

# IMPACT OF MOTOR LEARNING ON OVERALL SKILL-RELATED ANXIETY

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**Abstract:** The aim of this research is to determine the differences in participants' overall anxiety and its factors before and after the motor skill learning process. A sample consisted of 96 examinees, college students who attended 3 learning sessions of a handspring vault in a crouch position. Students estimated their own anxiety by a questionnaire on a scale 1 – 4 at the beginning of the learning process and before the third session. Total anxiety is constructed of 3 factors: somatic, cognitive and self-confidence. The results showed that the highest manifestation of student's anxiety was in the self-confidence referring to the highest (the worst) result, then in cognitive factor and the lowest in somatic factor. The average overall student's anxiety reduced from 2.26 to 1.83, and the reduction (improvement) is manifested in all three anxiety factors. Anxiety reduction could be affected by adaptation processes, higher level of motor skill performance, controlled condition in the learning process, and interaction of all mentioned. The conclusion is that the motor learning can reduce the skill-related anxiety so it is recommended that high-anxiety participants are retained in the learning process.

**Keywords:** anxiety factors, college students, learning process, motor skill.

## INTRODUCTION

Anxiety is an emotional state that is manifested through irritability, tension, psychosomatic disorders, crying bursts, aggression, decision making difficulties, insomnia and depression (Lebedina Manzoni, 2007). It is also manifested through many physiological changes including increased heart frequency, increased blood pressure, and tension of the body all of which indicate the hyperactivity of the vegetative nervous system. Its possible cause is the human need for understanding, anticipating and controlling events in their own lives (Kelly, 1955, stated in Larsen & Buss, 2008). But as a result of the inability to understand and anticipate life events anxiety occurs. People become anxious when events are unpredictable, out of their control. On the other hand, because of uncertainty of anxiety, the person tries to materialize it by wrongly associating it with a particular object, situation or illness (Milivojević, 2010).

Symptoms of anxiety are manifested in 4 main areas: physical (somatic), emotional, cognitive and behavioral. During childhood anxiety generally increases with age (Achenbach, Howell, Quay, & Conners, 1991 stated in Oatley & Jenkins, 2007). Anxiety has many negative effects that can prevent normal functioning in different aspects of everyday life in various ways.

During school-age, school phobia or rejection of school occurs, which is an irrational fear of some aspects of school occasions. Physiological symptoms of anxiety or panic occur when offset becomes inevitable leading to partial or complete inability of school attendance (Wenar, 2002). Children and adolescents experience a great deal of stress, and as the most frequently mentioned source of stress in school age children is failure (Halstead, Cunningham, and Bennett Johnson, 1993 stated in Vizek Vidović, Rijavec, Vlahović-Štetić, & Miljković, 2014). Anxiety often occurs in situations where there are performance-related pressures, when failure has serious consequences and also when there is competition and comparison between students (Wigfield & Eccles, 1989, stated in Woolfolk, 2016). One of the occurring forms is test anxiety that causes a fall of success in the test situation. The reason is the action of two groups of factors: inadequate cognitive processes and elevated excitation of the autonomic nervous system (Liebert & Moriss, 1967 stated in Vizek Vidović et al., 2014). Highly test anxious students have a large number of distracting thoughts that hinder the recollection and problem solving. Their thoughts are directed to the possible negative consequences of failure in the test situation (Vizek Vidović et al., 2014).

Anxiety related to the motor activity is specific in relation to anxiety that is not related to motor activity (Bortoli,

& Robazza, 1995). Anxiety negatively affects performance at different levels of management, attention, interpretation but also the physical (motor) aspect (Nieuwenhuys & Oudejans, 2017). The same authors state that it also negatively affects the familiarity with situations and decision making referring to those situations. Furthermore, the feeling and perception of insecurity, anxiety and threat can interfere the motor learning and motor performance (Bortoli & Robazza, 1994). According to Ekornas, Lundervold, Tjus, and Heimann (2010), children with determined anxiety show impaired performance of motor skills and have a poor self-assessment of peer acceptance and body competence compared to the non-anxious children. In their research, Skirbekk, Hansen, Oerbeck, Wentzel-Larsen, and Kristensen (2012) determined that up to 19 children (46% of the sample) with established anxiety had results below the fifth percentile on the motor impairment test (M-ABC), indicating that motor function in anxious children is impaired to such an extent that they interfere with their everyday life activities.

According to Jones and Cale (1989), somatic anxiety is negatively related with the cognitive status (“digit span test”), while on the other hand, self-confidence and somatic anxiety are positively related with speed of motor performance. These findings suggest that somatic anxiety might be an important source of variation in motor performance. Anxiety is a factor that can also affect the reduced ability of motor visualization (“motor imagery”), which is an important factor in the motor learning process (Kahraman, Savci, Ozdogar, & Gedik 2018). Furthermore, Smith, Burwitz, and Jakeman (1988) determined that successful performance of motor tests in highly anxious conditions but only in front of spectators is increased. But, while evaluating the same performance under competitive conditions, performance was reduced. Likewise, anxiety also had an effect on cricket players in the way that they had less good contacts with the ball (Runswick, Oliver, Roca, Williams, & Bezodis, 2018).

There is a need to find a solution i.e. an answer to the question of how to reduce anxiety and thus its negative consequences. For example, Hordacre, Immink, Ridding, and Hillier (2016) determined that after simulated conditions of stress and anxiety, improved precision performance was achieved in the form of shorter performance time, retention of precision and lower variability. Also, training focused on improving work memory capacity and “quiet eye” training (observing the aim of performance) can significantly improve performance in high stress conditions (Ducrocq, Wilson M., Smith & Derakshan, 2017). Also, “quiet eye” training results in better external focus and also faster heart rate reduction and reduced muscular activity when shot-putting in golf compared to classic skill learning training (Moore, Vine, Cooke, Ring, & Wilson M.R., 2012). According to Oudejans, and Pijpers (2009), training in anxiety conditions can prevent the feeling of suffocation among elite athletes during motor performance due to adaptation on anxiety specific processes in human body. Mullen, Jones, Oliver, and Hardy (2016) state that the current research conducted on skilled but anxious athletes reported on the benefits of applying a “holistic approach” to achieving goals as compared to “segment approach” to avoid negative effects associated with conscious procession of task-related information.

For participants whose self-control strength was temporarily exhausted, the association between anxiety and performance was significant and negative. Raising the power of self-control can prevent the potentially negative effects of anxiety (Englert & Bertams, 2013). According to Stern, Cole, Gollwitzer, Oettingen, and Balcielis (2013), anxiety leads to excessive perception of distance which can impair the performance of the distance-related motor task. According to the same authors, intentional application can reduce the anxiety and thus lead to an appropriate perception of the distance of the target and thus successful performance. According to Mullen and Hardy (2000), explicitly (cognition during performance) learned motor skills are less susceptible to poor performance in stressful situations than implicitly (automatic performance) learned motor skill. An appropriate strategy needs to be planned for people so they could overcome inhibition and difficulties (Bortoli & Robazza, 1994).

The main aim of the research is to determine the differences in examinees’ overall anxiety before and after the motor skill learning process. The partial aims are to determine the differences in partial indicators of overall anxiety.

## METHODS

### *Participants*

96 students of the Faculty of Education in Osijek participated in the study, 10 males and 86 females, with an average age of 19.9 years (SD = 1,36). The study was approved by the Ethical Committee of Faculty of Education in Osijek, Croatia.

### Measure

The variables in this study are three factors of anxiety, somatic factor, cognitive factor, self-confidence, and also the overall total anxiety. Anxiety is self-assessed by the Competitive State Anxiety Inventory - 2, CSAI-2 (Martens, Vealey, & Burton, 1990), which the author has adapted to the research and ultimately contains five particles/estimates for each of the three anxiety factors. Answers to all 15 claims are on a scale from 1 to 4 (1 – at least, 2 – little, 3 – enough, 4 – very high). Questions for the somatic factor were reversed, so these responses were adjusted to other factors before calculating the overall result. The result of the examinees in each factor is the arithmetic mean of the five questions and also the overall anxiety is the arithmetic mean of all three factors.

### Test protocol

Handspring vault in a crouch position is a basic vaulting element in gymnastics. It is frequently included in Physical Education lessons because of its utility but also associated with a high level of participants' anxiety. Motor skill learning in this study will be conducted in three 90 minute sessions. The participants completed the questionnaire before the first and the third session of skill learning. The level of acquisition was assessed before and after the learning process on a scale from 1 to 5 (1 – the lowest, 5 – the highest). The questionnaire also contained a statement examining the initial state of skill acquisition. The participants who claim they can't perform a vault in any possible way were rated 0 and their initial level of acquisition was not assessed. Since 67 out of 96 students (70%) stated that they can't perform a vault, it can be concluded that the process of learning the motor skills in this research was related to the initial phases of skill acquisition.

### Statistical analysis

The descriptive statistics were: arithmetic mean (Mean), standard deviation ( $\sigma$ ), minimum (Min) and maximum (Max) for overall anxiety and its factors for both assessments. Correlation between variables was analysed by the Spearman's correlation rank. Wilcoxon matched pairs test was conducted to determine differences between the two assessments. The collected data were analysed with the computer program Statistica for Windows 13.3 (TIBCO Software Inc.).

## RESULTS

Table 1 shows descriptive parameters of overall anxiety and its factors for both assessments.

*Table 1. Descriptive parameters of overall anxiety and its factors.*

I. assessment	Mean	$\sigma$	Min	Max
Somatic factor	1.90	0.86	1.00	4.00
Cognitive factor	2.15	0.81	1.00	3.80
Self-confidence	2.72	0.92	1.00	4.00
Overall anxiety	2.26	0.78	1.00	3.93
II. assessment				
Somatic factor	1.47	0.70	1.00	4.00
Cognitive factor	1.69	0.70	1.00	3.60
Self-confidence	2.33	0.97	1.00	4.00
Overall anxiety	1.83	0.68	1.00	3.87

*Mean – arithmetic mean,  $\sigma$  – standard deviation, Min – minimal score, Max – maximal score.*

Considering that the higher score relates to a higher level of anxiety, the results from Table 1 show that the participants have the lowest results in the confidence factor, then in the cognitive factor and highest in the somatic factor. It is also noteworthy that after motor learning the overall anxiety and all three factors are reduced.

**Table 2.** The coefficients of correlation between the overall anxiety and its three factors separately for each of the two assessments and between the overall anxiety in both assessments.

		Somatic factor	Cognitive factor	Self-confidence	Overall anxiety
I. assessm.	Somatic factor	1.00			
	Cognitive factor	0.77	1.00		
	Self-confidence	0.74	0.70	1.00	
	Overall anxiety	0.89	0.90	0.91	1.00
II. assessm.	Somatic factor	1.00			
	Cognitive factor	0.70	1.00		
	Self-confidence	0.56	0.68	1.00	
	Overall anxiety	0.79	0.88	0.91	1.00

r (overall anxiety I. & II. assessment) = 0.73

Correlation coefficients of all three anxiety factors between themselves are almost equal and range from 0.70 to 0.77 in the first assessment and 0.56 to 0.70 in the second one. That shows that each anxiety factor differentiates from the other two but all of them are also interdependent at the same time. The greatest change in correlation coefficients in the assessment conducted after the motor learning occurs between the somatic factor and self-confidence in the way that the correlation coefficient reduced from 0.74 to 0.56. The reason to that could be that the differences between the two assessment were the highest in somatic factor and the lowest in self-confidence (table 3). The coefficient of correlation between the overall anxiety in two assessments is 0.73.

**Table 3.** Results of Wilcoxon matched pairs test in the overall anxiety and its factors between the two assessments.

	N	T	Z	p
Somatic factor	72	196.00	6.27	0.00
Cognitive factor	78	329.00	6.03	0.00
Self-confidence	77	588.50	4.64	0.00
Overall anxiety	90	383.50	6.70	0.00

*N* – number of determined differences, *T* – value, *Z* – value, *p* – value

The results of the analysis of differences show that there has been a statistically significant reduction in both overall anxiety and all three of its assessed factors. The Z value of the test shows that the least improvement was found in the confidence factor from all three factors. It was self-confidence that had the lowest result and it had the least (but statistically significant) improvement.

## DISCUSSION

As mentioned earlier, students have the highest anxiety in the confidence factor (2.72; 2.33), followed by the cognitive factor (2.15; 1.69) and finally the somatic factor (1.90; 1.47). Overall anxiety before the learning process on a scale of 1 to 4 was 2.26, which corresponds to 41.7 percentile of the scale. Overall anxiety after the learning process on a scale of 1 to 4 is 1.83, which corresponds to 27.7 percentile.

The correlation coefficient in the overall anxiety between the two assessments is 0.73. This shows that more anxious participants, after the process of motor learning still have a higher level of anxiety compared to less anxious participants despite the improvement. Correlation coefficients between all three factors of anxiety are approximately equal and range from 0.70 to 0.77. This shows significant but not total interdependence of all manifested factors of anxiety. There is enough space in the part of the uncommon variance of the factors to be manifested differently in different aspects of functioning. Thus, for example, Carzoli, et al. (2018) were trying to identify the association between cognitive and somatic factors with self-assessed 1 RM (maximum weight of one repetition). They determined that the cognitive factor was positively and significantly related to the difference between self-assessed and derived 1RM, the mentioned association with the somatic factor was not significant. That is, participants with higher cognitive anxiety

self-assess 1RM lower than it actually is. Jones and Cale (1989) also identified the functional diversity of anxiety factors. Somatic factor is negatively related with cognitive status of a person, while self-confidence and somatic factor are positively related to the speed of motor performance. According to the aforementioned authors, this finding suggests that the somatic factor of anxiety might be an important source of variation during motor performance.

Furthermore, the greatest change in correlation coefficients in assessment conducted after the motor learning occurs in the correlation of somatic factor and self confidence in the way that correlation reduced from 0.74 to 0.56. This change occurred because of the uneven improvement of three factors of anxiety. As already mentioned, the greatest improvement was determined in the somatic factor, and the least in self-confidence.

The results of the analysis of differences show that there was a statistically significant reduction in both overall anxiety and all three of its assessed factors. Dealing with source anxiety, in this case vaulting, under controlled conditions (expert supervision, minimal chance of injury) has resulted in its reduction. Stern et al. (2013) have also determined that intentional exposure to anxiety could reduce it and thus improve the performance. According to Hordacre et al. (2016) after the simulated conditions of stress and anxiety, there was an improvement in performance, in their case the improvement in precision. In this research the level of motor skills was assessed by only one surveyor just as a complementary variable because the level of acquisition was not the purpose of research. However, it is also important to point out that there was an improvement in the level of acquisition motor skills, the students' average grade at the end of the second lesson was 2.75 and at the end of the third lesson 3.23. The increased level of skill acquisition could also have a positive effect on the reduction of anxiety.

The Z values of the test show that the least improvement was found in self-confidence. Self-confidence was the factor that had the highest (worst) result and the least (statistically significant) improvement. The participants had the lowest manifestation of anxiety in the somatic factor, and the highest improvement. According to Oudejans and Pijper (2009), training in anxious conditions can prevent the feeling of suffocation (somatic anxiety) among elite athletes during motor performance due to their adaptation on specific physiological processes that accompany anxiety.

One of the causes of anxiety reduction can be the adaptive processes in the brain that take place during intentional exposure to the anxiety. On the other hand, the higher level of acquisition of motor skills could reduce the overall anxiety because of its relation to the skill. The purpose and the consequence of motor learning is the higher level of acquisition of motor skills. Thus, by a reversible reaction, it could reduce anxiety to a certain extent. Furthermore, controlled conditions can reduce anxiety by removing irrational thoughts about possible falls and injuries. As aforementioned, anxiety occurs as a consequence of the inability to understand and predict life events. Because of its uncertainty, in the attempt to make the anxiety concrete, people mistakenly link it to a particular object (situation, illness) (Milivojević, 2010).

The physical activity itself helps to reduce anxiety and its symptoms (Salmon, 2001, stated in Mišigoj-Duraković et al., 2018). It encourages positive aspects of physical excitation and enables to train the tolerance of such somatic symptoms. That provides the response in more adaptive way even when a person has only a perception of the threat. Because it induces sympathetic reactions and raises the excitation of the body in a similar way as the real threat.

From all the aforementioned facts, it is possible to recommend, even to highly anxious participants, the retention in the learning process as consequently the reduction of anxiety can be expected through these adaptation processes in the human body.

## CONCLUSION

The purpose of this research is to determine if the process of learning the motor skills could reduce the skill-related anxiety. The results showed that students' highest anxiety manifestation is in the self-confidence factor, then the cognitive factor and the lowest in the somatic factor. The average overall anxiety of students reduced from 2.26 to 1.83 and the reduction was manifested in all three factors of anxiety. There are several factors that could explain the reduction of overall anxiety: adaptation processes, higher levels of motor skills acquisition, controlled conditions during learning process, or interaction of the aforementioned.

The conclusion is that the process of motor learning can reduce skill-related anxiety even in initial phases of acquisition. The intentional exposure to the anxiety in controlled conditions could be reduced because of the adaptive processes in the human body. Therefore, it is recommended that the highly anxious participants are maintained in the



skill learning process because the consequential improvement is expected. Personal experience of post-acquisition reduced anxiety could affect the initial state of skill-related anxiety in future similar situations. That could improve the overall satisfaction of the participants and consequently the effects of motor learning and exercising.

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