Jurnal Kejuruteraan 37(4) 2025: 1851-1857
https://doi.org/10.17576/jkukm-2025-37(4)-23

An Analysis of Effect and Consequence Associated with Stress Among Technical Vocational Teachers in Malaysia Using Artificial Intelligence (AI) Machine Learning

Sazwan Syafiq Mazlan* & Mohd Taufik Jusoh @ Tajudin*

Faculty of Engineering, National Defence University of Malaysia, Malaysia

Corresponding author: sazwan@upnm.edu.my & taufik@upnm.edu.my

Received 10 October 2024, Received in revised form 28 April 2025
Accepted 12 May 2025, Available online 30 July 2025

ABSTRACT

The white-collar vocational teaching is a profession at high risk for stress. This research attempted to predict and determine the effect and consequence associated with the stress among technical vocational teachers in Malaysia. A cross-sectional random sample was taken on seven (7) vocational college in Perak, which involve approximately 490 technical teaching staff. The questionnaire method by Depression, Anxiety and Stress Scale (DASS-42) and Job Content Questionnaire (JCQ) instrument used as a data to indicate stress level among teachers. These data consist of psychosocial factors contributing to stress, a simple and multiple linear regression analysis were carried out. The prediction element of Artificial Intelligence (AI) implements Support Vector Machine (SVM) method, ignites a few groups of stress teacher start to form among the others. As in the 2023 to 2025, expected a clear segregation between normal and stress teacher within the boundary. While in 2026-2029, expected a huge migration trends of normal to critical teacher dominate the chart. However, the AI system are still depending on several controlled variable, and the result are still expected to be, means there must be a room to improvise the situation of teacher mental health and etc.

Keywords: Stress analysis; artificial intelligence; machine learning

INTRODUCTION

Teacher is a very important person to educated student at all level (primary and secondary). As for the vocational teacher, it deals with technical syllabus and modern learning tools. Somehow, as the leader of the class, these teachers should be equipped with various technical knowledge and expertise. Transformation from regular/ normal teacher into technical expert requires tons of learning skills. Therefore, all the learning curve triggered the unpleasant working area, also known as stress. Occupational stress is a running around topic among vocational teacher that can lead to decrement of work performance. Vocational teacher working environment are slightly from the primary and secondary teacher. They must be well equipped with technical knowledge, understanding and skill. As a result, teachers often encounter negative emotions in their work environment, including anger, frustration, anxiety, depression, and nervousness, which stem from various aspects of their teaching roles (Kyriacou 2001). Over time, research on stress among vocational teachers has grown significantly, becoming a key area of focus in educational studies across many developed nations. (Vandenberghe and Huberman 1999; Kyriacou 2001; Hanizah 2003).

Several surrounding factor such as culture, social, living style, economic and educational differences between state and country should be taken into account. Conducting research on teacher stress within individual countries is essential, as it allows for the incorporation of local circumstances into the analysis, providing a more context-specific understanding. The aim of this study was to analyse the effect and consequence among vocational teacher related to the working environment, whereby Artificial Intelligence (AI) method will be applied in machine learning algorithm.

Teaching has been identified as a high-risk occupation for stress (Chan and Hui 1995; Pithers and Forgaty 1995). According to a report by the Health and Safety Executive (2000a) in the United Kingdom, teaching was found to be the most stressful profession, surpassing other fields such

as nursing, management, and professional or community services. The report highlighted that two out of every five teachers in the UK experienced stress, in contrast to one in five workers in other industries.

Meanwhile, in year 1989, Okebukola and Jegede designed a few sets of questionnaires to study factors related to occupational stress among teachers in Nigeria. The report state They found five (5) main factors related to stress: student factors, teacher factors, the school working environment, administrative procedures and service conditions. Most of the female teachers were more influenced by the school environment and administrative procedures compared to the male teachers. Borg et al. (1991) produced a questionnaire to investigate occupational stress among teachers and result found out the major causes of stress is at the workplace itself, problems of student attitudes, problem with time and resource management, lack of professional recognition and interpersonal relationships.

Studies conducted in Malaysia have identified various factors contributing to stress among teachers, including the use of information technology (Hanizah 2003), years of teaching experience (Mokhtar 1998), the working environment, and feelings of responsibility (Ismail 1998), as well as school type and perceptions of inadequate school facilities (Chan 1998). Given that technical teachers are at an elevated risk for burnout, assessing teacher stress is essential, as it plays a key role in understanding the underlying processes that lead to burnout.

LIRERATURE REVIEW

The study of stress began during the era of war. Selye (1950) described the human adaptation system as a response to surrounding threats. Later, Lazarus (1966) posited that stress arises from the perception of stressors and the failure of coping mechanisms to address them effectively. Numerous studies on teachers' stress levels in Malaysia have yielded varied results. However, common findings identify job demands as a primary factor, with challenges increasing over time (Ambotang & Bayong 2018; Raman & Othman 2017). Other significant factors include school administrators, educational policies (Hadi et al. 2009; Halim et al. 2006), and workplace environments.

Hadi et al. (2009) highlighted that age and duration of work play important roles in stress levels, with most studies focusing on workplace demands. While less common, some research examines non-workplace stressors, finding that personal challenges, such as incompetence (Tamin & Mohamad 2020), work-life balance struggles, and lack of family and community support, also contribute to stress. Additionally, studies have explored the effects of stress, revealing that teaching large numbers of students, managing assignments, and administrative work increase the risk of depression among teachers (Burhanuddin & Ahmad 2018). Similarly, Zahiruddin and Vevehkanandar (2019) found high prevalence rates of depression, anxiety, and stress symptoms among teachers.

Musa et al. (2018) suggested that stress can cause severe physical, mental, and behavioral effects. Lazarus (1966) argued that humans employ coping mechanisms to manage perceived threats. Understanding these coping strategies is essential to addressing teacher stress. Research into Malaysian teachers' coping mechanisms has revealed strategies such as appraisal coping (Parahakaran 2021), social and community support, adaptive behavioral coping (Mahmud et al. 2018), and maladaptive coping behaviors (Mohamad Hisham 2017). Although limited, these studies indicate that teachers rely on specific strategies to handle stress effectively. Positive social support can enable teachers to manage workloads more effectively (Yang et al. 2016), emphasizing the importance of encouragement and effective communication from school leaders.

The literature reveals that most studies on teacher stress have utilized adapted questionnaires or self-administered surveys, with the DASS-21 (Lovibond & Lovibond 1995) and Job Content Questionnaire (JCQ) (Karasek et al. 1998) being the most commonly used instruments. The DASS-21, a validated and reliable tool, measures stress levels in non-clinical samples, while the JCQ is effective in examining workplace stress and job dissatisfaction. Additionally, studies have explored the effects of stress, revealing that teaching large numbers of students, managing assignments, and administrative work increase the risk of depression among teachers (Burhanuddin & Ahmad, 2018). Similarly, Zahiruddin and Vevehkanandar (2019) found high prevalence rates of depression (43.0%), anxiety (68.0%), and stress (32.3%) symptoms among teachers.

This study recognizes the high levels of stress among Malaysian teachers and advocates for the development of a dedicated stress index for teachers. While DASS-21 measures individual stress levels and JCQ evaluates job dissatisfaction, a teacher-specific stress index could address the gaps in understanding teacher stress. The proposed index examines stressors, effects, and coping mechanisms, offering researchers a comprehensive framework to explore the issue further and develop effective stress management guidelines for teachers.

METHODOLOGY

SUBJECTS

A cross-sectional study was conducted in Perak vocational college. A few random sampling techniques was applied to select study subjects. All subjects were recruited at the school office after given written consent. Self-administered questionnaires were distributed among the teachers. The study protocol was classified as private and confidential document, as the teacher requires obligate to provides honest feedback and involves profile privacy.

JOB CONTENT QUESTIONNAIRE

The Occupational Stress Inventory (OSI), which effectively assesses occupational stress, strain, and available coping resources, along with the Job Content Questionnaire (JCQ), were employed to identify the psychosocial factors that contribute to stress. The OSI is designed to assess three dimensions of occupational adjustment: stress, psychological strain, and professional coping resources. The strain resulting from these factors is measured through four subscales: vocational strain, psychological strain, interpersonal strain and physical strain

DEPRESSION ANXIETY AND STRESS 21 ITEMS QUESTIONNAIRE

The questionnaires stress level is used to measured using the Depression Anxiety and Stress 21 Items Questionnaire (DASS 21). The questionnaire consists of three self-reported scales aimed at assessing the negative emotional states of depression, anxiety, and stress. Developed by Lovibond and Lovibond (1995), the DASS has become widely utilized across various settings for measuring these emotional states. Furthermore, the DASS questionnaire also used to measures negative emotional states based on clinical symptoms and meets the requirements of both researchers and scientists (professional clinicians). The DASS questionnaire, which serves as an objective tool for measuring health indicators such as depression, anxiety, and stress, combined with the JCQ, underscores the direct influence of job stress on health problems, as proposed by Harmy (2001). One of the strengths of the DASS is its ability to efficiently assess depression, anxiety, and stress in a brief yet psychometrically robust manner (Brown et al. 1996). While the DASS 42 provides more reliable scores and detailed information on specific symptoms, the DASS 21 offers the advantage of being quicker to administer, taking only half the time.

DATA ANALYSIS

Support vector machine (SVM) is a set of related supervised learning methods used to identify and classify the prevalence of stress among vocational teachers. The property of the SVM is able to minimize the error based on structural risk minimize. In order to achieved that, SVM plot input vector to a higher space dimension whereby a hyperplane is constructed. The SVM regression type 1 was used to sort data. It does minimize the error function by expression in Equation (1) and (2).

$$y = f(x) * \rho \tag{1}$$

$$f(x) = \min \frac{1}{2} w + C \sum_{i=1}^{n} (\xi_i + \xi_i^*) \tag{2}$$

The phase ∅ defines by:

$$Q_{ij} = k(x_i x_j) = \emptyset(x_i), \emptyset(x_j) \tag{3}$$

with subject to:

$$z = y_i - w\emptyset(x_i) - b < \xi + \xi_i \tag{4}$$

$$w = w\emptyset(x_i) + b - y_i < \xi + \xi_i \tag{5}$$

whereby,

$$\gamma > 0, i = 1,2,3 \ldots n \tag{6}$$

The RBF kernel selection

$$R = \exp(-y \mid x_i - x_j|^2) + p \tag{7}$$

$$B = \sum_{i=1}^{n} (\alpha_i - \alpha_i^*) K(x_i, x) + p \tag{8}$$

substitute the RBF kernel

$$F = \sum_{i=1}^{n} (\alpha_i - \alpha_i^*) \big(\exp(-y \mid x_i - x_j|^2) + p \tag{9}$$

The parameter involves in SVM algorithm is i: set point, w: hyperplane, ξ: linear separable, C: bound, ξ_i:: update parameter of kernel parameter (Gamma), b: constant, ρ: noise. The kernel θ is used to transform data

from the input (independent) to the feature space, whereby t_n is the boundary, if $p>t_n$; feature will discard.

RESULTS AND DISCUSSION

The data was initially analyzed using descriptive statistics to provide an overview of the data distribution. Socio-demographic characteristics, job factors, and the prevalence of stress were described using means and standard deviations for normally distributed continuous variables, and medians and interquartile ranges for non-normally distributed continuous variables.

Frequencies and percentages were used to represent categorical variables. To explore associations between stress scores and job-related factors, multiple linear regression (MLR) analysis was applied. Prior to conducting the MLR, scatter plots were created to examine relationships between outcome variables (stress scores) and numerical independent variables. For univariable analysis, simple linear regression (SLR) was applied to both numerical and categorical independent variables. Categorical variables with small cell sizes, which were found to be non-significant in the univariate analysis, were merged in a clinically meaningful manner before being reanalyzed using SLR. To assess the appropriateness of the functional forms of the variables, scatter plots of standardized residuals against the numerical independent variables were examined. Additionally, scatter plots of standardized residuals against independent variables not included in the model were analyzed to check for any relationship with the outcome variable. Once the assumptions and model fitness were confirmed, the best-fit model was derived. The final model, excluding interaction terms, was interpreted. The results were presented with both crude and adjusted regression coefficients, 95% confidence intervals (CI), t-statistics with degrees of freedom, corresponding p-values, and the overall R^2 values. Table 1 displays the mean and standard deviation of the OSI measurements for vocational teachers.

TABLE 1. Means and standard deviation (SD) of the OSI

OSI	Vocational Teacher	
	Means	SD
Vocational strain (VS)	18.5	5.7
Psychological strain (PS)	22.4	7.8
Interpersonal strain (IS)	21.6	6.4
Physical strain (P)	19.9	7.4

As shown in Table 1, the four elements measured by the OSI are vocational strain, psychological strain, interpersonal strain, and physical strain. Among all, PS dominant the league while others are around the corner measurement. This indicate, the PS are influenced by the working environment as tons of technical things revolved from normal secondary school to technical college. As the cognitive dissonance theory suggest it is a psychological frustration that teachers struggle to find solution in order to reduce or eliminate the problem. Furthermore, this frustration and threatening than cognitive dissonance due to major cultural value system may be involved. Table 2, indicated the percentage measurement prevalence of the vocational teacher based on five (5) level of stress.

TABLE 2. Prevalence of stress among vocational teachers.

Stress level	%
Normal	66.0
Mild	17.4
Moderate	8.1
Severe	5.1
Extremely severe	3.4

According to Table 2, majority teacher falls under normal stress level which is 66%. However, as for others element such as mild, moderate, severe and extremely severe triggered some marks. Even though these values are considered very small, the caution strategy and planning should take place in monitor and prevent action.

SVM DATA ANALYSIS

The data analysis by SVM applied Radial Basis Function (RBF) algorithm to classify by finding group or stress. It is categorized into 2 group; treatment (blue) and critical (red). The treatment consists of normal, mild and moderate stress group. At this level, the stress level is considered early stage, and easy to treat. As for the critical consist of severe and extremely severe stress level. In normal psychological practice, these group requires urgent consultation treatment with counsellor or expert in the area. As delayed the treatment within this group may effect on the teacher safety and health issue. Figure 1, 2 and 3 shows a classification group of stress level along the year apply the k-mean technique of with 2^{-2} of (K).

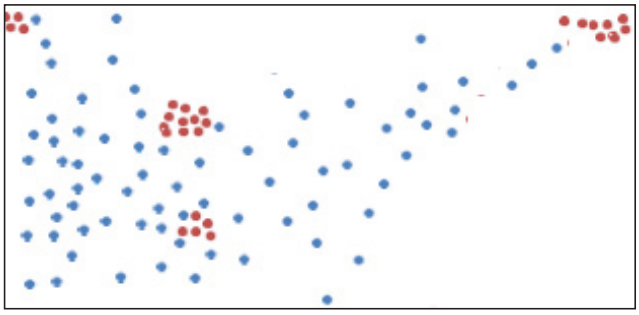

FIGURE 1. Classification group of stress level in year 2020-2022.

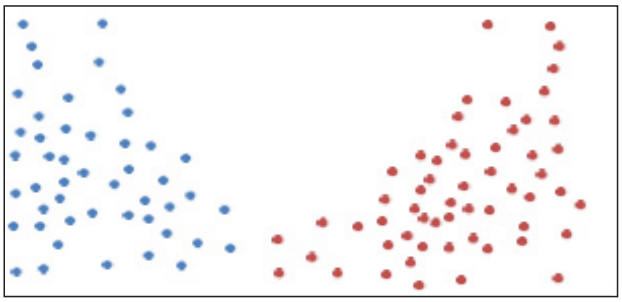

FIGURE 2. Prediction classification group of stress level in year 2023-2025.

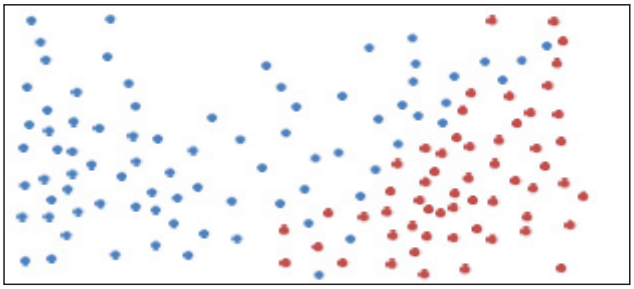

FIGURE 3. Prediction classification group of stress level in year 2026-2029.

Based on the Figure 1, the classification between red and blue dots are in the targeted group. Since the blue dots dominate the chart, which means possibility of occurring the risk among the teacher are still manageable. The stress level is in the early stage and treatable. However, in Figure 2, shows a clear separation between red and blur dots. In addition, the number of red dots is increasing rapidly, it means the teacher stress mentality transforming from treatable to critical. While in Figure 3, a clear migration of blue dots to red, and this is expecting by the ends of 2029. It clearly indicates the number of mental health among vocational teacher are classified as critical and urge for treatment.

As the machine learning tools are depending on the controlling parameter, the expected result in the upcoming year does not provides good working environment and positive mentality. The average stress level among vocational teachers is still manageable. However, based on the overall prevalence of stress, it still poses a risk to teachers' health and well-being. The factors significantly associated with stress were age, duration of work and psychological job demands. The subjective characteristics related to working conditions had more influence on the subjects' emotional health than the objective characteristics. This suggests that job-related factors have a minimal impact on stress levels among vocational teachers. However, personal, social, technological, and financial factors, which were not addressed in this study, should be examined in future research to identify the key contributors to stress levels among secondary school teachers.

The findings from this study offer valuable insights into the extent of the stress issue among vocational school teachers. The results point to a clear need for further investigation into the underlying causes of stress. This could highlight potential weaknesses in the current teaching services and suggest improvements for the working

environment. Several findings from this study carry significant implications for public health and policy, particularly because simple, practical measures to alter working conditions or behaviors could help alleviate some of the stress-related issues identified. Providing better support and information for teachers, as well as adjusting their training programs, could positively influence teacher behaviors, potentially reducing emotional health issues such as stress. Additionally, assessing areas such as the adoption of new teaching strategies, official duty hours, and the level of extracurricular involvement could help create a more effective regulatory framework. This would enable educational staff to find solutions to some of their challenges.

This study only evaluated the level of stress among the vocational teachers. Other factors may also affect the emotional health status of teachers. In this study, the stress analysis was low, thus job factors did not contribute much to stress among the teachers. Other factors, such as personal, social technological and financial factors which were not being covered in this study, should be looked into more deeply in order to obtain the main contributory factors towards stress among teachers.

CONCLUSION

This study aimed to examine the effects and consequences of stress among technical vocational teachers in Malaysia, employing a blend of traditional stress assessment tools and advanced artificial intelligence (AI) machine learning methods. The findings reveal that stress is a considerable concern among this group, with various psychosocial factors contributing to different levels of stress. The application of the DASS-42 and Job Content Questionnaire (JCQ) helped pinpoint key stressors, including work-related demands, psychological strain, and environmental challenges.

The Support Vector Machine (SVM) analysis provided predictive insights into future stress trends. Notably, the data indicated a shift from manageable to critical stress levels in the coming years, posing a potential risk to the mental health and overall well-being of vocational teachers. Specifically, the SVM model predicted an increasing proportion of teachers experiencing severe and extreme stress, underscoring the urgent need for mental health interventions and support systems.

One critical observation from this study is the significant role of psychological job demands, which were found to exert a stronger influence on stress levels than other job-related factors. This highlights the need to address cognitive and emotional workloads in the workplace. Furthermore, although personal and social factors were not directly examined in this study, they may play a role in exacerbating stress and warrant further investigation.

The study also revealed notable differences between normal stress levels and those categorized as moderate to severe. Teachers experiencing higher levels of stress are at greater risk of burnout, and the AI predictions indicate that these teachers should be prioritized for targeted intervention programs. The ability of AI to predict stress trends over the next few years can prove invaluable for implementing proactive mental health strategies, allowing educational institutions to prepare for and mitigate potential crises.

This research effectively highlights the widespread issue of stress among technical vocational teachers in Malaysia, utilizing a unique combination of psychometric stress tools and AI machine learning to identify, analyze, and predict stress trends. The results confirm that stress is a complex issue influenced by both workplace demands and personal factors, and that AI can be an effective tool for forecasting future stress levels among teachers. The findings suggest that while most teachers currently experience manageable levels of stress, a worrying proportion are already facing moderate to severe stress, which is expected to worsen in the near future. These trends emphasize the urgent need for targeted interventions, particularly for teachers experiencing severe stress. Mental health support systems, better workload management, and effective coping strategies must be prioritized to reduce the negative impacts of teacher stress.

Furthermore, the study stresses the value of integrating AI-based tools within educational institutions to monitor, predict, and address stress-related issues proactively. The combination of AI with traditional psychological assessments offers a comprehensive approach to understanding teacher stress, providing crucial insights for policymakers and educational leaders to enhance working conditions and promote the well-being of teachers in Malaysia.

In conclusion, while the immediate future may seem manageable for most vocational teachers, the troubling trends forecasted by the AI model suggest that the situation could significantly worsen without intervention. Therefore, educational institutions must take swift action to implement policies focused on stress reduction and provide the necessary support systems to foster a healthier and more productive teaching environment.

ACKNOWLEDGEMENT

This research did not receive external funding.

DECLARATION OF COMPETING INTEREST

None

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