

Influence of Mental Workload on Job Performance

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Abstract

The study examined the influence of mental workload on job performance of two category of workers in the university namely, the academic and non-academic workers. 100 workers that were made up of 50 academic and 50 non-academic workers comprising of 68 male and 32 female participated in the study. Multiple Resource Questionnaire (MRQ) and Perceived Work Performance Scale (PWPS) were used to collect responses from the participants. Data were analyzed using Pearson correlation, independent t-test and Univariate Analysis of Variance. Testing four hypotheses, results showed that there is no significant relationship between mental workload and job performance. Also, findings indicated that male workers do not exhibit greater mental workload than female workers. Furthermore, there is no significant main influence of age and educational qualifications on job performance, but there is significant main influence of length of service on job performance. No significant interaction influence of age, educational qualifications and length of service was found on job performance. However, there is significant difference in the level of mental workload of academic and non-academic workers.

Keywords: mental workload, job performance, academic workers, non-academic workers, age, educational qualifications, length of service.

1. Introduction

The term workload refers to a number of different yet related entities. It is the hypothetical relationship between a group or individual human operator and tasks demands (Riley, Lyall & Wiener, 1994). Workload can be characterized as a mental construct that reflects the mental strain resulting from performing a task under specific environmental and operational conditions, coupled with the capability of the operator to respond to those demands. Workload is not only task specific, but also person specific. It involves individual capacities and motivation to perform a task. Workload is also referred to as the total energy output of a system, particularly of a person performing strenuous task overtime. Mental workload is the portion of operator information processing capacity or resources that is actually required to meet system demands. It is a demand placed upon humans. Mental workload is the difference between the capacities of the information processing system that are required for task performance to satisfy performance expectations and the capacity available at any given time (Backs & Ryan, 1992).

It is the mental effort that human operator devotes to control or supervision relative to his/her capacity to expand mental effort (Boles & Law, 1998), the perceived relationship between the amount of mental processing capability or resources and the amount required by the task (Hart & Staveland, 1988), and the cost of performing a task in terms of a reduction in the capacity to perform additional tasks that use the same processing resource (Riley, Lyall & Wiener, 1994). Tsang and Velazquez (1990) suggests that the workload construct was conceived to explain the inability of human operator to cope with the requirements of task, and that workload measures are an attempt to characterize performance of a task relative to the operator's capability.

Backs and Ryan (1992) findings seem to argue that workload reflects demand on a single, undifferentiated pool of resources where all tasks interact similarly and constant overhead. It is now thought that the human information processor is appropriately represented as comprising multiple resources that are engaged differently according to the characteristics of the task demands (Wickens & Hollands, 2000). Workload is frequently described by terms such as mental strain (the concept of mental effort) and emotional strain (the excess mental effort that comes from anxiety evoking cognitive aspects of the task). Wickens and Hollands (2000) maintains that workload involve environmental demands and the ability of the operator to cope with those demands.

Backs and Seljos (1994) stated that the concept of mental workload is an applied construct and does not have a one-to-one relationship with attention capacity or resources in information processing theories. Aspects of workload seem to fall within three broad categories namely, the amount of work and number of things to do, time and the particular aspect of time one is concerned with, and the subjective psychological experiences of the human operator (Boles & Law, 1998). Workload is thought to be multidimensional and multifaceted, and it results from the aggregation of many different demands. Backs and Seljos (1994) noted that as workload cannot be directly observed, it must be inferred from observation of overt behaviour or measure of psychological and physiological processes. The assessment of operator workload has a vital impact on the design of new human-machine systems. By evaluating operator workload during the design of a new system, or iteration of an existing system, problems such as workload bottlenecks and overload can be identified. Job performance is an extremely important criterion that relates to organizational outcomes and success. Job performance has been described as something a single person does, and it is the interpretation of the output and quality of job (Campbell, 1990), the balance between all factors of production that gives the greater returns for the smallest effort (Wickens & Hollands, 2000), and as the way employees perform their work (Boles, 2001).

Job performance deals with the workplace, it most commonly refers to the standard of work that corresponds to good quality and productivity. Performance must be directed toward organizational goals that are relevant to the job. Therefore, performance does not include activities where effort is expended toward achieving peripheral goals. For example, the effort put towards the goal of getting to work in the shortest amount of time is not performance (except where it is concerned with avoiding lateness). Employee's performance is determined during job performance reviews, with an employer taken into account factors such as leadership skills, time management, organizational skills and productivity to analyse each employee on an individual basis. When analyzing job performance, you have to understand the aspects of the job you are completing as well as the goals that you are working to achieve. The elements of job performance consist of knowledge, thoroughness, responsiveness, motivation and support. To set objectives for job performance entails defining the elements of the job performance, and creating goals that represent this definition and work to achieve these goals (Omolayo, 2005).

Campbell (1990) proposed eight factor model of performance namely;

- a) Task specific behaviours which include those behaviours that an individual undertakes as part of a job. They are the core substantive tasks that delineate one job from another.
- b) Non-task specific behaviours which an individual is required to undertake, but which do not pertain only to a particular job.
- c) Written and oral communication tasks which refer to the contents of a message and the adeptness with which the message is delivered.
- d) Individual's performance can also be assessed in terms of effort, either day-to-day, or when there are extraordinary circumstances. This factor reflects the degree to which people commit themselves to job tasks.
- e) Aspect of personal discipline. Individuals would be expected to be in good standing with the law.
- f) In jobs where people work closely or are highly interdependent, performance may include the degree to which a person helps out the groups and his/her colleagues.
- g) Many jobs also have a supervisory or leadership component. The individual will be responsible for meeting out rewards and punishments.
- h) A managerial task would be setting an organizational goal or responding to external stimuli to assist a group in achieving its goals. In addition, a manager might be responsible for monitoring group and individual progress towards goal and monitoring organizational resources.

Riley, Lyall and Wiener (1994) opined that whenever there is a mismatch between central executive mechanism and the current cognitive state, the energetical construct of effort can be involved in actively manipulating the current state towards the target state. According to them, the central executive mechanism compares the current cognitive state with a required or target. By investing mental effort, the detrimental influence of stressor (such as noise, information overload or monotony) can be a successful compensation of mental effort to maintain performance. Riley, et al (1994) also puts forward the aspect of strategy. They revealed that a minimal strategy is one of inaction, therefore, performance will probably not be very high because the effort cost are always low. They further stressed that goal changes often result to decreased performance.

Boles and Adair (2001) examined the cause of workload through the Multiple Resources Questionnaire (MRQ) and suggest that this method correlates well with other methods such as the Modified Cooper Harper (MCH) scale. Linking MRQ with MCH will provide a validated workload measurement that has diagnostic support. A relation between task demand and task performance has been described by Motowildo and Van Scotter (1994). In the study, three regions were created namely, A, B and C. Region A is described as low operator workload with high performance. In this region, increase in demands does not lead to performance decrements. In region B, the level of performance declines with increased task demand and workload. In region C, extreme levels of load have diminished performance to a minimum level, and performance remains at this minimum level with further increases in demand.

He found that primary-task workload measure (a measure of performance) will only be sensitive to variations in levels of workload in region B while in region a, performance remains stable and is independent variation in demand. In region C, performance remains at a minimum level, independent of demand. Measures like self-report may be sensitive in region B and may clearly reveal overload in region C, but need not to be sensitive in region A. While extreme levels of load resulting in overload can be situated in the C region, it is not clear where the domain of under-load is. He concluded that relationship exist between demand, workload and performance. The relation exists in principle for each separate resource.

The implication is that auditory task demands, visual task demands and central demands do not necessarily have to be in the same region. In summary, workload can be characterized as a mental construct that reflects the mental strain resulting from performing a task under specific environmental and operational conditions. However, job performance may likely be determined by the level of workload, and may therefore affect the performance of workers. The importance of this study is to create awareness among managers of organizations on the importance of mental workload on workers' job performance. It will enlighten them of the demand a task imposes on a worker on the job, thereby giving the managers the opportunity to increase or reduce the task for higher job performance. This study is set out to assess how mental workload will influence job performance.

2. Hypotheses

1. There will be a significant relationship between mental workload and job performance.
2. Male workers will exhibit greater mental workload than female workers.
3. Age, educational level, and length of service will significantly have a main and interaction influence on job performance.
4. There will be a significant difference in the level of mental workload of academic staff and non-academic workers.

3. Design

This study is a survey study. A correlation design is used to find out the relationship between mental workload and perceived job performance of workers.

4. Participants

The participants used in this study are academic and non-academic workers in Ekiti State University, Nigeria. They are made up of 100 workers comprising of 50 academic and 50 non-academic workers. Their age ranges between 26 years to 58 years with a mean age of 42.

5. Instruments

Two research instruments were used to collect data for this study. They are:

5.1 Multiple Resource Questionnaire (MRQ)

MRQ is a 17-item scale that measure for subjective workload assessment. A major motivation in development of the instrument was to provide a means of predicting the amount of interference between varying combinations of tasks in multitask situations. The reliability data of the questionnaire from two studies based on computer games and laboratory tasks show inter-rater reliability range of .57 to .83 with reliability expected to 0.9 when data are aggregated to over 8 or more raters (Boles & Adair, 2001). Validity of the questionnaire was reported using two different approaches. The first experiment test for the construct validity of the MRQ by examining its sensitivity to key workload dimensions measured by other subjective techniques. In the second experiment, criterion validity of MRQ was tested to predict relative interference in a multi-tasking context.

The results were analysed using ANOVA, and it showed a significant difference from zero, averaging across the three similarity measures (1,20) = 5.56, $p < .05$, and a non-significant difference between them (2,40) = 2.50 $p < .05$. These results indicated that the MRQ significantly predicted dual-task interference. Adelusi (2012) reported a test-retest reliability of 0.85 for Nigerian samples. The response to the questionnaire is usually expressed in terms of the following: No usage = 0, Light Usage = 1, Moderate Usage = 2, Heavy Usage = 3, Extreme Usage = 4. To score the scale, the alternative responses were direct scoring 0, 1, 2, 3 and 4, respectively from No usage to Extreme usage for all the statement.

5.2 Perceived Work Performance Scale (PWPS)

This scale was developed by Brown and Leigh (1996). It is a self rating scale which measure how a worker feels about his/her performance on duties. The scale also measure employee characteristic tendencies to work for long hours, and hard means of achieving success rather than their activities during a specific time period. The scale is divided into two dimensions namely Time commitment and Work intensity. The scale has co-efficient alpha of 0.82; time commitment (.86 and .82), work intensity (.82 and .83). The content validity of the scale as reported by Adelusi (2012) is 0.73 for Nigerian samples. The response to the questionnaire is expressed in terms of Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, Strongly Disagree = 1. Reversed items are scored 1, while strongly disagree on each item is added up to obtain the overall score. For example, items are reversed from 5,4,3,2,1 to 1,2,3,4,5 respectively and are added up to obtain an individual's overall score on Perceived Work Performance Scale (PWPS).

6. Data collection Procedure

The two questionnaires were administered to the workers in their respective offices after the research participants were assured of confidentiality of their responses. No time limit was given for the completion of the questionnaire. Data collection lasted for six weeks.

7. Statistical Analysis

Pearson correlation, independent t-test and Univariate Analysis of Variance (UNIANOVA) were used to analyse the hypotheses generated for this study.

8. Results

The results of the data analysis are presented in table form below.

Table 1: Descriptive analysis of biographic characteristics of the participants

Table 1: Descriptive analysis of biographic characteristics of the participants

Demographics	Frequency	Percentage (%)
<u>Gender</u>		
Male	68	68
Female	32	32
Total	100	100
<u>Age</u>		
26-36 years	29	29
37-47 years	54	54
48-58 years	17	17
Total	100	100
<u>Educational Qualifications</u>		
SSCE certificate	1	1
National Diploma	28	28
University degrees	71	71
Total	100	100
<u>Marital status</u>		
Married	16	16
Divorced	83	83
Widower	1	1
Total	100	100
<u>Department</u>		
Academic staff	50	50
Non-academic staff	50	50
Total	100	100
<u>Length of service</u>		
1-5 years	41	41
6-10 years	29	29
11-25 years	30	30
Total	100	100

Table 1 shows that 68 male and 32 female participated in the study comprising of 50 academic and 50 non-academic workers. Participants whose age range falls between 26 and 36 years are 29, those that fall between 37 and 47 years are 54 while the age range of 17 participants falls between 48 and 58 years. Moreover, Table 1 indicated that 71 participants possess University degrees, 28 possess National Diploma while only 1 had Senior Secondary School certificate. Furthermore, 16 of the participants are married, 83 are divorcee while only 1 of the participants is a widower. Table 1 also shows that 41 participants have spent between 1 and 5 years on the job, 29 of them have spent between 6 and 10 years while 30 participants have spent between 11 and 25 years on the job.

Table 2: Descriptive analysis showing participants' mean and standard deviation scores on age, length of service, mental workload and job performance.

Variable	N	Mean	Standard Deviation
Age	100	40.00	7.51
Length of service	100	8.38	5.97
Mental workload	100	36.97	6.43
Job performance	100	27.59	3.29

Table 2 showed the Mean (M) and Standard Deviation (SD) value of the variables namely age with 40.00 (M) and 7.51 (SD); length of service with 8.38 (M) and 5.97 (SD); mental workload with 36.97 (M) and 6.43 (SD); and job performance with 27.59 (M) and 3.29 (SD).

Table 3: Correlation table showing the relationship between mental workload and job performance.

Variable	N	X	SD	DF	R	p
Mental workload	100	36.97	6.43	98	-0.001	>0.05
Job performance	100	27.59	3.29			

$$r(98) = -0.001, p > 0.05$$

Table 3 above shows that there is no significant relationship between mental workload and job performance. The mean and standard deviation value of mental workload are 36.97 and 6.43 respectively while those of job performance are 27.59 and 3.29 respectively. Therefore, at degree of freedom 98 and significance level of 0.05, the correlation value is -0.001, hence, the first hypothesis is rejected.

Table 4: Independent t-test showing the difference in the male and female workers on mental workload.

Variable	Gender	N	x	SD	DF	T	p
Mental Workload	Male	68	35.97	6.46	98	-0.224	>0.05
	Female	32	36.28	6.48			

$$t(98) = -0.224, p > 0.05$$

The result from Table 4 revealed that male workers do not exhibit greater mental workload than female workers. The mean and standard deviation value of male are 35.97 and 6.46 respectively while those of female are 36.28 and 6.48 respectively. Therefore, at degree of freedom 98 and significance level of 0.05, the independent t value is -0.224, hence, hypothesis two is rejected.

Table 5: Univariate ANOVA showing the interaction effect of age, educational qualifications and length of service on job performance.

Source	Sum of Squares	DF	Mean Square	F	p
Age	.417	2	.209	.020	<0.05
EQual	.001	1	.001	.000	<0.05
LOS	76.431	2	38.216	3.575	>0.05
Age * EQual	5.452	1	5.452	.510	>0.05
Age * LOS	35.104	3	11.701	1.095	>0.05
EQual * LOS	4.010	2	2.005	.188	>0.05
Age * EQual * LOS	5.498	1	5.498	.514	>0.05
Error	929.890	87	10.688		
Total	77195.000	100			
Corrected Total	1074.190	99			

EQual: Educational Qualifications; LOS: Length of Service

Table 6: Table showing the mean and length of years in service.

Length of service	Mean
1-5 years	26.75
6-10 years	29.94
11-25 years	27.05

Table 5 shows that age has no significant main influence on job performance, [F(2,99)=.020, p<0.05]. Also, educational qualification has no significant main influence on job performance [F(1,99)=.000, p<0.05]. However, length of service has significant main influence of on job performance. Workers that have spent between 6 and 10 years on the job have higher mean score (29.94) than those that have spent between 1 and 5 years (26.75), and between 11 and 25 years (27.05) as shown in Table 6. However, there is no significant interaction influence of age, educational qualifications and length of service on job performance [F(1,99)=.514, p>0.05].

Table 7: Independent t-test showing the mental workload of academic and non-academic workers.

Variable	Department	N	X	SD	DF	T	p
Mental workload	Academic	50	32.82	5.15			
	Non-academic	50	39.32	5.97	98	-5.83	>0.05

$$t(98) = -5.83, p > 0.05$$

Table 7 shows significant difference in the mental workload of academic and non-academic workers. The mean and standard deviation value of academic workers are 32.82 and 5.15 respectively while those of non-academic workers are 39.32 and 5.97 respectively. Therefore, at degree of freedom 98 and significance level of 0.05, the independent t value is -5.83, hence, hypothesis 4 is accepted.

9. Discussion

Findings from this study revealed that no significant relationship exist between mental workload and job performance. This suggests that mental workload have no effect on job performance. The plausible explanation of this finding is that increase or decrease in task demand does not affect job performance of workers because they are working towards the realization and achievement of organizational goals. The thoroughness and responsiveness of workers to their job, their knowledge of the job and the motivation and support received on the job cannot be inhibited by job demand. This finding did not support the previous findings of Motowildo and Van Scotter (1994) who found a relationship between job demands, workload and job performance. Their findings revealed that increase in job demand leads to decrease in job performance, and that extreme level of workload can cause diminished performance to a minimum level. The implication of their findings is that continuous increase in task demand could lead to continuous decrease in job performance.

Furthermore, the previous finding of Riley, Lyall and Wiener (1994) does not support the present finding. Riley, et al (1994) found that minimal strategy to work activity brings inaction which could lead to low performance whereas minimal mental effort brought to a work activity may not necessarily brings about low performance. This is because the type of work activity being performed may require the use of minimal mental effort to achieve high performance on the job. However, the present finding shows that increase in task demand does not affect job performance negatively. Result also showed that male workers do not exhibit greater mental workload than female workers. This suggests that both male and female workers have the ability to perform tasks and activities which are given to them. They both experience mental and emotional strain on the job. The probable explanation of this finding is that both male and female workers invest mental effort into their work activities to achieve performance on the job. This corroborate Riley, et al (1994) that investing mental effort into a work activity can make the influence of stressor such as noise and information overload to be a compensation for performance maintenance.

Furthermore, age and educational qualifications does not have significant main influence on job performance. The plausible explanation of this is that age and educational qualifications does not influence the productivity of workers on the job. Workers have individual goals to achieve and needs to meet, therefore, they cannot be deterred in the achievement of their goals and realization of their needs. However, length of service has significant main influence on job performance. Result revealed that workers that have spent between 6 and 10 years will perform higher on the job than those that have sent between 1 and 5 years. This shows the importance of years of experience on the job. Spending many years on the job will facilitate on-the-job skill acquisition, mastery of the job knowledge and ability to manipulate the job for increased productivity. This suggests that the workload of the organization and its environmental demands, and the ability to cope with those demands would be known better by workers with many years of experience on the job than workers with less years of experience.

This corroborates the view of Wickens and Hollands (2000) that workload involves environmental demand and the ability of the operator to cope with those demands. Workers with many years of experience on the job would have engaged themselves in different tasks and work activities which would have enhance their attention capacity and shaping their mental effort towards job performance. In addition, there is no significant interaction influence of age, educational qualifications and length of service on job performance.

This means that the age of workers, their educational qualifications and length of service in the organization does not have any interaction influence on their productivity and performance on the job. This suggests that the predictive variables (age, educational qualifications and length of service) do not influence the performance of workers on the job.

This possible explanation of this finding is that mental efforts that workers bring into work activities can bring about job performance. This corroborates Riley, et al (1994) that mental effort can be a successful compensation to maintain performance. Significant difference was found in the level of mental workload of academic and non-academic workers. This may be due to different activities performed by the workers. Academic workers teach, engage in research and perform other academic related matters whereas the non-academic workers are saddled with administrative responsibilities. This suggests that minimal mental effort is required to perform administrative responsibilities of the non-academic workers unlike the academic workers that engage in multiple and multi-divisionary activities which requires concentrated increased mental efforts and attention capacity to achieve performance. This corroborates Riley, et al (1994) that the level of mental effort brought to work activity will determine the level of performance.

10. Conclusion

Based on the findings of this study, the following conclusions are made.

- a) There is no significant relationship between mental workload and performance.
- b) Male workers do not exhibit greater mental workload than female workers.
- c) There is no significant main effect of age and educational qualifications on job performance, but significant main effect of length of service on job performance exist.
- a) There is no significant interaction effect of age, educational qualifications and length of service on job performance.
- b) There is significant difference in the mental workload of academic and non-academic workers.

11. Recommendations

The following recommendations are made.

The high level of mental workload in organizations commands attention. Therefore, management of organizations do not only need to consider the job performance of their workers, but also to assess their mental workload frequently. Furthermore, organizations should make available the incentives that could increase job performance to their workers. These incentives include intrinsic (such as recognition, respect, sense of belonging, and the likes) and extrinsic motivators (such as good pay package and allowances, job security, objective performance evaluation, and the likes).

References

- Adelusi, A.O. (2012). Mental workload and academic performance: Any relationship Unpublished B.Sc thesis, Department of Psychology, Ekiti State University, Nigeria.
- Backs, R.W. & Ryan, A.M. (1992). Multimodal measures of mental workload during dual task performance: Energetic demand of cognitive processes Proceeding of the Human Factors Society. CA: Human Factors Society, 1413- 1417.
- Backs, R.W. & Seljos, K.A. (1994). Metabolic and cardiorespiratory measures of mental effort: The effect of level of difficulty in a working memory task. *International Journal of Psychophysiology*, 16, 57-68.
[http://dx.doi.org/10.1016/0167-8760\(94\)90042-6](http://dx.doi.org/10.1016/0167-8760(94)90042-6)
- Boles, D.B. (2001). Multiple resources. In W. Karwowski (Ed.) *International encyclopedia of Ergonomics and Human factors*. NY: Taylor & Francis.
- Boles, D.B. & Adair, L.P. (2001). Validity of the Multiple Resources Questionnaire (MRQ). *Proceedings of the Human Factors and Ergonomics Society*.
- Boles, D.B & Law, M.B. (1998). A simultaneous task comparison of differentiated hemispheric resource theory. *Journal of Experimental Psychology, Human perception and Performance*, 24, 204-215.
<http://dx.doi.org/10.1037/0096-1523.24.1.204> PMID:9483826
- Campbell, J.P. (1990). Modeling the performance prediction problem in Industrial and Organizational Psychology. In M.D. Dunnette & L.M. Hough (Eds.) *Handbook of Industrial and Organizational Psychology* (pp. 687-732). Georgia: Hooks.
- Hart, S.G. & Staveland, L.E. (1988). Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. In P.A. Hancock & N. Meshkati (Eds.) *Human Mental workload*. (pp. 139-183). Amsterdam: North-Holland.
[http://dx.doi.org/10.1016/S0166-4115\(08\)62386-9](http://dx.doi.org/10.1016/S0166-4115(08)62386-9)
- Motowildo, S.J & Van Scotter, J.R. (1994). Evidence that task performance should be distinguish from contextual performance. *Journal of Applied Psychology*, 70, 475- 480.
<http://dx.doi.org/10.1037/0021-9010.79.4.475>
- Omolayo, B.O. (2005). *Psychology of human being at work*. Akure: Adeyemo Publishers.
- Riley, V., Lyall, E. & Wiener, E. (1994). Analytic workload model for flight deck design and evaluation. *Proceedings of the Human Factors and Ergonomics Society* 38, 81-84.
<http://dx.doi.org/10.1177/154193129403800115>
- Tsang, P.S. & Velazquez, V.L. (1990). Diagnosticity and multidimensional subjective workload ratings. *Ergonomics*, 39, 358-581.
<http://dx.doi.org/10.1080/00140139608964470> PMID:8849491
- Wickens, C.D. & Hollands, J.G. (2000). *Engineering Psychology and human performance*. NJ: Prentice Hall.