International Journal of Applied Psychology 2025, 15(2): 29-39
DOI: 10.5923/j.ijap.20251502.01

The Conceptualization of the Term "Feeling Stressed" Among Polyvalent Nursing Students at ISPITS of Rabat-Morocco

Fouad Ktiri*, Benacer Himmi, Hicham Sfar

Higher Institute of Nursing Professions and Health Techniques, Rabat, Morocco

Abstract **Objectives:** The present study examined how the polyvalent nursing students of the Higher Institute of Nursing Professions and Health Techniques (ISPITS-Rabat-Morocco) conceived the term "feeling stressed". We checked whether they were referring to a specific type of sensation (emotional, mental, physical) or two of them or all together, when they were saying they were stressed at the time they felt it. **Materials and methods:** A quantitative cross-sectional study was conducted among students of the three years of polyvalent nursing courses. Using a 7-Likert scale, the students were asked to assess their states of stress and their emotional, mental and physical sensations that they were experiencing before and after carrying out a mental arithmetic task. An ordinal logistic regression method was used to investigate the association between the state of stress and the 3 types of sensations. **Results:** 222 polyvalent nursing students out of 307 were included in the experience. Their increased perceived states of stress, after carrying out the mental task, were found to be significantly associated with the emotional distress and the mental fatigue and not with the physical tiredness. The mental sensation (mental fatigue) was found to have more effects in predicting the likelihood of feeling stressed. In addition, the lower the intensity of emotional or mental sensation, the more likely the students were to experience stress, given that one of the both sensations is held constant whatever the intensity of physical sensation. We conclude that the polyvalent nursing students refer more to mental fatigue than to emotional distress, and not to physical tiredness, when they say they felt stressed. The implications of the study are discussed.

Keywords "Feeling stressed", Emotional sensation, Mental sensation, Physical sensation

1. Introduction

Stress phenomenon

The stress phenomenon has been studied for many decades. Many psychological models and empirical studies have been developed and carried out respectively in order to understand the stress concept and investigate its effects on physical and mental health. Some of these studies were those of Walter Cannon (Fight and Flight model: 1932) [1], Hans Selye (General Adaptation Syndrome: 1950) [2], Susan Folkmann & Richard S. Lazarus (Transactional theory of stress: 1984) [3] and Fouad Ktiri (Tri-Transactional theory of stress: 2016) [4].

People and students suffering from stress

The number of people who suffer from stress has been increasing throughout the world for many years. In the modern era it is rising day by day and approximately all ages experience stress [5]. In Sweden, this number has more than doubled between 2008 and 2018 and the percentage of stress-related illnesses has also risen by 119 % between 2010 and 2015 [6]. Students are no exception. Nursing students, among others, suffer also from stress. Their level of stress, according to many studies, is high. It is due to the required complex care they give during their practicum [7]. It was also stated that nursing students are more stressed than students of other health courses [8].

The term stress: use and meaning

Not only there is a rise in the number of stress-related illnesses, but the term "stress" has started for many years to be widely used [9] [10] [11] and everywhere in western society as well as by researchers of social sciences and the lay people [12]. The expression "feeling stressed out" has also become familiar among individuals [13]. The vast use of the term stress is not recent. It was pointed out some decades ago (1988) that it had been used, and sometimes abused, by scientists and non-scientists [14].

However, despite the wide use of the term stress in everyday language, not all people mean the same thing. It is vague and difficult to define precisely [15] and the

* Corresponding author:
f_ktiri@yahoo.com (Fouad Ktiri)
Received: Mar. 25, 2025; Accepted: Apr. 19, 2025; Published: Apr. 22, 2025
Published online at http://journal.sapub.org/ijap

disagreement about its meaning was indicated as well as before [16] and very recently [17]. It could refer either to subjective feelings of distress or to factors that cause them. It was also described as an ambiguous term, which means for some people excitement and challenge (good stress) or as an undesirable state of frustration, chronic fatigue (bad stress) [18]. Hans Selye was the first who used it in the late 1930s. He borrowed it from physics [14], meaning the forces or pressures that deform a material object. He used it in physiology to describe the non-specific changes that occur in the organism after it faces any demand [19], i.e. the inner feelings that result from them. For Chrousos et al. (1988), the words "stress" and "stressor" (stress factor) mean the state of threatened balance or harmony and the disturbing forces that threat this harmony respectively [14].

The use of the term stress in the present study

In the present study, the term stress refers to an unpleasant state that a person could experience after he/she faces a stressor and then says, "I am stressed" or "I feel stressed".

Nevertheless, even when referring to this definition, not all people describe the same subjective sensation or feeling. Some express being stressed at work when they are under pressure, so that effectiveness is related to stress, i.e working hard [20]. Some other people refer to "frustration, "chronic fatigue" or the "inability to cope" as undesirable negative states [21]. In a recent study (2022) the term "stressed" was used to mean a negative state that differs from reported emotional states, namely "worried", "hesitant", "anxious", "frustrated", "sad", "reluctant", "depressed" and "scared" [22]. Students, like anyone else, suffer from stress, and use this term particularly when their exams approach. Some of them use it to describe the Stress caused by anxiety about exam uncertainty and performance, the latter being requested by parents and teachers [23]. In a study [24], examining the impact of stress on the secondary students' achievement motivation, the term was used to imply strain, inability or hardship. For Apriliyani, I., and Maryoto [25], who investigated the relation between stress levels and coping mechanisms in thesis writing among undergraduate nursing students, the term referred to the demands or pressure suffered by individuals to adapt to such pressures.

In the present study, in order to eliminate the confusion in the term stress that is used as a subjective negative feeling, we will differentiate between physical, mental and emotional states, which could refer, in their adverse aspects, to physical, mental and emotional stresses. Some authors have also distinguished, in their study, between different types of feelings.

In their Toulousaine stress scale, the authors distinguished between 4 different states of stress: physical ("I bite my nails"…), psychological ("I worry"…) psycho-physiological ("I am tired"…) and temporal ("I have difficulty organizing what I have to do"…) [26]. Classifying human stress as the purpose of their study using blood oxygen saturation experience [27], Xinyu Liu, X. et al. differentiated between emotional (psychological) and physical stress, such as nervousness and muscle tension resulting from excessive exercise respectively.

The aim of the present study

In the previous studies, the word "stress" and the term "feeling stressed" were investigated, sometimes interchangeably, in terms of causes and/or consequences. Other researchers examined them with regard to how people describe their general states when they declare stressed, such as being under pressure or depleted of their internal reserves or which combination of sensations make them generally say they feel stressed.

In their study [28], interviewing employees, Gail K. and Fiona J. examined the lay representations of work stress, the occupational stress, its causes and consequences. They found that little consensus was found in how employees interpreted the concept of stress: they referred to a range of different personal, social and environmental factors when defining the term stress. The meaning of the term among children was illustrated by the findings of Kostenius, C. et al. [29] study conducted on Swedish schoolchildren who perceived stress as related to time and challenges: "being out of time" , "being in a fleeing" or " being lifted to excel".

According to Zheng, Shuai, et al. [30], through the development of a traditional Chinese medicine questionnaire for diagnosing stress, the most commonly reported symptoms of stress (n=65 symptoms) by both women and men are "anxious or racing thoughts", "constant worrying" and "inability to concentrate".

However, to our best knowledge, no research was conducted to precisely investigate what kind of unpleasant sensations make people constantly say they are stressed every time they experience it. Thus, by distinguishing between the 3 types of sensations (emotional, mental and physical), the aim of the present empirical study is to check whether they refer to one or two of them or all together. In other words, we will check to which of these sensations' intensities, the intensity of their perceived state of stress is significantly associated.

Due to their high stress level compared to other health courses [8] and due to their high number compared to students in other sections, the polyvalent nursing students will be used as the current study population. In addition, to have a sufficient number of participants in the present study who could feel stressed, an experimental framework will be proposed. They will undergo a mental test, which, according to previous studies, increases stress. We will also make them practice an exercise of relaxation in order to reduce it.

2. Methods and Materials

Study design and period

The research was conducted from May to June 2021 at the Higher Institute of Nursing Professions and Health Techniques (ISPITS) of Rabat-Morocco that offers 3-years bachelor's degree in paramedical courses. A quantitative cross-sectional study was employed.

Study population and sample size

The number of students studying polyvalent nursing courses in the first, second and third years at the ISPITS institute is high (N=307) compared with the other sections.

Considering that some students might be absent, the selection of the participants was based on their availability (i.e. their presence in classes). A convenience non-probability sampling method was adopted.

The suitable sample size calculated using the Taro Yamane formula [31] was 174.

$$n = \frac{N}{1 + N(e)^2}$$

Where
n = sample size
N = population size
e = the level of precision = 5%

Eligibility criteria

The inclusion criteria were that the participants had to:

- have a level of education sufficient to understand how to fill a 7-likert scale and carry out a serial subtraction arithmetic;
- be of any cultural, socio-economic or social status, since stress is a universal phenomenon. The polyvalent nursing students met the 2 above conditions.

Materials

In order to make the participants experience states of stress, we employed a mental task. It consisted of a serial subtraction test in which the participants had to decrement 1022 by 13 during 3 minutes without using a calculator. This task, known to induce a cognitive workload, has been used in previous studies and showed its stressful effect on subjects.

Another task was carried out after the first one, so as the participants would not have remained stressed. It consisted of a relaxation exercise accompanied with music. During this practice, the participant sat on a chair, closed his/her eyes and, without moving, listened to soft music for 8 minutes.

Assessment tool and scoring

To assess the level of stress and that of the emotional, mental and physical sensations perceived by the participants before and after carrying out the mental task, we used a one-item scale. This kind of scales was used in many previous studies. Elo et al, in their research, aimed the validity of a 5-Likert single-item scale whose responses vary from "not at all" to "very much" [32]. They asked the participants to answer the question "Stress means a situation in which a person feels tense, restless, nervous or anxious or is unable to sleep at night because his/her mind is troubled all the time. Do you feel this kind of stress these days?". Assessing the postoperative pain intensity in the post anesthesia care unit, Lee et al. [33] used an 11-point single scale whose responses varied from 0 (no pain) to 10 (worst imaginable pain).

After carrying out the mental task, the students were asked to choose the most appropriate intensity that corresponded to their perceived states. The intensities were on the 7-likert scores:

Stress state: very stressed (-3), stressed (-2), little stressed (-1), not stressed (0), little relaxed (+1), relaxed (+2), very relaxed (+3)

Emotional sensation: very bad (-3), bad (-2), little bad (-1), not bad (0), little happy (+1), happy (+2), very happy (+3)

Mental sensation (mental fatigue): very tired (-3), tired (-2), little tired (-1), not tired (0), little rested (+1), rested (+2), very rested (+3)

Physical sensation (physical fatigue): very tired (-3), tired (-2), little tired (-1), not tired (0), little rested (+1), rested (+2), very rested (+3)

Mental and physical fatigues, defined as a feeling of tiredness caused by demanding cognitive activity [34] and a feeling of bodily fatigue [35] respectively, were explained to the participants and how to assess them. Likewise, for allowing them to distinguish between emotional state, mental and physical fatigue, we let them know and select one or some types of emotions that could experience when they feel stressed. The kinds of emotions they had to select from were "nervous", "sad", "irritated", "disturbed", "anxious", "deceived", "feared" and "other".

Many studies have indicated the affective reactions that correspond to perceived stress. In their study to investigate if perceived emotions and mental stress had negative effects on the rescuers' performance, Sabina Hunziker et al. [36] defined negative emotions as shame, anxiety, irritation, disappointment, guilt, and desperation, and positive emotions as pride, relief, joy, pleasure, and interest. Nursing students, in the study conducted by Kristen L. Reeve et al. [37], were asked to select all feelings experienced in stressful situations, among others, worry, fear, grief, anxiety, anger, guilt, or depression.

Ethical considerations

Written approval was obtained from the Institute authorities to conduct the research. In addition, after explaining the procedure to the students, they provided an oral informed consent. They were also said they were free to participate or not.

Moreover, the mental arithmetic task used in clinical tests to evoke and detect stress [38], [39], [40], poses less ethical problems than some other stressors [41]. Also, an exercise of relaxation was performed to make the participants reduce their stress.

Data collection

The data was collected in classes. For each section of the polyvalent nursing students (S2, S4 and S6) that corresponds to the first, second and the third year respectively, we asked them to perform the task and then assess their perceived states. Data on name (the 2 first letters), surname, sex, date of birth, nationality, were also collected.

3. Data Analysis

The ordinal logistic regression model was used to investigate the relationships between the state of stress considered as a

dependent variable (DV) and the 3 independent variables corresponding to emotional, mental and physical sensations. The correlations between the ordinal independent variables, using Rho spearman coefficient, were calculated to check one of the assumptions (the multicollinearity) required to perform this model.

The Wilcoxon test was used to check whether the perceived states of stress intensities change between pre- and post- arithmetic task.

The Taro Yamen's formula (1973) was used to determine the minimum representative sample size.

The level of significance was set at 95% for all statistical parameters ($p<0.05$).

IBM SPSS (Version 26; IBM Corp, 2012) software was used to perform these analyses.

Ordinal logistic regression is a statistical method used to model the relationships between an ordinal variable and one or more predictors (explanatory variables). The predictors may be ordinal, continuous or categorical.

The ordinal logistic regression is an extension of the binary logistic regression, taking into account more than two ordered levels of the dependent variable. In this study, the number of the ordered categories of the state of stress (DV) is 7.

Instead of modeling the dependent variable itself, this statistical technique models the probability of its categories. The most well-known and most frequently used approach to model ordinal outcome is the proportional odds logistic regression model (POM) [42] [43].

In this model, we estimate the cumulative probabilities, rather than discrete categories, of being at or below a response-variable category versus being in categories above it. The effect of each independent variable is the same for all categories of the dependent variable. This is referred to as the parallel lines assumption.

Using the logit link function, the model performs logarithmic transformations of cumulative probabilities expressing then the non-linear relationships between the IVs and the DV in a linear model.

Thus, considering k+1 categories of the ordinal dependent variable Y, the cumulative probabilities of a response of Y less than or equal to a category (i) is given by:

$$P(Y<=i) = P_1+\ldots...+P_i \quad (1)$$

The corresponding cumulative odds is given as:

$$\text{Odds } (Y<=i) = \frac{P(Y<=i)}{(1-P(Y<=i))} = \frac{p1+\cdots..+Pi}{pi+1+\cdots+pk+1} \quad (2)$$

Using the Logit link function, the cumulative logits is defined as:

$$\text{Logit } (Y<=i) = \text{Log (odds)} \quad (3)$$

This model uses cumulative probabilities up to a threshold:

$$\text{Logit } (Y<=i) = \alpha_i - (\beta_{i1}X_1 + \cdots + \beta_{im}X_m) \quad (4)$$

For i = 1… k

Where $X_1 \ldots X_m$ are the independent variables. α_i is the intercept of the level i (the threshold for the i^{th} DV). $\beta_{i1} \ldots \beta_{im}$ are the regression coefficients that describe the effects of the independent variables on the dependent variable.

The proportional odds model is based on the assumption that the effects of the IV are the same, on the logarithmic scale, for all categories of the DV: there is one coefficient for each independent variable. Only the intercept α_i depends on the category i. In other words, the coefficients βi are equal across all levels of the outcome variable (i.e. across all logits). This is known as parallel lines (lines of the same slope βi are parallel) or proportional odds assumption.

The equation 4 shows that if the value of an independent variable X increases by one unit, the likelihood of a higher ranking increases or decreases too if the regression coefficient is positive or negative respectively, holding the other variables constant. It follows that the cumulative odds are:

$$\text{Odds } (y<=i) = \frac{\exp(\alpha i)}{\exp(\beta i1X1+\cdots+\beta imXm)} \quad (5)$$

The cumulative probabilities of a category response less than and equal to i is given as:

$$P(Y<=i) = \frac{e^{\alpha i-(\beta i1X1+\cdots+\beta imXm)}}{1+e^{\alpha i-(\beta i1X1+\cdots+\beta imXm)}} \quad (6)$$

In the case of the present study, P(stress<=i) is the estimated cumulative probabilities of a perceived state of stress intensity i (-3, -2, -1, 0, 1, 2, 3).

We used this statistical modeling to check which one or more independent variables among emotional, mental and physical sensations, have significant effects on the polyvalent nursing students' state of stress perception. An important feature of the POM is that the association between the dependent variable and the independent variables can be estimated in terms of odds ratio.

An odds ratio is the odds of being lower or higher on the outcome (the perceived state of stress) across its entire range (-3, -2, -1, 0, 1, 2). It is calculated considering one response category as a reference point and comparing the smaller categories with the larger categories.

By comparing with emotional, mental or physical sensations references, the odds ratio of being higher on the DV is:

$$\text{Odds ratio} = \frac{\left(\frac{Stress\ \leq i}{Stress\ >i}\right)_{sensation\ =j}}{\left(\frac{Stress\ \leq i}{Stress\ >i}\right)_{sensation\ \ reference}} = \exp(\beta im) \quad (7)$$

By comparing with a category (i-1), of a sensation (emotional, mental, physical) the odds ratio of being higher on the DV is:

$$\text{Odds ratio} = \exp(\beta im)/\exp(\beta(i-1)m \quad (8)$$

Example:

For a polyvalent nursing student whose emotional sensation intensity is "very bad" (-3) and comparing it with the intensity +3 "very happy" (+3) set as the reference), the odds ratio of being "very stressed" (-3) versus not "very stressed" (-2 or -1 or 0 or +1 or +2) is:

$$\text{Odds ratio} = \frac{\left(\frac{Stress\ \leq -3}{Stress\ >-3}\right)emotional\ \ sensation\ =-3}{\left(\frac{Stress\ \leq -3}{Stress\ >-3}\right)emotional\ \ sensation\ =+3} = \exp(\beta) \quad (9)$$

Where β is the coefficient regression that corresponds to the intensity "very bad" (-3).

In order to carry out the ordinal logistic regression, we checked the following assumptions: the scale of the DV, the independence-of-observations, the multicollinearity, the model fitting information and the parallel lines.

4. Results and Discussions

4.1. Descriptive Results

4.1.1. Study Variables

Table 1 shows the list of the dependent (state of stress) and the independent variables' (emotional, mental and physical sensations) categories. Their measurement was performed 2 times (at baseline and after the arithmetic task).

Table 1. List of dependent and independent variables of the study with respective categories

	Label	Categories
DVs	State of stress	-3, -2, -1, 0, 1, 2, 3
IVs	Emotional sensation	-3, -2, -1, 0, 1, 2, 3
	Mental sensation	-3, -2, -1, 0, 1, 2, 3
	Physical sensation	-3, -2, -1, 0, 1, 2, 3

Out of the 307 polyvalent nursing students who were admitted as eligible participants, 25,7 % of them were absent (n=79). 228 performed the mental task (serial subtractions test), but 6 of them did not fully fill out data. 222 of these students were then included in the study with 88,28 % of females and 11,72 % of males. Their mean age were 20,43 (SD=1,7; Min=17; Max=30).

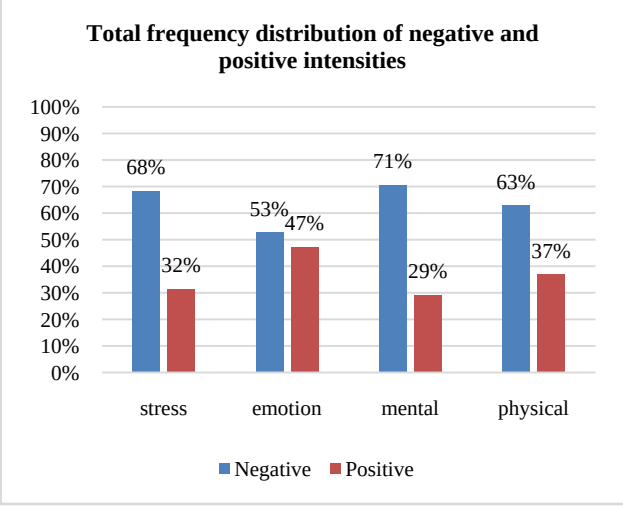

Figure 1. The total frequency percentage of negative and positive intensities of stress, emotional, mental and physical sensations after arithmetic task

The sample size is larger than required (>174) (see "Study population and sample size") for representing the whole target population. This reduces the standard error, which makes the sample more representative.

4.1.2. Comparison of Negative and Positive Intensities

Figure 1 illustrates that the total frequency of the negative categories (-3, -2, -1) of the DV and the IVs are higher compared to the positive categories (0, +1, +2, +3). This implies that most of the students negatively assessed their state of stress and their 3 types of sensations after they have carried the arithmetic task.

4.1.3. Effect of the Arithmetic Test on Stress

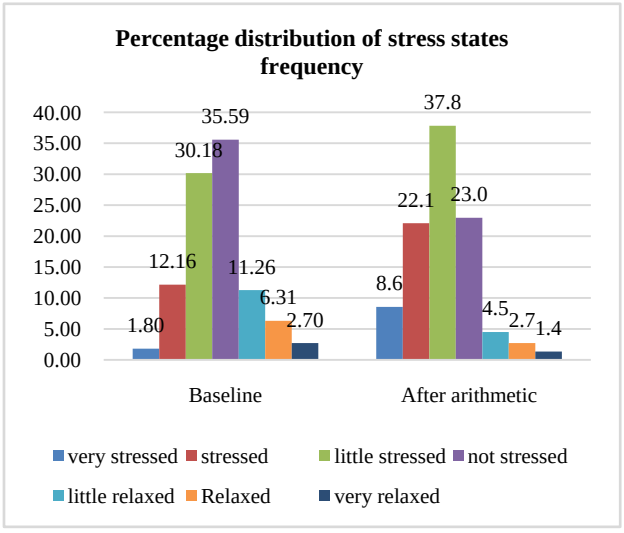

Figure 2. The frequency distribution of intensities of the state of stress assessed at baseline and after arithmetic task

Figure 2 shows the frequency percentage of the intensities of stress perceived by the polyvalent nursing students before and after performing the arithmetic task. The statistical analysis of the difference between pre-and post-arithmetic task shows a significant Wilcoxon test result (z=-7,213; p<0.0001). It illustrates that the percentages of the perceived negative states of stress intensities (very stressed, stressed and little stressed) and that of the positive states (not stressed, little relaxed, relaxed, and very relaxed) increase and decrease significantly respectively after performing the arithmetic test.

These findings are in line with many previous studies.

In their researches, Steptoe, A et al. [44], Kontaxis, S et al. [45], and Rinkevičius, M et al. [46], used this type of mental arithmetic to elicit mental negative stress. It was also considered, for Carter, J. R et al., investigating neural and cardiovascular responses to emotional stress, as a primary cognitive stress [47]. In the study conducted by Li, G et al., it was found that an arithmetic mental task could successfully induce mental fatigue [48].

4.2. Ordinal Logistic Regression Results

4.2.1. Assumptions

The assumptions of applying the ordinal logistic model were met: the dependent variable (state of stress) was measured on an ordering ordinal level and had more than 2 categories. The independence of observations is satisfied as

each observation came from a different polyvalent nursing student. For the test of multicollinearity, Table 2 represents the correlations between the independent variables measured after the arithmetic task. Despite the significant correlations between emotional, mental and physical sensations, none of them is highly correlated with each other (<0,650).

Multicollinearity occurs when the correlations between the variables are high (r>.90) (Tabachnick & Fidell 1996 as cited in Yılmaz, 2020) [49] [50].

Table 2. Correlations between the independent variables assessed after arithmetic task (N=222)

	Emotional sensation	Mental sensation	Physical sensation
Emotional sensation	1,000	,594	,444
Mental sensation	,594	1,000	,647
Physical sensation	,444	,647	1,000

**p<0.01 (2-tailed)

The overall highly significant fit of the model using the -2 log-likelihood X^2 statistics (Table 3) shows that, at the 5% significance level, the used model including the independent variables is better than the intercept-only model. This further indicates that at least one of the IVs (emotional, mental or physical sensations) has an effect on the perception of the state of stress.

Table 3. Model Fitting Information

	-2log Likelihood	Chi Square	df	Sig.
Intercept only	500,227			
Final	320,104	180,124	18	,000

Link function: Logit.

An insignificant goodness-of-fit test (p>0.05) (Table 4) indicates that this model with the selected predictors (emotional, mental and physical sensations variables) measured after the arithmetic test is a good fit and it is significant in predicting odds of being at or below a category of the state of stress (equation 4).

Table 4. Goodness-of-fit statistics

	Chi square	df	Sig.
Pearson	390,873	438	,949
Deviance	226,319	438	1,000

Link function: Logit

Table 5. Pseudo R2 values

Pseudo R^2	**After Arithmetic task**
Cox et Snell	,556
Nagelkerke	,582
McFadden	,263

Link function: Logit.

Table 5 shows the 3 values of the pseudo R-square coefficients, which represent the proportion of variance in the dependent variable (state of stress) explained by the independent variables.

Considering the Nagelkerke pseudo R2, since the interpretation of Cox and Snell pseudo-R2 value is difficult (Field, 2009, p. 269 as cited in Bozpolat 2016) [51] [52], the value of 0.582 indicated that the associations between the state of stress and the predictors was strong. 58,20% of variance in the perceived state of stress could be explained by the predictive variables.

Table 6. Test of parallel lines

Model	**-2 Log Likelihood**	**Chi square**	**Df**	**Sig.**
Null hypothesis	320,104			
General	284,576	35,528	90	1,000

Table 6 shows the test of parallel lines. The general model has a chi-square of 35,528 and a p-value greater than 5% level of significance. The null hypothesis is then rejected, implying that the proportional odds assumption is held for the used ordinal logistic model. In other words, the odds ratios for each predictor are equal across all categories of the DV.

4.2.2. Outcomes

Table 7 shows the outcomes of the ordinal logistic regression used to model the relationships between the intensities of the perceived states of stress and the intensities of the different sensations (emotional, mental and physical) assessed after performing the arithmetic task. The values of the regression coefficients (the estimates) and the corresponding standard errors, Wald's values and their significance's values and odds ratio are presented. The intensity (+3) of the state of stress and of the states of the 3 types of sensations was set as a reference point. Since the estimates are negative, the odds of being in lower categories versus higher categories were calculated on the base of (- β).

a) The significant categories of the DV

All the negative intensities (very stressed, stressed and little stressed) of the dependent variable are significantly highly (<0.0001) associated to the independent variables. The positive categories (little relaxed, relaxed), in contrast, are not (>0.05), while the category "not stressed" is slightly significantly associated (<0.05). This latter could be explained by the fact that some students could have confused this intensity with "little stressed".

b) The association between the DV and the IVS

The results show that the independent variables (emotional and mental sensations) in some of their negative and positive intensities are significantly associated with the dependent variable (the state of stress). In contrast, the physical sensation in all its intensities is not significantly associated with the perceived state of stress.

These findings imply that the state of stress perception depend on emotional and mental and not on physical sensations. This latter had then no effect on predicting the state of stress, despite that the percentage of its negative-assessed categories are higher compared to positive categories (63% vs 37%)

(Figure 1).

Thus, the negative states of stress, caused by the effect of mental arithmetic test, could be predicted by mental and emotional sensations and not by physical sensation.

c) Examining the IVS and their odds ratios

All the estimates of emotional and mental sensations are negative, which means that the 2 independent variables are the significant negative predictors of the state of stress. For a one unit increase in emotional or mental sensations (i.e. going from 0 to 1), there is a predicted decrease in the log odds of being in a higher level of the state of stress (equations 3 and 4), given that the other type of sensation is held constant. In other words, the odds of being in a lower category of the state of stress, considering a category of emotional or mental sensation, is greater than the odds of being in a higher one.

When we examine the mental sensation (mental fatigue) and considering its last negative intensity (-3:very tired), the estimated odds that a polyvalent nursing student (ISPITS institute) rates lower state of stress (<= i) comparing with i=+3 (very relaxed as a reference point), is 1048 , 1,23 and 3,47 times than if mental fatigue is "very rested" (+3), "tired" (-2) and "little tired" (-1) respectively (equations 7 and 8). The intensities "very tired" and "tired" have approximately the same effects on predicting the perceived state of stress to be lower, while the effect of "little tired" is approximately 4 times less than the intensity "very tired".

Examining the emotional sensation and considering its last negative intensity (-3:very bad), the estimated odds that a polyvalent nursing student (ISPITS institute) rates lower state of stress (<= i) comparing with i=+3 (very happy as a reference point), is 562, 9,05 and 19,37 times than if emotional state is "very happy" (+3), "bad" (-2) and "little bad" (-1) respectively. The effects of the intensities "very bad", "bad" and "little bad" on predicting the perceived state of stress to be lower are very different.

Either for emotional or mental sensations, the values of the odds ratios of the estimates decrease from the lowest intensity (-3) to the highest one (+2). This implies that when the intensity of emotional or mental sensations decreases (going from +3 to -3), the probability to be at lower state of stress intensity (more stressed) increases, when the mental or the emotional sensation is held constant respectively whatever the physical sensation is.

d) Comparison of emotional and mental sensations

Comparing between the 2 IVs (the mental and the emotional sensations) in terms of their association with the DV, we see that, contrary to emotional sensation, more intensities of the first one are significantly associated with the state of stress:

- Concerning the negative intensities, both of emotional (very bad, bad, little bad) and mental (very tired, tired, little tired) ones have effects on perceiving the negative state of stress. However, the association between the second one and the states of stress is highly significant than of the first one except for the intensity ("very bad": -3).
- Concerning the positive intensities: no positive intensity of emotional sensation is associated to stress perception. However, 2 of positive intensities of mental sensation, "little rested" and "not tired", are associated but not highly significant (<0.05). These categories were perhaps confused by students with "little tired".

In terms of their estimates, the ones of the mental sensation are greater than those of emotional sensation. This means that for one unit increase (going from 0 to 1) in a negative intensity of mental sensation there is an increase of the likelihood of being stressed greater than if there is one unit increase in a negative intensity of emotional sensation. In terms of odds ratios (Table 7) considered as a peculiar type of effect size [53], the odds of being more stressed (lower categories of the DV) is more obtained by one unit increase in a negative mental sensation than for one unit increase in a negative emotional sensation.

Otherwise, as it is analyzed above (see "Examining the IVS and their odds ratios"), in contrast to emotional sensation, whose effects (estimates) decrease approximately notably from "very bad" (-3) to "little bad" (-1), the effects of mental sensation intensities remain almost the same when we go from "very tired" (-3): to "little tired" (-1). This implies that it is more difficult to distinguish between mental tiredness intensities than the intensities of emotional distress?

We deduce then from the above outcomes that both mental fatigue and emotional distress could influence the feeling of stress of the polyvalent nursing students, but the first type of sensation has higher effects (from -3 to -1) to perceive the negative states of stress if the other sensation is held constant.

We conclude that after carrying out a mental arithmetic (serial subtractions), the polyvalent nursing students at ISPITS institute of Rabat-Morocco refer to emotional and mental sensations and not to physical sensation, when they say they feel stressed. In addition, if we compare between these 2 IVs, we could say that they tend to refer more to mental than to emotional sensation. In other words, feeling mentally fatigued increases the probability that the students feel stressed than if they feel emotionally distressed.

The difference between the mental fatigue and the emotional distress in terms of their influence on the perception of stress may be explained by the fact that the arithmetic task had more effects on the mental sensation than on the emotional one. This observation is supported by other previous studies. In a very recent study (2022), Alix-Fages et al. suggested that carrying out a demanding cognitive task might induce mental fatigue [54]. Dallaway, N. et al. suggested that performing a cognitive task for 10 mn induces mental fatigue [55].

Another explanation to this difference lies in the nature of the arithmetic mental task that involves a higher cognitive load and many sources of stress (time demand, performance evaluation and task performance) [47].

Also, referring to mental fatigue more than emotional distress when the students say they are stressed is also in line with the findings of other studies. Zheng, Shuai, et al.,

in their study, indicated that the first symptoms of stress reported by the participants were the mental overload: "racing thoughts" (mental) followed by "constant worrying" (emotional) and "inability to concentrate". In another research to examine the perception of cognitive overload by students learning in online courses, G Alleyne Bayne and Fethi A. Inan [56] developed a student mental fatigue survey. It consists of 8 items, among which the "I feel stressed when doing coursework" is the most strongly associated with the mental fatigue construct with a factor loading of 0.863 compared to emotional feelings like "I feel frustrated when doing coursework" or "I feel anxiety when doing coursework". A study conducted in 2020, investigating the symptoms of stress experienced by undergraduate students, revealed that highly rated symptoms are cognitive (inability to concentrate, memory problems,…) followed by emotional (anxiety, worry, phobia,…), physical and behavioral [57].

The findings above revealed that, after performing the arithmetic test, both emotional distress and mental fatigue were associated to the stress state. This leads us to wonder whether the 2 perceived-significant sensations are related to each other and not both caused by the mental task.

This remark is in line with some previous studies. G Alleyne Bayne and Fethi A. Inan [56] have also noted that when students are mentally fatigued they become stressed and emotionally distressed (anxious, frustrated). In another study [58], it was stated that emotional wellbeing and mental fatigue, referred as the cognitive overload, are linked, arguing that anxiety could lead to mental fatigue.

Nevertheless, according to the outcomes of the present study (Table 2), the mental and emotional sensations perceived by the nursing students are not highly correlated, implying that we could not confirm they are associated to each other in the present study.

Table 7. Parameter estimates of ordinal logistic regression model calculated after arithmetic task (N = 222)

Variable		Estimate (β)	Std error	Wald	95 % C.I.			
					Sig.	Lower	Upper	OR Exp(-β)
Thresholds	[Stress = -3]	-12,484	2,020	38,182	,000	-16,444	-8,524	
	[Stress = -2]	-10,164	1,999	25,863	,000	-14,082	-6,247	
	[Stress = -1]	-7,678	1,980	15,045	,000	-11,558	-3,798	
	[Stress = 0]	-4,905	1,924	6,499	,011	-8,676	-1,134	
	[Stress = 1]	-3,277	1,837	3,184	,074	-6,877	,322	
	[Stress = 2]	-1,447	1,712	,715	,398	-4,803	1,908	
Location	[Emotional sensation=-3]	-6,332	1,515	17,472	,000	-9,300	-3,363	562,28
	[Emotional sensation =-2]	-4,128	1,327	9,678	,002	-6,728	-1,527	62,05
	[Emotional sensation =-1]	-3,376	1,287	6,883	,009	-5,897	-,854	29,25
	[Emotional sensation = 0]	-2,341	1,281	3,338	,068	-4,853	,170	10,39
	[Emotional sensation = 1]	-2,546	1,307	3,795	,051	-5,108	,016	12,76
	[Emotional sensation = 2]	-1,414	1,258	1,264	,261	-3,880	1,051	4,11
	[Emotional sensation = 3]*	0	.	.	.	.	.	1,00
	[Mental sensation =-3]	-6,955	1,585	19,247	,000	-10,062	-3,848	1048,38
	[Mental sensation =-2]	-6,744	1,556	18,783	,000	-9,794	-3,694	848,95
	[Mental sensation =-1]	-5,711	1,522	14,080	,000	-8,694	-2,728	302,17
	[Mental sensation = 0]	-4,693	1,514	9,606	,002	-7,661	-1,725	109,18
	[Mental sensation = 1]	-3,651	1,778	4,220	,040	-7,135	-,167	38,51
	[Mental sensation = 2]	-2,256	1,417	2,535	,111	-5,032	,521	9,54
	[Mental sensation = 3]*	0	.	.	.	.	.	1,00
	[Physical sensation =-3]	-,145	1,046	,019	,890	-2,195	1,905	1,16
	[Physical sensation =-2]	,049	,986	,003	,960	-1,882	1,981	0,95
	[Physical sensation =-1]	-,162	,938	,030	,863	-2,001	1,678	1,18
	[Physical sensation = 0]	-,358	,975	,135	,713	-2,268	1,552	1,43
	[Physical sensation = 1]	,436	1,025	,181	,671	-1,574	2,445	0,65
	[Physical sensation = 2]	-,103	1,055	,010	,922	-2,170	1,964	1,11
	[Physical sensation = 3]*	0	.	.	.	.	.	1,00

* Reference category

5. Implications

From the findings of the present study, the implications that could be deduced are: the institute's teachers and officials who deal with stressed polyvalent nursing students, have to take into account that these latter are more likely to suffer from emotional distress and/or mental fatigue. This is especially during the exam's preparation period, a cognitive demanding work.

6. Limitations of the Study

A large percentage (72%) of the target's population (polyvalent nursing students) participated in the present study. However, the sampling method used, due to the expected absence of the nursing students, was non-probabilistic. The findings were obtained using a specific population and an arithmetic test that had more effects on the mental sensation and no effect on the physical one. The results could then not be generalized.

7. Conclusions

The purpose of the present study was to investigate if emotional distress, mental fatigue and physical tiredness could affect the feeling of the state of stress of the polyvalent nursing students at the ISPITS institute of Rabat-Morocco. The approach, distinguishing between the 3 types of sensations, was to our best knowledge not used in previous studies.

The students underwent a serial subtraction test to increase their stress. After performing the mental task, their increased perceived states of stress, in their intensities ("very stressed", "stressed", "little stressed"), were found to be significantly associated to mental fatigue and emotional distress and not to physical tiredness. In addition, the lower the intensity of emotional or mental sensation, the more likely the students are to experience stress.

Moreover, contrary to emotional distress where only the category "very bad:-3" was highly significantly associated, all negative intensities of the mental fatigue ("little tired", "tired" and "very tired" were highly associated ($p<0.0001$) with the perceived states of stress and its regression coefficients effects are higher than the first one.

We conclude that when a polyvalent nursing student of the ISPITS institute, after performing a serial subtractions test, says "I am stressed" or "I feel stressed", he/she refers to emotional negative feelings and mental fatigue, with this latter having more effects than the first one.

8. Recommendations

New other studies, targeting large populations and using other tests to elicit either emotional or physical sensations in addition to mental one, could investigate if the participants will always refer to the same sensations when they declare stressed or even relaxed. A new other study to investigate the relationships between mental fatigue and emotional distress is highly recommended so as to find out if people refer to only one sensation that causes the other ones to be also linked to the stress feeling.

Future studies could then allow us to find out if most people constantly refer to the same sensations when they say "I feel stressed". This would remove the confusion generated by the term «feeling stressed».

ACKNOWLEDGEMENTS

I would like to thank the ISPITS institute administration of Rabat-Morocco for allowing us to perform this experimentation. Our great thanks also to the polyvalent nursing department and its staff, including the professors, for permitting us access to the classrooms and doing the research.

Our sincere appreciation to the polyvalent nursing students of the 2020-21 academic year for their availability to participate in the study.

Our thanks are also expressed to all those who provided us with scientific knowledge, support and encouragement, including professors and friends.

REFERENCES

[1] Cannon, (1932). "The Wisdom of the Body". New York, NY: Norton.

[2] Selye, H. (1950). Stress and the general adaptation syndrome. British medical journal, 1(4667), 1383.

[3] Lazarus, R., S., Folkman, S. (1984). Stress, appraisal and coping, New York: Springer.

[4] Ktiri, F. (2016). New Dimensions of Stress and Its Numerical Modeling. International Journal of Applied Psychology, 6 (4), 100-109.

[5] Nooraini, H., Salamah, U., & Prasetyo, H. (2022, August). The Comparison of Classification of Stress Level Related to Student's Menstrual Cycle Irregularities with Support Vector Machine and Decision Tree Algorithm. In 2022 5th International Conference on Information and Communications Technology (ICOIACT) (pp. 133-138). IEEE.

[6] Bärg, A. (2019). Green spaces in urban environments as a human restoration resource.

[7] Labrague, L. J., McEnroe-Petitte, D. M., Gloe, D., Thomas, L., Papathanasiou, I. V., & Tsaras, K. (2017). A literature review on stress and coping strategies in nursing students. Journal of Mental Health, 26(5), 471-480.

[8] Ramadhani, R. D. (2023). Relationship Of Self Determination With Academic Resilience In Facing Lectures. INDONESIAN NURSING JOURNAL OF EDUCATION AND CLINIC (INJEC), 7(2).

[9] van den Broek, E. L. (2005, July). Empathic agent technology (eat). In Proceedings of the AAMAS-05 Agent-Based Systems

for Human Learning (ABSHL) workshop (pp. 59-67). The Netherlands: Utrecht.

[10] Patrawala, N. M. (2018). Teachers' Executive Functioning Abilities and Levels of Occupational Stress. University of Northern Colorado.

[11] Hashemipour, M. A., Hosseini, V., & Kamyabi, H. (2022). Stressors in Dental Students During the Transition from Theory to Practice: A Qualitative Research. South African Dental Journal, 77(7), 386-393.

[12] Chen, J. (2010). A cultural approach to understanding and working with Chinese migrants in New Zealand: a thesis presented in partial fulfillment of the requirements for the degree of Doctor of Clinical Psychology at Massey University, Albany, New Zealand (Doctoral dissertation, Massey University).

[13] Lapalme, J. (2011). Neighborhood Impacts on Stress: Perspectives of Adolescent Girls.

[14] Chrousos, G. P., Loriaux, D. L., & Gold, P. W. (1988). Introduction: The concept of stress and its historical development. In Mechanisms of physical and emotional stress (pp. 3-7). Springer, Boston, MA.

[15] Walters, S. (2020). 12.3 Understanding Stress. Psychology-1st Canadian Edition.

[16] Brown, J. M., & Campbell, E. A. (1990). Sources of occupational stress in the police. Work & stress, 4(4), 305-318.

[17] Borst, R. T. (2022). Stressed versus motivated public employees: a systematic review of the motivation and stress literatures through a contextualized job demands-resources model. Research Handbook on Motivation in Public Administration, 354-376.

[18] McEwen, B. S. (2005). Stressed or stressed out: what is the difference?. Journal of Psychiatry and Neuroscience, 30(5), 315-318.

[19] Selye, H. (1975). Confusion and controversy in the stress field. Journal of human stress, 1(2), 37-44.

[20] Harkness, A. M., Long, B. C., Bermbach, N., Patterson, K., Jordan, S., & Kahn, H. (2005). Talking about work stress: Discourse analysis and implications for stress interventions. Work & Stress, 19(2), 121-136.

[21] McEwen, B. S. (2005). Stressed or stressed out: what is the difference?. Journal of Psychiatry and Neuroscience, 30(5), 315.

[22] Kahraman, T., Rasova, K., Jonsdottir, J., Medina, C. S., Kos, D., Coote, S., ... & Kalron, A. (2022). The impact of the COVID-19 pandemic on physical therapy practice for people with multiple sclerosis: A multicenter survey study of the RIMS network. Multiple Sclerosis and Related Disorders, 62, 103799.

[23] Denscombe, M. (2000). Social conditions for stress: Young people's experience of doing GCSEs. British Educational Research Journal, 26 (3), 359–374. DOI: 10.1080/713651566.

[24] Sharma, P. (2021). An analysis of the effect of academic stress on achievement motivation among senior-secondary students of Mathura District. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(5), 498-502.

[25] Apriliyani, I., & Maryoto, M. (2020, February). The Relationship Between Coping Mechanisms and Stress Levels in Thesis Writing Among Undergraduate Nursing Students. In 1st International Conference on Community Health (ICCH 2019) (pp. 64-67). Atlantis Press.

[26] Esparbès-Pistre, S., Bergonnier-Dupuy, G., & Cazenave-Tapie, P. (2015). Le stress scolaire au collège et au lycée: différences entre filles et garçons. Éducation et francophonie, 43(2), 87-112.

[27] Liu, X., Shan, Y., Peng, M., Chen, H., & Chen, T. (2020). Human stress and StO2: database, features, and classification of emotional and physical stress. Entropy, 22(9), 962.

[28] Kinman, G., & Jones, F. (2005). Lay representations of workplace stress: What do people really mean when they say they are stressed?. Work & stress, 19(2), 101-120.

[29] Kostenius, C., & Öhrling, K. (2008). The meaning of stress from schoolchildren's perspective. Stress and Health: Journal of the International Society for the Investigation of Stress, 24(4), 287-293.

[30] Zheng, S., Kim, C., Meier, P., Sibbritt, D., & Zaslawski, C. (2017). Development of a novel questionnaire for the traditional Chinese medicine pattern diagnosis of stress. Journal of acupuncture and meridian studies, 10(4), 276-285.

[31] Yamane, T. (1973). Statistics: an introductory analysis-3.

[32] Elo, A. L., Leppänen, A., & Jahkola, A. (2003). Validity of a single-item measure of stress symptoms. Scandinavian journal of work, environment & health, 444-451.

[33] Lee, H. J., Cho, Y., Joo, H., Jeon, J. Y., Jang, Y. E., & Kim, J. T. (2021). Comparative study of verbal rating scale and numerical rating scale to assess postoperative pain intensity in the post anesthesia care unit: A prospective observational cohort study. Medicine, 100(6), e24314.

[34] Kovacevic, D. (2022). Effects of mental fatigue, exercise type, and exercise duration on the relative reinforcing value of exercise (Doctoral dissertation).

[35] Ilies, R., Huth, M., Ryan, A. M., & Dimotakis, N. (2015). Explaining the links between workload, distress, and work–family conflict among school employees: Physical, cognitive, and emotional fatigue. Journal of educational psychology, 107(4), 1136.

[36] Hunziker, S., Laschinger, L., Portmann-Schwarz, S., Semmer, N. K., Tschan, F., & Marsch, S. (2011). Perceived stress and team performance during a simulated resuscitation. Intensive care medicine, 37(9), 1473-1479.

[37] Reeve, K. L., Shumaker, C. J., Yearwood, E. L., Crowell, N. A., & Riley, J. B. (2013). Perceived stress and social support in undergraduate nursing students' educational experiences. Nurse education today, 33(4), 419-424.

[38] Steptoe, A., Ronaldson, A., Kostich, K., Lazzarino, A. I., Urbanova, L., & Carvalho, L. A. (2018). The effect of beta-adrenergic blockade on inflammatory and cardiovascular responses to acute mental stress. Brain, behavior, and immunity, 70, 369-375.

[39] Kontaxis, S., Lázaro, J., Hernando, A., Arza, A., Garzón, J. M., Gil, E.,... & Bailón, R. (2016). Mental stress detection using cardiorespiratory wavelet cross-bispectrum. In 2016 Computing in Cardiology Conference (CinC) (pp. 725-728). IEEE.

[40] Rinkevičius, M., Kontaxis, S., Gil, E., Bailón, R., Lázaro, J., Laguna, P., & Marozas, V. (2019). Photoplethysmogram Signal Morphology-Based Stress Assessment. In 2019 Computing in Cardiology (CinC) (pp. Page-1). IEEE.

[41] Patil, P., & Bennal, A. S. (2019). Cardiovascular responses for mental stress in normotensive offspring of hypertensive parents. National Journal of Physiology, Pharmacy and Pharmacology, 9(7), 613-616.

[42] Zheng, H., & Zheng, L. (2020). An investigation on language programs in US higher institutions—A case study on Chinese language programs. US-China Education Review, 10(6), 257-265.

[43] Bogdan, A. M., & Kulshreshtha, S. N. (2021). Canadian horticultural growers' perceptions of beneficial management practices for improved on-farm water management. Journal of Rural Studies, 87, 77-87.

[44] Steptoe, A., Ronaldson, A., Kostich, K., Lazzarino, A. I., Urbanova, L., & Carvalho, L. A. (2018). The effect of beta-adrenergic blockade on inflammatory and cardiovascular responses to acute mental stress. Brain, behavior, and immunity, 70, 369-375.

[45] Kontaxis, S., Lázaro, J., Hernando, A., Arza, A., Garzón, J. M., Gil, E.,... & Bailón, R. (2016). Mental stress detection using cardiorespiratory wavelet cross-bispectrum. In 2016 Computing in Cardiology Conference (CinC) (pp. 725-728). IEEE.

[46] Rinkevičius, M., Kontaxis, S., Gil, E., Bailón, R., Lázaro, J., Laguna, P., & Marozas, V. (2019). Photoplethysmogram Signal Morphology-Based Stress Assessment. In 2019 Computing in Cardiology (CinC) (pp. Page-1). IEEE

[47] Carter, J. R., Durocher, J. J., & Kern, R. P. (2008). Neural and cardiovascular responses to emotional stress in humans. American Journal of Physiology-Regulatory, Integrative and Comparative Physiology, 295(6), R1898-R1903.

[48] Li, G., Huang, S., Xu, W., Jiao, W., Jiang, Y., Gao, Z., & Zhang, J. (2020). The impact of mental fatigue on brain activity: A comparative study both in resting state and task state using EEG. BMC neuroscience, 21, 1-9.

[49] Tabachnick, B. G., & Fidell, L. S. (1996). Using Multivariate Statistics. New York, USA: Harper Collins College Publishers.

[50] Yılmaz, A. Ç. (2020). Partner selection following a failure (an analysis of Turkish TV series industry, 2007-2016) (Doctoral dissertation).

[51] Bozpolat, E. (2016). Investigation of the self-regulated learning strategies of students from the faculty of education using ordinal logistic regression analysis. Educational Sciences: Theory & Practice, 16(1).

[52] Field, A. (2009). Discovering statistics using SPSS (and sex and drugs and rock 'n' roll) (3th ed.). London, UK: Sage

[53] Ialongo, C. (2016). Understanding the effect size and its measures. Biochemia medica, 26(2), 150-163.

[54] Alix-Fages, C., Grgic, J., Jiménez-Martínez, P., Baz-Valle, E., & Balsalobre-Fernández, C. (2022). Effects of Mental Fatigue on Strength Endurance: A Systematic Review and Meta-Analysis. Motor Control, 1(aop), 1-20.

[55] Dallaway, N., Lucas, S. J., & Ring, C. (2022). Cognitive tasks elicit mental fatigue and impair subsequent physical task endurance: Effects of task duration and type. Psychophysiology, 59(12), e14126.

[56] Alleyne Bayne, G., & Inan, F. A. (2022). Development of the Online Course Overload Indicator and the Student Mental Fatigue Survey. International Review of Research in Open and Distributed Learning, 23(4), 74-92.

[57] Mustafa, S. M. S., & Alias, N. F. (2020). The symptoms of stress as perceived by University Students. Journal of Social Science Advanced Research, 1(1), 11-20.

[58] Tzafilkou, K., Perifanou, M., & Economides, A. A. (2021). Negative emotions, cognitive load, acceptance, and self-perceived learning outcome in emergency remote education during COVID-19. Education and information technologies, 26(6), 7497-7521.