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12. BENEFITS OF TECHNICAL EXERCISES ON ATTENTION AND AFFECTIVE STATE IN VIOLINISTS

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Abstract: *The study aims to validate a patented set of technical exercises, designed to improve the emotional state and attention levels of violinists for improved performance. The proposed exercises will provide real support to violinists who, like other instrumentalists, constantly face a state of chronic fatigue that can sometimes lead to physical and mental exhaustion, commonly known as burnout. The present research investigates variables such as positive and negative dispositions, positive and negative emotions, fatigue, calmness, attention, and energy levels of violinists before and after performing the proposed set of exercises. It also assesses the evolution of electrodermal response associated with attention level during the execution of the proposed exercises.*
Key words: *technical exercises, emotional state, attention, burnout, electrodermal response*

1. Introduction

The fact that musicians, in general, are subjected to extreme physical and emotional strain is highlighted by studies in music psychology and research on musicians' health (Steptoe, 1989). This field of study investigates the degrees of stress and fatigue experienced by musicians. Rehearsal sessions that are too rigorous or the pressure to execute perfectly can lead to intense stress and fatigue. Professional violinists are included in this category as well. They frequently experience physical and mental weariness, which can have a detrimental long-term effect on their affective state (Brodsky, 1996). This depletion is often accompanied by worry, low self-esteem, difficulty concentrating, and frustration related to practice or performance.

One's interaction with the world and with oneself, as well as other internal phenomena manifested through experiences, are all included in affectivity. This psychological concept includes a set of internal phenomena, in the form of internal or external experiences, that expresses the nature of the relationship between the subject, the world, and with oneself. An internal state of necessity and the dynamics of external objective facts, events, or situations are related in a way that is either in harmony or discordance with affectivity. Likewise, “affectivity refers to functions of alertness and energetic activation of the physical body, behaviour, and stimulation, related to stimuli and possibilities of satisfying one’s needs” (Nacu et al., 2021).

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Instrumentalists often experience stress, which can lead to burnout syndrome. The term has been defined in many ways, but one definition that has been connected to it describes burnout syndrome as "a chronic condition characterized by a state of complete exhaustion of individual energy, associated with intense frustration about work activities" (Maslach, Schaufeli, & Leiter, 2001). „A syndrome of emotional exhaustion, detachment, and a sense of low personal achievement that leads to decreased effectiveness at work" is one description of burnout that provides further insight into the topic (informedhealth.org, 2020). Many authors have named this phenomenon emotional weariness (Wrigh and Cropanzano, 1998; Maslach et al., 2016). Generally, burnout is classified as a factor that affects one's health even if it is not recognised as a medical illness (WHO, 2019).

In the period between 2020–2023, the first author of this paper developed a set of exercises and techniques to help violinists better themselves emotionally. These underwent ten preliminary runs using the proper technical and psychometric instruments. The exercises were patented in 2023 and have been tested on volunteer violinists for validation. Therefore, the objective of the current study is to determine whether and to what extent these technical exercises increase the study participants' affective states. Changes in the affective state were observed using the Positive and Negative Affective Affect Scale (PANAS-X, Watson and Clark, 1994). The scale in question measures affective values subjectively and was given as a pretest and posttest, that is, before and after the activities were completed.

Using a digital multimeter that was linked to a computer, the electrodermal response (EDR) of the violinists who took part in the study was measured in real time to objectively evaluate variations in the attention level. The difference in the skin's electrical properties brought on by sweat gland activity is known as the electrodermal response, and it can be measured as changes in cutaneous electrical resistance or electrical potential (Larousse, 2006). Variations in cutaneous electrical resistance were measured in this study.

According to Hăulică (2002), the EDR is a sign of nervous system activity and is linked to shifts in the body's attention state. More precisely, the EDR is an automatic reflex that depends on the brainstem and hypothalamus (Kiss, 2010). Real-time recording of the EDR was done while the technical activities were being carried out. The electrodermal response is an involuntary metric, which makes it simple to record, making its measurement one of the most popular markers in psychophysiology. Furthermore, EDR is the most important predictor of dissimulated behaviour in the polygraph technique since it offers accurate data regarding fluctuations in the subject's level of alertness (Kiss, 2010).

2. Method

The study aims to determine the extent to which the patented technical exercises enhance participants' affective states and attention spans. In this study, affectivity was measured using the PANAS-X scale (Positive and Negative Affective Affect Scale, Watson and Clark, 1994) to measure subjective parameters such as self-report of positive and negative affect, positive and negative emotions, fatigue, attention, calmness, and energy level. The objective physiological parameter electrodermal response, or EDR, was measured using a digital multimeter.

Therefore, the purpose of the study is to determine whether and to what extent the technical exercises improve the participants' affective state (as measured by higher scores on the subscales of positive affectivity, calm attention, energy level, and fatigue) and attention level (as measured by a lower electrodermal response level at the end of the intervention, indicating a higher level of attention than at the beginning of the intervention).

The electrodermal reaction parameter is automatically monitored and recorded during the execution of the exercises using a digital multimeter. The variations in these parameters' levels, measured both prior to and immediately following the technical exercises, serve as evidence of the exercises' effects. Thus, this study is a quasi-experiment, pretest-posttest. Participation in this research was entirely voluntary, and the participants are violinists from Romania and Ukraine (Iași, Bacău, Bucharest, and Chernivtsi).

Participants in the study are violinists from Iași, Bacău, Bucharest, and Chernivtsi in Romania and Ukraine. None of the participants received compensation for taking part in the study; participation in the research was entirely voluntary. There were twenty violinists (N = 20) in the research group, ranging in age from 19 to 52. Twelve of these (60%) are female, while eight (40%) are male.

Research instruments

Participants' affectivity was measured using the Positive and Negative Affects Scale - Extended version (PANAS-X, Watson and Clark, 1994). This self-report tool provides measurements at two mood levels: positive affect and negative affect, and examines eleven distinct emotions: fear, anger, guilt, hostility, shame, fatigue, surprise, joyfulness, self-confidence, attentiveness, and peacefulness. The internal consistency coefficient (Cronbach's Alpha, α) shows good values ranging from α = 0.83 to α =.90 for Positive Affect and from α = 0.85 to α = 0.90 for Negative Affect. The instrument can be administered in a maximum of 10 minutes.

The electrodermal reaction was assessed using a digital multimeter model PROTEK 506 that was connected to a computer and able to record the electrodermal reaction (EDR) evolution in real-time (Appendix 2). Scales and arpeggios are the foundation of the technical exercises designed to pique violinists' interest. These were written by the article's primary author and patented in 2023 (Patent No. 140549/02.03.2023, granted by the Benelux Office for Intellectual Property/i-DEPOT proof) (Appendix 1).

The fact that these activities are meant to be played rather than studied must be emphasised; violinists are accustomed to repeating everything related to performance—a reflex developed over years of study. We stress the significance of adhering to this guideline because it prevents them from repeating sounds that are not in line with the text. It should be mentioned that errors can be corrected along the way, as this has no bearing on the exercises' original intent.

Procedure

Participants signed an informed consent form at the beginning of the study, indicating their agreement to participate. The aim of the study and its methodology were clarified to the participants, taking roughly fifteen minutes. They were then asked to finish the PANAS-X scale, which took around ten minutes. The second stage of the research followed the following protocol (approximately 25 minutes):

(a) Fit the electrodes on the participant's epidermis, forehead, and lower back area, to measure the parameter "electrodermal reaction" (EDR).
(b) Connect the measuring device to the electrodes and the computer.
(c) The participant performs the patented technical exercises for 20 minutes. During the execution, the device automatically records the electrodermal response variations.
(d) The participant completes the exercises and the collected data is recorded on the computer.
(e) The electrodes are disconnected from the participant's epidermis. In the third stage, the participants again completed the Positive and Negative Affect Scale (PANAS-X). The last stage of the research consists of analyzing the data obtained by measuring psychophysiological parameters.

3. Results

To test the effectiveness of the technical exercises on the affective state of the violinists participating in the research, *paired-sample t-tests* were applied. The results of the statistical analysis indicate that the execution of technical exercises has a positive effect on the participants' affectivity, attention, and energy. The most pronounced effect, in the case of this group of participants, is observed for the variables *positive affect* ($t = -3.681$, $p < 0.050$, Cohen's $d = 0.84$) and *calmness* ($t = -3.048$, $p < 0.050$, Cohen's $d = 0.70$), in the sense of improving them, and for the variable *fatigue* ($t = 3.261$, $p < 0.050$, Cohen's $d = 0.75$), in the sense of decreasing it. Moreover, these exercises have a significant effect on *attention* levels ($t = -2.116$, $p < 0.050$, Cohen's $d = 0.50$). The effect size, *Cohen's d* is 0.50, a medium, significant level.

The results show a significant effect on positive emotions ($t = -2.760$ $p < 0.050$, Cohen's $d = 0.63$). The effect size is Cohen's $d = 0.63$ (medium to strong effect). There is also an improvement in negative emotions ($t = 2.231$, $p < 0.050$, Cohen's $d = 0.51$). Effect size shows a medium effect (Cohen's $d = 0.51$). Performing the exercises also influenced negative fundamental affect, with a decrease in negative affect observed following the performance of the technical exercises ($t = 2.663$, $p < 0.050$, Cohen's $d = 0.61$). Effect sizes were medium to strong (Cohen's Cohen's $d = 0.61$).

Furthermore, the energy level reported by participants following the execution of the technical exercises is strongly improved ($t = -2.604$, $p < 0.050$, Cohen's $d = 0.60$, medium to strong effect). All t-test results for paired samples are reported in Table 1. In conclusion, the results of the statistical analyses support the effectiveness of performing the proposed technical exercises, as they have positive effects on the affective state of violinists and the level of attention they need to perform, even when psycho-physical resources seem to be exhausted.

Tab. no. 1 Mean scores before and after technical exercises

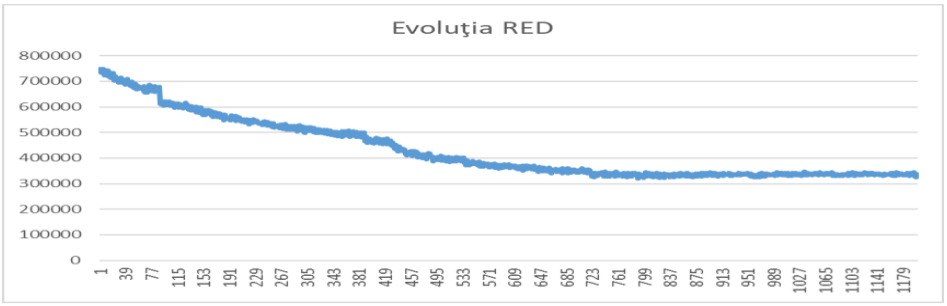
Affectivity factors	**Pretest Mean**	**Posttest mean**	**Mean difference**	***t*-test**	***p***	**d** (Cohen) (effect size)
Positive emotions	30,05	32,85	−2.80	−2.760	0.012	**0,63** (medium to strong)
Negative emotions	14,45	11,35	3.10	2.231	0.038	**0,51** (medium)
Positive affect	17,79	19,84	−2.04	−3.681	0.002	**0,84**

						(strong to very strong)
Negative affect	8.58	6,98	1.60	2.663	0.015	**0,61** (medium to strong)
Tiredness	9,00	6,05	2.95	3.261	0.004	**0,75** (medium to strong)
Atenttion	12,80	14,30	−1.50	−2.116	0.048	**0,50** (medium)
Calm	9,45	11,15	−1.70	−3.048	0.007	**0,70** (medium to strong)
Energy levels	3,00	3,55	−0.55	−2.604	0.017	**0,60** (medium to strong)

Note: N = 20; The effect size is calculated by Cohen's formula (Labăr, 2008, p. 83)

The electrodermal response (EDR) measurement, which is associated with the level of attention, generated the following graph (Figure 1).

Fig. no. 1 Evolution of electrodermal response (*N* = 20)



Note: A decrease in electrodermal response (EDR, measured in ohms, Ω) indicates an increase in attentional state (Kiss, 2010). Thus, the lower the electrodermal response, the higher the level of attention.

4. Conclusions

The purpose of the current study was to determine the effectiveness of the technical exercises developed by the first author in enhancing participants' affective states. The findings suggest a significant impact on affective state and give rise to the hypothesis that incorporating these exercises into violinists' regular daily practice regimen could ameliorate the condition of physical and mental exhaustion typical of instrumentalists. Numerous personal health issues have been associated with emotional exhaustion in the scientific literature, but an increasing amount of research is beginning to indicate that emotional exhaustion can also have negative effects on organisations.

For instance, Cropanzano et al. (2003) show that workers affected by burnout frequently plan to change occupations, perform poorly on the job, and show less dedication to the company. Burnout syndrome is linked to a variety of affective problems, including anxiety, anger, hostility, exhaustion, shame and guilt, poor self-confidence, diminished concentration, lack of excitement, and disgust, according to articles on the subject of burnout in instrumentalists. These justifications influences the choices related to the study variables and research tools used in the study. Even after twenty minutes of practice, the findings are indicative of the positive impact of the technical exercises.

This is supported by the results of the paired samples t-test and, more importantly, the change in EDR from high to lower values during execution (a development linked to an increase in attention level). Furthermore, a psychosomatic activating hormone called cortisol is produced in response to variations in EDR (Kiss, 2010). Enough cortisol is needed to stimulate the body in the proper manner.

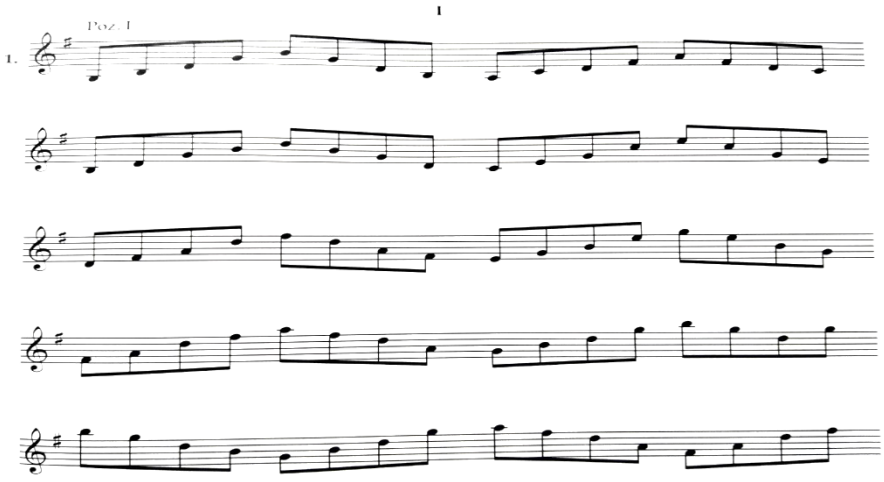
When it is secreted in excess over an extended period of time due to severe and prolonged stressors, the immune system is weakened, which eventually results in health issues (Selye, 1950).

This serves as additional support for practicing the suggested technical exercises on a regular basis (keeping in mind that 45 minutes is the ideal amount of time to practise the complete exercise, which includes the climb and descent of the six positions in which the exercises are performed). This results in the muscles warming up properly and, more importantly, in a positive sense of well-being and performance motivation. One limitation of the present research is the low number of participants. Even though, a large number of individuals were invited to participate, they declined. A possible reason is the performance anxiety that instrumentalists have, which is mostly caused by their dread of receiving a poor evaluation (Dumitru, 2014). Experts in the field of psychology and music psychology in particular have examined this fear extensively (Steptoe, 1989).

Another limitation is social desirability related to self-reported instruments. This is the natural tendency of participants to present themselves in a positive light, for fear of negative evaluation, but also out of a desire to help the researcher. Fortunately, this study benefits from an objective recording, with a technical measuring equipment, of the electrodermal reaction, which is always an involuntary response to external or internal stimuli. In this way, the social desirability effect is compensated for to some extent, and the PANAS questionnaire responses can be reliable. Future research should consider a larger group of participants to make the research results more reliable. Possible future research should take into account the social desirability effect, with the principal investigator avoiding interaction or face-to-face encounters with participants.

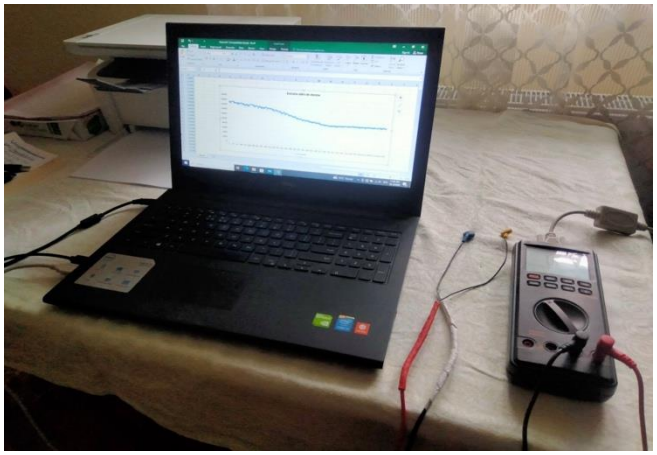
APPENDIX 1

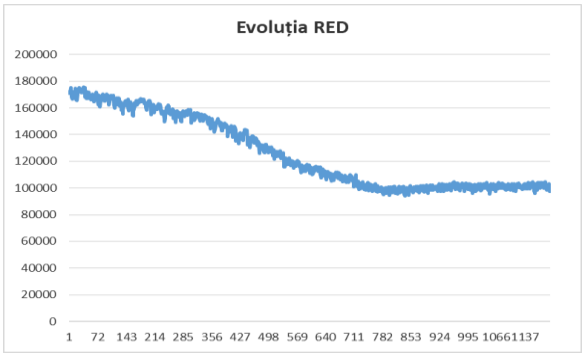
Technical violin exercises to stimulate attention and affective state



It is important to emphasize that these exercises should be played, not studied. We emphasize the importance of observing this recommendation because violinists are used to repeating any aspect of performance (perfection), and the reflex that has been formed during years of study urges them to repeat sounds that do not conform to the text. It is worth noting that the 'mistake' can be fixed on the way, as this does not affect the ultimate purpose for which the exercises were created.

APPENDIX 2
Electrodermal reaction measuring equipment (EDR)





In order to *objectively measure* the level of attention, we used an approved digital multimeter, model PROTEK 506, connected to a computer, capable of recording, in real-time, throughout the execution of the technical exercises, the evolution of *the electrodermal reaction* (*EDR*).

Interpretation of the recording results: the lower the electrical skin resistance (electrodermal response, EDR), the higher the level of attention

The EDR values are collected by two electrodes, one on the forehead and the other on the back, in the lumbar area (where the sweat glands are very productive).

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