International Journal of Mathematics And its Applications
Volume 3, Issue 4–A (2015), 95–103.
ISSN: 2347-1557
Available Online: http://ijmaa.in/

International Journal of Mathematics And its Applications

A Multiple Linear Regression Approach for the Analysis of Stress Factors of Faculty in Higher Educational Institutions

Research Article

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Abstract: One of the fast growing sectors in India and abroad is an education sector. This sector masses highly qualified and committed faculty to enhance the quality of education and also to equip the student to meet demand of the industry. In this process faculty has to face many challenges and difficulties to meet the requirements of the education sector. The objective of the present study is under taken to address the effects of different inducing stress factors on job stress of the faculty in higher educational institutions of chittoor district, Andhra Pradesh. Instrument was used in order to get the responses from higher education institutions faculty to achieve the above stated objective. Multiple linear regression and ANOVA were used to analyze the data collected from 500 respondents. Different models were suggested to different categories of faculty members in higher educational institutions to measure their occupational stress and also identified highly contributed factors related to job stress to prevent professional burnout of faculty in higher education.

Keywords: Faculty, Job stress, Multiple linear regression, ANOVA, Higher education.

1. Introduction and Preliminaries

Before defining stress, one should note that job stress differs from other life stresses [4]. Job stress is a term used to describe workplace related stresses [13]. It is commonly defined as, "the harmful physical and emotional responses that occur when the demands of the job exceed the capabilities, needs or resources of the worker". The concept of stress was first introduced in the life sciences by [10]. It was derived from the Latin word 'stringere'; it meant the experience of physical hardship, starvation, torture and pain. [10] defined stress as, "the non-specific response of the body to any demand placed upon it". Many people still get confused about pressure and stress, yet there's a great deal of difference between the two. We all experience pressure on a daily basis, and need it to motivate us and enable us to perform at our best - ask any athlete or actor. However, if we experience too much pressure without the opportunity to recover, we feel unable to cope and stress is the result. A stressor is any event or situation that perceived by an individual as a threat causing the individual to either adapt or initiate the stress response. Therefore a stressor is a stimulus and stress is a response, which means that stressor is the cause and stress is the effect. Stress is acceptable up to certain level to perform better, if it exceeds that level it reduces the performance of an individual both personal and professional. So it is very important to identify 'the optimum level of stress' and 'significant factors' causing the distress or hyper stress. Stress can be reduced when these significant factors are addressed properly.

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[3] indicated that " teaching is an occupation which is always demanding and changing". Globalization and privatization of the education system in India and abroad forced the higher education to be more proficient to survive in the world market by producing the stakeholders with better knowledge, accommodativeness, skills and proficiencies. In connection to this, the Indian higher education system had undergone rapid changes in terms of development, privatization, marketization, curricular reforms and pedagogical innovations. These changes have confronted the universities in terms of quality education, deficiency of faculty of high competence, ineffective teaching methodology, outdated curricular and assessment system, lack of appropriate reading materials, poor infrastructure facilities, faulty administration, faculty intake criteria, inability to entice and retain talented minds and absence of academically conducive atmosphere. Pressure on the higher education system and faculty is caused by attributes like the latest knowledge, skills, innovation, research in economic growth and development, the emergence of the information society and the need for quality. These factors in-turn adversely affects the quality of our higher education system and creates various stressors and strain in teachers which further deteriorates their performance and sometimes leads to job dissatisfaction.

The present study attempts to address the effects of different influencing stress factors on job stress of the faculty in higher educational institutions. Also different models are raised to different categories of faculty members to know the effects of different source factors of stress with respect to their environments with multiple linear regression analysis.

2. Literature Review

In this modern age more or less all professionals are experienced stress at their work place. Born out of high competition and its subsequent complexities, stress is a state of concern involving demand on physical or mental energy which can disturb the normal physiological and psychological functioning of an individual. Comparative studies of 26 occupations conducted by [6] conclude that teaching is one of the most stressful occupations. [5], examined staff perceptions of occupational stress in universities. These authors emphasized the facts that usually university teaching faculty has been regarded as a low-stress occupation; however with the increased workloads, reduced resources and pressure of producing good results due to tough competition this is no longer the case. Reference of [11] stated that occupational stress among employees from different careers found that doctors and teachers are highly stressed as compared to the employees from other professions. [9], found that 'negative implications of work stress are recognized as a challenge to both employers and workers in their study of work place and job performance'. Study of [12] investigated the level of professional burnout among the university teachers found that they have high levels of emotional exhaustion. Similar finding was revealed by [14] when they examined the level of perceived occupational stress and burnout in 56 male teachers of an engineering college.

3. Objectives of the Study

- To examine the level of stress for different categories of faculty members in higher educational institutions.
- To construct the statistical models to address the effects of stress factors on occupational stress of faculty in higher educational institutions.

4. Methodology

The most commonly known and used dependence analysis in multivariate method is the multiple regression. The technique deals with the study of dependence of one variable on a set of predictor variables. The predictor set, also known as

independent variables, influences the dependent variable or the response variable. The regression line for k explanatory variables $x_1, \ldots, x_k$ is defined as

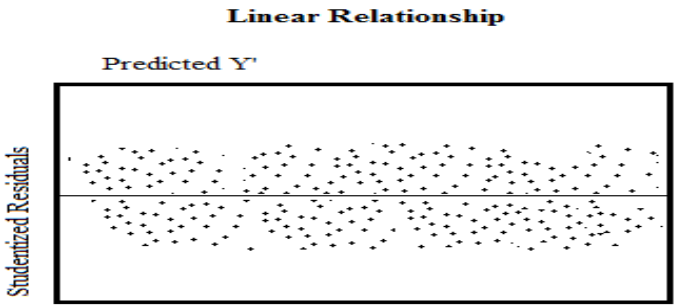
$$y = \beta_0 + \beta_1 x_{1i} + \cdots + \beta_k x_{ki} + \varepsilon_i \quad \text{for } i = 1, \ldots, n, \tag{1}$$

where β_0 =intercept of y = constant term. $\beta_1, \ldots, \beta_k$ are coefficients relating to k explanatory variables to the variables of interest. In order to estimate the $\beta's$ we follow the least square approach. The variance σ^2 may be estimated by $s^2 = \frac{\sum e_i^2}{n-k-1}$, also known as the mean-squared error (or MSE). The estimate of the standard error s is the square root of the MSE. Across behavioral science disciplines, multiple linear regression (MR) is a standard statistical technique in a researchers toolbox. An extension of simple linear regression, MR allows researchers to answer questions that consider the role(s) that multiple independent variables play in accounting for variance in a single dependent variable. Researchers tend to rely heavily on beta weights when interpreting MR results (e.g., Nimon, Gavrilova, & Roberts, [8]; Zientek, Carpraro, & Capraro, [15]).

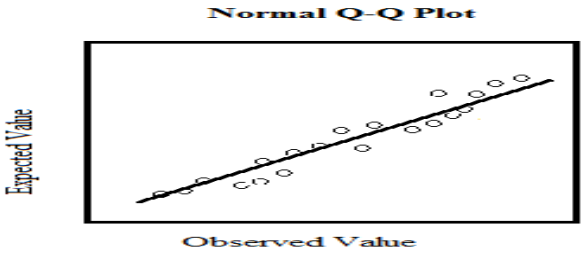
4.1. Assumptions in Multiple Linear Regression

Multiple linear regression analysis makes some key assumptions which are (i) Linear relationship (ii) Multivariate normality (iii) No multicollinearity (iv) No auto-correlation (v) Homoscedasticity.

Firstly, multiple linear regression needs the relationship between the independent and dependent variables to be linear. It is also important to check for outliers since multiple linear regression is sensitive to outlier effects. The linearity assumption can best be tested with scatter plots.

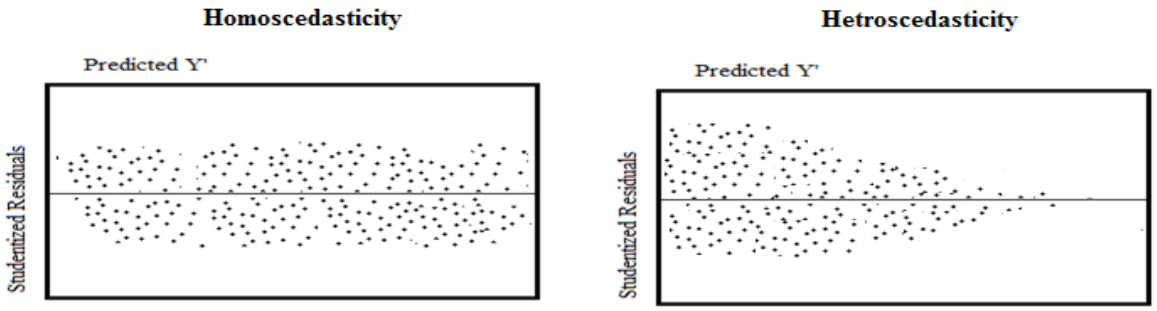


Secondly, the multiple linear regression analysis requires all variables to be normal. This assumption can best be checked with a histogram and a fitted normal curve or a Q-Q-Plot. Normality can be checked with a goodness of fit test, e.g., the Kolmogorov-Smirnoff test. When the data is not normally distributed a non-linear transformation, e.g., log-transformation might fix this issue. However it can introduce effects of multicollinearity.



Thirdly, multiple linear regression assumes that there is little or no multicollinearity in the data. Multicollinearity occurs when the independent variables are not independent from each other.Variance Inflation Factor (VIF) is one of the inspection methods of multicollinearity. The variance inflation factor of the linear regression is defined as VIF = 1/T. where T is tolerance which is equal to 1- $R^{2.}$ .VIF > 10 there is an indication for multicollinearity to be present.

Other important independence assumption is that the error of the mean is uncorrelated; that is that the standard mean error of the dependent variable is independent from the independent variables. Fourthly, multiple linear regression analysis requires that there is little or no autocorrelation in the data. Autocorrelation occurs when the residuals are not independent from each other. The last assumption the multiple linear regression analysis makes is homoscedasticity. The scatter plot is good way to check whether homoscedasticity (that is the error terms along the regression line are equal) is given.



By testing whether these assumptions are satisfied by the data researcher should use the multiple regression analysis to build a model for the dependent and set of independent variables under consideration. In the present study all the assumptions of the multiple linear regression are tested and constructed different models for different categories of faculty to predict the occupational stress in their profession. . The data of 500 respondents was collected using stratified random sampling technique by covering faculty of technical and non-technical institutions of Andhra Pradesh. Further SPSS-19 version software was used for the analysis of the data.

5. Analysis

5.1. Descriptive Statistical Analysis

A total of 500 faculty members from both technical (250) and technical (250) institutions were participated in the study. Table 1 shows that comparatively technical institution faculty members have experienced more stress than non-technical institution faculty members since its mean score was 2.50 which is greater than 1.96. Also it indicate that lack of managerial support contributes to stress at the work place in technical institution faculty members (mean score was 2.46) and monotonies in the job causes the stress for non-technical institution faculty members (mean score was 2.27). The overall stress level of faculty was moderate, since its score was 2.23 which is the average of 2.50 and 1.96.

Descriptive Statistics					
	Technical Institutions		Non-Technical Institutions		N
	Mean	Std. Deviation	Mean	Std. Deviation	
My job is stressful	2.50	1.095	1.96	.960	250
Managerial support	2.46	.515	1.70	.617	250
Work Environment	2.22	.758	2.00	.598	250
Monotonies in the job	2.12	.793	2.27	.631	250
Student Centered issues	1.95	.787	1.74	.616	250
Poor interpersonal relations	2.02	.791	2.03	.765	250
Job insecurity	1.44	1.140	1.48	.941	250
Role Conflict	2.08	.800	1.75	.762	250

Table 1. **Descriptive Statistics of stress factors**

5.2. Multiple Linear Regression Analysis

5.2.1 Regression model for technical institution faculty:

The regression Table-2 summarizes the model performance through the following statistics.

R: R represents the multiple correlations co-efficient with the range lies between -1 and +1. Since the R value is 0.794 means that there is a high positive relation between the overall stress and stress factors of the technical institution faculty.

R square: R^2 represents the coefficient of determination, which is a measure of how much of the variability in the outcome is accounted for by the predictors and it lies between 0 and 1. Since the R square value is 0.630 i.e 63% of the explained variation is there in the stress of the faculty members.

Adjusted R square: It gives an idea of how well the model generalizes and ideally we would like its value to be the same or close to the value of R square. Since the difference is 0.011 (0.630 - 0.619 =0.011 or 1.1%) means that if the model were derived from population rather than a sample it would account for approximately 1.1 % less variance in the outcome.

Standard Error of Estimate: This is also referred to as the root mean squared error. It is the standard deviation of the error term and the square root of the Mean Square for the Residuals in the ANOVA table

Durbin-Watson statistic: It informs about whether the assumption of independent errors is tenable. The closer to 2 that the value is, the better, and for these data the value is 1.811, which is close to 2 that the assumption has almost certainly been met.

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.794[a]	.630	.619	.676	1.811
a. Predictors: (Constant), My job is stressful, Managerial support, Work Environment, Monotonies in the job, Poor interpersonal relations, Job insecurity, Role ConflictStudent Centered issues,					
b. Dependent Variable: My job is stressful					

Table 2. **Model summary for stress factors**

Here the null hypothesis $H_0 : \beta_i = 0$ against Alternative hypothesis $H_1 : \beta_i \neq 0$.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	187.962	7	26.852	58.788	.000[b]
	Residual	110.534	242	.457		
	Total	298.496	242			
a. Dependent Variable: My job is stressful						
b. Predictors: (Constant), My job is stressful, Managerial support, Work Environment, Monotonies in the job, Student Centered issues, Poor interpersonal relations, Job insecurity, Role Conflict						

Table 3. **ANOVA for model fit**

From the above ANOVA Table-3, F value is significant since its value is less than 0.05. It means that there is strong evidence that $\beta_i \neq 0$ that is the dependent variable, "My job is stressful" is reliable.

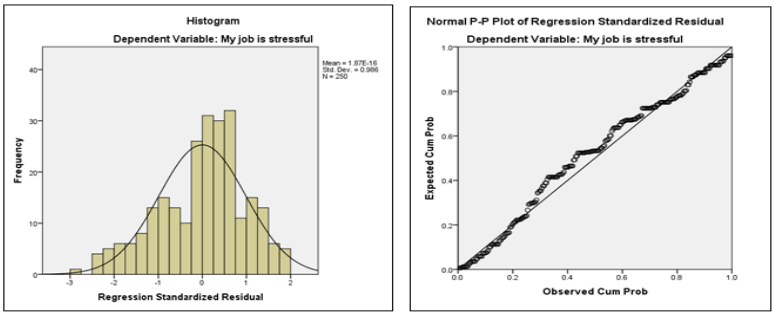


Figure 1. **Histogram and P-P plot for Normality test**

Figure 1 'Histogram of residuals' to shows a histogram with normal overlay of the distribution of the residuals. This gives us an indication of how well our sample can predict a normal distribution in the population. Normal P-P plot, the distribution is considered to be normal to the extent that the plotted points match the diagonal line. The model co-efficient Table 3

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-1.180	.270		-4.369	.000		
	Managerial support	.242	.091	.114	2.648	.009	.829	1.206
	Work Environment	.422	.065	.292	6.459	.000	.750	1.334
	Monotonies in the job	.441	.072	.319	6.119	.000	.562	1.779
	Student Centered issues	.307	.065	.220	4.730	.000	.705	1.419
	Poor interpersonal relations	.267	.073	.193	3.658	.000	.550	1.817
	Job insecurity	.014	.042	.014	.325	.746	.783	1.278
	Role Conflict	.026	.057	.019	.444	.657	.869	1.150
a. Dependent Variable: My job is stressful								

Table 4. **Coefficient table for stress factors**

reports the coefficients for Managerial support, Work Environment, Monotonies in the job, Student Centered issues, Poor interpersonal relations are strongly impact on technical institution faculty stress since the sig values are less than 0.05. Therefore the regression model

$$Y = -1.180 + 0.242(F1) + 0.422(F2) + 0.441(F3) + 0.307(F4) + 0.267(F5) + ei \quad (2)$$

That is STRESS = -1.180 + 0.242 (Managerial support) +0.422 (Work Environment) + 0.441(Monotonies in the job) + 0.307 (Student Centered issues) + 0.267 (Poor interpersonal relations) + ei

5.2.2 Regression model for technical institution faculty:

The regression table-4 summarizes the model performance through the following statistics.

R: Since the R value is 0.55 means that there is a moderate positive relation between the overall stress and stress factors of the non-technical institution faculty.

R square: R^2 represents the coefficient of determination, which is 0.302 i.e 30.2% of the explained variation is there in the stress of the non-technical institution faculty members.

Durbin-Watson statistic: For the data of non-technical institution faculty members the Durbin-Watson statistic is 2.018, which is very close to 2, hence the assumption of independent errors is tenable.

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.550[a]	.302	.282	.814	2.018
a. Predictors: (Constant), My job is stressful, Managerial support, Work Environment, Monotonies in the job, Poor interpersonal relations, Job insecurity, Role ConflictStudent Centered issues,					
b. Dependent Variable: My job is stressful					

Table 5. **Model summary for stress factors**

Here the null hypothesis $H_0 : \beta_i = 0$ against Alternative hypothesis $H_1 : \beta_i \neq 0$.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69.368	7	9.910	14.967	.000[b]
	Residual	160.232	242	.662		
	Total	229.600	249			
a. Dependent Variable: My job is stressful						
b. Predictors: (Constant), My job is stressful, Managerial support, Work Environment, Monotonies in the job, Student Centered issues, Poor interpersonal relations, Job insecurity, Role Conflict						

Table 6. **ANOVA for model fit**

From the above ANOVA Table 6, F value is significant since its value is less than 0.05. It means that there is strong evidence that $\beta_i \neq 0$ that is the dependent variable, "My job is stressful" is reliable.

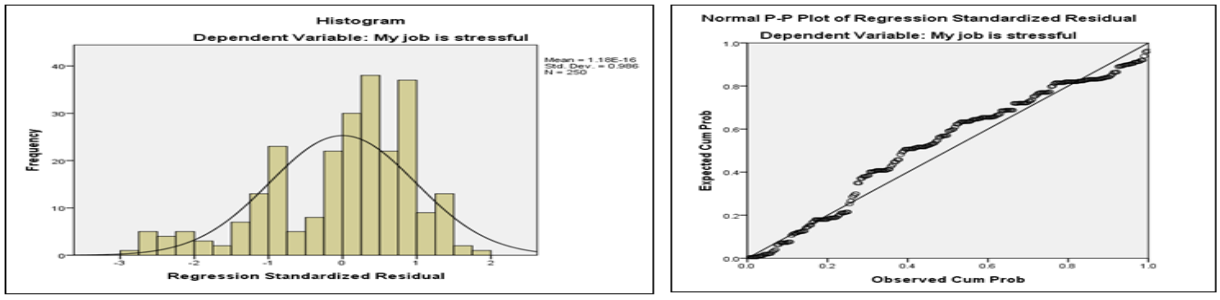


Figure 2. **Histogram and P-P plot for Normality test**

Figure 2 Histogram of residuals' shows a histogram with normal overlay of the distribution of the residuals and the same is also observed in 'Normal P-P plot'.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.594	.277		-2.148	.033		
	Managerial support	.253	.089	.163	2.859	.005	.890	1.124
	Work Environment	.452	.100	.282	4.530	.000	.746	1.340
	Monotonies in the job	.307	.098	.202	3.146	.002	.702	1.424
	Student Centered issues	.042	.092	.027	.456	.649	.823	1.215
	Poor interpersonal relations	.205	.075	.163	2.739	.007	.810	1.235
	Job insecurity	.035	.056	.034	.620	.536	.947	1.056
	Role Conflict	-.011	.073	-.009	-.153	.879	.859	1.150
a. Dependent Variable: My job is stressful								

Table 7. **Coefficient table for stress factors**

The model co-efficient table-6 reports the coefficients for Managerial support, Work Environment, Monotonies in the job,

and Poor interpersonal relations are strongly impact on non-technical institution faculty stress since the sig values are less than 0.05. Therefore the regression model

$$Y = -0.594 + 0.253(F1) + 0.452(F2) + 0.307(F3) + 0.205(F5) + e_i \tag{3}$$

That is STRESS = -0.594 + 0.253 (Managerial support) + 0.452 (Work Environment) +0.307 (Monotonies in the job) + 0.205 (Poor interpersonal relations) + e_i

6. Conclusions

Each 250 faculty members of technical and non-technical institutions were participated in this study and their average stress score is approximately 2. It indicates that they are experiencing moderate stress at work place. But comparatively technical institution faculty had the high job stress since their score is more than non-technical faculty score. From multiple liner regression analysis it is revealed that Managerial support, Work Environment, Monotonies in the job, and Poor interpersonal relations are strongly impact on stress of both technical and non-technical institution faculty. Moreover in technical education faculty had the various students centered issues related to operational concerns. The results of regression suggest that there is a high impact of work environment on faculty stress in both technical and non-technical institutions.

It is fact that work environment is very important factor for any organization. Conducive working environment in the organization increases employee performance and decreases their stress gradually. Hence it is the duty of management to provide the good working environment with their support to promote the quality education. Another important factor identified in this study was monotonies in the job because in our education system there were systemic faults that do not let our demand for good education translate into a great marketplace with excellent education services. But in the present scenario the Indian education system has been undergoing tremendous changes and teachers need to stay up-to-date. Also there are certain parameters like outcome based education and all are indispensable to accreditation for any educational institutions to endorse the quality education in India.

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