and continuous motor skills, such as swimming. 79 swimmers (male N = 37; female N = 42) at an average age of 17 took part in this study. In order to assess imagery ability, the Movement Imagery Questionnaire 3 was used, Portuguese version (Mendes et al., 2016). After analysis of the results, these show that in each and every imagery modality, the scores in the three groups differ significantly. In kinesthetic and external visual imagery the elite and sub-elite groups' scores, although not statistically different from each other, are significantly higher than those of the non-elite group. In internal visual imagery, the differences between all the compared pairs of groups are statistically significant. The elite group got the highest scores, followed by the sub-elite group average scores and finally the non-elite group average scores. According to these results, the conclusion is that athletes with better performance show greater imagery ability and that apparently the external visual imagery proved to be the best intervention method among swimming athletes.

Keywords: Imagery, movement imagery questionnaire – 3, athlete level, swimming.

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Imagery abilities in differents swimmers

RESUMEN

La capacidad de controlar y generar imágenes mentales está presente en todos los individuos, pero varía de sujeto a sujeto, por lo tanto, es importante entender que la habilidad de visualización mental es una capacidad que se puede modificar con el entrenamiento y la experimentación, y no una habilidad fija. El objetivo de nuestro estudio fue el de comparar la habilidad de visualización mental en practicantes de Elite, Sub-Elite y No-Elite, en una modalidad deportiva con habilidades motoras cerradas y continuas, la natación. En este estudio participaron 79 sujetos practicantes de Natación (N = 76) (género masculino N = 37, género femenino N = 42) con una edad media de 17 años (DE = 3,1). Se definieron tres niveles de práctica, el grupo de Elite (N = 29), el grupo Sub-Elite (N = 27) y No-Elite (N = 23). Para evaluar la habilidad de visualización mental se utilizó el *Movement Imagery Questionnaire - 3*, versión portuguesa (Mendes *et al*., 2015). Después de analizar los resultados verificamos que en todas y cada una de las modalidades de visualización mental, las medias obtenidas en los tres grupos (Elite, Sub-Elite y No-Elite) muestran diferencias significativas. De acuerdo con estos resultados podemos concluir que los atletas con mejor rendimiento deportivo muestran una mejor capacidad de visualización mental y que, aparentemente, la modalidad visual externa resultó como el mejor método de intervención para practicantes de Natación.

Palabras clave: visualización mental, *movement imagery questionnaire- 3*, nível de practicantes, natación

RESUMO

A habilidade de controlar e gerar imagens mentais está presente em todos os indivíduos, mas varia de sujeito para sujeito. Consequentemente, é importante entender que a habilidade de *imagery* é uma capacidade que pode ser modificável com o treino e a experimentação, e não uma habilidade fixa. O objetivo do nosso estudo foi comparar a habilidade de *imagery* em praticantes de Elite, Sub-Elite e Não-Elite, numa modalidade com habilidades motoras fechadas e contínuas, a Natação. Neste estudo, participaram 79 sujeitos praticantes de Natação (N = 76) (sexo masculino N = 37; sexo feminino N = 42), com uma média de idades de 17 anos (SD = 3.1). Foram definidos três níveis de prática, sendo o grupo de Elite (N = 29), o grupo Sub-Elite (N = 27) e Não-Elite (N = 23). Para avaliar a habilidade de *imagery*, foi utilizado o *Movement Imagery Questionnaire - 3*, versão portuguesa (Mendes *et al.*, 2015). Após a análise dos resultados, verificámos que em todas e em cada uma das modalidades do *imagery*, as médias obtidas nos três grupos (Elite, Sub-Elite e Não-Elite) apresentam diferenças significativas. De acordo com estes resultados, podemos concluir que atletas com melhor performance desportiva revelam uma melhor capacidade de *imagery* e que aparentemente a modalidade visual externa se revelou como melhor método de intervenção em praticantes de Natação.

Palavras chave: *imagery*, *movement imagery questionnaire- 3*, nível de praticante, natação

INTRODUCTION

Despite little research on the imagery impact on athletes performance in sports involving closed and continuous motor skills, such as running and swimming, qualitative research suggests that athletes who do these sports frequently use imagery to improve their motor performance (MacIntyre & Moran, 2007; Post, Muncie, & Simpson, 2012; Weinberg et al., 2003). In a study that included Olympic swimmers, athletes say that they use imagery to improve their sports performance (Parnabas, Parnabas, & Parnabas, 2015; Ungerleider & Olding, 1991). This can be explained by the fact that technical execution strongly determines sports performance (Marinho et al., 2010).

In the sport context, imagery can be considered as a creation or recreation of an experience generated by information in the memory. It involves sensitive, perceptive and emotional characteristics, which can occur without previous real stimulus, normally associated with the experience which should provide physiological and psychological effects on the performer (Fletcher, 2005). Holmes and Calmels (2008) give a definition of imagery adapted from Fletcher (2005): imagery, in sport context, can be considered as neural generation or regeneration of neural parts, which represent the brain network, involving sensorial, perceptive and emotional characteristics, dependent on personal conscious control, and that can occur in absence of perceptual assessment and is functionally equivalent to the imaged sport movement. The applied model of imagery use, proposed by Martin, Moritz, and Hall (1999) is one of the most commonly used and with better results used in sport (Cumming & Williams, 2013). In this model, the practice context is considered determinant for the way IM is used, with repercussions including at the results level. When McAvinue and Robertson (2008) examined measures of motor imagery ability, they drew the conclusion that, due to the individual differences in imagery ability, it was crucial to assess each individual's own capacity, prior to any study which would involve motor imagery. For example, several authors state that successful athletes show greater imagery ability (Gregg & Hall, 2006; Mendes et al., 2015; Roberts et al., 2008).

According to some studies, imagery ability shows benefits in athletes learning ability and performance (Amorim et al., 2017; Cumming & Williams, 2012; Martini et al., 2016; Williams & Cumming, 2012). Few authors refer the importance of understanding which type of imagery is more appropriate for each individual (kinesthetic, internal visual or external visual imagery), in order to get the best results during its application process (McAvinue & Robertson, 2008; Williams et al., 2012). Concerning the type of imagery, athletes basically describe four of them (visual, kinesthetic, auditory and olfactory), with the visual and the kinesthetic ones being the most often and most extensively used (Weinberg & Gould, 2011). When imagery is intended to simulate an action or movement, the focus is normally on kinesthetic and visual imagery (Cumming & Williams, 2012).

Visual representation includes information about what the individual sees in their images and it can be done through two different perspectives: internal perspective, in the first person, named as internal visual imagery, in which the individual is part of the movement or action, i. e., one imagines watching oneself through one's own eyes; external perspective, in the third person, named as external visual imagery, in which the individual is the observer as if one were watching the movement or action outside one's body (Holmes & Calmels, 2008). White and Hardy (1995) state that each visual perspective has different purposes: the perspective of external visual imagery is valued in the execution of tasks such as movement learning, and when the execution or body coordination is important, i. e., imaging how the movement or action should be performed; the perspective of internal visual imagery is valued in open

skills in which the sense of timing is important (the individual is able to image the sense of space and when the movements should begin).

The kinesthetic modality of movement involves representation of sensations of how the execution of the movement is felt, like the tension in a muscle when it contracts while going up some stairs. The internal feeling involves awareness of posture and body movements, also known as own perception or kinesthesia, as well as the strength and effort felt during the movements (Callow & Watters, 2005; Kim et al., 1998). Kinesthetic imagery has a greater impact on the athletes training and performance (Fery & Morizot, 2000; Smyth & Waller, 1998) and when the movement outcome is related to sports performance. Post et al. (2012), in their studie, analyzed imagery ability through MIQ – R in four competing athletes, in which they showed higher scores in kinesthetic imagery than visual imagery. Nezam et al. (2014) carried out a study similar to the present one, in which they compared imagery ability in Elite, Sub-Elite and Non Elite in different sports modalities, drawing the conclusion that there are statistically significant differences among the three groups. The elite athletes got higher scores whereas the three groups of athletes did not show statistically significant differences in the external visual imagery.

This study can help coaches and support teams to structure technical intervention programs with swimmers. Therefore, and with the purpose of improving the knowledge of imagery ability, the aim of this study is to compare imagery ability in Elite, Sub-Elite and Non Elite athletes, within a sport involving closed and continuous motor skills - swimming. Imagery ability is expected to be better in the Elite group than in Sub-Elite and Non Elite Groups, and the Elite group.

METHODS

Participants

Participated in this study, 79 swimmers (N = 79), (males N = 37; females N = 42) at an average of 17 (SD = 3.1) years. The criterion of participation and standardization of the sample was to have been a federate athlete for at least two years. They should be able to execute four movements MIQ – 3 and should not have had previous imagery experience. Three practice levels have been set: the Elite group consisted of athletes of the National team of the Portuguese Swimming Federation (N = 29; males N=13; females N=16) at an average 17 (SD = 3.4) years, the Sub-Elite group consisted of federate athletes participating in National competitions (N = 27; males N=13; females N=14) at an average 17 (SD = 2,9) years, , and the Non Elite group consisted of non-federated athletes who swim at least two hours a week (N = 23, males N= 11; females N=12) at an average 17 (SD = 3..2) years. It is considered nonprobabilistic as it was chosen by the researcher following subjective criteria and according to the aim of the study (Tuckman & Harper, 2012).

Instruments

The Movement Imagery Questionnaire MIQ – 3 Portuguese version (Mendes et al., 2016), was used. This instrument consisting of three subscales used to assess kinesthetic, internal and external visual imagery. Four basic movements are executed: knee lift, jump, arm movement, waist bend. The same movements are physically executed and imaged three times (in each imagery modality), resulting in a 12-item questionnaire. In order to assess clarity of imaging, two Likert subscales with seven rating points were used, which ranged from “very difficult to see (or feel)” to “very easy to see (or feel)”, according to the imagery modality used. Before completing the questionnaire the participants were provided with definitions of kinesthetic, internal and external visual imagery. Internal visual imagery was

defined as "When you are watching yourself executing a movement from an internal point of view, or in the first person, it is as if you were inside yourself watching and executing the movement through your eyes". The external visual imagery defined as "When you watch yourself executing a movement through an external point of view or in the third person as if you were watching a DVD". Kinesthetic imagery was defined as "feelings and sensations you experience as if you were actually executing the movement". MIQ – 3 showed good internal reliability for each factor through confirmatory factor analysis, showing Cronbach alpha coefficients over 0.7, average variance over 0.5. The imagery score is the result of the addition of internal and external imaging scores and the kinesthetic sense scores, each one showing a maximum score of 28 and a total of 84 in MIQ – 3 (Williams et al., 2012). The Portuguese version of MIQ-3 validated by Mendes et al. (2016) was carried out for this study, which showed internal consistency rates throughout the questionnaire and in its three factors, through Cronbach alpha (MIQ – 3 = 0.88; kinesthetic imagery = 0.79; internal visual imagery = 0.79; internal visual imagery = 0.79).

Procedure: data collection

Every athletes and/or guardians (under 18 years) were duly informed about the study, as far as the participation of their children is concerned, from goals to procedures. Only those who were allowed, whose parents filled the consent form according to the Declaration of Helsinki (2008), were included in the sample. Every instruction concerning the procedures was submitted in writing so that every individual had the same information. The instrument was always applied in similar places and settings for all participants, in a room with the maximum number of five athletes and all subject completed the questionnaire individually, where the right environment was provided so that the athletes could be concentrated while completing the questionnaire. Data were collected anonymously to guarantee its confidentiality, making sure it would not be individually passed on to third parties.

Statistical Analysis

Statistical reporting was carried out using the SPSS (v. 21.0). Descriptive statistics, including means and standard deviation and Shapiro-Wilk normality test, was used initially. One Way ANOVA test with Fisher's Least Significant Difference (LSD) post-hoc tests were used in order to calculate the differences between kinesthetic, internal and external visual imagery, according to athletes level. Effect sizes (*d* Cohen) are reported as: 0-0.2, trivial; 0.21-0.6, short; 0.61-1.2, moderate; 1.21-2.0, long; ≥ 2.0, very long (Hopkins et al., 2009). In addition, the significance level adopted to reject the null hypothesis was $p \leq 0.05$ (Ho, 2014).

RESULTS

Prior to statistical analysis, the internal consistency through Cronbach alpha of the questionnaire was measured which showed good internal consistency for three factors underlying MIQ-3 (MIQ-3 = 0.82; kinesthetic imagery = 0.76; internal visual imagery = 0.75; external visual imagery = 0.79) (Hair et al., 2014). Table 1 shows a clear tendency in each and every imagery modality. The Elite group shows the highest average scores, followed by the average scores of the Sub-Elite group and finally the averages scores of the Non Elite group. On the other hand, observing the standard deviation and the minimum and maximum scores in each imagery modality, we can say that the data concentration shows the same tendency, i. e., in the Elite group the scores are more concentrated, and less concentrated in the Sub-Elite group, whereas the Non Elite group shows the least concentrated scores. Thus, among the three groups, the Elite

group shows the highest mean scores and consistently closer to each other, whereas the Sub-Elite and the Non Elite group showed lower mean scores and higher dispersion of results.

Table 1.
Description statistics of modalities of Imagery and distribution of the sample

		N	Minimum	Maximum	M±SD	Sig.
Kinesthetic Imagery	Elite	29	13	27	21.3±3.9	0.194*
	Sub-Elite	27	10	28	19.7±4.1	0.64*
	Non Elite	23	9	21	16.4±3.8	0.187*
Internal Visual Imagery	Elite	29	17	27	23.2±2.8	0.36*
	Sub-Elite	27	13	26	21.1±4	0.051*
	Non Elite	23	8	23	16.5±4.1	0.414*
External Visual Imagery	Elite	29	14	28	23.9±2.3	0.085*
	Sub-Elite	27	11	28	22±4.3	0.079*
	Non Elite	23	11	23	17.4±3.7	0.051*

p> 0.05

The normality of scores in the imagery modalities for each group was tested through the Shapiro-Wik test. The *p* values of the Shapiro-Wilk test are all significant (*p*>0.5), which shows the normality of scores in each imagery modality for each analyzed group. The significance of differences identified in the statistical description in the several Imagery modalities (kinesthetic, internal and external visual imagery) for each group (Elite, Sub-Elite and Non Elite) in table 2 is analyzed through the Analysis of Variance technique (ANOVA). When comparing these three groups of swimmers the p-value of the test statistics in each and every imagery modality (kinesthetic, internal and external visual imagery) is <0.001, which means that the scores in each analysed group are different. Thus, it can be said that in each and every imagery modality, the scores of the three groups (Elite, Sub-Elite and Non Elite) show statistically very significant differences (*p* <0.001).

Table 2.
Results of One Way ANOVA between Elite, Sub-Elite e Non Elite athletes

ANOVA						
		Sum of the Squares	*df*	Mean Square	*F*	*Sig.*
Kinesthetic Imagery	Between Groups	316.902	2	158.451	10.25	<0.001*
	Within Groups	1174.87	76	15.459		
Internal Visual Imagery	Between Groups	586.431	2	293.215	22.126	<0.001*
	Within Groups	1.007.164	76	13.252		
External Visual Imagery	Between Groups	558.358	2	279.179	19.747	<0.001*
	Within Groups	1.074.477	76	14.138		

**p* < 0.001

As the analysis of the table above shows, the resulting scores for each group (Elite, Sub-Elite and Non Elite) in each imagery modality cannot be considered similar. Therefore, those groups should be analyzed in pairs. Is shown in table 3 through the Fisher's Least Significant Difference (LSD) test. The p-value in each imagery for each pair of groups show statistically significant all the differences in which the p-value is less than .05. The scores of the Elite and Sub-Elite groups in kinesthetic and external visual imagery, although not statistically different from each other (even though the Elite group got a higher score than the Sub-Elite group), are significantly higher than those of the Non Elite group. In Internal visual imagery, the differences between every pair of groups are statistically different. The Elite group got the highest mean scores followed by those of the Sub-Elite group and finally the Non Elite group mean scores. This table also shows a great effect of expertise in imagery ability in the Elite Group when compare with the Non Elite Group in the three modalities of Imagery: Kinesthetic – d = 1.27(90%CI: 0.75 - 1.75); Internal Visual Imagery - d = 1.95(90%CI: 1.37 - 2.48); External Visual Imagery - d = 2.17(90%CI: 1.56 - 2.71).

Table 3.

The result of LDS post-hoc between groups and Effect size

Multiple Comparisons

LSD

Dependent Variable	(I)Level	(J) Level	Mean Difference (I-J)	Std. Error	Sig.	Effect size: Differences in means (*d*; 95% CI)
Kinesthetic Imagery	Elite	Sub-Elite	15.696	105.148	.140	0.4(-0.05 - 0.84) short
	Elite	Non Elite	4.91904	109.781	0.000**	1.27(0.75 - 1.75) long
	Sub-Elite	Non Elite	3.34944	111.565	0.004**	0.83(0.33 - 1.3) moderate
Internal Visual Imagery	Elite	Sub-Elite	2.09579	.97355	0.035*	0.52(0.07 - 0.96) short
	Elite	Non Elite	6.68516	101.644	0.000**	1.95(1.37 - 2.48) long
	Sub-Elite	Non Elite	4.58937	103.296	0.000**	1.14(0.62 - 1.62) moderate
External Visual Imagery	Elite	Sub- Elite	1.894	100.555	0.063	0.56(0.10 - 1) short
	Elite	Non Elite	6.49625	104.986	0.000**	2.17(1.56 - 2.71) very long
	Sub-Elite	Non Elite	4.60225	106.692	0.000**	1.14(0.62 - 1.62) moderate

Discussion

The aim of this study was to compare imagery ability in Elite, Sub-Elite and Non Elite athletes within a sport involving closed and continuous motor skills - Swimming. Although research suggests that athletes who do continuous skill sports frequently use imagery to enhance motor performance (Amorim, Duarte-Mendes & Travassos, 2018; MacIntyre & Moran, 2007; Post et al., 2012; Weinberg & Gould, 2015), there is still little research specifically in the impact of imagery on swimmers. Parnabas et al. (2015), in their study on the correlation between the use of imagery

and sports performance among swimmers, found that there is a positive correlation between internal and external imagery and sports performance. In addition, McAvinue

This study shows that there are differences among the three levels of swimmers. The Elite group got the highest mean scores in the three imagery modalities, which is consistent with research carried out by Gregg and Hall (2006) and Roberts et al. (2008). In kinesthetic and external visual imagery, despite the Elite group's get higher scores when compared with the Sub-Elite group they were not statistically different from each other, however, are significantly higher than the Non Elite group. In internal visual imagery, the differences between the compared pairs of groups are statistically significant. The Elite group got the highest mean scores, followed by those of the Sub-Elite group and finally the Non Elite group mean scores.

Nezam et al. (2014) got similar results and found statistically significant differences among the three groups in internal visual and kinesthetic imagery. The Elite group had significantly higher scores than the Sub-Elite and Non Elite groups. In what concerns to external visual imagery, unlike our study, no statistically significant differences were found (Nezam et al. 2014). As to the results of the use of MIQ – 3 in the three groups, they showed a higher score in external visual imagery rates, suggests that the external visual imagery is the best method of intervention for swimmers, like White and Hardy's study (1995), in which the authors state that external visual imagery is the most appropriate to use in execution of tasks such as learning of movements, and when body coordination is important, i. e., imaging how the movement or action should be executed. Parnabas et al. (2015) state that sports like swimming not only require physical skills, but they also point out the importance of imagery, therefore advising sports psychologists, coaches and other participants in the training process to recommend the use of imagery as a performance-enhancing strategy.

and Robertson (2008) also highlight the importance of imagery ability assessment due to each individual's particular differences.

Therefore, the scores in the kinesthetic imagery has a higher impact on athletes training and performance (Fery & Morizot, 2000; Smyth & Waller, 1998) and when the outcome of the movement is related with sports performance, might have been conditioned. According to the resulting data, in each and every imagery modality, the scores of the three groups (Elite, Sub-Elite and Non Elite) show statistically very significant differences. In internal visual imagery, the differences between all pairs of groups are statistically significant. The Elite group had the highest mean scores, followed by the Sub-Elite group mean scores and finally by those of the Non Elite group.

This study has some limitations, namely the fact that the Elite athletes are not considered professional athletes, which would be the level in sports performance plays a more relevant role. Future research should replicate this study in different age groups in swimming and evaluate the application of imagery programs based on imagery ability of the subjects in sports performance. We also suggest to relate the imagery ability with different motor skills in other sports modalities, as already has been reported in the literature (Fortes et al., 2019; Williams et al., 2012,).

As to the results of the use of the MIQ – 3 in the three groups, they showed a higher score in external visual imagery, which suggests that the external visual imagery is the best method of intervention among swimming athletes. This information is important to highlight the use of imagery questionnaires (Mendes et al., 2016) to evaluate the imagery ability of the subjects when imagery programs are applied to improve sports performance by coaches and support teams in the organization of technical intervention for swimmers.

PRATICAL IMPLICATIONS

This information is important to highlight the use of imagery questionnaires (Mendes et al., 2016) to evaluate the imagery ability of the subjects when imagery programs are applied to improve sports performance by coaches and support teams in the organization of technical intervention for swimmers. Moreover, recent research has focused on the preparation for main performance and warm-up has been investigated as essential to optimize subsequent performance. This is common with imagery, that aims to maximize performance. So, perhaps the imagery could be included as part of the warm-up. Some reviews on swimming (Neiva, Marques, Barbosa, Izquierdo, & Marinho, 2014) and team sports (Silva, Neiva, Marques, Izquierdo, & Marinho, 2018) focused on the importance of different strategies during warm-up and post-warm-up.

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