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Optimization of Performance in Alpine Skiing Through Different Mental Training Techniques

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Abstract
Problem Statement: effects of applying mental training techniques in alpine skiers aged 12 ± 6 and 19 ± 2 years, for 2 years. Daily stressors, compared to traumatic events, are increasingly recognized as important risk factors for mental health. The role of general self-efficacy on the relationship between daily stress and aspects of mental health has not yet been examined. [1]. *Purpose of Study:* to determine whether by applying mental training techniques certain psychological factors able to influence performance optimization in alpine skiing can be modified. The experimental series comprised 20 skiers, from the clubs CSS Gheorgheni (HR), CSS Baia – Sprie (MM), and FEFS students. The control series comprising 20 skiers, from the clubs CSM Gheorgheni (HR), CSS Sibiu (SB), CS Corona Brasov (BV), CSS Sinaia (PH), CSS Petroşani (HD), CSS Topliţa (HR), CS Miercurea-Ciuc (CV), Crazy – Byke (SB). *Methods:* we psychological tests for attention (MA- focused, AP_2 – perceptual attention, AD – distributed), EMAS S – state of anxiety, PDE – emotional distress. Participants were asked to train their working memory using computerised verbal and spatial working memory span tasks for 3 months [2], on the most important action of motor act in alpine skiing and after answering to [3], [4] tests which were used. We used SPSS 17.0 for statistical analysis. *Findings and Results:* by using mental training techniques through imagery and NLP techniques, we managed to improve performance on the level of visual, auditory and kinaesthetic acuity, as well as the level of perceptual attention (AP2), [5]. *Conclusions and Recommendations*: Findings show that the application of mental training techniques leads to lower anxiety issues (EMAS) and emotional distress (PDE) in skiers' behaviour. Performance in alpine skiers can be improved by increasing perceptual attention, following the stimulation of visual, auditory, and kinaesthetic channel in alpine skiers. The effects of mental training practice in alpine skiers is better using through imagery and NLP techniques also, [6].

1. Introduction

Problem Statement: effects of applying mental training techniques in alpine skiers aged 12±6 – 19±2 years old for 2 years. This study focused on imagery, NLP techniques as tools for mental training. Results showed that, during this study, most of the sportsmen agreed with imagery and NLP techniques, they talked about such aspects and consider them as useful before, during and after the competition.

In the elaboration of the plan, we need to keep in mind certain suggestions, of different researchers from the domain of sport psychology and mental training: we need to keep in mind the benefits and limits of imagery and NLP. This functions well if the sportsman gets totally involved and if imagery is part of the daily program, [7]. It is possible that in using mental training, in imagery to be needed help in the development, enhancement and evaluation of the preparation program, from psychologists, which may not be present in all clubs.

To ensure that participants trained at an optimally challenging level, task difficulty was increased or decreased adaptively depending on a trainee's performance levels (adaptive training) [8].

Purpose of Study: to determine whether by applying of mental training techniques certain psychological factors able to influence performance optimization in alpine skiing can be modified.

The three factors analysed were the following:

1. The study of cognitive components involved in constructing complex images in alpine skiing, conducted as follows: testing attention capacity by applying attention tests (MA), AD) (AP_2) in athletes (initial, final). The monitoring of stress, cause for anxiety (EMAS) and emotional distress (PDE).
2. The study of sensations participating to the process of forming complex images through mental imagery or NLP techniques. It was possible by identifying the semantics of certain words (initial, final) by the applying the [3] and [4] tests (initial, final) and by determining clearly the main communication channel of each athlete.
3. The optimization of sports performance, through associated–dissociated NLP techniques, "keywords" and "anchors", metalanguage. The research is part of the doctoral thesis of the first author.

Many previous studies have reported that medals [9], [10], [11], and athletes' success are actually the ones that measure achievements in sport at various levels.

At the beginnings of mental training development in sport, several studies were conducted on the importance and necessity of mental toughness [12], [13], [14], [15] in becoming a champion.

Following the direction of previous studies, other scientists elaborated sport-specific questionnaires to test the mental skills of athletes across different competitive standards and sports. On the other hand, researches have also found that negative self-talk can lower an athlete's self-confidence [16]. Research findings have shown that elite and successful athletes are more committed, motivated, self-confident, focused, and able to cope with adversity, and peak under pressure.

Specialists can use such body of knowledge to plan, implement, and optimize psychological treatments, thereby helping experienced performers and beginners achieve their best. [17].

Researchers have focused on individual psychological factors (goal setting, relaxation, imagery and self-talk) and their influences on performance.

Empirical studies have also focused on individual psychological factors (e.g., confidence, motivation, attention, visualization and psychosomatic skills) and on their influence upon performance [11].

To fully illuminate the processes at work behind the impact of stress on mental health, it is essential to examine the buffering potential of psychological resources and coping mechanisms (Wheaton, 1985), cited by [1].

Through internal neuron systems of actions, external copies are created that are responsible for triggering the actions at the level of the same stimuli, while during observation they will be created through active repetitions [18]. The last can represent an example to fully explain the way in which cognitive skills within a movement may be improved through mental training [19].

There is evidence that chronic stress of daily life is a better predictor of mental health and well-being [20].

Often, a combination of internal and external information of images for constructing symbolically a verbal-based intervention verbal is used, such as of mental training, which uses the description of a motor task (Mayer and Hermann, 2009; cited by [21]. Through imagery, one can become aware of motor processes [22]. These mental processes influence the motor system, on one hand; on the other, they are activated to construct motor networks. Mental training is actually determined by these networks [23].

The human brain is known to respond adaptively to varying environmental demands [24]. There is general consensus that in addition to our genes, novel activities and experiences may shape the brain's structure and organisation and, hence, our behaviour. However, the neural correlates of learning in the human brain still remain poorly understood [8].

2. Material and Method

Subjects: the experimental series comprising 20 skiers aged 12±6 years old– 19±2 years old, children and juniors from the clubs CSS Gheorgheni (HR), CSS Baia – Sprie (MM), and FEFS students.

The control series had 20 skiers 12±6 years old– 19±2 years old, children and juniors from the club CSM Gheorgheni (HR), CSS Sibiu (SB), and FEFS students, CS Corona Brasov (BV), CSS Sinaia (PH), CSS Petroșani (HD), CSS Toplița (HR), CS Miercurea-Ciuc (CV), Crazy – Byke (SB).

Parameter selection is a method that very few past studies [25], have utilized to optimize their results. However, this may relate to it being a more effective method on larger datasets, which would have greater variability in data than smaller datasets. In this section, we discuss the effects and implementation of parameter selection [26].

For determining research hypotheses, we assumed that the application of mental imagery techniques creates new behavioural models, which will determine the optimization of alpine skiing performances:

1. Improving the skiers' motor image capacity.
2. Increasing attention capacity: focused, distributed and spirit of observation.
3. The application of mental training improves the performance behaviour of athletes and alters dysfunctional negative emotions: anxiety, emotional distress; it also increases positive emotions: self-confidence.

Depending on the data three possible types of learning can be employed, including supervised learning, semi-supervised learning, and unsupervised learning. Supervised learning is performed if all of the data is labeled; semi supervised learning is performed when there is unlabeled data along with labeled data; and, unsupervised learning is performed when all of the data is unlabeled [26].

Methods: objectifying mental training by applying psychological tests: for attention (MA- focused, AP_2 – perceptual attention, AD – distributed, EMAS – state of anxiety, PDE – emotional distress); for measuring the quality of NLP techniques – Jacobson Sid, Bandler Richard & Thomson Garner (*visual, auditory and kinaesthetic acuity)*

It is useful to perform a parameter selection process because sometimes slight changes to a certain parameter's values of a given learning method cause considerable variability in the resulting prediction model. Selection of a parameter that some how regulates the complexity (e.g. regularization parameters, which penalize complexity and target the over fitting problem) of the prediction model developed by the learning method is especially important [26].

3. Findings and Discussions

Data processing shows that mental training techniques improve performance for the experimental series, but not for the control series, (which has not benefitted from this intervention) concerning the following skills: motor representations – through specific tests applied, focused attention (MA), Perceptual attention (AP_2), Distributed attention (AD). Lower anxiety issues (EMAS) and emotional distress (PDE) were also recorded.

Table 1. *Descriptive statistics.*

	Series	N	Mean	Standard deviation	Standard error Mean
Jacobson_TI	Experimental	20	60.85	6.869	1.536
	Control	20	60.95	6.362	1.423
Bandler_TI	Experimental	20	58.4500	3.53144	.78965
	Control	20	58.4000	4.23519	.94702
Focused_attentionTI	Experimental	20	27.9000	6.12931	1.37056
	Control	20	28.4000	7.92996	1.77319
Perceptual_attentionTI	Experimental	20	15.4500	2.96426	.66283
	Control	20	15.2000	3.65052	.81628
Distributed_attentionTI	Experimental	20	.1515	.08635	.01931
	Control	20	.1515	.06401	.01431
EMAS_TI	Experimental	20	29.1000	7.70441	1.72276
	Control	20	29.1500	7.82893	1.75060
PDE_TI	Experimental	20	20.7500	9.33513	2.08740
	Control	20	20.9500	13.30799	2.97576

Upon the initial testing, the control and the experimental series are similar and they start from the same point before the intervention, because we obtained for Jacobson p=.862>.05, Bandler and Thomson p=.404>.05, Focused attention p=.608 >.05, Perceptual attention p=.450>.05, Distributed attention p=.345>.05, EMAS p=.547>.05 and PDE p=.285>.05 (see Figure 1 and Table 2).

We applied a *t* test for independent samples to determine whether the series are similar before the intervention, reason for which we introduced within the analysis scores for the initial testing of measurements: Jacobson, S., Bandler, R. And Thomson, G., Focused attention, Perceptual attention, Distributed attention, EMAS and PDE (see Table 2).

Table 2. *T test for independent samples.*

		Levene's equal variances test	
		F	Sig.
Jacobson_TI	Equal variances assumed	.031	.862
	Equal variances not assumed		
Bandler_TI	Equal variances assumed	.713	.404
	Equal variances not assumed		
Focused_attentionTI	Equal variances assumed	.267	.608
	Equal variances not assumed		
Perceptual_attentionTI	Equal variances assumed	.583	.450
	Equal variances not assumed		
Distributed_attentionTI	Equal variances assumed	.913	.345
	Equal variances not assumed		
EMAS_TI	Equal variances assumed	.369	.547
	Equal variances not assumed		
PDE_TI	Equal variances assumed	1.177	.285
	Equal variances not assumed		

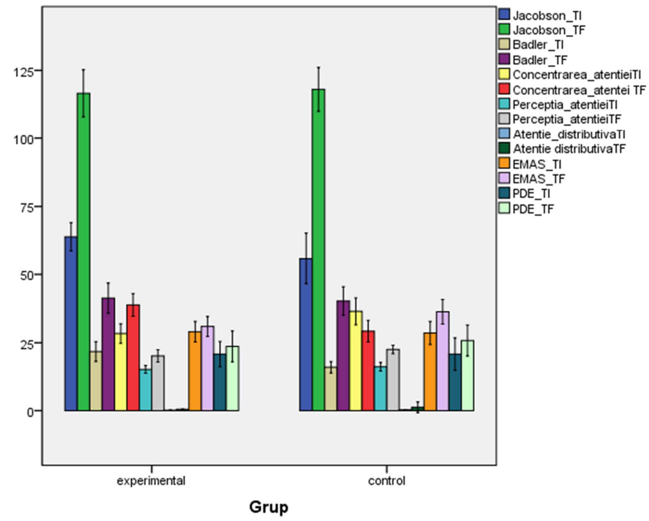

Figure 1. *Comparison of means in the psychological tests Le and Lc.*

Considering that the 0.5 significance threshold was exceeded, the two series starts from the same level; had we obtained values under 0.5, the two series would have been different and there would have been no point in continuing the analysis. To determine whether the intervention is successful, we calculated a *t* test for paired samples, to pinpoint the differences between pre-intervention and post-intervention measurements. The means obtained illustrate a difference after applying the intervention (see Tables 3 and 4).

More precisely, the use of imagery techniques improves performance in tests measuring visual, auditory and kinaesthetic acuity, (assessed through Jacobson and Bandler, R & Thomson, G. tests) as well as the level of perceptual attention (AP_2), see Table 5.

Data confirm that the application of mental training techniques leads to lower anxiety issues (EMAS) and emotional distress (PDE) in skiers' behaviour.

Table 3. *Descriptive statistics – Experimental series.*

		Mean	N	Standard deviation	Standard error mean
Pair 1	Jacobson_TI	60.85	20	6.869	1.536
	Jacobson_TF	117.35	20	17.825	3.986
Pair 2	Bandler_TI	58.4500	20	3.53144	.78965
	Bandler_TF	65.6500	20	6.36003	1.42215
Pair 3	Focused_attentionTI	27.9000	20	6.12931	1.37056
	Concentrarea_ateneiTF	41.4500	20	6.73932	1.50696
Pair 4	Perceptual_attentionTI	15.4500	20	2.96426	.66283
	Perceptual_attentionTF	21.2500	20	4.06364	.90866
Pair 5	Distributed_attentionTI	.1515	20	.08635	.01931
	Distributed_attentionTF	.5115	20	.21350	.04774
Pair 6	EMAS_TI	29.1000	20	7.70441	1.72276
	EMAS_TF	53.5500	20	9.32159	2.08437
Pair 7	PDE_TI	20.7500	20	9.33513	2.08740
	PDE_TF	32.8500	20	10.32256	2.30819

Table 4. *Descriptive statistics – Control series.*

		Mean	N	Standard deviation	Standard error mean
Pair 1	Jacobson_TI	60.95	20	6.362	1.423
	Jacobson_TF	62.05	20	5.995	1.341
Pair 2	Bandler_TI	58.4000	20	4.23519	.94702
	Bandler_TF	61.3000	20	4.76942	1.06647
Pair 3	Focused_attentionTI	28.4000	20	7.92996	1.77319
	focused_attention TF	36.9500	20	10.85539	2.42734
Pair 4	Perceptual_attentionTI	15.2000	20	3.65052	.81628
	Perceptual_attentionTF	17.0500	20	2.91051	.65081
Pair 5	Distributed_attentionTI	.1515	20	.06401	.01431
	Distributed_attentionTF	.2795	20	.06605	.01477
Pair 6	EMAS_TI	29.1500	20	7.82893	1.75060
	EMAS_TF	36.9000	20	9.78129	2.18716
Pair 7	PDE_TI	20.9500	20	13.30799	2.97576
	PDE_TF	22.9500	20	10.67942	2.38799

***Table 5.** T test for independent samples, final measurements.*

		Levene's test for equal variances				
		F	Sig.	t	df	Sig. (2-tailed)
Jacobson_TF	Equal variances assumed	16.067	.000	13.151	38	.000
	Equal variances not assumed			13.151	23.245	.000
Bandler_TF	Equal variances assumed	1.001	.323	2.447	38	.019
	Equal variances not assumed			2.447	35.235	.020
Foccused attentionTF	Equal variances assumed	5.140	.029	1.575	38	.124
	Equal variances not assumed			1.575	31.752	.125
Perceptual_attentionTF	Equal variances assumed	2.309	.137	3.758	38	.001
	Equal variances not assumed			3.758	34.432	.001
Distributed_attentionTF	Equal variances assumed	19.353	.000	4.643	38	.000
	Equal variances not assumed			4.643	22.604	.000
EMAS_TF	Equal variances assumed	.021	.884	5.511	38	.000
	Equal variances not assumed			5.511	37.912	.000
PDE_TF	Equal variances assumed	.412	.525	2.981	38	.005
	Equal variances not assumed			2.981	37.956	.005

According to our findings, the intervention improved performance concerning the measured dimensions because we obtained statistically significant thresholds. However, for certain dimensions, the assumption of equal variances calculated using Levene's test was not confirmed, such as for Jacobson, $M=117.35$ for the experimental series and $M=62.05$ for the control series, $t(38)=13.151$, $p=.00<.05$; Focused attention $M=41.45$ for the experimental series and $M=36.95$ for the control series, $t(38)=1.575$, $p=.029<.05$, and Distributed attention, cu $M=5.11$ for the experimental series and $M=2.79$ for the control series, $t(38) = 4.643$, $p=.00<.05$. Hence, for these dimensions, though results may appear significant, we cannot make any statements because the assumption was not confirmed. In Bandler, Perceptual attention, EMAS and PDE, statistically significant results were found; thus, they were improved following the intervention. More, precisely, the expected results for Levene's test and the assumption of equal variances were confirmed. For Bandler, we obtained $M= 65.6$ for the experimental series and $M=61.3$ for the control series, $t(38) = 2.4$, $p = 0.02 < 0.05$, for Perceptual attention, experimental series $M= 21.2$ and control series $M= 17$, $t(38) = 3.7$, $p = 0.00 < 0.05$, for EMAS, experimental series $M= 53.5$ and control series $M= 36.9$, $t(38) = 5.5$, $p = 0.00 < 0.05$, while for PDE, experimental series obtained $M= 32.8$ and control series $M= 22.9$, $t(38) = 2.9$, $p = 0.00 < 0.05$ (see Table 5).

4. Conclusions and Recommendations

The first and second hypotheses were confirmed for some dimensions, while for others not. More precisely, the use of imagery techniques improves performance in tests measuring visual, auditory and kinaesthetic acuity, (Jacobson and Bandler, R & Thomson, G.) and it increases the level of perceptual attention (AP_2). The third hypothesis was confirmed. Findings show that the application of mental training techniques leads to lower anxiety issues (EMAS) and emotional distress (PDE) in skiers' behaviour.

Furthermore, it improves *self-confidence* and *focusing on being a winner*, to which we add *lower anxiety and emotional distress.* The aforementioned study is also supported by other authors [29], who argue that goal setting method improves game skills, techniques and performances and that it *increases concentration,* an aspect necessary for winning competitions.

Similarly, there is evidence for its intervening role in context of occupational and student's examination stress [30].

The use of imagery in training leads to outstanding performances [31]. Imagery is the mental training of a skill or of a task to accomplish, without executing it per se. It is more than visualisation, because it includes all senses. Imagery is a strong instrument when used right. It can improve physical performances and it is useful during pre-season and competitions.

The strength of the association between stress and mental state depends on characteristics and strategies that differ-entity individuals from one another [32].

The purpose of this study was to highlight the importance of psychological factors in sport, (alpine skiing, in our case). The psychological factors were taken into account either by measuring certain emotional dimensions, or by influencing them through NLP techniques and mental imagery, naturally.

Moreover, considering the recognition that complete mental health is more than just the absence of psychopathological symptoms [33], the traditional one-dimensional model is no longer sufficient.

As expected and as scientific literature indicates, the use of mental imagery techniques and of NLP increased skiers' performances both during competitions and concerning certain dimensions, such as attention (focused, perceptual, distributed) and motor representations. Besides attention and representation (known to affect directly skiing performance), the psychological techniques used have led to lower anxiety and emotional distress levels. Anxiety and emotional distress may interfere with and entail negative consequences concerning performance.

The only difference is that instead of iterating through different test sets, the parameter selection method iterates through each of the pre-defined set of possible parameter values. At every iteration, it uses the same training and test set to estimate a model that describes the data and assess the precision of

the model by computing appropriate validation measures respectively. The parameter value that results in the most precise model is then selected as the optimal parameter value [26].

Findings suggest that self-efficacy operates as a buffer of daily stress. However, a full mediation model was not supported as multiple psychological resources can have protective effects. This study provides the first transnational evidence for different stress-buffer effects for the two dimensions of mental health [1].

The goal of this study was to underscore the beneficial effects of relaxation strategies and NLP techniques for alpine skiing; future studies could clarify the underlying mechanisms of these processes. In the same line of future researches, we propose to study other psychological intervention methods meant to improve skiers' performance.

Fundamental research on the neuroscience of cognition should progress far more rapidly when cortical areas supporting specific psychological tasks can be more unambiguously identified. This topic

is discussed more fully in a book chapter by [27], [28]. Currently, standard functional image analysis methodology is unable even to assign brain activity to a particular bank of a sulcus, once smoothing and

averaging have been performed across human brains. The great power of spatial mapping of brain activity for understanding when differently labeled tasks are in fact the same, and when apparently similar tasks

are actually dissociated, can only be used to its fullest when the neuronal substrate of brain functional activity has been properly identified. Meta-analysis, already showing great promise, should really take off

when such correlations have even been partly established [26].

We argue for interdisciplinary and for the use of psychology knowledge to enrich the experience of skiers, to help them redirect dysfunctional and negative emotions, to self-regulate and, not least, to increase skiing performance.

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