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Ergonomic Principles Needed by Garment Workers for Pattern Drafting in South Eastern Nigeria

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Abstract

The study investigated ergonomic principles needed by garment workers for pattern drafting in South Eastern Nigeria. Three research questions and one hypothesis were formulated to guide the study. Descriptive survey research design was adopted for the study. The population was made up of 267 garment workers drawn from the 19 registered garment companies in South Eastern Nigeria. Structured questionnaire on ergonomic principles needed by garment workers for pattern drafting was used for data collection. Data were analyzed using mean, standard deviation, improvement need index and ANOVA. The findings showed that garment workers needed ergonomic principles in pattern drafting in the following, adjusting the table height to accommodate different workers, tilting the table height to improve visibility, use of cushioned chair to prevent tissue compression at the area of Ischia tubrosities among others. Major constraints to adoption of the needed ergonomic principles include: ignorance about the long term effect of occupational injury, nonchalant attitude towards ones health and safety among others. Ways of enhancing adoption of the needed ergonomic principles for pattern drafting include; organizing seminars and workshop for greater awareness on ergonomic hazards and prevention among others. Based on the findings of the study, it was recommended that the identified needed ergonomic principles should be packaged into training manuals for garment works by the government in collaboration with trade union.

Key words: Ergonomic, Principles, Pattern, Drafting, Garment, Workers

Introduction

Designing and drafting of garment patterns are among the preliminary processes involved in garment making (Igbo and Iloeje, 2014). Garment designers make a number of sketches as they allow their imagination flow on paper. Consequently these sketches are assessed, scrutinized, corrected and developed into garment designs with style features. The final pattern is graded into sizes for mass production of the garment (Sarka, 2011; Muhundham, 2013).

Pattern designers are therefore engaged in long hours of performing the same task repeatedly under constrained posture. This often predispose the garment workers to what is known as Repetitive Strain Injury (RSI) or Musculoskeletal Disorder (MSD) (American Apparel and Footwear Association: AAFA, 2005; Oziem, 2019). Repetitive Strain Injury (RSI) or (MSD) affect the muscle, nerves, tendons, ligaments, joints, cartilage and spinal disc (Adhakari, 2018). The major symptom being chronic pains in upper extremities and waist (Pascreli, 2008; Wells, 2018). The severity of the injury increases over time and does not stop unless the worker changers the factors that created the injury in the first place (Occupational Health Safety and Administration, 2000; Stevenson, 2018). This involves application of ergonomic principles in the workplace.

The term ergonomics is coined from Greek word "ergon" meaning "work" and "nomous" – "law" in other words work rules. Ergonomics is the science of designing machines, products and system to maximize safety, comfort and efficiency of the people who use it. It tries to adjust the job to fit the body needs (Alan, 2008). Ergonomics considers workers efficiency productivity and speed. Workspaces are well designed to ensure that workers perform their jobs in optimal comfort, without experiencing unnecessary physical and mental fatigue that can slow down performance, reduce accuracy or cause accidents. Thus workplaces are designed with injury prevention in mind (Pascreali, 2008; Ergonomics in the Workplace, 2018; Wells, 2018).

Ergonomics has principles guiding its application. These principles are methods of preventing work hazards, stress and fatigue in the workplace. Ergonomics principles include: working in neutral postures i.e. maintaining the 'S' curve of the spine, reducing excessive force, repetitive motion and pressure points, keeping everything within easy reach to prevent bending and twisting the trunk among others (Mcleod, 2008). Ergonomics are hinged on maintaining good working posture, easy of reach tools and equipment maintaining comfortable workplaces and environmental and safety consciousness in workplace. Ergonomics is therefore beneficial to people in several ways, it improves productivity and quality of work, it also improves safety and health of the workers, reduces absenteeism from work and reduces occupational injuries and illness (Adhakari, 2018; Ergonomics in the Workplace, 2018; Wells, 2018).

Most times ergonomics are neglected when thinking about potential hazards that exist in the workplace (Muhundham, 2013). This is because injuries caused by ergonomics hazards are not obvious as injuries from falls from a height, dangerous chemicals among others. However, RSI or MSD can be detrimental and can lead to physical disability in the risk factor if left uncontrolled (Stevenson, 2018). It is the single largest category of workplace injuries and are responsible for almost 30% of all workers compensation cost (Adhakari, 2018). According to United States Bureau of Labour Statistics (2012) more than 60% of the workplace illnesses are associated with RSI. A national survey in Netherlands have shown a high annual incidence of musculoskeletal disorder symptoms of (47%) in the garment industry where preventive measures are thin on ground (Mctammy, 2001).

The researcher through experience, observation and preliminary studies carried out using focus group discussions in South Eastern Nigeria observed that the garment workers suffer from RSI or MSDs, their work practice and workstation were not in accordance with ergonomic principles. Solution proffered to the problem of RSI does not bear the principles of ergonomics

in mind. These include quitting the job, medical treatment or making up one's mind to live with it.

To minimize these potential strains and injury, it is important to improve the ergonomics of the workplace. Thus the prevalence of RSI among the garment workers and their ignorance about ergonomic principles is a serious gap that need to be filled. In other to do this, it is imperative to first of all study their current work practice and workstation in order to determine the ergonomic principles they needed in their garment companies for pattern drafting, hence the need for the study.

Purpose of the Study

The major purpose of the study was to investigate ergonomic principles needed by garment workers for pattern drafting in South Eastern Nigeria. Specifically, the study determined:

1. ergonomic principles needed for pattern drafting in South Eastern Nigeria.
2. problems encountered by garment workers in adopting the needed ergonomic principles in South Eastern Nigeria.
3. ways of enhancing the adoption of the needed ergonomic principles.

Hypothesis

$H0_1$: There is no significant difference in the mean responses of garment workers with different number of years of experience on important ergonomic principles needed in their garment companies.

Methodology

Design of the Study: Descriptive survey research design was used for the study.

***Area of the Study*:** The study was carried out in South Eastern Nigeria. South Eastern Nigeria is largely dominated by the Igbo ethnic group which are generally known for their commercial activities. Their entrepreneurship drive has made them to diversify in various areas of manufacturing, including garment production. Most of these garment industries are sited in Aba and Onitsha which are the two major commercial cities in the South Eastern Nigeria. Only 19 garment companies were registered; ten (10) in Aba and nine (9) in Onitsha. Greater number of the garment companies were not registered but for the purpose of this study, only the registered ones were used.

***Population for the Study*:** The population for this study was made up of 267 garment workers which were drawn from the 19 registered garment companies in Aba and Onitsha (Source: Garment Industries Ad www.webcrawler.com). These are the two major commercial cities where most garment companies were sited in South Eastern Nigeria. The garment workers or operators within these companies were used, because they are directly involved in the sewing job; drafting, cutting, stitching/assembling, finishing and packaging of garments.

***Sample for the Study*:** The entire population was used since the population size was manageable.

***Instrument for Data Collection*:** Data was collected using a structured 45 item questionnaire titled Ergonomic Principles Needed for Garment Workers for Pattern Drafting (EPNGWPD). The instrument was validated by three experts. Two lecturers from University of Nigeria Nsukka and one physiotherapist from Federal Medical Centre, Owerri. The questionnaire items were designed to elicit the necessary information needed for ascertaining ergonomic principles needed by garment workers for pattern drafting in South Eastern Nigeria.

***Data Collection and Analysis*:** Two hundred and sixty-seven (267) copies of the questionnaire were administered to the respondents with the help of five research

assistants. The instrument recorded 97.3% return rate, 260 copies were returned out of the 267 copies administered.

***Method of Data Analysis*:** The data were analyzed using mean, standard deviation, need gap and ANOVA.

To determine the need gap the following procedures were adopted:

weighted mean of each item under the needed category (XN) was calculated.

weighted mean of each item under the performance category (XP) was calculated.

difference between the two weighted means for each item (XN – XP) was determined.

The decision rules were as follows:

- A zero (0) value indicated that ergonomic principles were not needed because the level at which the item was needed is equal to the level at which the respondents can perform it.
- A positive (+) value indicated that capacity building is needed because the level at which the item was needed is higher than the level at which the respondents perform it.
- A negative (-) value indicated that ergonomic principles is needed because the level at which the item was needed is lower than the level at which the respondents can perform it.

Results

The results of this study were presented in Tables 1 – 4 based on the specific purposes.

The data for answering research question one are presented in Table 1

Table 1: Need Gap Analysis (NGA) of ergonomics principles needed by garment workers for pattern drafting and the present level of practice by the garment workers (N = 260).

S/N	Ergonomic principles needed by garment workers for pattern drafting	$\overline{X_N}$	$\overline{X_P}$	NG $(\overline{X_N} - \overline{X_P})$	Remarks
1.	Adjusting the table height to accommodate different workers	3.56	2.36	1.17	IN
2.	Ideal table height for drafting should be 2" – 3" below the workers elbow level	3.40	2.56	0.84	IN
3.	Tilting the drafting table to improve posture and visibility	3.62	2.83	0.79	IN
4.	Arranging the drafting tools, pencils, paper, pin, ruler, etc within easy reach of the worker	3.47	2.35	1.12	IN
5.	Organizing the work station to rotate between standing/sitting posture	3.59	2.32	1.27	IN
6.	Use of task lighting to increase visibility	3.13	3.19	- 0.06	INN
7.	Placing of foot rest to minimize fatigue and blood circulation problem during prolong standing.	3.63	2.56	1.07	IN
8.	Using of swivel chairs to reduce the rate of twisting the body when the worker turns sideways	3.28	2.91	0.37	IN
9.	Drafting chair with lumber curve and firm cushioning on the back rest and seat pan is preferred to help support the back.	3.59	2.43	1.16	IN
10.	Using of chairs with forward tilt at the edge to help take away contact pressure off the leg of the worker.	3.21	3.10	0.11	IN

Note: X_N = Mean Needed; X_P = Mean Practices; NG = Need Gap; IN = Improvement Needed; INN = Improvement Not Needed

Table 1 shows that the nine out of the ten ergonomics principles had their need gap (NG) values ranged from 0.11 to 1.27 which are all positive. This indicates that the garment workers in Southeast Nigeria require improvement in the nine identified ergonomics principles that are required for pattern drafting of fabric. On the other hand, the need gap value for item six was -0.06 which was negative, indicating that garment workers in Southeast Nigeria did not require improvement in using task lighting to increase visibility in garment industry in Southeast Nigeria.

Table 2: Mean Ratings of the Responses of the Respondents on possible constraints to adoption of the needed ergonomic principles by garment workers in South East Zone. (N – 260)

S/N	Possible constraints to adoption of ergonomic principles include:	$\overline{X}$	SD	Rmk
	(a) Human Factors (Worker)			
1.	Physical disability like deformed limbs.	3.33	0.94	A
2.	Lack of training skills and experience on ergonomic principles.	3.27	0.82	A
3.	Cost of ergonomically optimization of work station.	3.61	0.68	A
4.	Lack of funds for procurement of improved tools and equipments.	3.64	0.65	A
5.	Problem of technology transfer e.g. standard sewing machine height for Asian descend not matching the body size of Africans with large body size.	3.46	0.83	A
6.	Non-challant attitude towards ones health and safety	3.70	0.64	A
7.	Loss of control over work due to pressure of work	3.54	0.83	A
8.	Problem of overcrowding in workplace due to limited space.	3.63	0.68	A
9.	Not accepting to be taught better ways of performing task.	3.53	0.85	A
10.	Inability to read hand book and instructional manuals.	3.74	0.56	A
11.	Ignorance about the long term effect of occupational injury and as such does not see the need.	3.53	0.83	A
	(b) Environmental Factors			
12.	Extreme weather conditions which may be too hot or cold for proper work.	3.44	0.85	A
13.	Inadequate power supply to operate automated equipment and tools and illumination of work surface.	3.80	0.55	A
14.	Crowding of work area due to problem of space as workplace not originally designed for the job.	3.55	0.67	A

Note: X = Mean; SD = Standard Deviation; A = Agreed; N = Number of Respondents

Table 2 reveals that, the mean ratings of the responses of the respondents on all the 14 items in the table ranged from 3.27 to 3.80 which were greater than the cut-off point value of 2.50 on 4 point rating scale. This finding indicated that garment workers in Southeast Nigeria agreed that all the 14 identified items in the table are the constraints militating against the adoption of the needed ergonomic principles by garment workers in Southeast Nigeria. The standard deviation values of the 14 items in the table ranged from 0.55 to 0.94 which indicated that the responses of the respondents are close to the mean and one another.

Table 3: Mean Ratings of the Responses of the Respondents on ways through which the adoption of these needed ergonomics principles can be enhanced (N = 260)

S/N	Possible ways through which the adoption of ergonomic principles be enhanced include:	$\overline{X}$	SD	Rmk
	(a) Creating Awareness			
1.	Public enlightenment campaign on the benefits of application of ergonomic principles and ways of adopting it.	3.53	0.83	A
2.	Radio and television programmes on dangers of developing Repetitive Strain Injuries (RSIs) or Work Related Musculoskeletal Disorder (WMSDs)	3.56	0.82	A
3.	Leaflets, posters and flyers on rules and regulations formula on occupational, safety and health.	3.61	0.71	A
4.	Bill board information on ergonomic principles – "work smart".	3.86	0.44	A
5.	Health talks on occupational health and safety in the garment industry	3.53	0.83	A
	(b) Arousing Interest			
6.	Case study meetings on application of ergonomic principles in the garment industry and ways of adopting it	3.60	0.81	A
7.	Brain storming on application of ergonomic principles in the garment industry	3.53	0.85	A
8.	Formation of adoption of ergonomic principles discussion groups	3.68	0.70	A
9.	Radio talk shows/commentaries on ways of adopting ergonomic principles in the garment industry.	3.73	0.64	A
10	Display of ergonomic sewing tools and accessories	3.20	0.98	A
	(c) Enhancing Evaluation Process			
11	Continuous training of workers at all levels	3.53	0.82	A
12.	Organize seminars and invite professionals to make presentation on the various aspects of the application of ergonomic principles in the garment industry	3.42	0.92	A
13.	Creation of web page of web site on application of ergonomic principles in the garment industry.	3.56	0.82	A
14.	Exhibition with display of stickers, magazines and newsletters on ergonomic principles and its application.	3.73	0.62	A
15.	Dramatization and role playing on application of ergonomic principles and the adoption processes.	3.59	0.81	A
16.	Display of some ergonomic tools and accessories used in the sewing industries to show their intricacies and benefits.	3.63	0.82	A
	(d) Encouraging Trial			
17.	Organize competitions on application of ergonomic principles in the manufacture section of the garment industry	3.71	0.49	A
18.	Train management staff and trade union leaders and representatives to train others.	3.41	0.88	A
19.	Give take home assignment to management staff and trade union leaders in order to encourage practice in their industry	3.71	0.49	A
20	Arrange for group practical sessions to enhance practice of trials	3.57	0.81	A
21	Allow time for result demonstration.	3.38	0.89	A
	(e) Ensure Adoption			
22	Organize and present award for long practicing industry or workers	3.52	0.83	A
23	Generate indigenous local practice groups instead of foreign ones	3.61	0.76	A
24	Form new practicing groups	3.54	0.77	A
25	For allied industry practicing groups	3.63	0.76	A

Note: X = Mean; SD = Standard Deviation; A = Agreed; N = Number of Respondents

Table 3 shows that the mean ratings of the responses of the respondents of the 25 items in the table ranged from 3.20 to 3.86 which were all greater than the cut-off point value of 2.50 on 4 point rating scale. This finding indicated that garment workers in Southeast Nigeria agreed that all the 25 identified items in the table are the possible ways through which the adoption of the needed ergonomics principles be enhanced in garment industry in Southeast Nigeria. The standard deviation values of the 25 items in the table ranged from 0.44 to 0.98 which indicated that the responses of the respondents are close to the mean and one another.

Testing of Hypotheses

$H0_1$: There is no significant difference in the mean response of garment workers with different number of years of experience on important ergonomics principles garment workers need to adopt for pattern drafting in their garment companies.

The data for tasting hypothesis one are presented in Table 4.

Table 4: Analysis of Variance (ANOVA) in the Mean Ratings of the Responses of Garment Workers on Ergonomics Principles Needed for Pattern Drafting in Garment Industry.

S/N	Ergonomic principles needed by garment workers for pattern drafting	Total Sum of Square	Mean Square	F-cal	P-value (Sig)	Rmk
1.	Adjusting the table height to accommodate different workers	171.754	0.66	1.25	0.28	NS
2.	Ideal table height for drafting should be 2"-3" below the workers elbow level	222.785	0.86	0.34	0.84	NS
3.	Tilting the drafting table to improve posture and visibility	158.812	0.60	1.87	0.11	NS
4.	Arranging the drafting tools, pencils, paper, pin, ruler, etc within easy reach of the worker	196.862	0.74	3.30	0.03	S*
5.	Organizing the work station to rotate between standing/sitting posture	170,785	0.66	0.31	0.87	NS
6.	Use of task lighting to increase visibility	192.288	0.35	3.13	0.04	S*
7.	Placing of foot rest to minimize fatigue and blood circulation problem during prolong standing.	102.288	0.39	1.37	0.24	NS
8.	Using of swivel chairs to reduce the rate of twisting the body when the worker turns sideways	248.504	0.96	0.97	0.42	NS
9.	Drafting chair with lumber curve and firm cushioning on the back rest and seat pan is preferred to help support the back.	168.785	0.66	0.15	0.96	NS
10.	Using of chairs with forward tilt at the edge to help take away contact pressure off the leg of the worker.	141.365	0.53	1.79	0.13	NS

Note: Level of Sig. = 0.05; **NS** = Not Significant; **S*** = Significant; DF – Degree of Freedom = 259

Table 4 shows that 8 out of the 10 items in the table had their p-values ranged from 0.11 to 0.96 which were greater than 0.05 level of significance. This indicated that

there were no significant differences in the mean ratings of the responses of garment workers with less than 10 years, between 11 to 20 years and above 21 years of working experience on ergonomics principles needed by garment workers for pattern drafting in garment industry. Therefore, the null hypothesis of no significant difference in the mean ratings of the responses of the garment works based on their years of working experience was accepted for the 8 identified items of pattern drafting in garment industry. On the other hand, the p-values of the remaining two items, specifically item 4 and 6 were 0.03 and 0.04 respectively which were in each case less than 0.05 level of significance. This indicated that there were significant differences in the mean ratings of the responses the garment workers based on their years of working experience on the remaining 2 items of patterns drafting in garment industry in South-East Nigeria. Therefore, the null hypothesis of no significant difference was rejected for the 2 identified ergonomics principles needed by garment workers for pattern drafting.

Post-hoc analysis with scheffe test of multiple comparisons was used to show the direction of the significant difference in the mean ratings of the responses of the three groups of respondents on the two significant items. The result of the Post-hoc showed that, there were significant differences between the response of garment workers with less than 10 years of working experience and those with more than 21 years of working experience on the two items.

Discussion of Findings

The discussion of the findings showed that the respondents needed ergonomic improvement in pattern drafting in the following: adjusting the table height to accommodate different workers, tilting the drafting table to improve visibility, drafting chair should have lumbar curve and foam cushioning on the back rest and seat pan to help support the back among others. This is consistent with the findings of Sardar, Imohan, Mandahawi (2006) in Dhaka Bangladesh which revealed poor application of ergonomic principles, unadjustable table height, seat devoid of back rest which would have allowed intermittent micro breaks for resting the upper body after stressful session of bending the trunk and neck. Also seats were hard and wooden without cushion to prevent tissue compression at the area of the Ischia tubuosities. Similarly Sealesta and Thatcher (2009) also found garment workers using spinning cones and pillows to raise the height of the seats for greater visibility. Finally, Adedoyin & Olusegun (2015) who also observed anthropometric differences in workers resulting in ergonomic hazards. These findings negates the recommendation of Hargrare and Graig (2000), Sewing Craft and Alliance (2008), Health and Safety Executive (2013) and Oziem (2019) which emphasized workers sitting or standing in neutral position in other to keep the spine aligned and prevent tissue injury. In essence tasks lighting, chairs and work aids may be raised or lowered to accommodate body dimensions of the user for increased comfort and efficiency. It was not surprising that the garment works as revealed by the findings needed ergonomic improvement in pattern drafting tasks. This underscores the reason for the prevalence of RSI among them, observed in the preliminary study.

Furthermore, all the 14 items on possible constant on adoption of ergonomic principles by garment workers were accepted with mean rating ranging from (X = 3.27 – 3.80) which were greater than the cut-off point value of 2.50 on 4 – point rating scale. Also the standard deviation values of the 14 items in the table ranged from 0.55 to 0.94 which indicated that the responses of the respondents were close to the mean and one another. The possible constraints

include; cost of ergonomically optimization of work place, nonchalant attitude towards one's health and safety, ignorance about the long term effect of occupational injury and as such does not see the need among others.

The findings is in line with observation of International Labour Organization (2001) and Stevenson (2018) about the nonchalant disposition of many workers in developing countries who view ergonomic principles as idealistic and for others, ergonomic problems may not be high on the priority health and safety problems they face. This disposition may also reflect their ignorance about the long term effect of ergonomic hazards which according to (Scoff, 2011) only 23% estimated Cumulative Trauma Disorder (CTDs) also known as RSI patients return to their previous jobs after surgery and perhaps a third of CTDs patients will require unlimited medical treatment, ignorance of the respondents may be attributed to lack of awareness in Nigeria as revealed by the findings of Ismaila (2010) where only 3.4% of the population of the respondents were aware of ergonomics.

Finally, the 25 items on ways of enhancing the adoption of ergonomic principles were all accepted which include; public enlightenment on benefits of application of ergonomic principles through mass media viz radio, leaflets, billboards among others, organization of seminars and workshops for garment workers among others. These agrees with the recommendations of AAFA (2005) and Stevenson (2018) organizing at least annual training for employee which should include discussions on prevention of work related CTDs or RSI, the principles of and goals of ergonomics, signs and symptoms of Work Related Muscloskeletal Disorder (WMSPs) and how to arrange the workplace to reduce ergonomic problems. Enlightenment of works and general public is very important to encourage proactive health care which is far cheaper than reactive healthcare. Prevention is better than cure.

Conclusion

Work related ill health takes its toil in reducing workers efficiency, productivity and even death in some cases. Ergonomics also known as humanics tries to adjust the job to suit the body needs of the workers. It helps to improve productivity, efficiency, safety and health of workers and reduces occupational injuries and illness. Occupational health of garment worker which are engaged in pattern drafting which is a major process in garment making is of paramount concern. Improper workstation and work procedures have been found as a major risk factor in the development of RSI or CTDs. Hence, the need for ergonomic improvement.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. The Government through the Ministry of Commerce and Industry under the trade unions should help to package the identified ergonomic principles needed by garment workers for pattern drafting into training manuals or buffeting.
2. Public enlightenment by Government through the mass media.
3. Inclusion of ergonomic hazard prevention in the school curriculum under first aid and safety education.
4. Practice of ergonomic principles by Home Economics teachers in pattern drafting practicals to inculcate the adoption of ergonomic principles into their students.

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