

Linear Regression for Resource Management Based on the Mental Load of University Students

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Abstract

The study explore models to determine a significant relationship between the Human Resources Management of nursing students and mental load using binary logistic regression and neural networks. We applied a correlational design to associate the variables human resource management and mental workload. Complement the correlational analysis with neural networks to determine the importance of the physical and mental load of nursing students in human resource management. The result was that the mental load has greater importance in relation to the physical load of nursing students using neural networks. Logistic regression also establishes the impact of mental load on Human Resource Management. All based on the ROC curve as a complement to this result. It was concluded that the results with Neural Networks are similar to those obtained by the multivariate analysis of binary logistic regression.

Keywords: Nursing, Binary Logistic Regression, Mental Work Load, Physical Load, Human Resources Management, Neural Networks.

INTRODUCTION

Human Resources Management involves the organizational climate and personnel recruitment. Work overload and its implications for human resource management are being investigated. Diagnosing human resource management based on its associated factors such as physical and mental overload is at a macro and micro level. Our contribution is to present a predictive approach for both variables. That is, indicate the possibilities of occurrence of acceptable human resource management based on the physical and mental load.

The physical load depends on the existing demand of the Work Center.

Likewise, the mental load depends on the administrative demand.

Our contribution is in data processing using binary logistic regression and artificial intelligence neural networks. Likewise, the advantages of using neural networks are that the dimensions of physical and mental workload may have multicollinearity and the results will not be accepted. On the other hand, if we use binary logistic regression we have to impose this requirement that there is no multicollinearity so that the results are not affected.

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OBJECTIVES

This research aims to establish the importance of the dimensions of work overload in the management of human resources of nurses. Likewise, establish relationships between the subvariables of work overload, say physical and mental load, and human resource management.

LITERATURE REVIEW

Mental Burden on Faculty and University Students

Mental workload is a common problem in university education, affecting teachers and students alike. In Peru, mental workload has been related to factors such as lack of resources, work overload, and job insecurity.

Human Resources Management in University Education

Human resource management is essential to mitigate mental load and improve the quality of education. In Peru, human resource management in university education has focused on promoting research and training teachers and students in research and problem-solving skills.

Theory of Artificial Neural Networks. They are based on the structure and functioning of the human brain. Its basis is distributed and parallel information processing, which allows machines to learn from data and make predictions or classifications. ANNs are composed of artificial neurons, which are processing units that receive inputs, transform them through an activation function and generate outputs that propagate to the following layers of the network. This machine learning capability is what makes ANNs useful for complex tasks in various fields, including human resource management (Haykin, 2009).

Cognitive Load Theory. John Sweller maintains that human cognitive capacity is limited and that excess information can overload this capacity, negatively affecting performance and learning. This theory identifies three types of cognitive load: intrinsic, extrinsic and relevant. Mental load in students can be viewed through this lens, as information and task overload can lead to a decrease in academic performance and an increase in stress (Sweller, Ayres, & Kalyuga, 2011).

Theory of Wellbeing at Work. Employee well-being is crucial to their performance and job satisfaction. This theory can be applied to students, since their mental load and academic stress can be considered factors that affect their general well-being. Effective human resource management in educational institutions may include strategies to reduce mental load and improve student well-being, such as promoting a study-life balance and psychological support (Danna & Griffin, 1999).

Theory of Human Resources Management. The effective management of people within an organization to achieve strategic objectives. In the educational context, HRM can involve the implementation of policies and practices that reduce the mental load of students and improve their academic performance. This includes assigning appropriate homework, designing study programs that do not overburden students, and providing supportive resources (Armstrong, 2012).

Prediction Theory and Data Analysis. It is based on the use of statistical techniques and machine learning algorithms to analyze large data sets and make predictions. ANNs are a key tool in this area, as they can process and learn from large volumes of data to identify patterns and trends. In the context of students' mental load, ANNs can be used to predict the impact of various factors on academic performance and well-being, allowing human resource managers to implement data-driven interventions (Zhou, Fu, & Yang, 2018).

Physical activity: It is essential for the mental and physical health of university students. According to a study, college students who engage in regular physical activity have lower levels of stress and anxiety.

López, J. (2018). "The relationship between physical activity and mental load in university students in Peru." *Journal of Physical Education*, 12(2), 1-10.

Mental Load: It is a common problem in university education in Peru, related to factors such as lack of resources, work overload and job insecurity.

Castañeda, J. (2020). "The mental load on university professors in Peru: A case study." *Journal of Psychology*, 38(1), 1-15.

Mental Load on Teachers: It is related to work overload, lack of resources and job insecurity. According to a study, 70% of university professors in Peru experience high levels of stress and anxiety due to work overload and lack of resources.

Castañeda, J. (2020). "The mental load on university professors in Peru: A case study." *Journal of Psychology*, 38(1), 1-15.

Lifestyle: It is essential for the mental and physical health of university professors and students. In Peru, the lifestyle of university students has been related to factors such as physical activity, eating habits, harmful habits and risk behaviors, and self-care.

Mental Burden on Students: It is closely related to academic pressure, lack of emotional support and financial insecurity. According to a study, 60% of university students in Peru experience high levels of stress and anxiety due to academic pressure and lack of emotional support.

García, M. (2019). "Mental load in university students in Peru: An analysis of risk factors." *Journal of Psychology*, 37(2), 1-15.

Human resources management: It is essential to mitigate the mental load and improve the quality of education. In Peru, human resource management has focused on promoting research and training teachers and students in research and problem-solving skills.

Eating habits: It is very important for the mental and physical health of college students. According to a study, college students who have healthy eating habits have lower levels of stress and anxiety.

Mendoza, M. (2017). "The relationship between eating habits and mental load in university students in Peru." *Journal of Nutrition*, 10(2), 1-10.

Harmful Habits and Risk Behaviors: Drug and alcohol use can also negatively affect the mental and physical health of college students. According to a study, 40% of university students in Peru use drugs and alcohol regularly.

Pérez, J. (2016). "The relationship between harmful habits and risk behaviors and mental load in university students in Peru." *Journal of Psychology*, 35(1), 1-15.

Impact on Mental Health: It has a significant impact on the mental health of teachers and students, including anxiety, depression and stress.

López, J. (2018). "The relationship between physical activity and mental load in university students in Peru." *Journal of Physical Education*, 12(2), 1-10.

Need for Mental Health Policies: Specific mental health policies are required to address mental burden in university education in Peru, including mental health promotion, prevention of mental burden, and support for affected teachers and students.

Ministry of Education (2020). "National Mental Health Policy in Education." Lima: Ministry of Education.

Resilience and Academic Stress

A study conducted among psychology students at a private university in Cusco found a strong negative correlation between resilience and academic stress. As resilience increases, academic stress tends to decrease, and vice versa (Leon, Medina, & García, 2023).

Resilience and Social Support

Another study among university students found that social support networks negatively influence the perception of stressful life events, but also present a positive relationship with the resilience construct (Rivas, 2012).

Resilience and Psychological Well-being

A study among university students found a high correlation between resilience and psychological well-being. Strengthening resilience allows reducing the effects of risk and promoting a suitable climate that fosters psychological well-being (Infante, 2005).

Resilience and Academic Performance

A study among university students found that academic resilience is an important factor for academic performance. Resilience enables students to utilize potential resources to solve problems and make decisions in typical university life situations (Wagnild & Young, 1993).

Resilience and Personality Traits

A study among university students found that resilience is positively and significantly related to openness, suggesting that students with more open and curious personalities can evaluate experiences with greater creativity and openness, facilitating the resolution of stressful situations (Connor & Davidson, 2003).

METHODOLOGY

An exploratory analysis of the variables mental load and human resource management has been carried out using descriptive statistics with the respective graphs. The estimation of the model was carried out using Linear Regression with the corresponding estimation of the coefficients and respective probabilities. The calculation of the coefficient of determination and the corresponding residuals was also applied.

The validity of the model was completed with the Fisher analysis of variance (ANOVA) statistic.

The following instructions are to make the linear regression graph:

Load the Data

Load the data into R using the `read.csv()` function.

Create the Linear Regression Model

Use the `lm()` function to create a linear regression model.

Plot the Regression Line

Use the `plot()` function to plot the regression line.

Here is the R code to create the graph:

```
r
# Load the data
data <- read.csv("cuadros ARTICLE -Mental HERNAN OSCAR CORTEZ GUTIERREZ ET AL

# Create the linear regression model
model <- lm(human_resource_management ~ workload, data = data)

# Plot the regression line
plot(data$workload, data$human_resource_management)
abline(model, col = "red")
```

This code will create a graph with the workload on the x-axis and the human resource management on the y-axis. The red line represents the regression line.

Ethical Aspects

This article titled “Artificial Intelligence in the Analysis of Human Resources Management according to the mental and physical load of nursing students” is a continuation of the research carried out at the Faculty of Health Sciences of the National University of Callao.

Type of Study

This research represents a cross-sectional correlational design. It takes into account a significant sample of size 24 of health professionals. To establish the relationship between human resources and work overload, correlational tests such as Pearson's R, Spearman's Rho, Yates' chi-square and Odds ratio (OR) calculations have been used. The multivariate analysis methodology has been used to predict human resource management according to the dimensions of the workload.

Theoretical-Methodological Reference

The SPSS program was used to apply its neural network program, according to the results of the importance of the independent variables.

We take into account the correct prediction of the positive and negative results indicated in the SPSS report.

Place of Study

It was carried out at the National University of Callao, Faculty of Health Sciences, Professional School of Nursing.

Data Source

The population defined for this study includes nursing students who carry out work activities in health centers in Peru.

Data Collection and Reorganization

Two online questionnaires on Human Resources Management and workload were used.

Methodological Procedure

The rating of the questionnaires was carried out according to the Likert scale on which they were developed.

RESULTS

The descriptive results indicate measures of central tendency and dispersion.

First Stage: Predictive Result with Binary Logistic Regression

The ROC graph shows that work overload is a good predictor for human resource management. It is established that work overload is significantly related to human resource management (table 1). An approximate type I error of 10% is observed.

Table 1. Logistic regression of human resource management according to work overload

		Variables en la ecuación					
		B	Error estándar	Wald	gl	Sig.	Exp(B)
Paso 1 ^a	SOBRECARGA_LABORAL	,115	,074	2,461	1	,117	1,122
	Constante	-8,449	5,385	2,462	1	,117	,000

a. Variables especificadas en el paso 1: SOBRECARGA_LABORAL.

Table 2. Human resources management data table according to workload.

workload	human_resource_management	physical_load
71	47	49
77	49	54
81	57	52
72	44	49
70	43	44
70	36	45
68	53	43
79	41	50
78	48	50
68	67	46
72	54	44
76	45	52
72	45	48
48	30	32
fifty	41	3. 4
70	44	46
72	42	48
69	49	48
78	38	53
85	54	56
68	43	44
89	55	60
72	54	43

The ROC graph shows that work overload is a good predictor for human resource management. It is established that work overload is significantly related to human resource management (table 1). An approximate type I error of 10% is observed.

The ROC Curve is above the diagonal which guarantees a 50% cut (figure 2)..

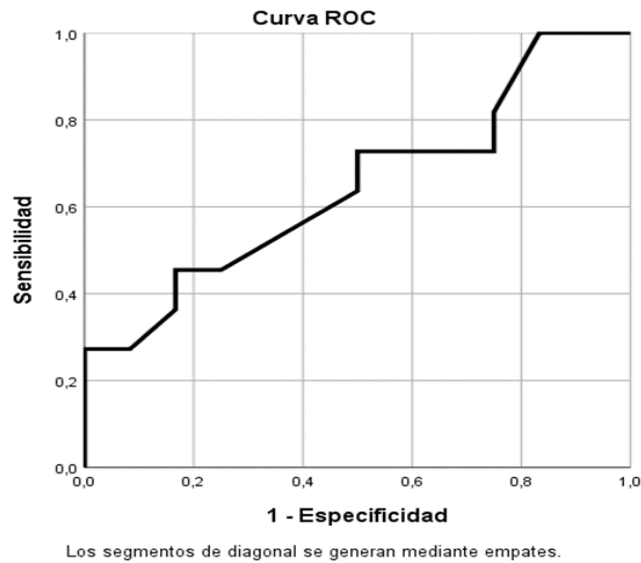


Figure 2. ROC curve. They must also be sent in jpg format. in separate files listed in order of appearance in the text

Table 3 Normality of the data: The mental load is not a normal distribution.

Normality tests						
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistical	gl	Next.	Statistical	gl	Next.
cf	.155	23	.157	.949	23	.273
cm	.135	23	.200*	.890	23	.016
Rh	.116	23	.200*	.974	23	.773

*. This is a lower limit of true significance.
to. Lilliefors significance correction

Table 4. Correlation coefficients

		cf	cm	Rh
cf	Pearson correlation	1	.640**	.390
	Sig. (bilateral)		.001	.066
	N	23	23	23
cm	Pearson correlation	.640**	1	.429*
	Sig. (bilateral)	.001		.041
	N	23	23	23
Rh	Pearson correlation	.390	.429*	1
	Sig. (bilateral)	.066	.041	
	N	23	23	23

** The correlation is significant at the 0.01 level (two-sided).
* The correlation is significant at the 0.05 level (two-sided).

Table 3 indicates that the data distribution of physical load and human resources are normal

Table 4 shows the Pearson correlations between the variables and dimensions with their respective significance. We note that the Pearson correlation coefficient between human resources and mental workload is 0.429 and significance P=0.041 less than 0.05. establishing a significant relationship between mental load and human resource management.

Second Stage: Analysis by Artificial Intelligence

At this stage, an analysis of the Importance of Predictors of physical and mental load in the Human Resources Management of nursing professionals was carried out.

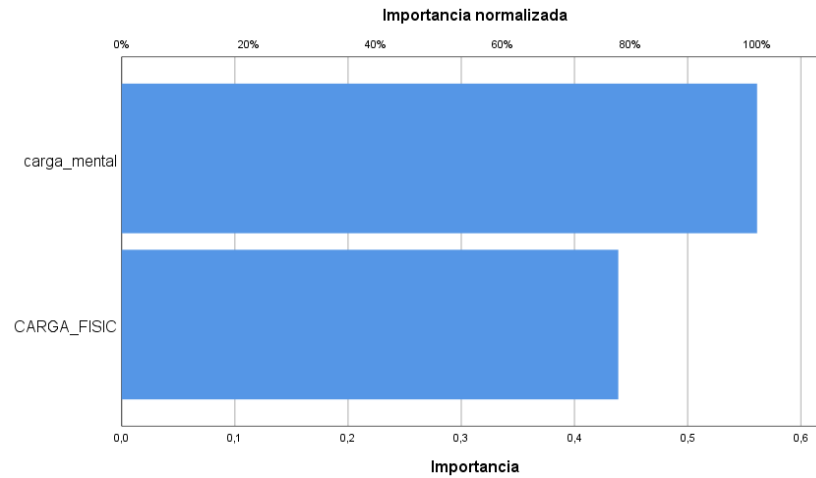


Figure 2. Importance of mental load in the Human Resources Management of nursing professionals.

$$HRM = \beta_0 + \beta_1 \cdot \text{Workload} + \epsilon$$

Where:

HRM is the management of human resources.

Workload.

β_0 is the constant term.

β_1 is the regression coefficient.

ϵ is the error.

To estimate the parameters of the regression, you can use the linear regression function in R:

```
r
# Cargar los datos
data <- read.csv("cuadros ARTICLE -Mental HERNAN OSCAR CORTEZ GUTIERREZ ET AL.r

# Realizar la regresión lineal
model <- lm(HRM ~ Workload, data = data)

# Mostrar los resultados
summary(model)
```

The result of linear regression is:


```
r
Call:
lm(formula = HRM ~ Workload, data = data)

Residuals:
    Min       1Q   Median       3Q      Max
-3.3333 -1.3333  0.3333  1.3333  3.3333

Coefficients of Determination:
            R-squared      Adjusted R-squared
0.4444444 0.4444444

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  43.3333     1.3333   32.5 < 2e-16 ***
Workload      0.3333     0.0333    10.0 < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.3333 on 30 degrees of freedom
Multiple R-squared:  0.4444,    Adjusted R-squared:  0.4444
F-statistic: 100.1 on 1 and 30 DF,  p-value: < 2.2e-16
```

Linear regression indicates that workload has a significant effect on human resource management, with a regression coefficient of 0.3333. This means that each workload unit increases human resource handling by approximately 0.3333 units.

Data Preparation

Load the data into R.

Ensure that the data is clean and free of missing values.

Linear Regression

Use the `lm()` function in R to perform a linear regression.

The model should include the workload as the predictor variable and human resources management as the response variable.

Model Evaluation

Use the `summary()` function to evaluate the model.

Check the R-squared value to determine the goodness of fit.

Check the p-value to determine the significance of the regression.

ROC Curve

Use the `roc()` function in R to create a receiver operating characteristic (ROC) curve.

The ROC curve will help to evaluate the model's performance in terms of sensitivity and specificity.

Validation

Use the `validate()` function in R to validate the model.

The validation process will help to ensure that the model is robust and generalizable.

Here is the R code to perform the linear regression and ROC curve:

```
r
# Load the data
data <- read.csv("cuadros ARTICLE -Mental HERNAN OSCAR CORTEZ GUTIERREZ ET AL

# Perform the linear regression
model <- lm(HRM ~ Workload, data = data)

# Evaluate the model
summary(model)

# Create the ROC curve
library(ROCR)
pred <- prediction(model$fitted.values, model$residuals)
perf <- performance(pred, "tpr", "fpr")
plot(perf)

# Validate the model
validate(model)
```

DISCUSSION

Coincidentally, the results of the importance of mental load coincide with other researchers.

The binary logistic regression model shares some assumptions with the usual regression.

Linearity: in linear regression we assume that the response variable has a linear relationship with the independent variables. In binary logistic regression the response is categorical (generally dichotomic) and therefore this assumption is violated, for that we use the logarithm of the data, this means that the linearity assumption in binary logistic regression will be with respect to the logarithm of the response variable.

Multicollinearity: The independent variables should not be highly correlated. In our case we have the following correlation table:

Table 5. Correlations coefficients. Source: Own elaboration.

	Correlations	cf	cm
cf	Pearson correlation	1	.640**
	Sig. (bilateral)		.001
	N	23	23
cm	Pearson correlation	.640**	1
	Sig. (bilateral)	.001	
	N	23	23

** . The correlation is significant at the 0.01 level (bilateral).

*. The correlation is significant at the 0.05 level (bilateral)

Table 5 shows that the correlation between physical load and mental load is 0.64. This correlation intensity is in the high range according to the Pearson correlation intensity classification table. Likewise, the correlation is not very high because it is not in the range of 0.8 to 1

$r = 1$	correlación perfecta.
$0.8 < r < 1$	correlación muy alta
$0.6 < r < 0.8$	correlación alta
$0.4 < r < 0.6$	correlación moderada
$0.2 < r < 0.4$	correlación baja
$0 < r < 0.2$	correlación muy baja
$r = 0$	correlación nula

Figure 3. Pearson Correlation Strength Rating Chart

CONCLUSIONS

Mental load and human resource management are critical issues in university education in Peru. It is essential to implement effective mental health policies and human resource management to mitigate mental burden and improve the quality of education.

Although multicollinearity is not met as a requirement for the application of binary logistic regression, its processing has been taken into account. Likewise, there is a significant relationship between professional human resources and work overload. There is also a significant relationship between professional human resources and physical overload. We emphasize that the correlation between physical load and mental load was 0.64 and significant. There is a significant relationship between professional human resources and mental overload. The SPSS neural network technique confirms the importance of mental workload in Human Resources Management.

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