Determinants of the level of stress experienced by teachers at different educational levels: a descriptive discriminant approach

J. E. Osemwenkhae[a], A. Iduseri [a,§] and F. Meka[b]

[a]Department of Statistics, University of Benin, Benin City, Nigeria
[b]College of Education, Agbor, Nigeria

Teachers stress and continuing high attrition rates for the teaching profession have remained a global challenge due to the significant multiple impacts, especially as it affects their output, health and social life. This study aimed to identify the stress factors responsible for the perceived differences in the level of stress experienced by teachers in public primary, secondary and tertiary schools using Delta State, Nigeria as a case study. A survey was conducted by a self-administered questionnaire tagged Teacher Stress Questionnaire (TSQ) for data gathering. Descriptive Discriminant Analysis (DDA) was used to analyse the scores obtained for 90 teachers which cut across the three groups of the Nigeria educational system. The findings of the study revealed that the significant difference in the levels of stress experienced by teachers in the three groups is determined by two constructs (latent) variables. The first latent variable which is a linear combination of social and organisational factors is responsible for the significant differences in the levels of stress among the three groups, while the second latent variable which is a linear combination of environmental and task demand factors is ultimately responsible for the significant difference in the levels of stress experienced by tertiary lecturers compared to primary and secondary school teachers.
Keywords: teachers stress; descriptive discriminant analysis; discriminating factors; latent variable

1.   Introduction

Since the past two decades, the phenomenon of stress among teachers at different educational levels is alarmingly widespread and increasing (Suganya and Rajkumar, 2016). With change in cultural norms and traditions in the societies, there has been a drastic change in the expectations from a teacher or academician. Some of these changes have limited the roles/authority which a teacher in the past could exercise and some have put additional burden on teachers in respect of their core responsibility of providing knowledge and services to the society. The society in return, often blindly criticized teachers when they fail to provide knowledge and services to society according to expectations. Therefore, when a teacher perceives that demands exceed his personal and social resources he or she is able to mobilize, such feeling or experience could result to what is termed as teachers' stress (sometimes referred to as lecturers' burnout among academicians). In Nigeria, a teacher or an academician often work in a constant socially isolated environment surrounded by hostile views and sometimes threat of physical abuse, and at the same time under a constant fear and threat of accountability for each and every action of both own self and that of the pupil. This alone can be a sufficient cause for stress for the teacher or an academician. Stress is considered to be the main factor contributing towards job dissatisfaction and job-related illness. This in turn results in a significant loss of skilled and experienced teachers and

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academicians through resignation, and premature retirement from all levels of the teaching workforce (Van Dick et al., 2001; ISSUE BRIEF, 2017). The stressed teacher, who remains within the profession, is likely to be less effective in key areas such as lesson organisation, student behaviour management, responsiveness to students, and self-confidence relationships with peers. On the other hand, the stressed academician is likely to be less effective in key areas such as effective lecture delivery, student's project supervision, publishing research articles and self-confidence interactions/partnership with peers.

Most research on teachers stress either focussed on assessing the level of stress or identifying factors responsible for the level of stress among teachers working in universities, secondary schools or elementary/primary schools, with the common aim of ascertaining the impact on students' academic performance and/or teachers' health (Hoglund *et al*., 2015; Katz *et al.*, 2016; Baraza *et al.*, 2016; ISSUE BRIEF, 2017; McCarthy *et al.*, 2009; Hasan, 2014; Demjaha et al., 2015; Fako, 2010; Kiveshnie *et al.*, 2013; Kavita and Hassan, 2018). Considering the significant impact of stress among teachers in these different educational levels, the literature seems silent on the factors responsible for the perceived differences in the levels of stress among primary, secondary and university teachers**.** This is a gap to be filled by the present study. Therefore, the purpose of this study is to identify the major discriminating factorsthat determine the levels of stress experienced by teachers in the three levels of the Nigerian educational system, using Delta State as a case study. The rest of the article is structured as follows: First, the extant literatures on relevant stressors are reviewed. This is followed by a description of the research materials and methods used in the study. The results of our enquiry are then discussed. Finally, the concluding remarks are presented.

2.   Literature Review

Teachers stress has been well established as a significant problem (Hansen and Sullivan, 2003; Jepson and Forrest, 2006; Klassen *et al.*, 2010; McCarthy *et al.*, 2009). Hasan (2014) and Demjaha *et al.* (2015) in their study of occupational stress reported a high level of stress among primary school teachers. Johannsen (2011) studied teachers stress from elementary, middle and secondary schools in Georgia and found that elementary school teachers have significantly higher stress than their middle or high school counterparts. A number of studies on occupational stress of teachers working in secondary schools show that they experience moderate level of stress in their job setting (Aftab and Khatoon, 2012; Reddy and Anuradha, 2013). Results of similar studies conducted in universities depicted that on average, the lecturers' experienced a higher degree of job stress (Parray *et al*., 2016). A lot of studies have also identified stressors such as number of students taught (Lackritz, 2004), time invested in various activities outside teaching and research (Lackritz, 2004), numerical student evaluations (Lackritz, 2004), teaching load (Suganya and Rajkumar, 2016; Todd-Mancillas and Johnson, 1987), reward systems (Todd-Mancillas and Johnson, 1987), level of income/salary (Briscoe, 1984), administrative style (Johnson, 1989), communication and environmental problems (Johnson, 1989), and demographic factors as major causes of stress among teachers/academicians.

Many other research works (Adeoye, 2002; Fako, 2010; Kiveshnie *et al.*, 2013) have examined other causes of stress among teachers but none have looked into the factors that are

responsible for the perceived differences in the level of stress experienced by teachers in primary, secondary, and tertiary schools, especially in a developing country like Nigeria. This is a gap to be filled by the present study. Teacher or academician stress, certainly remains a global concern. In 2007, six European nations agreed, through the European Trade Union Commission on Education (ETUCE), to substantially increase knowledge about teacher stress and to implement programs in an effort to reduce it (Billehoj, 2007). These global concerns have been translated into research from not only Europe, but from Asia and Africa as well. In addition to the review of related literatures, weprovide a brief examination of some of the stressors prevalent within the education environment. The choices of stressors reviewed here are based on stressors that finally entered the analysis.

2.1   Organisational factors

2.1.1   Organisation's culture and structure

Stressful situations occur within schools because of the organisation's culture, structure, and nature of the management procedures. Kahn and Cooper (1993) indicate that limited opportunities for advancement, insufficient performance feedback, performance assessment measures being inadequate, and biased control systems and culture within the organisation may be perceived as potential stressors. Also, unreasonably set time frames, unrealistic deadlines, poor work conditions, as well as poor consultation and communication may also be perceived as potential stressors (Brown and Ralph, 1998, Kyriacou, 2001). It is further highlighted by Olivier and Venter (2003) that the lack of discipline in schools, the abolishment of corporal punishment, unmotivated learners, redeployment, poor retirement packages for teachers, large teacher-pupil ratios and a new curriculum approach all contribute to the increase in stress levels of teachers.

2.1.2   Lack of Influence

Steenkamp (2003) surmise that not being involved in decision making has been established across all occupational groups to be the most salient source of stress that correlates with low self-esteem. Several studies have also highlighted that teachers feel that they have a lack of control and decision-making powers due to the hierarchical nature of bureaucratic structures at schools which concentrates power in the hands of a few (Dinham, 1993).

2.1.3   Colleagues

According to Sutherland and Cooper (2000), poor work relations are defined as "having low trust, low levels of supportiveness and low interest in problem solving within the organisation or institution". Supervisors, peers and subordinates can dramatically influence each other just by their interactions. At the tertiary level, competition among colleagues and differences in personality clashes amongst fellow lecturers can give rise to stress (Cartwright and Cooper, 1997). Jarvis (2002) found that factors such as social support amongst colleagues and leadership style or proper mentoring have an impact on levels of stress amongst educators. Cartwright and Cooper (1997) indicated that in situations where the relationship between a supervisor and subordinate is psychologically unhealthy, problems of emotional instability may occur. Conversely, a young lecturer having access to proper

mentoring from his/her superior colleagues or supervisor can only experience positive or good stress.

2.2   Task demand factors

2.2.1 *Understaffing*

The effect of understaffing in schools is felt mostly by educators in the school system. This is as a result of the fact that the teacher will have to teach more classes and will have to teach large classes. This can affect classroom discipline which is a significant source of stress (Jarvis, 2002). According to Heinesen (2010), "class size is one of the factors that impact upon academic success and general relationship is a negative one". In the context of tertiary institutions, the few lecturers may not be able to effectively cover their course outline and some basic courses will not be taught. Consequently, majority of the final outputs may result in educated derelicts.

2.2.2 *Overtime*

Various researchers have indicated that administrative work done outside the scope of the classroom is a source of stress to teachers (Pithers and Soden, 1998). In a university system, most lecturers serving as academic advisors is left with little or no time for research and teaching. Jacobs and Winslow (2004) stated that academicians have more autonomy regarding the substance of their work and more flexibility in their daily schedules but they work long hours for less pay than many other professionals. This is the case of most educators in developing countries like Nigeria.In fact, there are growing evidences that no Nigerian university either private or government owned can genuinely claim to be immune from this stressor (Adebiyi, 2011 and King and King, 1990).

2.2.3 *Role Conflict*

According to King and King (1990), role conflict arises when an employee's experiences incompatible demands or goals surrounding tasks connected with their job which can induce negative emotional reaction due to perceived inability to be effective on the job. Furthermore, having to do tasks that are not perceived to be part of one's job or role, can potentially lead to stress (Cartwright and Cooper, 1997). Role conflict related stress results in students' poor academic performance which often manifests in the form of poor pass rates (Jackson, 2004).

2.3   Environmental factors

Environmental factors causing stress are those systemic factors that are not intrinsic to teaching, but depend on the climate of the educational institution including the political domain. These systemic factors often feed the dynamics of the individual organisation (Jarvis, 2002). A survey conducted in 1998, by the Institute of Criminology, in Pretoria, South Africa revealed that crime and violence is endemic to both primary and secondary schools. In Nigeria's schools, the major problem is the menace of cultism. Its impact usually depends on the educational level.

2.4   Social factors

2.4.1   Lack of reward/recognition

Studies done by Steenkamp (2003) and Johnson (1989) found that respondents indicated that low salaries cause a great deal of stress, especially taking into account the after-hours input their jobs demand from them and how negative effect of their salaries when compared with those of their colleagues in the private sector and other government departments. That is perhaps the reason why some teachers/lecturers embark on second jobs, mostly to the detriment of the school and the learners.

3.   Materials and Methods

3.1   Data collection

Data for this study were collected by using a questionnaire tagged Teacher Stress Questionnaire (TSQ). All potential stressors (outcome variables) derived from prior research were used to form the basis of the TSQ. The data collection process involved two stages: first, we randomly selected three public primary schools and three public secondary schools, one from each of the three senatorial districts, and the three public universities in Delta state to form the three groups. Therefore, the three levels of the Nigerian educational system were considered suitable in designating group memberships. Secondly, ten teachers were selected and administered the TSQ from each of the nine public schools using purposive sampling. The choice for the sampling technique is to ensure that respondents such as those on sabbatical, associate and part-time, coppers, as well as those on teaching practice are exempted. Thus, scores were obtained for 90 teachers in Delta State, Nigeria, which cut across the three levels of the Nigerian educational system: primary, secondary and tertiary schools.

3.2   Technical details of descriptive discriminant approach

When the basic question of interest pertains to group differences with respect to a set of outcome variables, descriptive discriminant analysis (DDA) will be the preferred statistical technique to use (Huberty and Wisenbaker, 1992 and Huberty and Olejnik, 2006). In addition to the primary goal of discriminating among groups, DDA can examine the most parsimonious way to discriminate between groups, investigate the amount of variance accounted for by the discriminating variables, and evaluate the relative contribution of each discriminant (continuous) variable in the linear discriminant function (LDF). When dealing with three or more groups, the linear combination of the discriminating variables, X_s for the ith individual ($i = 1, 2, \ldots, n_g$) of group g (g = 1, 2, …, G) may be written as

$$Z_{ig} = b_i X_{i1g} + b_2 X_{i2g} + \ldots + b_p X_{ipg} \tag{1}$$

where Z_{ig} is the LDF score for the ith individual in group g, b_i are the raw weights and X_i are the outcome (or discriminating) variables. Because variability among means is due in part to variability among individuals, the discriminant criterion, λ, in the case of three groups, is defined as the ratio of the variability among group means, SS_A, to that within groups, SS_W, (Huberty and Olejnik, 2006). Thus

$$\lambda = \frac{SS_A}{SS_W} = \frac{b^T A b}{b^T W b}, \tag{2}$$

$$A = \sum_{g=1}^{3} n_g \left(\overline{X}_g - \overline{X} \right) \left(\overline{X}_g - \overline{X} \right)^T \text{ and } W = S_{XX}^{(1)} + S_{XX}^{(2)} + S_{XX}^{(3)}, \tag{3}$$

where A is the sum of squares and cross products matrix among groups, and W represents the pooled sum of squares and cross products matrices for groups 1, 2, and 3, respectively. To determine the values of b's that maximize, λ, we obtain the partial derivative of (2) with respect to b, and set this equal to zero. The result is

$$\frac{\partial \lambda}{\partial b} = \frac{2 \left[\left(b^T W b \right) \left(A b \right) - \left(b^T A b \right) \left(W b \right) \right]}{\left(b^T W b \right)^2} = 0 \tag{4}$$

Dividing both numerator and denominator by $b^T W b$, we obtain:

$$\frac{2 \left(A b - \lambda W b \right)}{b^T W b} = 0$$

$$\left(A - \lambda W \right) b = 0 \tag{5}$$

If W is symmetric, W^{-1}must exist, pre-multiplying (3) by W^{-1} results in

$$\left(W^{-1} A - \lambda I \right) b = 0 \tag{6}$$

From (4), the characteristic equation of the matrix, $W^{-1}A$ is

$$\left[W^{-1} A - \lambda I \right] = 0 \tag{7}$$

Solving Eq. (7) results in two eigenvalues (that are necessarily decreasing in value, i.e., $\lambda_1 > \lambda_2$), and each value of λ obtained has associated with it an eigenvector, *b*, the elements of which are the weights or coefficients applied to the *Xs* in determining the two corresponding discriminant functions

$$Z_1 = b_1 X_1 + b_2 X_2 \cdots + b_8 X_8$$

$$Z_2 = b_1 X_1 + b_2 X_2 \cdots + b_8 X_8 \tag{8}$$

The first function, Z_1, defines a dimension on which the groups differ maximally, and the second function, Z_2, defines a dimension uncorrelated with the first, on which group differences are second in magnitude. These raw weights, *b*s, could be used for the purpose of classification. However, they are totally uninterpretable as weights, and the scores they produce for the data cases have no intrinsic meaning.

In order to obtain weights that will produce discriminant scores which are measured in standard deviation units, we simply adjust the weights. The new vector of weights is

$$v = \frac{b}{\sqrt{b^T S b}} \tag{9}$$

where v is the unstandardized discriminant weights, b is the raw weights as defined in Eq. (8), and S is the pooled within groups variance-covariance matrix. This vector of weights, v, is called "unstandardized discriminant weights" because the original data have not been standardized. This standardized weights can be used to compare the relative importance of the discriminating variables if the variances of each variable are nearly equal. Should this not occur, the coefficients are further adjusted from the unstandardized weights (v's) to standardized weights (u's) by using the following transformation

$$u_i = \sqrt{\frac{w_{ii}}{n-G}} \qquad (10)$$

where w_{ii} is the sum of squares for variable i as defined in Eq. (3), n is the total number of cases, and G is the number of groups.

To see the relative importance of each outcome variable on each dimension as defined in Eq. (8), pooled within-groups correlations between the outcome variables and the standardized discriminant functions (i.e., the functions that would be obtained when the standardized weights in Eq. (10) are substituted in Eq. (8) are computed as follows

$$S_{ij} = \frac{1}{\sqrt{\omega_{ii}\omega_{kk}}} \sum_{k=1}^{P} \omega_{ik} u_{kj} \qquad (11)$$

where S_{ij} is the within-groups structure coefficient for variable i and function j, ω_{ik} is the pooled within-groups correlation coefficient between outcome variables i and k, and u_{kj} is standardized discriminant function coefficient for outcome variable k on function j. This vector of correlations, S_{ij}, is called structure coefficients or discriminant loadings. They serve like factor loadings in factor analysis. By considering the set of outcome variables that load most heavily on a given discriminant function or dimension, the researcher may infer a suitable label for that dimension.

3.3   Multivariate test of assumptions and significance

Linear discriminant analysis (discriminant analysis or DA) which is a parametric method that has two set sets of procedures: predictive discriminant analysis (PDA) and descriptive discriminant analysis (DDA), is computationally similar to multivariate analysis of variance (MANOVA), and all assumptions for MANOVA apply. However, DDA is designed to successfully identifies the linear combination of attributes which contribute maximally to group separation. Consequently, the function and structure coefficients are the focus, with the hit rate being immaterial (Onwuegbuzie and Daniel, 2003). Therefore, two of the basic assumptions of DA must be tenable for us to have a valid conclusion. These are: (1) test of equality of Group Means (or centroids) which will enable us examine whether there are significant differences among the groups on each of the outcome variable, and (2) test of significance of the LDF to permit the conclusion that the groups differ significantly on the basis of the LDFs, Z_1 and Z_2. On the assumption of multivariate normality, research has shown that multivariate normality is not required to estimate most multivariate parameters (e.g., function coefficients and structure coefficients), as far as the distributions of the variables are reasonably comparable (Ashcraft, 1998). Indeed, one researcher commented

that "with or without data normality assumption, we can arrive at the same LDA features, which explains its robustness" (Yang Xiaozhou, 2020, p. 1). Similarly, if the assumption of equality of variance-covariance matrices does not hold, cases will tend to be over classified into groups with greater dispersion (Tabachnik and Fidell, 2007). This mean that violation of equality of variance-covariance matrices assumption becomes an issues when the focus is on classifying subjects into one of several groups (which is the focus of PDA), and not on revealing major differences among groups (which is the focus of DDA).

3.3.1 *Equality of group centroids*

The hypothesis of interest is:

$$H_0 : \mu^{(1)} = \mu^{(2)} == \mu^{(3)} \quad Vs \quad H_1 : \mu^{(1)} \neq \mu^{(2)} \neq \mu^{(3)}$$

The Wilks's lambda, Λ, multivariate measure (cited in Klecka, 1980, p. 39) of group differences over several variables which is most appropriate in the present context is

$$\Lambda = \prod_{i=k+1}^{q} \frac{1}{1 + \lambda_i} \tag{12}$$

where λ_i are the latent roots or eigenvalues obtained by solving Eq. (7), k denotes the number of functions already derived, and in this instance, k=0. Thus, we will reject the null hypothesis if Wilk's lambda is small (close to zero). The computational result is

$$\Lambda = \left(\frac{1}{1 + 31.604} \right) \left(\frac{1}{1 + 13.995} \right) = 0.00205 .$$

The Wilks's lambda, Λ, value which is near zero denote high discrimination. In other words, the group centroids are greatly separated and very distinct relative to the amount of dispersion within the groups.

3.3.2 *significance of the LDF*

The hypothesis of interest is:

$$H_0 : \lambda = 0 \left(i.e., all \ \overline{Z}_G \ are \ equal \right) \quad vs \quad H_1 : \lambda \neq 0$$

A test of significance of the kth root λ_k, may be carried out using Wilks' 1932 statistic (cited in Richard et al, 1980, p. 190 – 191) expressed as

$$\Lambda_k = \prod_{i=1}^{r} \frac{1}{1 + \lambda_i} \tag{13}$$

where Λ_k is the Wilks's lambda for the kth function, λ_i is the ith eigenvalue obtained by solving Eq. (7), and r is the number of nonzero values of λ. We test the significance of the Wilks's lambda by converting it to the chi-square distribution using the transformation

$$V_k = - \left[n - 1 - \frac{(p + G)}{2} \right] \ln \Lambda_k \tag{14}$$

V_k has an approximate chi-square distribution with (p-k+1) (G-k) degree of freedom, where p is the number of outcome variables and G is the number of groups. $H_0$is rejected if $V_k>V_\alpha[(p-k+1)(G-k)]$. The computational result is

$$V_1 = -\left[90-1-\frac{(8+3)}{2}\right]\ln(0.00205) = 516.858 \text{ with p(G-1) = 8(2) =16 degrees of freedom, and}$$

$$V_2 = -\left[90-1-\frac{(8+3)}{2}\right]\ln(0.06669) = 226.093 \text{ with } (p-k+1)(G-k) = (7)(1) = 7 \text{ degrees of}$$

freedom. At 5% level of significance, we rejected the hypothesis that the discriminant criterion, λ, is not sufficiently different from zero. This implies that the three groups differ significantly on the basis of the two dimensions or LDFs, Z_1 and Z_2, represented in the outcome variables.

4.   Results and Discussions

The scores obtained for the 90 teachers was analyzed using the DISCRIMINANT subprogram in SPSS. The METHOD=Stepwise option was chosen to specify the criteria by which the potential stressors would be included in the analysis. At the end of the analysis, two significant linear discriminant functions (LDFs) or latent variables had linear combinations of eight outcome variables out of the thirteen potential outcome variables or stressors initially entered in the analysis. The SPSS selected outputs that are presented in this section are based on their relevance to the study objective, however, we tested for multivariate normality and equality of variance-covariance matrices and their results were not tenable. In DDA, if there are no significant group differences, it is not worthwhile proceeding any further with the analysis. The differences in mean value of each outcome variables across the groups depicted in the group statistics table in the Appendix further provides evidence of significant separation among the three groups as reported earlier in Section 3.3.1. The SPSS output of the adjusted raw weights, b, to unstandardized weights, v, as obtained in Eq. (8) are shown in Table 1.

Table 1 shows the vector of unstandardized weights for the two discriminant functions Z_1 and Z_2 based on analysis of the outcome variables scores. The product of these weights with the observations, yields discriminant scores for making classifications in PDA. These two discriminant function were found to be significant as reported in Section 3.3.2. Therefore, each function is a measurement of some dimension (characteristic). To further ascertain the above claim, we examined the functions at group means or centroids as shown in Table2. The two functions are obtained by simply multiplying each outcome variable mean for each group in the group statistics table in the Appendix with its corresponding discriminant weight in Table 1, and each obtained result added to the constant for both functions Z_1 and Z_2. The centroids are the mean values for each group of the dependent variable for each function.

Examination of Table2 reveals that the three group means absolute values are quite different from each other for function Z_1, while the group mean absolute value for G_1 and G_2 are quite similar compared to that of G_3 for function Z_2. This finding means that the degree of stress experienced by teachers are quite different across the three groups for function Z_1. While for function Z_2, the degree of stress experienced by lecturers in tertiary schools is quite different

compared to that of the teachers in primary and secondary schools. Further examination of Table 2 shows that each group mean is quite different for both functions Z_1 and Z_2. This finding means that the two functions, Z_1 and Z_2 are measuring different dimensions, and that the groups can be differentiated on the bases of these two dimensions measured by the outcome variables under consideration.

Table 1:   Unstandardized Canonical Discriminant Function Coefficients

Outcome Variables	Function	
	Z_1	Z_2
Overtime	-.268	.115
Organizational culture/structure	.541	.198
Environment	.026	.513
Lack of influence	.492	.241
Role conflict	-.377	-.424
Understaffing	-.032	.428
Colleague	.398	.187
Lack of reward/ recognition	.434	-.019
(Constant)	-5.641	-7.007

Table 2:   Functions at Group Centroids

Group	Function	
	Z_1	Z_2
Primary (G_1)	2.518	-4.917
Secondary (G_2)	5.150	3.907
Tertiary (G_3)	-7.668	1.010

Unstandardized canonical discriminant functions evaluated at group means

The dimensions along which the groups differ are defined on the basis of the emphasis (weights) accorded the Xs as shown in Table 1. Considering the fact that these weights are based on analysis of raw Xs scores, the relative magnitudes of its elements may be influenced by differences, both in scaling and in variability, among the Xs. In addition, the weights will not reliably asses the relative importance of the outcome variables if there is high multicollinearity of the independents. In order to overcome these challenges, we obtained a correlation matrix to check for multicollinearity (see Table 3), and scaled the weights in Table 1 to standardized weights, u. The SPSS output of the adjusted unstandardized weights, v, to standardized weights, u, as obtained in Eq. (10) are shown in Table 4.

Table 3 shows the SPSS output for the correlation coefficients between the outcome variables. Hand calculations of this output can be obtained by first computing each group correlation matrix before averaging. This table serves as an alternative test for multicollinearity using variance inflation factor (VIF) values. A cursory look at Table 3 shows that there are no coefficients with magnitudes of .80 or higher. Therefore, the assumption of low multicollinearity of independents is tenable and the standardized canonical discriminant weights, u, will reliably asses the relative importance of the outcome variables.

Table 3: Pooled within-groups correlation matrix

Outcome Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Overtime(X_1)	1.000	.107	.035	.194	.077	.089	.257	.085
Org. culture/structure(X_2)	.107	1.000	-.075	.028	.140	-.052	-.009	-.196
Environment(X_3)	.035	-.075	1.000	-.026	-.123	.103	-.045	-.287
Lack of influence(X_4)	.194	.028	-.026	1.000	.133	-.004	.103	.187
Role conflict (X_5)	.077	.140	-.123	.133	1.000	.119	.139	.239
Under staffing (X_6)	.089	-.052	.103	-.004	.119	1.000	-.108	.055
Colleague(X_7)	.257	-.099	-.045	.103	.139	-.108	1.000	.160
Lack of reward/recognition(X_8)	.085	-.196	-.278	.183	.239	.055	.160	1.000

Table 4:   Standardized Canonical Discriminant Function Coefficients

	Function	
Outcome Variables	Z_1	Z_2
Overtime (X_1)	-.497	.214
Organizational culture/structure (X_2)	.644	.236
Environment (X_3)	.028	.548
Lack of influence (X_4)	.395	.194
Role conflict (X_5)	-.395	-.444
Under staffing (X_6)	-.044	.578
Colleague(X_7)	.333	.156
Lack of reward/recognition (X_8)	.632	-.028

A cursory look at column 2 of Table 4 shows that both organizational culture/structure, and lack of reward/recognition are the most important outcome variables while overtime was next in importance. The two outcome variables with large equivalent weights stand out as those that strongly predict allocation to the primary, secondary or tertiary group using function, Z_1. While in column 3 of Table 4, understaffing score was the most important followed by environment. Therefore, using function, Z_2, these two variables with large coefficient stands out as those that strongly predict allocation to the three groups.

However, for the fact that in more than two groups of the dependent, the standardized discriminant weights may not tell between which groups the variable is most or least discriminating. For this purpose, the structure matrix in Table 5serves as alternative way of indicating the relative contribution/importance of the outcome variables. Table 5 shows the pooled within-groups correlations between the outcome variables and the standardized canonical discriminant functions.

These correlations serve like factor loadings in factor analysis, and by identifying the set of variables that has the largest absolute correlations associated with each discriminant function, one may infer a suitable label for that dimension. Generally, just like factor loadings, 0.30 is seen as the cut-off between important and less important variables. Examination of column two of Table 5 reveals that lack of reward/recognition, organizational culture/structure, lack of influence, and colleagues structure coefficients are more important than the rest stressors or outcome variables. Lack of reward/recognition come under social factors, while organizational culture/structure, lack of influence, and colleagues come under organizational factors which suggests a label of social and organisational factors as the

dimension measured by the discriminant function Z_1. In other words, social and organisational factors are the stress factors responsible for the perceived differences in the levels of stress experienced by teachers in public primary, secondary and tertiary schools in Nigeria.

Table 5:   Structure Matrix

	Function	
Outcome Variables	Z_1	Z_2
Lack of reward/recognition (X_1)	.485*	-.222
Organizational culture/structure (X_2)	.419*	.135
Lack of influence (X_3)	.413*	.178
Colleague (X_4)	.290*	.076
Environment (X_5)	-.195	.648*
Understaffing (X_6)	-.167	.570*
Role conflict (X_7)	-.102	-.352*
Overtime (X_8)	-.245	.351*

Variables ordered by absolute size of correlation within function.

*. Largest absolute correlation between each variable and any discriminant function

Similarly, column 3 of Table 5 shows that environment, understaffing, role conflict, and overtime are more important than the rest stressors. Since understaffing, role conflict, and overtime comes under task demand factors, this suggest that the discriminant function Z_2 is measure of environment and task demand factors. The fact that both primary and secondary school teachers had much larger means (-5.0 and 4.0) than tertiary teachers (1.0) as shown in column 3 of Table 2, also suggest that there exists a significant difference in the level of stress experienced by university teachers compared to that of the primary and secondary school teachers. This is consistent with what we would expect on the basis of the unique environment and task demands of tertiary school lecturers which is strikingly different from that of the primary and secondary school teachers.

5   Conclusion

This study undertook to identify the discriminating factors that are responsible for the perceived differences in the levels of stress experienced by teachers in primary, secondary and tertiary schools in Nigeria using Delta State as a case study. The obtained results in Sections 3.3.1, the group statistics tables in the Appendix, and Table 2showsthat the three groups were significantly different in terms of the level of stress experienced by them. Also, the obtained results in column 2 of Tables 4 and 5, shows that organizational culture/structure, and lack of reward/recognition are the most important stressors that determine the level of stress experienced by teachers in the three groups or educational levels. These stressors come under organizational and social factors, and suggests that these two stress factors are responsible for the perceived differences in the level of stress experienced by teachers in public primary, secondary and tertiary schools in Nigeria.

The observed difference in the level of stress experienced by tertiary schoolteachers when compared to that of primary and secondary school teachers depicted in Table 2, as well as the revealed stressors with largest loadings for the same function, Z_2, depicted in Table 5demonstrate that academicians has a higher task demand, and work in a more hostile

environment. A tertiary institution teacher/lecturer basic job description involves knowledge creation and knowledge transmission through the processes of research and teaching. The same lecturer is often faced with disruptive behaviour by students resulting from large class sizes compounded by poorly equipped lecture theatre, heavy workloads resulting from teaching both undergraduate and post graduate students, unprevented rude behaviours and violence by students and so on. Thus, the observed consistency between the obtained results for function, Z_2, in Tables 4 and 5 affirm task demand and environmental factors as the factors responsible for the observed difference between tertiary school teachers and teachers of primary and secondary schools.

Teachers stress is a costly and distressing phenomenon, which damage both individuals and institutions/organizations. For this reason, educators, administrators, and academicians should collaborate with Government at all levels in order to come out with policies/programs targeted at organizational, task demand, environmental and social factors with the aim of preventing the stress associated with teaching/lecturing across the three levels of educational system for the benefit of all educators and students.

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References

Adebiyi, D. (2011). *Prevalence of Stress Among University of Ado-Ekiti Lecturer.* Ph.D. Thesis, Ekiti State University, Ado-Ekiti, Nigeria.

Adeoye, E.A. (2002). Correlates of Job Stress Among Females' Academics at the University of Ilorin. *The Nigerian Journal for Guidance and Counseling,* 4, 126-179.

Aftab, M. and Khatoon, T. (2012). Demographic Differences and Occupational Stress of Secondary School Teachers. *European Scientific Journal,* 8(5), 159-175.

Ashcraft, A.S. (1998). *Ways to Evaluate the Assumption of Multivariate Normality*, Paper presented at the Annual Meetings of the Southwestern Psychological Association, New Orleans, LA.

Baraza, O.T., Simatwa, E. M. W. and Gogo, J. O. (2016). Levels of Stress Among Secondary School Teachers and its Implication on Students' Academic Performance in Kenya: A Case Study of Kakamega North Sub County, *Greener Journal of Educational Research,* 6(2), 052-066.

Billehoj, H. (2007). Report on the ETUCE Survey on Teachers Work Related Stress. Available at: http://etuce.homestead.com/News/2008.

Briscoe, M.L. (1984), Reflections on Academic Burnout, *ADE Bulletin,* 079**,** 1-7. Available at: http://www.mla.org/ade/bulletin/n079/079001.htm.

Brown, M. and Ralph, S. (1998). *The identification of Stress in Teachers,* In: Dunham and Varma (Eds.), Stress in Teachers, Wurr Publishers, London.

Cartwright, S., and Cooper, C.L. (1997). *Managing Workplace Stress*, Sage Publications Inc., USA.

Demjaha, T.A., Minov, J., Stoleski, S. and Zafirova, B. (2015). Stress Causing Factors Among Teachers in Elementary Schools and their Relationship with Demographic and Job Characteristics. *Journal of Medical Sciences,* 3(3), 493 – 499.

Dinham, S. (1993). Teachers Under Stress, *Australia Educational Research,* 20(3), 1- 16.

Fako, T.T. (2010). Occupational Stress Among University Employees in Botswana, *European Journal of Social Sciences,* 15(3), 313 – 326.

Hasan, D.A. (2014). A study of Occupational Stress of Primary School Teachers, *Educationia Confab,* 3(4), 11-19.

Hansen, J.I. and Sullivan, B.A. (2003). Assessment of Workplace Stress: Occupational Stress, its Consequences, and Common Causes of Teacher Stress in Measuring Up: Assessment Issues for Teachers, Counselors and Administrators. Available at: http://eric.ed.gov/PDFS/ED480078.

Heinesen, E. (2010). Estimating Class-Size Effects Using Within-School Variation in Subject-Specific Classes, *The Economic Journal,* 120(545), 737-760.

Hoglund, W.L.G., Klingle, K.E. and Hosan, N.E. (2015). Classroom Risks and Resources: Teacher Burnout, Classroom Quality and Children's Adjustment in High Needs Elementary Schools, *Journal of School Psychology,* 53(5), 337-357.

Huberty, C.J. and Olejnik, O. (2006). *Applied MANOVA and Discriminant Analysis*, John Wiley and Sons, Inc., Hoboken, New Jersey.

Huberty, C.J. and Wisenbaker, J.M. (1992). Variable Importance in Multivariate Group Comparisons, *Journal of Educational Statistics,* 17, 75–91.

Issue Brief (2017). Teacher Stress and Health: Effects on Teachers, Students, and Schools. Available at: http://prevention.psu.edu/uploads/files/rwjf430428.pdf

Jackson, L. T. B. (2004). *An Adapted Model of Burnout for Teachers in South Africa*. Unpublished Ph.D. Thesis, Potchefstroom University for Christian Higher Education, Potchefstroom.

Jacobs, J.A. and Winslow, S.E. (2004). Overworked Faculty: Job Stresses and Family Demands, *Annals of the AAPSS,* 596, 104-129.

Jarvis, M. (2002). Teacher Stress: A Critical Review of Recent Findings and Suggestions for Future Research Directions, Available at: http://www.isma.org.uk/stressnw/teachstress.htm.

Jepson, E. and Forrest, S. (2006). Individual Contributory Factors in Teacher Stress: The Role of Achievement Striving and Occupational Commitment. *British Journal of Educational Psychology,* 76, 183–197.

Johannsen, S.E. (2011). *An Analysis of the Occupational Stress Factors Identified by Certified Teachers,* PhD Thesis, Georgia Southern University, Georgia.

Johnson, T. (1989). A study of full-time faculty burnout at Evergreen Valley College. Available at: http://www.eric.ed.gov/sitemap/html_0900000b80042aa9.html.

Kahn, R.L. and Cooper, C.L. (1993). *Stress in the Dealing Room: High Performers Under Pressure,* Routledge, London.

Katz, D.A., Greenberg, M.T., Klein, L.C. & Jennings, P.A., (2016). Associations Between Salivary α-amylase, Cortisol and Self-Report Indicators of Health and Wellbeing Among Educators. *Teacher and Teacher Education,* 54, 98-106.

Kavita, K. and Hassan, N. C. (2018). Work Stress Among Teachers: A Comparison Between Primary and Secondary School Teachers, *International Journal of Academic Research in Progressive Education and Development,* 7(4), 60–66.

King, L. and King, D. (1990). Role Conflict and Role Ambiguity: A Critical Assessment of Construct Validity, *Psychology Bulletin,* 107, 48-64.

Kiveshnie, N., Christoff, J.B. and Christo, A.B. (2013). Causes of Stress in Public Schools and its Impact on Work Performance of Educators, *Journal Social Sciences,* 34(2), 177-190.

Klecka, W.R. (1980). *Discriminant Analysis,* Sage Publications, Berverly Hills.

Klassen, R.M., Usher, E.L. and Bong, M. (2010). Teacher's Collective Efficacy, Job Satisfaction, and Job Stress in Cross-Cultural Context, *The Journal of Experimental Education,*78(4), 464-86.

Kyriacou, C. (2001). Teacher Stress: Direction for Future Research, *Educational Review,* 53(1), 27-36.

Lackritz, J.R. (2004). Exploring Burnout Among University Faculty: Incidence, Performance, and Demographic Issues, Teaching and Teacher Education, *An International Journal of Research and Studies,* 20(7), 713-729.

McCarthy, C.J., Lambert, R.G., O'Donnell, M. and Melendres, L.T. (2009). The Relation of Elementary Teachers' Experience, Stress, and Coping Resources to Burnout Symptoms. *Elementary School Journal,* 109(3), 282-300.

Olivier, M.A.J. and Venter, D.J.L. (2003). The Extent and Causes of Stress in Teachers in the George Region, *South African Journal of Education,* 23(3), 186-192.

Onwuegbuzie, A.J. and Daniel, L.G. (2003). Typology of Analytical and Interpretational Errors in Quantitative and Qualitative Educational Research, *Current Issues in Education,* *6(2)*, 1 – 33. Available at: http//cie.asu.edu/ojs/index.php/cieatasu/article/view/1609/651; assessed May 2, 2019.

Parray, M.W., Kumar, S. and Awasthi, P. (2016). Stress Among Teachers: A Theoretical Examination, *The International Journal of Indian Psychology,* 3(4), 88-97.

Pithers, R.T. and Soden, R. (1998). Scottish and Australian Teacher Stress and Strain: A Comparative Study, *British Journal of Educational Psychology,* 68, 269- 279.

Reddy, G.L. and Anuradha, R.V. (2013). Occupational Stress of Higher Secondary Teachers Working in Vellore District, *International Journal of Educational Planning & Administration,* 2(3), 9-24.

Richard, H.L., Peter, F.M. and Ruth, Z.G. (1980). *Introduction to Bivariate and Multivariate Analysis*. Scott, Foresman and Company, USA.

Steenkamp, C. (2003). *Stress in a Medium and Awaiting Trial Correctional Environment.* Unpublished Master's Dissertation, University of the Western Cape.

Suganya, S. and Rajkumar, D.A. (2016). Job Stress Among Teaching Faculty – A review, *International Journal of Applied Engineering Research,* 11(2), 1322-1324.

Sutherland, V.J. and Cooper, C.L. (2000). *Strategic Stress Management,* Palgrave Publishers Ltd, London.

Tabachnick, B.G, and Fidell, L.S. (2007) *Using multivariate statistics, 5th Ed.,* Pearson Education, Inc, New York.

Todd-Mancillas, W.R. and Johnson, P. (1987). Academic Burnout: One Perspective, Paper presented at the 3rd Annual Conference on Communication Therapy, University Park, Illinois. Available at: http://www.eric.ed.gov/sitemap/html_0900000b80112cc8.html.

Van Dick, R., Phillips U., Marburg, M. and Wagner, U. (2001). Stress and Strain in Teaching: A structural Equation Approach, *British Journal of Educational Psychology,* 71, 243-259.

YangXiaozhou (2020). Towards Data Science: Linear Discriminant Analysis Explained. Available at https://towardsdatascience.com/linear-discriminant-analysis-explained-f88be6c1e00b.

Appendix

Group Statistics

Group	Mean	Std. Dev.	Valid N
Group 1 (G₁)			
Overtime	4.3000	1.78403	30
Organizational culture/structure	6.2667	.94443	30
Environment	.8667	.89955	30
Lack of influence	3.4000	.81368	30
Role conflict	4.7667	1.22287	30
Understaffing	1.7333	.82768	30
Colleague	3.1000	.71197	30
Lack of reward/recognition	11.1667	.94989	30
Group 2 (G₂)			
Overtime	8.8333	1.62063	30
Organizational culture/structure	9.0000	1.11417	30
Environment	6.4333	1.04000	30
Lack of influence	5.5333	.77608	30
Role conflict	1.2333	.77385	30
Understaffing	7.9333	1.33735	30
Colleague	4.3000	.83666	30
Lack of reward/recognition	10.1667	1.44039	30
Group 3 (G₃)			
Overtime	12.7667	2.11209	30
Organizational culture/structure	2.1333	1.45586	30
Environment	7.1000	1.24152	30
Lack of influence	.8667	.81931	30
Role conflict	3.6667	1.09334	30
Understaffing	8.6000	1.73404	30
Colleague	1.0000	.94686	30
Lack of reward/recognition	2.0667	1.83704	30