Full Length Research Paper

Pattern of computer usage and visual acuity among computer users at National Open University of Nigeria (NOUN)

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Computerized jobs are more sedentary as it requires more cognitive processing and mental attention. Besides, to put computers into operation for many tasks in tandem means that the operator would necessarily sit before visual display terminal of computers screen within a very restricted posture range. This could have deteriorative effects on the eyes. Hence, this study investigated the pattern of computer use in association with visual acuity among National Open University of Nigeria (NOUN) staff. The study was a cross-sectional survey which utilized multi-stage sampling method to recruit 297 staff from selected 17 NOUN Study Centres. A self-administered and structured questionnaire was used to obtain information for the study. Snellens and Jeggars chart were used to determine visual acuity among the respondents. Findings from the study revealed that prolonged "daily" computer use was associated with less desirable visual acuity (p<0.05). Likewise, the longer the hours spent on daily computer use, the lesser the desirable visual acuity (p<0.05). It is however, recommended that periodic eye examination and public health campaign should be adopted as preventive strategies in order to maintain vision integrity among computer users.

Key words: Pattern, computer use, visual acuity.

INTRODUCTION

Computer has become one of the main tools in educational operation requiring prolonged daily usage. The use of computer device has increased throughout the developed countries ranging from five minutes a day to eight hours a day depending on the type of job a person does. The extent to which an individual experiences computer usage related symptoms is largely dependent upon visual demands of the task being performed.

According to Gupta et al. (2014), 70 to 75% of

computer workers have eye problems which are the most frequently related health problems. Up to 90% of computer users report visual problems and eye irritation which are associated with tasks that require repetitive motions occurring over long period of time. Various degrees of eye dysfunctions appear to suggest that it originates from prolonged and protracted working before computer (Sauter, 2001; Ellahi et al., 2011).

The human visual system is responsible for acquiring and processing the visual information. Eye condition such as irritation, allergic conjunctivitis, blurred vision, eye aches, glaucoma and refractive errors represents a group of undesirable hazards to health that form a recognizable pattern, especially of something undesirable that have been linked to prolonged sitting before computers under operation (Amalia et al., 2010; Ellahi et al., 2011; Akinbinu and Mashalla, 2013).

Visual acuity is the measurement of acuteness of central vision. Visual acuity is a complex phenomenon influenced by many factors; some of which are the state of the image forming mechanism of the eye, the state of the cones and stimulus factors including illumination, brightness of the stimulus, contrast between stimulus and background.

Accommodation is an active process that requires muscular effort. The degree to which the lens curvature can be increased is, of course limited and light rays from a very near object cannot be brought to focus on the retina even with the greatest effort. The nearest point to the eye at which an object can be brought into clear focus by accommodation is called the near point of vision. The near point recedes throughout life, slowly at first and then rapidly with advancing age, from approximately 90 cm at age 10 to approximately 83 cm at age 60. By the time a normal individual reaches age 40, the loss of accommodation is usually sufficient to make reading and close work difficult (Ganong, 2007).

Competitiveness in today's world requires the use of computers for problem solving. At the National Open University of Nigeria (NOUN), there is no resident staff and student on the campuses/study centres, while the bulk of activities in NOUN are the production and provision of instructional materials to learners (students). The learning activity of the institution is predicated on effective system of communication which takes the advantage of the existence of computers and associated devices in carrying out the function of teaching.

The shift to almost 100% computer use by many companies and institutions was alluded to by Abdelaziz et al. (2009) and Ellahi et al (2011) whose work observed that health complaints are often found predominantly in computer users. Investigation of these health concerns gave birth to the emergence of what has been described as Computer Vision Syndrome. These syndromes include complaints such as eye irritation, eye strain, eye ache, lacrimation, blurred vision, hypermetropia, photophobia

and carpal tunnel syndrome.

In view of the boundless structure of the NOUN, the use of Information and Communication Technologies (ICT) has greatly influenced performance of tasks of staff which requires the use of computer and keeps them on this device for prolonged hours. Literatures were reviewed on human visual system, visual acuity, eye and vision related complaints, visual demands of computer workers, computer usage in Nigeria and eye health problems as well as the mechanism and operation of open and distance learning.

METHODOLOGY

This research was a cross sectional descriptive survey of the staff of National Open University of Nigeria (NOUN). The study comprised of 297 staff randomly selected from the 902 staff (using Fischer's minimum sample size determination formular). Multi-staged random sampling method was used to select 17 study centres from the 44 existing study centers of NOUN. The subjects included in the survey were devoid of any visual related problems and procedures were guided by the standard ethical practice of the University of Ilorin and NOUN.

A self-constructed questionnaire and Snellens chart were the tools used to obtain information from the subjects. Visual acuity was conducted with the help of 4 trained Ophthalmic Nurses at near similar conditions in the various centres of investigation. Visual acuity were graded as "very desirable", "desirable" and "not so desirable" acuities (Table 1).

Data obtained were expressed in means, frequencies and percentages. Chi square statistic and correlation analysis were used to test for the relationship among computer usage, pattern of usage and visual acuity at 5% level of significance using Statistical Package for Social Sciences (SPSS) version 16.

RESULTS

Descriptive analyses in frequencies and percentages were used to describe the pattern of computer usage among the subjects (Figure 1). The respondents were first divided by whether or not they use computer; hence, Chi square analysis was used to measure the association between computer use and visual acuity (Tables 2 and 3). The patterns of computer use among computer users were further correlated with their visual acuities (right and left eye visual acuities). Also, some of the results were presented based on three staff categories of NOUN which are actively involved in computer use. These are the academic, administrative and support staff (e.g. technicians, counsellors, drivers, etc). Males, subjects in the lesser age groups, those with less than 4 years of experience and academic staff, use computers more than their other counterparts. Subjects who are in their late 50s account for the majority of non computer users (Table 4).

The Chi square analysis showed that computer usage is significantly associated with visual acuity. Subjects who do not use computer have more desirable acuities than

Table 1. Visual acuity codes and interpretation from Snellen's chart (Field Survey Template, 2014).

Visual acuity code	Interpretation
6/4 6/5	Very desirable
6/6	Desirable
6/9 6/12 6/18 6/24 6/36 6/60	Not so desirable

Table 2. Demographic characteristics of subjects based on computer usage.

Demographic characteristics of subjects		Computer users (CU) = 188	Non computer users (NCU) = 109	Total = 297
Gender	Male	97 (78.2%)	27 (21.8%)	124
	Female	91 (52.6%)	82 (47.4%)	173
Age	Less than 30 years	38 (79.2%)	10 (20.8%)	48
	31-42 years	78 (73.6%)	28 (26.4%)	106
	43-54 years	69 (61.1%)	44 (38.9%)	113
	55 years and above	3 (10.0%)	27 (90.0%)	30
Years of working experience (NOUN)	1-3 years	102 (89.5%)	12 (10.5%)	114
	4-6 years	51 (58.0%)	37 (42.0%)	88
	7 years and above	35 (36.8%)	60 (63.2%)	95
Job description	Academic	85 (92.4%)	7 (7.6%)	92
	Administrative	64 (48.5%)	68 (51.5%)	132
	Support	39 (53.4%)	34 (46.6%)	73

Table 3. Visual acuity and computer use.

Eye		N	Very desirable	Desirable	Not so desirable	χ^2	P value
Right eye	CU	188	7 (37.0)	110 (57.0)	71 (85.0)	11.990	0.002
	NCU	109	12 (63.0)	84 (43.0)	13 (15.0)		
Left eye	CU	188	5 (29.0)	112 (57.0)	71 (84.0)	23.429	<0.0001
	NCU	109	12 (71.0)	83 (43.0)	14 (16.0)		

CU: Computer users; NCU: non computer users.

their counterparts (Table 3).

Frequency of computer use (occasionally, weekly and daily) significantly correlates with visual acuity of the subject (Table 5). The scatter plots (Figures 2 and 3) showed that less desirable acuity is significantly associated with daily computer use.

Table 4. Pattern of computer use and visual acuity.

Pattern of usage	Duration	N	Eye	Very desirable (%)	Desirable (%)	Not so desirable (%)
Duration of computer use	1-3 years	38	Right	0 (0.0)	24 (63.2)	14 (36.8)
			Left	0 (0.0)	24 (63.2)	14 (36.8)
	4-6 years	70	Right	3 (4.3)	37 (52.9)	30 (42.9)
			Left	2 (2.9)	37 (52.9)	31 (44.3)
	7 years above	80	Right	4 (5.0)	48 (60.0)	28 (35.0)
			Left	3 (3.8)	51 (63.8)	26 (32.5)
Daily computer use	1-4 h	80	Right	2 (2.5)	46 (57.5)	32 (40.0)
			Left	1 (1.2)	46 (57.5)	33 (41.2)
	5-8 h	89	Right	4 (4.5)	50 (56.2)	35 (39.3)
			Left	4 (4.5)	52 (58.4)	33 (37.1)
	Above 8 h	19	Right	1 (5.3)	13 (68.4)	5 (26.3)
			Left	0 (0.0)	14 (73.7)	5 (26.3)
Frequency of computer use	Occasionally	28	Right	3 (10.7)	17 (60.7)	8 (28.6)
			Left	4 (14.3)	16 (57.1)	8 (28.6)
	Weekly	46	Right	2 (4.3)	29 (63.0)	15 (32.6)
			Left	0 (0.0)	30 (65.2)	16 (34.8)
	Daily	114	Right	2 (1.8)	63 (55.3)	49 (43.0)
			Left	1 (0.9)	66 (57.9)	47 (41.2)

Table 5. Correlation analysis showing the relationship between pattern of computer use and visual acuity.

Pattern of usage	Eye	N	Pearson correlation	p value
Duration of computer use	Right	188	-0.058	0.432
	Left	188	-0.076	0.301
Daily Computer use	Right	188	-0.073	0.317
	Left	188	-0.086	0.239
Frequency of computer use	Right	188	0.161*	0.027
	Left	188	0.160*	0.028

*Significant correlation $p < 0.05$.

DISCUSSION

The application of computers in institutions of higher learning is best exemplified by Open University system that depends largely on computer use for distance learning activities.

The bulk of activities at the NOUN are the production and provision of instructional materials to learners (students). The learning activity is predicated on effective system of communication which takes the advantage of the existence of computers and associated devices in carrying out the function of teaching.
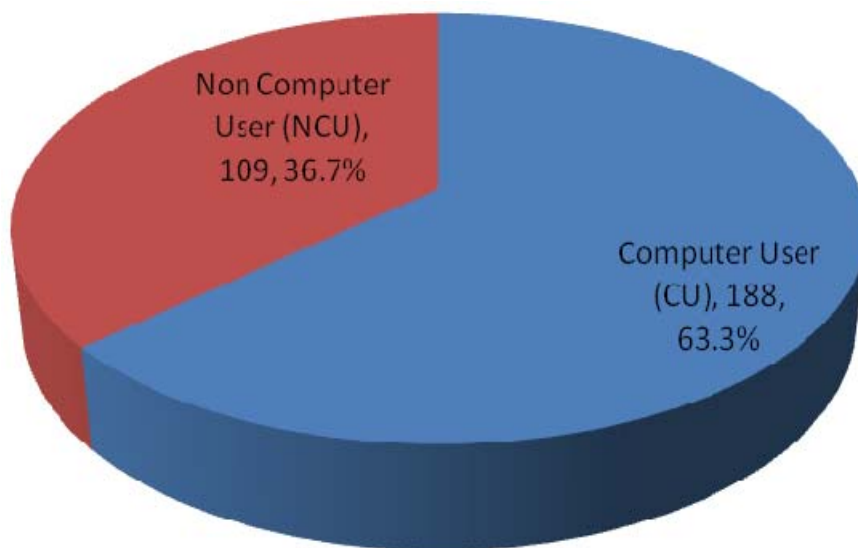
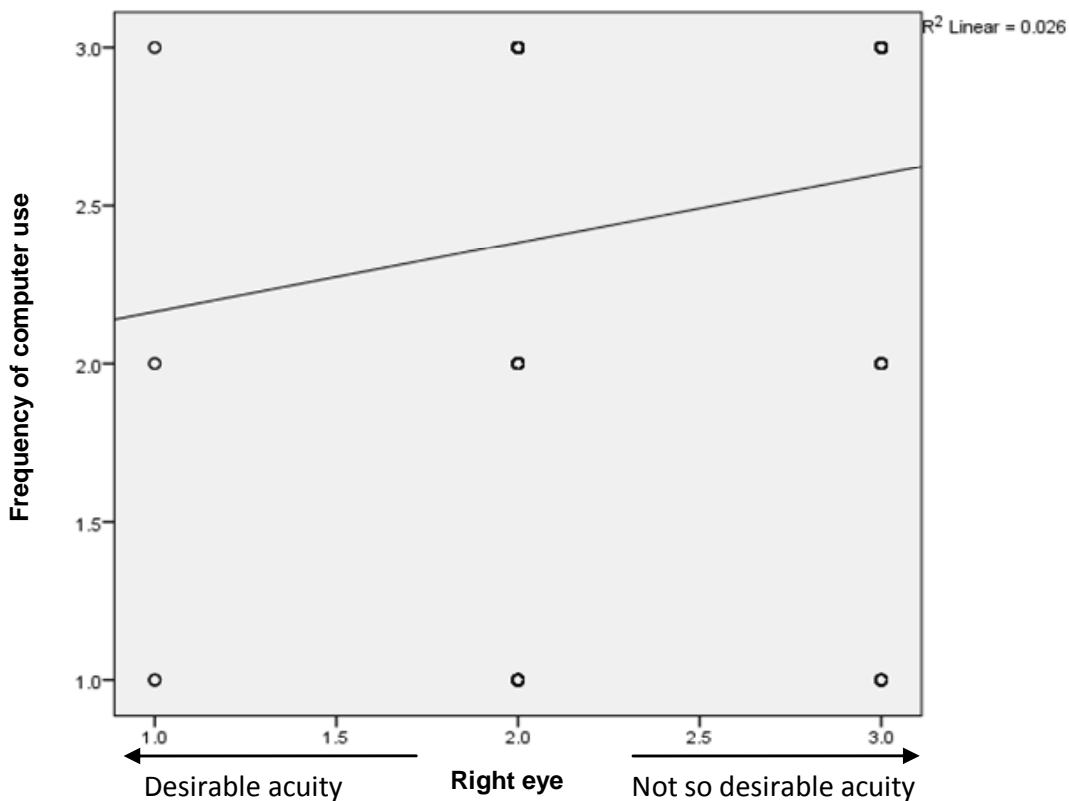**Figure 1.** Computer use among NOUN staff.

Figure 2. Correlation between frequency of computer use and the right eye visual acuity.

The findings of this study revealed that less desired visual acuity exist more among the academics (89%), the group whose roles make the highest demand on the use of computers. Strongly implicated is the prolonged use of computer as a risk factor for visual dysfunctions even if some environmental and genetic factors may be contri-
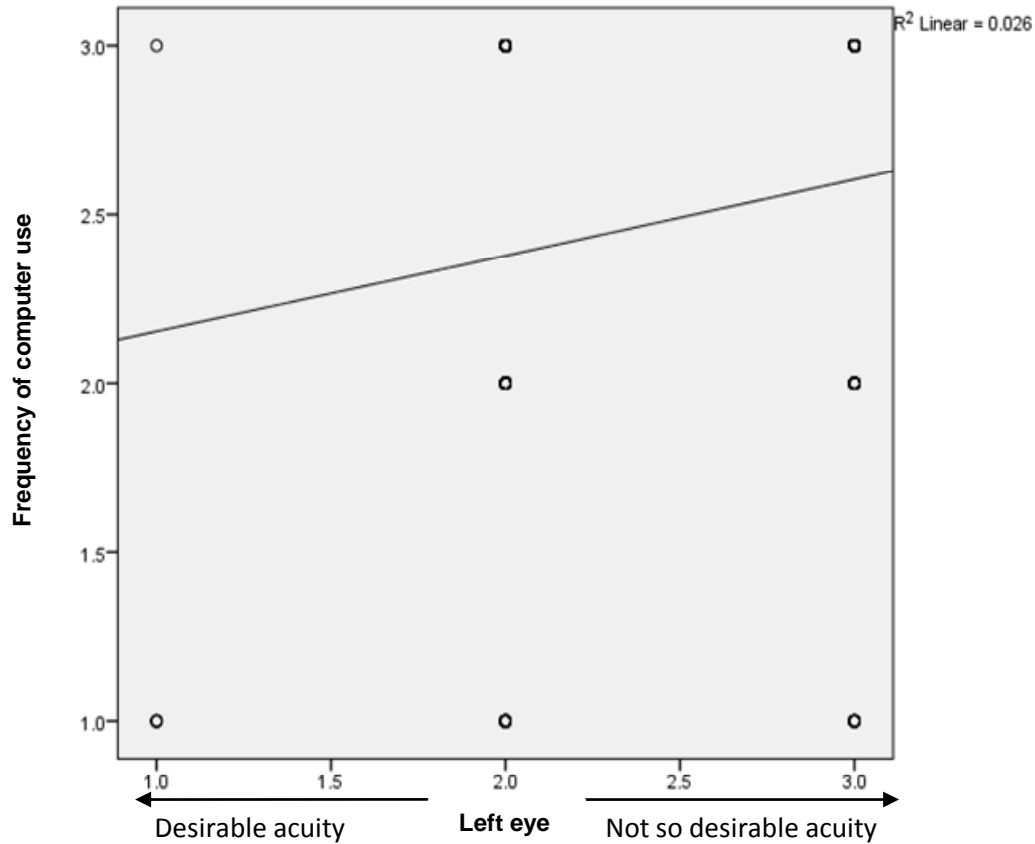
Figure 3. Correlation between frequency of computer use and the left eye visual acuity.

buting to this as observed by Sanchez et al. (2010) and Tatemichi et al. (2004).

The findings on the investigation of pattern of computer usage further established the association between computer usage and visual acuity; less desirable acuity were found in staff with daily computer users compared to their counterparts with weekly and occasional use. The length of time spent daily was also identified to be a contributing factor with not so desirable acuity. Staff who spent more than 8 h on daily computer use had less desirable acuity than their counterparts who spent less.

The findings showed a continuous increase in the percentage of staff with visual dysfunctions as daily duration of exposure to computer increases agreed with the previous study by Abdelaziz et al. (2009) who affirmed that duration of computer usage may have effect on visual acuity. Since near point recedes throughout life starts slowly at first and then rapidly as an individual advances in age from approximately 90 cm at age 10 to about 83 cm at age 60. This recession has been attributed primarily to increasing hardness of the lens consequently leading to loss of accommodation precipitated by steady decrease in the degree to which the curvature of the lens has been increased.

Institute of Electrical and Electronics Engineers (IEEE, 2003) reported that concentrating on the screen for long period could reduce the blink rate and allow the tear film on the surface of the eye to dry which can result into dry and sore eyes. Suzuki et al. (2006) in a study conducted by the Department of Human Factor Engineering, University of Occupational and Environmental Health, Japan, revealed that visual strain occurred after merely 60 min of video terminal work, which further resulted in lower productivity.

Seybert (2007) examined the differences in the regular use of ICT among women and men in the different members States European Union. In nearly all European countries and in all age groups, however, men are more regular users of both computers and the internet than women and many more men than women are employed in computing jobs throughout the European Union.

Tomte (2011) also noted that the overall picture of the situation relating to gender and ICT has so far been that men have been dominant and left the women behind.

The continuous steady decrease in the percentage of computer users with normal visual acuity as the number of years of computer usage increases, testifies to the fact that years of usage is a risk factor to visual acuity of

computer users.

Conclusion

This study has attempted to investigate the pattern of computer usage and visual acuity among computer users at the NOUN. This study therefore concludes that prolonged computer usage over a long period of time without interaction of activity may lead to the propagation of poor vision and lower productivity. Hence, it is suggested that that periodic eye examination and public health campaign should be adopted as preventive strategies in order to maintain vision integrity among computer users. Sensitization of staff on the effective use of computer with necessary precautions to limit the dangers of job hazards should be frequently organized for staff in the institution.

Conflict of interest

Authors have none to declare.

REFERENCES

Abdelaziz MM, Fahim SA, Mousa DB, Gaya BI (2009). Effects of Computer use on visual acuity and colour vision among computer workers in Zaria. Eur. J. Sci. Res. 35(1):99-105.
Akinbinu TR, Mashalla YJ (2013). Knowledge of computer vision syndrome among computer users in the workplace in Abuja, Nigeria. J. Physiol. Pathophysiol. 4(4):58-63.
Amalia H, Suardana GG, Artini W (2010). Accommodative insufficiency as cause of asthenopia in computer-using students. Univ. Med. 29(2):78-83.
Ellahi A, Khalil MS, Akram F (2011). Computer users at risk: Health disorders associated with prolonged computer use. E3 J. Bus. Manag. Econ. 2(4):171-182.
Gupta R, Gour D, Mamta M (2014). Interventional Cohort Study for evaluation of Computer Vision Syndrome among Computer Workers. Int. J. Med. Res. Rev. 2(1).
Institute of Electrical and Electronics Engineers (IEEE) (2003). Proceedings. Asia-Pacific Conference on Environmental Electromagnetics (IEEE Cat. No.03EX702). Environmental Electromagnetics, 2003. CEEM 2003. Proceedings. Asia-Pacific Conference on 4-7 Nov. 2003 Hangzhou, China.
Sauter S (2001). Predictors of strain in VDT users and traditional office workers. In: Grandjean E (Ed.), Ergonomics and health in modern offices. London Taylor and Francis pp. 129, 135.
Seybert H (2007). Gender differences in the use of computers and the internet. Statistics in focus: Population and social conditions (Eurosat), Issue number 119/2007.
Suzuki S, Goto E, Dogru M, Asano-Kato N, Matsumoto Y, Hara Y, Fujishima H, Tsubota K (2006). Tear film lipid layer alterations in allergic conjunctivitis. Cornea 25(3):277-280.
Tatemichi M, Nakano T, Tanaka K, Hayashi T, Nawa T, Miyamoto T, Hiro H, Sugita M (2004). Possible association between heavy computer users and glaucomatous visual field abnormalities: a cross sectional study in Japanese workers. J. Epidemiol. Community Health 58(12):1021-1027.
Tomte C (2011). Challenging our views on ICT, Gender and Education: In Nordic Journal of Digital Library. Available at: http://www.idunn.no/ts/dk/2011