



CHARACTERISTICS OF COPING STRATEGIES RELATED TO STRESS FOR PHYSICAL EDUCATION AND SPORTS TEACHERS

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ABSTRACT

Each person's activities and efforts are related to dealing with different situations with varying stress levels. For every person this is known to lead to the formation of an individual structure of different coping strategies related to the perceived level of stress. The adequacy of this structure is entirely dependent on the efficiency of each person's actions and is a basis for its own refinement. Given that the structure of coping strategies is inadequate, this can lead to hindered possibilities for growth and hence, a lower quality of life. **The aim of this study** is to establish the key features of coping strategies for Physical Education and Sports (PES) teachers. To achieve this goal, a review of literature was carried out, with the addition of **live observations and discourse with the participants** of the study. The teachers' coping strategies were evaluated with the COPE-1 questionnaire. The obtained data was analyzed via descriptive statistics, hypothesis testing, correlation analysis, hierarchical clustering and t-SNE dimensionality reduction. **Results** from the analyses are presented in their respective graphs. During the interpretation of the results, it was established that the studied male and female PES teachers have well-structured coping strategies. The main established ones are Active coping, Planning, and Positive reinterpretation and growth. It was also established that the teachers from the studied sample rarely rely on strategies such as Turning to religion, Acceptance, Behavioral disengagement and Alcohol-drug disengagement.

Key words: stress, coping strategies, teachers, physical education and sports

INTRODUCTION

Stress is an inevitable part of modern-day life. Generally, stress is an universal phenomenon which is present in situations, related to growth and positive experiences, as well as in situations related to discomfort and tension. Studies on stress have a long history, and despite the differences between different outlooks, it is undeniably defined as an important phenomenon (1). A multitude of studies exist which examine the problem related to stress in the context of its causal factors and the immediate and long-term consequences of stress. An important role for the scientific research of stress is the problem about stress in the work environment. It is commonly regarded

as a global-scale problem, which affects multiple fields of work for the developed countries.

The professional activity of teachers is regarded as one of the professions which is related to highest levels of stress (2-4). The activities which a teacher performs, in particular in the context of Physical Education and Sports, can be characterized by conducting the educational process in the conditions of active motoric and cognitive activity. The main sources of stress in modern-day educational system can be attributed to: the necessity of refining the curriculum and its content according to the available equipment, motor skills and abilities of the students; the lack of an adequate (and in working order) infrastructure and equipment; problems with students regarding their class attendance, discipline and motivation for active participation; low subject status; authority of the teacher, and many others (5).

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An important aspect related to stress in the work environment, as well as in every-day life is the approach utilized for coping with it. Coping is a crucial part of the theoretical and practical studies of stress, and it can be defined as the set of methods and actions which are applied in stress situations, aimed at overcoming and preventing the negative impact of such situations (6). According to the impact of different strategies related to stress in the professional environment, two main types can be established - controlling and avoiding (7). The first group of strategies related to controlling have a predominantly restraining influence on the development of emotional exhaustion by contributing to the level of personal achievements, and the second group of strategies have a reversed impact on the aforementioned components.

MATERIALS AND METHODS

Based on the theoretical analysis, a hypothesis was derived that the preferred strategies for dealing with stress among male and female teachers are predominantly positive and have a relatively similar structure.

The **aim** of this research paper is to establish the most informative coping strategies of PES teachers in terms of preference. To achieve this goal, the following main tasks were considered:

1. Development of the theoretical foundations of the research topic;
2. Conducting an experiment to reveal the patterns behind the studied coping strategies of male and female physical education teachers, based on their preference level through the COPE-1 questionnaire;
3. Data analysis using statistical methods and unsupervised machine learning methods;
4. Analysis and interpretation of the established results for revealing the key features of the coping strategies structure among PES teachers.

The **object of study** for this paper is the peculiarities of stress coping strategies of PES teachers.

The **subjects of the study** are 92 PES teachers, of whom 40 were male and 52 were female, all of which were aged from 25 to 65 years.

The applied scientific methods which constitute the research methodology for completing each task and achieving the goal of the research paper include: review of literature, application of the

COPE-1 questionnaire and an open discourse with the studied teachers.

Based on the theoretic understanding of the problem, it was established that based on the works of S. Folkman and R. Lazarus (8) and their interview-based questionnaire (9), Carver et al., (10) developed a methodology based on a refined questionnaire for evaluating different coping strategies, which they named COPE-1. The questionnaire was translated and adapted to Bulgarian by A. Rusinova-Hristova and G. Karastoyanov (11). The questionnaire itself contains 53 items, grouped into 14 sets, which define the key coping strategies: S1 Active coping, S2 Planning, S3 Suppression of competing activities, S4 Restraint coping, S5 Seeking social support for instrumental reasons, S6 Seeking social support for emotional reasons, S7 Positive reinterpretation and growth, S8 Denial, S9 Turning to religion, S10 Focusing on and venting of emotions, S11 Acceptance, S12 Behavioral disengagement, S13 Mental disengagement and S14 Alcohol-drug disengagement. The test contains 4 secondary factors, which combine all 14 key coping strategies. For the purpose of this study, they are not interpreted. Results from the questionnaire were subjected to statistical analysis, which included inferential methods based on descriptive statistics, confidence intervals and correlation analysis. In addition, unsupervised machine learning techniques were also applied, including hierarchical clustering and t-SNE (t-distributed Stochastic Neighbor Embedding) for dimensionality reduction and visualization.

RESULTS AND DISCUSSION

Based on the yielded results, certain patterns were established for the coping strategies of the studied teachers. Initially, a non-parametric hypothesis test (Mann-Whitney's U-test) was utilized to verify whether there is a statistically significant difference between the score distributions of male and female teachers for each coping strategy. The assumption for an underlying normal distribution for non-parametric hypothesis tests does not need to hold true. Due to the initially unknown distribution of each coping strategy's score, Mann-Whitney's U-test was assumed to be preferable to other parametric tests. Moreover, as each coping strategy's score value is discrete due to the nature of the questionnaire, certain errors related to the imprecise measuring scale can occur. However, the effect of these errors can be partially dampened using the ranks of

answer scores instead of their actual values. It is crucial to acknowledge that although Mann-Whitney's U-test is robust for non-normal distributions, its performance is not robust in cases where the central tendency measures of the compared samples' distributions are not informative enough, as in cases where either of the underlying distributions is multimodal. Therefore, in order to reduce the probability of a Type II error, other alternative methods for statistical inference are advisory in these cases, as demonstrated throughout the paper.

Based on the established results, it was concluded that 12 out of 14 coping strategies do not exhibit statistically significant differences in terms of their medians ($p > 0.05$). These statistically insignificant differences can be due to the similar central tendency of the coping strategies structure for both male and female PE teachers. The only 2 strategies which were established to have a statistically significant difference among male and female teachers are S10 (Focusing on and venting of emotions) and S14 (Alcohol-drug disengagement). A larger number of female PE teachers consider that the consumption of alcohol in stress situations is not a successful way of coping with stress ($\bar{X} = 1.25$, $s = 0.4$). The same would apply for

male PES teachers ($\bar{X} = 1.61$, $s = 0.83$), although their score is significantly higher ($p = 0.003$). This observable difference shows that male PES teachers are to some extent more prone to accepting this strategy as a valid one. The same conclusions can be drawn for coping strategy S10 (Focusing on and venting of emotions). Its mean score value for female teachers ($\bar{X} = 2.68$, $s = 0.63$) is higher than the one estimated for male teachers ($\bar{X} = 2.29$, $s = 0.72$). Based on Mann-Whitney's U-test, comparing both distributions, it can be assumed that female teachers tend to rely on emotional expression slightly more, compared to male teachers ($p = 0.007$).

There are some tendencies for existing differences between the two sampled group of teachers for coping strategies S9 (Turning to religion) ($p = 0.074$), S6 (Seeking social support for emotional reasons) ($p = 0.108$) and S4 (Restraint coping) ($p = 0.130$).

A key criterion for assessing the structure of coping strategies is their overall ranking, based on the score value of each strategy, which indicates the frequency of their occurrence (**Figure 1**).

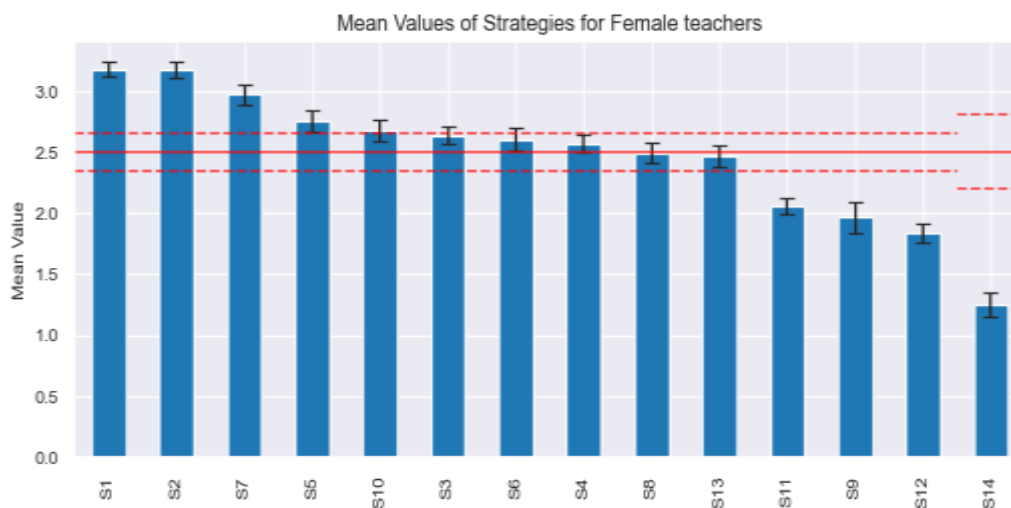


Figure 1. Female PES teachers' coping strategies

As the statistical distribution for all coping strategies scores is initially unknown, the uniform distribution for all 53 item scores was used as a benchmark. This approach was applied both for the obtained results for the male and female teachers and it serves as a way of distinguishing each coping strategy's mean score value from the mean score of the sum of the uniformly distributed score values. The

dashed red line in **Figure 1** serves as an indicator of the confidence interval of the mean score values for each benchmark of all coping strategies, depending on the evaluated sample size. The benchmark mean score values for coping strategies S1–S13 follow a discrete variant of the Bates distribution, as these are derived from the mean value of 4 independent and uniformly distributed random variables,

corresponding to each item per strategy. In contrast, S14 consists of a single item, resulting in a uniform distribution. Consequently, the confidence interval for the sample mean of S14 is wider compared to that of S1–S13. In this case, the distribution for the scores of coping strategies S1-S13 can be described with the following mean and standard deviation values: $\bar{X}=2.50$, $s=0.56$, while S14 can be characterized via the following values: $\bar{X}=2.50$, $s=1.12$. Therefore, based on the obtained mean and standard deviation values, one can estimate the confidence interval for the benchmark means, depending on the sample size of the questionnaire's participants.

When the 95% confidence interval of the sample mean for each benchmark distribution and each coping strategy's mean 95% confidence interval are compared, one can evaluate which strategies are significantly different. These strategies which do not have an overlap between the two confidence intervals can be considered as the ones with a significantly higher or lower frequency of occurrence (based on the preference level in the questionnaire). **Figure 2** applies the same assumptions as the ones previously discussed for **Figure 1**. However, the confidence intervals for the means of the benchmark distributions are adjusted for the number of evaluated male PES teachers.

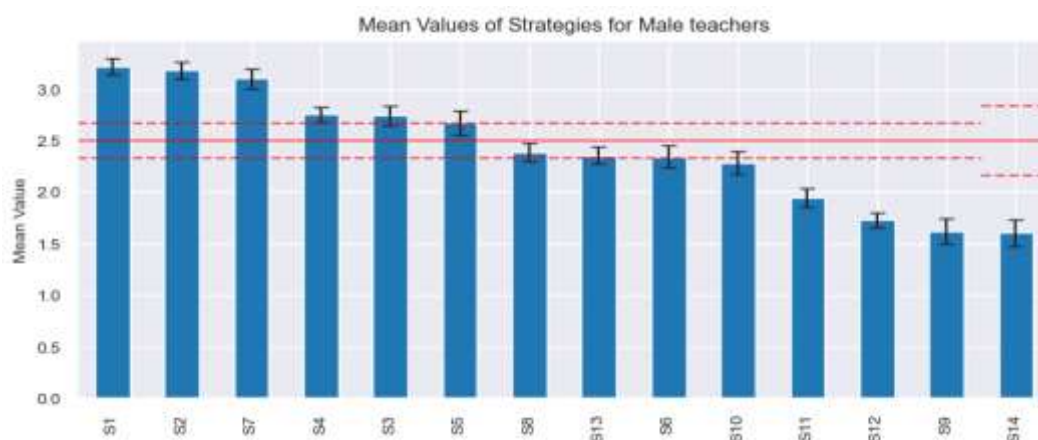


Figure 2. Male PES teachers' coping strategies

Based on the results from **Figure 1** and **Figure 2**, one can conclude that the most informative coping strategies with the highest scores are S1 (Active coping), S2 (Planning) and S7 (Positive reinterpretation and growth). Moreover, these strategies both apply to male and female PES teachers. There is a difference in the fourth strategy for both male and female teachers – for the female sample it is S5 (Seeking social support for instrumental reasons) ($\bar{X}=2.75$, $s=0.63$), while for male teachers it is S4 (Restraint coping) ($\bar{X}=2.76$, $s=0.49$). Both male and female teachers have the same set of 4 coping strategies which they actively avoid – S9 (Turning to religion), S11 (Acceptance), S12 (Behavioral disengagement) and S14 (Alcohol-drug disengagement).

It should be pointed out that the observed ranking of all coping strategies can be different

for other samples, given the same study is conducted, as their score values' confidence intervals overlap. Hence, it is more robust to consider all coping strategies not as an ordered list, but as a collection of three major sets – 1) preferred coping strategies (with highest frequency), 2) avoided coping strategies (with lowest frequency) and 3) coping strategies with an undefined preference level (with medium level frequency).

Investigating the correlations between all coping strategies can also prove useful for establishing certain patterns for the studied sample of teachers. For the purpose of this study, the Spearman (lower left matrix) and Kendall (upper right matrix) correlation coefficients were used (**Figure 3**).



Figure 3. Correlation matrix heatmap for the studied 14 copings strategies, based on Spearman and Kendall correlation coefficients (both male and female teachers)

The coping strategy with the highest score S1 (Active coping), correlates with the strategies S7 (Positive reinterpretation and growth) and S3 (Suppression of competing activities). This indicates that all three strategies constitute a higher-level structure related to the behavioral patterns of the analyzed teachers. The correlations between S7 and S2 (Planning) are slightly lower ($\rho=0.68$, $\tau=0.56$), but still can be considered to be highly informative. Strategies S1 and S7 are moderately correlated ($\rho=0.48$), similar to S1 and S3 ($\rho=0.45$). All considered dependencies, along with the established correlation matrix, show that PES teachers have an overall good coping strategies' structure. It can be assumed that the studied PES teachers have a predominantly positive mindset, which is responsible for the strongly developed positive coping strategies for dealing with stress

in different situations. Additional patterns can also be observed for the strategies' structure such as the correlation between S6 (Seeking social support for emotional reasons) and S10 (Focusing on and venting of emotions) ($\rho=0.72$, $\tau=0.58$). At the same time S6 correlates with S5 (Seeking social support for instrumental reasons) ($\rho=0.67$) which is also important for the work of PES teachers.

All established interpretations, based on the confidence intervals' level of overlapping, as well as the correlation matrix were confirmed by the results obtained from hierarchical clustering analysis. **Figure 4** shows a dendrogram based on the clustering analysis using the Manhattan distance and the Complete linkage method.

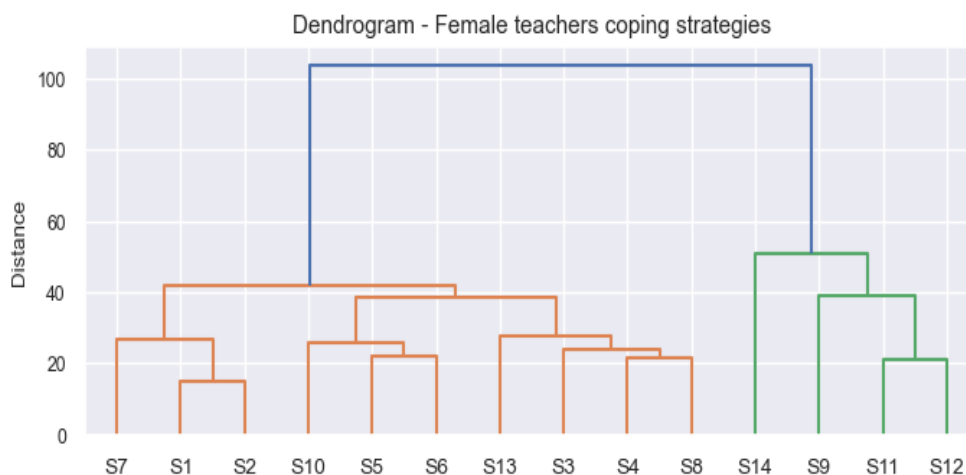


Figure 4. Dendrogram showing the hierarchical structure of the studied female PES teachers' coping strategies

The provided dendrogram serves as a proof of concept for establishing two major groups of strategies both for the male and female PES teachers, based on their score similarities for all individuals. The first major cluster includes ten strategies, divided into two sub-groups with three strategies in the first one (S1, S2, S7) and seven in the second one (S3, S4, S5, S6, S8, S10, S13). Once more, it can be concluded that active coping and planning correspond with positive thinking. As it was previously

established, these three strategies are among the most preferred coping strategies both for male and female PES teachers. The second sub-group of strategies shows that strategies related to passiveness and behavioral disengagement are highly associated.

The overall structure behind the studied male PES teachers' coping strategies is similar to the one of the studied female teachers, as shown in **Figure 5**.

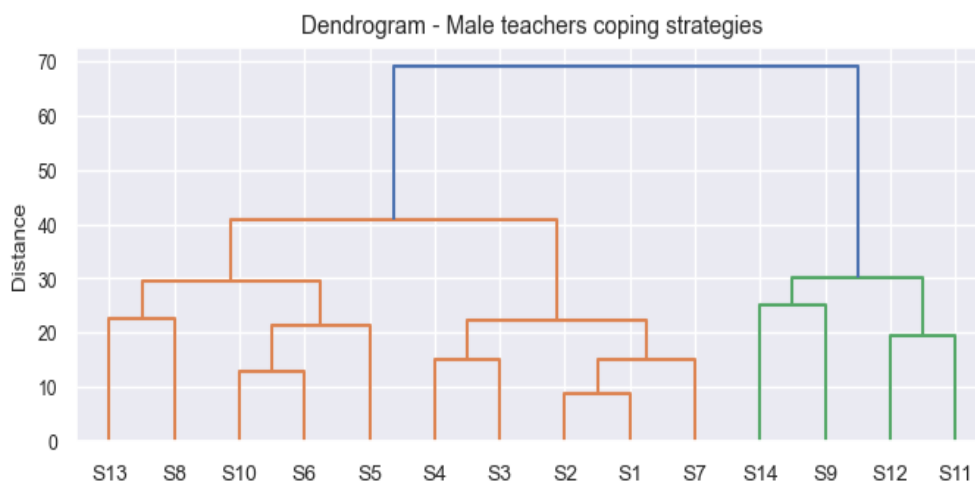


Figure 5. Dendrogram showing the hierarchical structure of the studied male PES teachers' coping strategies

Once more, all coping strategies are grouped into two major clusters. Similarly, the first cluster consists of two subgroups: (S1, S2, S3, S4, S7) and (S5, S6, S8, S10, S13). It is evident that strategies S1 (Active coping), S2 (Planning) and S7 (Positive reinterpretation and growth) are once more present in the first major cluster. However, for the male teachers, these three strategies are closely related to strategies S3 (Suppression of competing activities) and S4 (Restraint coping). These findings support the hypothesis that there is no significant difference in the coping strategies' structure for male and female teachers. Moreover, it can be concluded based on this first cluster of strategies, both groups exhibit an adequate coping mechanism. The second key group of coping strategies, both for male and female teachers, includes: S11, S12, S14 and S9. This hierarchical structure of stress coping strategies once more corresponds to the one observed in the results obtained by the inferential method, based on confidence intervals. The higher level of association between the strategies S11 (Acceptance), and S12 (Behavioral disengagement) leads one to believe that acceptance impacts both male and

female teachers' commitment to the search for adequate solutions in a negative manner. Strategies such as S14 (Alcohol-drug disengagement) and S9 (Turning to religion) do not seem to have a significant role on the nature of the overall view of teachers' coping mechanisms, apart from them being deliberately avoided.

Once more, it can be concluded that the hierarchical structures of clustered coping strategies are similar for the studied groups of male and female teachers. However, to obtain a more comprehensive understanding of the overall structure of coping strategies, the t-SNE method was employed. This technique embeds the 14-dimensional space, where each dimension represents a coping strategy, into a 2-dimensional space. The t-SNE algorithm optimizes the representation by minimizing the Kullback–Leibler divergence between the neighborhood distances in the original 14-dimensional space and their corresponding distances in the target 2-dimensional space. The t-SNE method is often used for visualization, as shown in **Figure 6**.

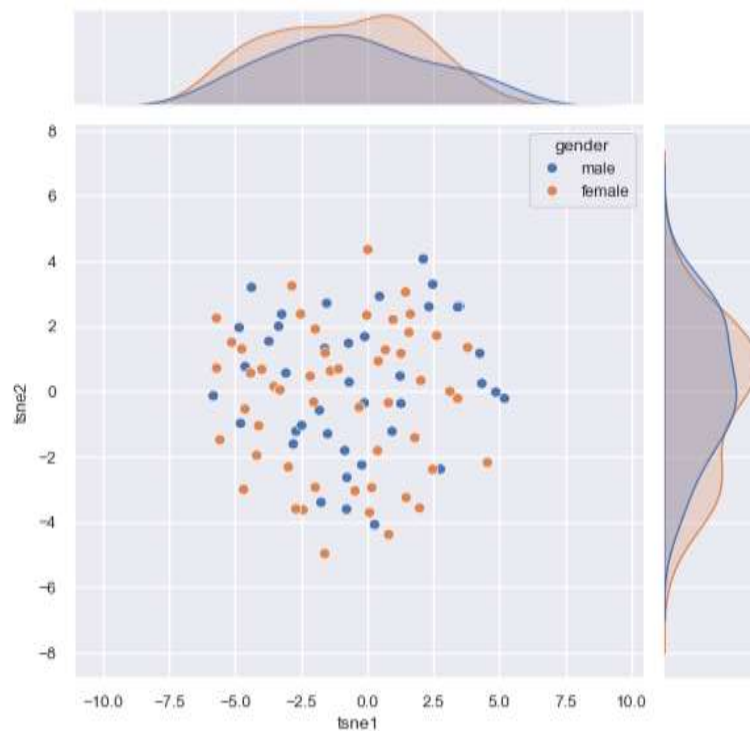


Figure 6. Dimensionality reduction using t-SNE and the resulting non-parametric probability density functions of the two coping strategies' overall factors

The two established axes can be interpreted as the two leading overall factors in the structure of stress coping strategies for male and female teachers. This representation can be considered robust, as the representation itself corresponds to the two major factors of coping strategies identified via the use of confidence intervals, correlation matrix and hierarchical clustering. The higher correlation coefficients associated with the first factor (tsne1) are related to the following coping strategies: S1 (Active coping) ($\rho=0.71$), S2 (Planning) ($\rho=0.67$), S3 (Suppression of competing activities) ($\rho=0.54$), S4 (Restraint coping) ($\rho=0.67$), S5 (Seeking social support for instrumental reasons) ($\rho=0.47$), S7 (Positive reinterpretation and growth) ($\rho=0.68$) and S8 (Denial) ($\rho=0.51$). The high level of positive correlation among the strategies from the first factor are structured on the basis of positive thinking and desire for self-improvement. The second factor (tsne2) was identified to be highly correlated to the following coping strategies: S9 (Turning to religion) ($\rho = -0.54$), S11 (Acceptance) ($\rho = -0.56$), S12 (Behavioral disengagement) ($\rho = -0.69$) and S14 (Alcohol-drug disengagement) ($\rho = -0.44$). The observed correlations with the second major factor are negative and hence, the higher its value, the less negative impact each strategy has on the teachers' overall coping efficiency. Based on the obtained results, it can be argued that the general structure of stress

copied strategies of female and male teachers is similar. However, some intricate differences are present which refer to the joint probability distributions of the two derived global factors for the coping strategies of male and female teachers. In the analyzed group of women, Kernel density estimation revealed a bimodal distribution for both factors, suggesting the presence of two distinct subgroups among the female teachers: one exhibiting an exceptional level of coping and the other demonstrating a below-average level of coping. The mode of the distribution of the male teachers on both factors is located between the two modes of the inferred factors in the female group, which provides an explanation of the non-significant results obtained via the Mann-Whitney U-test.

CONCLUSIONS

To conclude, the established coping skills of PES teachers with respect to their efficient professional performance can be considered satisfactory both for the male and female group. Moreover, based on the established results from this study, the following conclusions can be drawn:

1. The professional activity of PES teachers is inevitably related to overcoming various difficult and unpleasant stressful situations. Hence, due to their similar professional profile, no significant difference was observed for the state of their coping strategies' overall structure. However,

certain peculiarities do exist for both male and female teachers. Despite that, they do not alter the overall similarities between both structures, especially the majority of associations between preferred and avoided coping strategies.

2. As the established leading coping strategies of female and male teachers are positive, this is directly related to the dominance of positive thinking, adequate planning and efficient actions in their respective work environment. Furthermore, it can be concluded that the studied teachers tend to successfully avoid strategies related to denial, as well as mental and behavioral disengagement.
3. The two identified major factors of coping strategies provide a key insight for determining specific means to further influence and improve the coping strategies' structure of the studied teachers by further enhancing the frequency of occurrence of positive and active strategies.
4. In order to improve the overall structure of stress coping strategies for certain PES teachers, who predominantly rely on negative or passive strategies, it is recommended that they should be further familiarized with the nature of stress and the various consequences of its neuro-physiological impact.

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