Access to and use of computer ergonomics related information among PhD students in East Africa: a case of University of Dares Salaam -Tanzania and Makerere University-Uganda

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Abstract

This study has assessed PhD students' access to and use of computer ergonomics related information in East Africa where the University of Dar es Salaam (UDSM) and Makerere University (MUK) have been used as study areas. PhD students' involvement in the study was considered important given their need for and duration of computer usage in their studies. A close-ended questionnaire was used to collect data from a sample of 221 PhD students [151 (68.3%) from the UDSM and 70 (31.7%) from MUK]. The study used a factor analysis to analyze information needs while descriptive statistics were used to find frequencies and mean values, and rank information sources. In-depth interviews were used to complement quantitative data. The data collected through this method were analyzed thematically. From the data analyzed, the study has found a large information and knowledge gap among PhD students. The gap spans across areas such as required technologies, computer working environments, recommended ergonomically friendly operational procedures, and effects of poor computer ergonomics. The study has also found that interpersonal communication through colleagues/friends, informal discussions within PhD clubs, medical officers or physiotherapists, social media and other internet sources are the dominant computer ergonomics information sources. Inspired by Ranganathan's theory, the study, among other things, recommends striking a balance between information sources so as to more effectively meet users' information needs.

Key words: Information access to and use; computer ergonomics; computer ergonomics information; PhD students; habitual computer users; universities

Introduction

For about two decades now, computers have turned into an essential component of almost any work, such that it is hard to find a profession that does not use them (Choobineth et al., 2006; Shi, 2011). Today, firms use computers as operational, tactical, and strategic tools in order to gain competitive advantage. In other words, these devises are now compulsory working tools for individuals; be it in formal and informal work environments or for in personal activities. In fact, computers are heavily used in manufacturing, agriculture, health, telecommunication, and logistics to mention a few. For instance, thanks to computers, electronic services such as e-learning, e-banking, e-procurement, e-health, e-government, e-

voting, e-commerce, e-dating, e-ticket booking, and e-mailing are common today (Masele & Kagoya, 2018). Individuals that mostly use computers in their work are termed as habitual computer users/operators (Barnatt, 2010). Barnatt (2010) states that these individuals include secretaries, typists, data entry clerks, telesales operators, and academicians whose jobs depend more or less on computers and related equipments. For these individuals to get the most out of these devices, their safety has to be ensured. As such, computer related safety measures including proper ergonomic positioning are paramount (Benmoussa et al., 2019; Mowatt et al., 2017). In this regard, unless they are well informed on proper ergonomic [referred to as the science of fitting workplace conditions and job demands to the capabilities and inabilities of an individual worker (Salvendy, 2001)] requirements, habitual computer users will remain vulnerable to computer usage safety and health risks.

Rodrigues (1993) envisages that with good positioning, good work place design, and good working practices in general; computers are clean, quiet, and safe to use. However, if not properly used they can be dangerous to users' health and safety. Studies (Grandjean, 1987; Punnett & Berqvist, 1997; Tittranonda et al., 1999; Marcus et al., 2002; Munshi, Varghese & Dhar-Munshi, 2017; Mohan et al., 2019) indicate that prolonged computer usage together with improper work habits, poor posture, poor workstation design, and poor work environment can cause muscle soreness, fatigue, and injury. These factors are also known to cause eye strains, upper musculoskeletal system or frequent neck and shoulder pains (Zhiyong & Nina, 2003; Wilson & Best, 2005; Munshi, Varghese & Dhar-Munshi, 2017; Mohan et al., 2019).

Like with other habitual computer users, the health risks associated with computer usage faced by scholars are alarming and require immediate attention. For example, a survey involving 1544 graduating seniors at Harvard University reported that over half of them experienced symptoms connected to these risks with 12.6% of them indicating to experience such symptoms after computing for one hour or less (Katz et al., 2000). The risk factors identified by the study were academic concentration in computer science and using a computer for more than 20 hours per week. A study by Masele & Kagoya (2018) indicated that the mean number of hours respondents spent on computers doing PhD related work per day was 8 or more. Consequently, the students reported to experience various ergonomic related health risks like eye strains resulting in eye defects, sight fatigue, headaches, tension stress, limbs disorders, double vision. Apart from that, some of the students that had just finalized their thesis had disk inflammatory/degenerative disorders. The study also revealed that in some cases, the health problems were severe enough to require flying students to hospitals and other physiotherapy centers for medical attention that resulted in unexpected expenses (Masele & Kagoya, 2018). As such, unless the situation is checked in advance, many computer operators are likely to face medical expenses, miss career opportunities, perform poorly at work, and have reduced quality of life and productivity. The situation is also likely to increase compensation claims.

Therefore, PhD students' computer usage must be kept optimal in respect of usage safety and health requirements. Benmoussa et al., (2019) stress that adhering to and application of ergonomics principles largely increases efficiency, thus improving performance. Pater & Button (1992) add that adherence to computer ergonomics principles reduces fatigue, negative work stress, and helps to keep skilled staff on the job while improving internal public relations and reducing liability exposure. In fact, it is of no use obtaining a doctorate degree only to end up with permanent ill-health due to something that could have been easily avoided.

Available evidence indicates that studies related to computer ergonomics problems have had a medical point of view with little attention paid to the information context. For some studies (such as Mvungi et al., 2008; Sadeghi, et al., 2012; Keykhaie et al., 2014; van Dijk, et al., 2015; Kumah et al., 2016; Sirajudeen et al., 2017), information aspects have only appeared in their recommendation sections. However, some studies (Sadeghi, et al., 2012; Keykhaie et al., 2014; van Dijk, et al., 2015) have acknowledged that computer users knowledgeable about computer ergonomics requirements and risks are usually integral parts of workplace safety programs. This is because, knowledge plays a crucial role in the behavioral patterns one adopts (Kumah et al., 2016). In fact, limited knowledge on computer ergonomics among users affects their work habits, adopted postures, and perceptions of the discomforts they experience (Kumah et al. (2016). It is from this milieu that the role of information and knowledge in minimizing health risks related to computer usage comes in.

Information, defined as knowledge in communicable form, is recognized today as one of the main requirements for development that everybody needs on a daily basis to be able to carry out any activity. Unless one is informed, he/she cannot be knowledgeable. According to Moursund (1999), knowledge is information in accumulated form. This study opines that, the more PhD students are informed about risks associated with improper computer usage; the more likely they are to follow ICT safety and health requirements.

Mitchell (1994) considers information as a therapy important in empowering people with self-care abilities. Levin et al. (1979) defined self-care as "an intentional behaviour that a lay person takes on his or her own behalf, or on behalf of the family, friends, or community to promote health or treat illnesses". Evans (2001) advances that information is an important tool that people work with when they are thinking. Information is thus important for behavioural change as it interacts with the inner mind, altering it in relation to the outer world. However, studies (Koller et al., 2001; Powell & Smith, 2003) assert that people cannot use information in whatever format it is unless they have access to it. According to Mathiesen (2014), a person has access to information when he/she has the freedom or opportunity to obtain, make use of, and benefit it. Despite the presence of numerous studies on computer ergonomics, to the best of the researcher's knowledge, no single study has examined access to and use of computer ergonomics information among computer users in East Africa. It was against this background that this study was formulated so as to assess access to and use of information related to computer ergonomics among habitual computer users in developing countries.

In East African as well as Sub Saharan Africa, ergonomics is a relatively novel concept and yet to be considered by most enterprises as an essential component of their work environments. A study by Masele & Kagoya (2018) conducted at the University of Dar es Salaam -Tanzania and Makerere University- Kampala, Uganda, revealed that little attention was paid to ergonomics issues among universities. Although the study conducted by Mvungi et al. (2008) at National Institute of Medical Research (NIMR) - Tanzania recommended that all computer users be given relevant information relating to their health and safety, its focus was on health hazards related to computer use. In particular, the extent to which PhD students access and use computer ergonomics information is still unclear. As a result, this study was carried out. Understanding this phenomenon has practical implications to parties responsible for the formulation of information and communication strategies for providing information to PhD students. The study is also likely to inform policy makers on how to minimize computer ergonomics related risks and improve computer working environment. The present study, first of its kind in East Africa, aimed at assessing PhD students' access to and use of

information related to computer ergonomics at University of Dar es Salaam in Tanzania and University of Makerere in Uganda. Specifically, the study sought to:

- Establish computer ergonomics information needs of PhD students; and,
- Assess computer ergonomics' information sources accessed and used by PhD students.

Literature review

The Ranganathan Five Laws of Information Use

Ranganathanian thinking on the use of information has been one of the very prominent theories used to explain information needs, access, and use. Ranganathan presented five laws related to information science for the first time in 1928. A number of changeover from the words 'book/s' to 'document/s' to 'link/s' to 'software' to 'libraires' to 'information', 'tapes' etc. have happened depending on contexts (Sen, 2008). Of course, many have tried to put old wine in a new bottle implying that they are averse to the criticism of Ranganathan (Sen, 2008). The five laws include: 1. Information is for use; 2. Every user his or her information; 3. Every piece of information its user; 4. Save the time of the information user; and, 5. The universe of information is ever growing.

Critically looking at these laws, the core essence is to fight for users' right to information of all kinds. The second law in particular provides roots to the freedom to access information and knowledge in the forms of all kinds. According to Bhatt (2011), in order to make effective use of these laws, bodies responsible for information provision must adopt marketing tools such that all potential sources are well known and utilized by potential respective information users. Mathiesen (2014) conceived "5 facets of information access" where he expounds that, for information to be accessible; it must meet the five facets which are: (1) availability, (2) reachability, (3) findability, (4) comprehensibility, and (5) usability. Considered as active users, information users will only consider information or communication to be effective if it is goal directed. This means, ergonomics information should not only be accessible but also able to meet both hosting universities and PhD students' computer ergonomics information needs. Otherwise, the information sources may be rendered less important. It was for this reason that the Ranganathan's laws were considered relevant and useful in guiding the efforts to understand PhD students' access to and use of information related to computer ergonomics. The study presupposed that, unless computer ergonomic information available is relevant, accessible, in right format, complete, and useable; its presence will make no difference. Consequently, users will remain prone to health risks related to computer ergonomics.

Information and its role in fights against workplace computer ergonomics problems

According to Nyam, Akawe, and Tyonun (2015), just like food, shelter, and cloths, information is indisputably one of the necessities of life. According to Evans (2001) information is needed in all spheres of life to facilitate decision making and engendering progress. The author also considers information as an input to our minds that we work with when thinking. Information interacts with the inner mind, altering it based on the outer world for behavioral change. Dervin et al. (1980) see information as anything a person finds informing, through which people perceive to have a sense of control and power. Mitchell et

al. (1994) consider information as therapy, which according to Levin et al. (1979), provides people with assistance needed in self-care a lay person takes on his or her own behalf, or on the behalf of a family, friends, or community to promote health or to treat illness.

However, Elly & Silayo (2013) supposes that users are conceived of as active, such that, for information or communication to be effective, it has to be goal directed. The essence of goal specific information entails context, location, and other factors such as accessibility. These elements are relevant in defining information needs of a particular group of users. It is thus very pertinent to address the information needs of a particular group of individuals from their context, environment, engagement work, and responsibilities (Elly & Silayo, 2013; Joshi et al., 2015). Savolainen (2007), points out that context is relevant in information behaviour, which is described as how people need, seek, manage, and use information. For example, the needs of computer ergonomics information users may differ as a result of the type of working station, the room one is given, the positioning of chairs and tables, and screen brightness. Koller et al. (2001) assert that people seek information that they perceive to be relevant to their contexts and tend to use sources that are accessible physically and technically (Koller et al., 2001). Powell and Smith (2003) add that people cannot use information in whatever format unless they have access to it. In other words, for computer ergonomics information to be effective, it has to be accessible and relevant to users' needs.

According to NCIPC (1989), injury prevention strategies are grouped into Passive Structural Strategy and Active Behavioral Strategy. Passive approaches involve changing products or environments by the responsible authority to make them safer for all, irrespective of the behavior of individuals (NCIPC, 1989; Nzyuko, 2015). For example, in some developed countries like the UK, there is a legislation to protect computer operators from the risks inherent in computer use (ScreamSaver, 2001) by setting out computer use legal requirements for employers. The requirements aim at ensuring that; all computers fit a minimum specification for health use, all work stations are assessed for risks; and computer equipment are fit for the job at hand to avoid strains and discomfort (Ankrum & Nemeth, 1995).

Active approaches as opposed to passive approaches rely on individuals to take an active role in protecting themselves, irrespective of hazards in their environments (NCIPC, 1989). In connection to active behavioural approach, DiLillo et al. (2002) argue that it is not possible to reduce injuries without some element of behaviour change. One must understand his/her vulnerability and develop the desire for protection and corrective actions. The argument is in line with Geller (1998) who asserts that although change of behaviour into an unpleasant or unwelcome one is not automatic, after some practices, the new behaviour becomes self-directed, habitual, or automatic. From this context, institutions offering PhDs and individual computer users are both responsible for ensuring that computer usage is ergonomically friendly through employment of required passive and active strategies. However, this is only possible when people have relevant information on computer ergonomics. TRozlina et al., (2012) connect the failure to comply with computer ergonomics principles with ignorance or indifference where some organizations or at least managers simply do not realize the value of ergonomic planning. All the same, PhD students need to actively change in behaviour so as to ensure that irrespective of how the working environment are prepared by hosting institutions, they can still ensure a safe usage of computers. Sirajudeen et al. (2017) argue that sound ergonomic knowledge and skills are essential in enabling computer users to identify and solve workplace computer ergonomics problems through identifying hazards and managing them.

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A study conducted by Sadeghi, et al (2012) involving 75 computer users showed that knowledgeable groups of computer users had positive attitudes towards and insights about computer ergonomic principles. This finding supports Rodrigues' (1993) argument that technology is not a problem in itself, but rather the manner in which it is used. In fact, ensuring good workplace design and good working practices including positioning of computers and taking regular breaks from using them are all responsibilities of human beings (Rozline et al., 2007). Therefore, a well-informed PhD student is likely to actively ensure that the hardware/software, tables, chairs, room lighting, and background environment are in appropriate balance so as to ensure safety. Mowatt et al., (2017) argue that modification of study environments and provision of user education are the best strategy for preventing many computer ergonomic related problems.

However, despite the existence of abundant literature on computer ergonomics, to the best of the researcher's knowledge, studies with focus on access to and use of computer ergonomics information among PhD students in the study area are lacking. As such, the literature available has been found to have nothing on sources of information related to computer ergonomics accessed and used by PhD students or how their information needs are being attended to. This is what pushed the researcher to carry out this study.

Methodology

This study was conducted involving PhD students enrolled in various PhD programs at the University of Dar es Salaam (UDSM) and Makerere University (MUK). Involving PhD students in this study was considered important given the amount of computer usage they require in their studies. Worldwide, PhD study journey not only takes the longest period of time compared to other tertiary levels but also involves a lot of prolonged sitting in front of computers to work. Evidence indicates that PhD studies range from three to six years or more, with a mean of more than 8 hours spent working on computers per day (Masele & Kagoya, 2018). Masele & Kagoya (2018) exemplify that under the Tanzanian University Qualification Framework, out of the 540 credits considered as a minimum requirement for PhD, half (270 credits) are contributed by dissertations while coursework is responsible for the remaining 270 (TCU, 2012). This is unlike in bachelor and masters study levels where learning is characterized by lectures and less of individual assignments (TCU, 2012). In Uganda, the minimum number of credit hours is 240 which are supposed to be covered in at least six semesters (three years) as compared to only 120 credits completed in three years under bachelor degrees or one to two years for masters level (NCHE, 2011). In contrast, in Rwanda, a minimum of 540 credits have to be completed at PhDs level while masters' students have to complete only 180 credits (Rwandan Qualification Framework, 2007). In Europe, a PhD takes a minimum of 4 calendar years which is equivalent to a minimum of 480 credits hours (UCL, 2015). Selection of PhD students was thus considered representative of other habitual computer users in the region. UDSM and MUK were purposively selected because both of them are old and relatively large universities in East Africa with each having many PhD programs as compared to other new universities in the region.

This study employed a descriptive research design which according to Kothari (2004) seeks to obtain relevant and precise information on the current status of a problem or phenomenon and whenever possible, draws valid general conclusions from the facts discovered. A cross-sectional survey employing close-ended questionnaires was done involving conveniently selected PhD students from the two universities under study. The

study employed electronic and printed questionnaires which were used depending on each respondent's preference. Respondents were left to fill the questionnaires at their own time. The responses from individual respondents were later on collected or mailed back physically or electronically to the researcher. Although the study targeted a sample of 250 PhD students, at the time data analysis was carried out, 221 had responded (a response rate of 88.4%).

To ensure validity of the questionnaire: the questions were adapted from previous related studies and previewed by experts before being pretested on twenty (20) respondents (Saunders et al., 2003). A Cronbach's alpha coefficient of 0.877 was obtained in a reliability test that proved that the instrument was reliable (see also Saunders et al., 2003; Hair et al., 2010). The quantitative data collected was analyzed for data reduction employing factor analysis and descriptive statistics to find frequencies and mean values, and rank the sources of information accordingly. All of the quantitative data analysis was done using Statistical Package for Social Services (SPSS version 22) software. In-depth interviews were carried out involving 6 PhD students who willingly volunteered and had indicated to have been highly affected by their prolonged computer usage. The qualitative data gathered through interviews complemented the quantitative data collected and were analyzed thematically (Leeach & Onwuegbuzue, 2007). The data was used to expound the discussion of the findings from the main survey.

Findings

Respondents' characteristics

In terms of study programmes, the results show that Information Studies contributed 11 (4.9%) respondents, Business Administration 53 (24.0%), History 4 (1.8%), Education 16 (7.2%), Sociology 2 (0.9%), Mathematics 23(10.4%), and ICT 41 (18.6%) respondents. The findings also show that Political Science and Public Administration contributed 6 (2.7%) respondents, Economics 18 (8.1%), Botany 2 (0.9%), Environmental Science 4(1.8%), Kiswahili 3(1.4), Linguistics 5 (2.3%), NARAM 10 (4.5%), Laws 5(2.3%), Archaeology 4(1.8%), Chemistry 5 (2.3%), and Development Studies 9(4.1%).

As indicated in Table 1, out of 250 targeted respondents, a response rate of 88.4% equal to 221 participants was achieved by the study. Among these, 151 (68.3%) were from UDSM and 70 (31.7%) from MUK. Regarding the profile of the respondents, the results show that 150 (67.9%) of them were males while 71 (32.1%) were females. Apart from that, the study indicates that just over half (117: 52.9%) of the respondents were aged between 31and 40 years, followed by 85 (38.55%) aged between 42 and 50 years. Still on age, the findings show that 17 (7.7%) respondents were of above 50 years of age while only 2 (0.9%) were aged below 30 years. Regarding the duration of studies, the findings indicate that 84 (38%) respondents had spent between one to three years on their PhD studies, followed by 80 (36.2%) who had already spent between three to five years while 20 (9%) had already spent more than five years. The findings further show that 37 (16.7%) respondents had spent less than one year on their ongoing studies. The mean number of hours respondents spent on computers for their PhD works was 8.20. In fact, 78 (35.3%) respondents used 8 hours on their computers, followed by 16.7% who spent 9 hours, 14.5% who spent 10 hours, 10.4% who spent 6 hours and another 10.4% who said they were using 7 hours of their day on computers. In general, the findings imply that a total of 193 (87.3%) respondents worked on computers for not less than 6 hours (see Table 1).

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Table 1: Respondents' characteristics

Item	Attributes (n = 221)	Frequency	Percent
University	UDSM	151	68.3
	MUK	70	31.7
PhD study programs enrolled	Information Studies	11	4.6
	Business Administration	53	24.0
	History	4	1.8
	Education	16	7.2
	Sociology	2	0.9
	Mathematics	23	10.4
	ICT	41	18.6
	Political Science & Public administration	6	2.7
	Economics	18	8.1
	Botany	2	0.9
	Environmental Science	4	1.8
	Kiswahili	3	1.4
	Linguistics	5	2.3
	Natural Resource Assessment &Management	10	4.5
	Laws	5	2.3
	Archeology	4	1.8
	Chemistry	5	2.3
	Development Studies	9	4.1
Age	Below 30 years	2	0.9
	Between 31- 40 years	117	52.9
	Between 41- 50 years	85	38.5
	Above 50 years	17	7.7
Gender	Male	150	67.9
	Female	71	32.1
Years into PhD studies	Under One year	37	16.7
	Between One year and Three years	84	38.0
	Between three years and five years	80	36.2
	Above Five years	20	9.0
Number of hours spent working on a computer on daily basis	Four (4)	10	4.5
	Five (5)	4	1.8
	Six (6)	21	9.5
	Seven (7)	22	10
	Eight (8)	78	35
	Nine (9)	39	18
	Ten (10)	34	15
	Eleven (11)	6	3
	Twelve (12)	3	1.4
	Thirteen (13)	3	1.4
	Fourteen (14)	1	0.5

PhD students' computer ergonomics information needs

In order to establish PhD students' computer ergonomic information needs, a factor analysis was used to find and classify the computer ergonomics information needs presented by the students. The factor extraction was done using principal components analysis. Items that did not load strongly (i.e. loading below 0.50 of variance) were dropped (see also Hair et al., 2010). To assess factorability of data, a Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were used. As indicated in Table 2, the Bartlett's test of sphericity was significant at p-value 0.000<0.05 and KMO value of 0.873>0.5 implying that the values were above the recommended cut-off point of 0.5 (Hair et al., 2010). According to Table 3, PhD students using computers needed information related to suitable technology, suitable computer working environment, recommended operational procedures, and side effects related to poor computer ergonomics. The respondents required this information in order to plan for appropriate ergonomics strategies for their PhDs including selecting ergonomically friendly hardware and software as well as what to immediate when signs of injury are noticed.

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.873
Bartlett's Test of Sphericity	Approx. Chi-Square	6269.088
	Df	780
	Sig.	.000

Table 3: Factor analysis of the computer ergonomics information needs

	Component			
	1	**2**	**3**	**4**
CER5-Awareness on back and neck ache risks facing computer users	.810			
CER4- Awareness on eye strains and headache risks facing computer users	.766			
CER6- Awareness on wrist and hand disorders risks facing computer users	.728			
CER3- Awareness on disk inflammatory/degenerative disorders risks	.624			
CER2-Understanding the general vulnerability related to habitual computer usage	.620			
TF4-Ensuring that no item of workstation equipment generates excess heat that could cause discomfort		.830		
TF5-Using a flat screen monitor compliant with CRT displays in order to screen electromagnetic radiation outside of the visible spectrum to negligible levels		.791		
TF6-Employing software to provide feedback to users on its status and performance		.786		
TF3-Ensuring that radiation reduction shields are provided to the computer in use		.791		

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WE3-Provided with ergonomic tables that have adjustable base for keyboard	.831	
WE2-Provided with adjustable seat height as well as adjustable back height and tilt to support prolonged computer working.	.820	
WE5-Provided with foot and hand support in ICT working environment	.735	
PR3-Standing and pose after every periods of working with a computer		.855
PR5- PR4-Positioning of screen in relationship to eye level, wrist and forearms		.815
PR6-Taking regular short breaks from computer to reduce ergonomic workload like after every 30 minutes		.793
PR2-Timing for display screen equipment users to close their eyes for 30 seconds every 15 minutes or so		.718
PR1-Keyboard height positioned to allow the user to maintain elbow in 90° flexion		.704

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

NOTE: *CER- Computer ergonomics risks; TF- Technological factors; WE- Working environment; PR- Operational procedures*

In response to information they possessed relating to postures of head, neck, trunk, wrist and hand, and thigh and feet in relation to computer monitors, key boards, chairs, and tables, the study findings show that there was a vital information and knowledge gap among students at the surveyed universities. The major information and knowledge gaps identified in this study are related to the required technology, computer working environment, recommended ergonomically friendly operational procedures, and side effects related to poor computer ergonomic risks. These needs explain the fact that most of the respondents reported to have in one way or another suffered from issues related to poor computer ergonomic working environment. For example, the types of ergonomic related suffering with their respective percentages as presented in Table 4 indicate that: 80.5% of respondents had suffered from backaches, 78.2% suffered from neck-aches, 75.6% suffered from headaches, 62.4% suffered from wrist and hand pains, 58.4% suffered from eye strain disorders, 47.6% suffered from watering eyes while 47.0% suffered from blurred vision. About 27% of respondents had ever been absent from work, and 14% had ever been hospitalized due to disorders resulting from prolonged computer use.

Table 4: Computer ergonomics related safety and health problems experienced by respondents

Statements	**Responses**				
	Never	**Seldom**	**Sometimes**	**Often**	**Always**
Suffered from eye strain disorders	49(22.2%)	23(18.4%)	61(27.6%)	42(19.0%)	26(11.8%)
Suffered from blurred vision.	59(26.7%)	58(26.2	49(22.2	39(17.6	16(7.2%)

		%)	%)	%)	
Suffered from watering eyes.	64(29.0%)	62(23.5 %)	51(23.1 %)	43(19.5 %)	11(5.0%)
Suffered from headaches.	24(10.4%)	31(14.0 %)	85(38.5 %)	57(25.8 %)	25(11.3 %)
Suffered from backaches	16(7.2%)	27(12.2 %)	91(41.2 %)	48(21.7 %)	39(17.6 %)
Suffered from neck aches.	21(9.5%)	26(11.8 %)	82(37.1 %)	54(24.4 %)	37(16.7 %)
Suffered from wrist and hand pain.	37(16.7%)	46(20.8 %)	61(27.6 %)	57(25.8 %)	20(9.0%)
Have been absent from work	114(51.6 %)	47(21.3 %)	24(10.9 %)	19(8.6%)	17(7.7%)
Have been hospitalized	136(61.5 %)	53(24.0 %)	17(7.7%)	11(5.0%)	4(1.8%)

The responses relating to recommended ergonomic procedures indicate that only 123 (55.6%) respondents had knowledge on periodic time for breaks or changing of activity so as to reduce body workload. Further, the study shows that 115 (52.0%) respondents had knowledge on the importance of standing and posing after every certain periods before the onset of fatigue, 106 (47.9%) had knowledge on the importance of timing for display screen equipment and closing eyes for 30 seconds every 15 minutes or so. Apart from that, 79 (35.7%) respondents said they were knowledgeable of the need to position screens in relationship to eye level, wrist and forearms while 69 (31.2%) were knowledgeable of keyboard height positioning to allow a user to maintain elbow in 90° flexion.

Responses relating to working environment were as follows: 111 (50.2%) respondents opined that providing respondents with ergonomic tables with an adjustable base for a keyboard could save users from ergonomic risks; 105 (47.5%) respondents mentioned that positioning their chairs in relations to seat height as well back height, tilt together with adjustability and adaptation to the lumbar curve could save them from computer ergonomic risks and; 45 (20.3%) respondents indicated that the provision of foot and hand support in ICT working environment has an impact on the prevention of ergonomic risks. Responses regarding awareness on risks relating to poor computer ergonomic settings indicate that majority of respondents were unaware of the following: back and neck ache risks 59.1%; eyes strains and headaches risks (62.6%); wrist and hand disorders risks (46.3%); disk inflammatory/degenerative disorders risks (47.2%) and; vulnerability related to habitual computer usage (41.7%).

Information related to the technology behind the computers in use indicated that majority of respondents were not aware of how suitably the technology could be positioned. In fact, only 34 (15.4%) were aware of the importance of employing software to provide feedback to computer operators on computers' status and performance; 131(59.2%) were aware of the importance of ensuring that no item of their workstation equipment generated excessive heat that could cause them discomfort. In addition, 107(48.5%) respondents said they were informed on the importance of using flat screen monitors compliant with CRT displays in order to screen electromagnetic radiation outside of the visible spectrum to negligible levels. Apart from that only 26 (11.8%) respondents were informed on the importance of ensuring that radiation reduction shields are available on computers in use.

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Access to computer ergonomics information

The second objective of this study was to identify and profile the sources/channels of computer ergonomics information commonly used and accessed by the PhD students under study. To do this, a descriptive analysis was used to rank the importance of the sources from the data collected using a five-point Likert scale (1 – not important at all to 5 – very important). As presented in Table 5, it was revealed that interpersonal communication involving colleagues/friends was the dominant source of computer ergonomics information and knowledge among the PhD students as confirmed by 132 (72.9%) respondents. This was followed by informal discussions within established PhD clubs (140: 63.3%); medical officers or physiotherapists (103: 56.9%); social media including Facebook, Twitter, WhatsApp, and Instagram and internet sources. These were followed by university unit systems administrators (130: 71.8%). The other sources that were mentioned are TV medical sessions, public health exhibition and addressing systems, radio, instructors and supervisors, and NGOs. Poster, brochures/leaflets, newsletters, health magazines, and newspapers were also mentioned. Unfortunately, sources like information centres, books and articles, and libraries which are considered important in ensuring information access and dissemination (UNESCO, 2001) featured poorly on the least with a mean of 2.52. A more or less similar state was echoed by some interviewees. For example, while probing interviewee #1, a UDSM PhD student pursuing Business Administration, he argued:

> In most cases, we rely to a great extent on our networks including friends some of who are from our PhD club. Social networks such as WhatsApp have overtaken a number of information sources that were once considered unavoidable. Any important information including that related to computer ergonomics is shared among our networks.

A more ore similar reflection was noted from interviewees #2, a PhD student pursuing Mathematics at MUK who commented that:

> When it comes to sensitive medical issues such as ergonomics, my most trusted sources of information are medical doctors and physiotherapists. When I have such a problem some of my close medical doctors and/or my physiotherapists have been reliant ergonomics information sources. Otherwise one has to be a really close and trusted friend or relative if I am to share such information with them. With the emergency of social networks especially WhatsApp, valuable information including that on ergonomics is shared through re-transmission from one WhatsApp group to another.

Table 5: Information sources for computer ergonomics requirements

Information source	N	Mean	Rank
Interpersonal communication	221	4.06	1
PhD club informal discussions	221	4.05	2
Medical/physiotherapy officers	221	4.02	3
Social media e.g. Facebooks; Twitter; WhatsApp; Instagram	221	3.98	4

Internets sources through Search engines and health related databases	221	3.97	5
Television	221	3.95	6
Systems administrator	221	3.94	7
Public health exhibitions and addresses	221	3.93	8
Radio	221	3.71	9
Instructors and supervisors	221	3.69	10
NGOs	221	3.69	11
Posters	221	3.57	12
Leaflets/brochures	221	3.48	13
Newsletters	221	3.45	14
Health magazines	221	3.43	15
News papers	221	3.43	16
Information centers	221	2.99	17
Books and articles	221	2.95	18
Library	221	2.52	19

During interview sessions, the role of training and education was very clearly. For example, during a session, interviewee #3, a PhD student from a business school at UDSM pointed out that:

> … if students were oriented to computer ergonomics in their early days of using computers or at least immediately as one joins PhD studies, it would have been very instrumental in creating awareness on computer safety and health issues related to computer usage. This could go along the provision of manuals on safety and health usage of computers in order to inculcate knowledge relating to computer ergonomics among users.

This argument is in line with an argument by Mowatt et al. (2017) that says universities should seek mechanisms for educating students of the importance of good computer usage practices. The authors exemplified important orientation aspects to include safety measures, early signs and warnings of health problems. Interestingly one interviewee, labelled #4 from school of Law at the University of Dar es Salaam argued that"…as grown up individuals, PhD students need to adopt an active approach to looking for informational materials and equipments by themselves". A similar argument was posed by an economics student labelled #5 from Makerere University. The two informants demonstrated how assuming an active role had helped them to keep themselves free from ergonomics problems regardless of the inadequacy of passive measures. Another interviewee pursuing a PhD in computer science at Makerere University labelled as #6 argued that:

> Health checkups for at least once per year are crucial in order to stay informed on any early warnings related to computer ergonomics risks including how to properly handle them.

These and similar arguments imply that some users have assumed active roles in protecting themselves from health issues arising from computer usage. That is to say, computer users should not completely wait for passive measures to happen in order to protect themselves but rather assume active roles to do so.

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Discussion

This study has shown a large information and knowledge gap available among PhD students in the surveyed universities. Consequently, most of the respondents in the study revealed to have, in one way or another, experienced health issues due to poor computer ergonomic working environments. The major information and knowledge gaps identified related to required technologies, computer working environments, recommended ergonomically friendly operational procedures, and side effects related to poor computer ergonomic risks. On the other hand, the students appear to have information relating to head, neck, trunk, wrist, hand, thigh, and feet postures in relation to computer monitors, key board, chair, and tables. These findings are more or less similar to those found by Mvungi et al. (2008) in a study conducted at NIMR. These researchers revealed that 50% of respondents were complaining that their chairs did not support their legs in a horizontal position while 32% of the respondents were complaining that their chairs did not allow their feet to touch the floor firmly. The findings are also consistent with what Shikdar & Al-Kindi (2003) found. The researchers reported that neck, back, and shoulder discomforts, eyestrain, burning and itchy eyes, headaches and red eyes were the prominent disorders. These symptoms could be attributed to poor workstation ergonomics ranging from bad lighting conditions, bad ventilation, and monitor placement (Ankrum & Nemeth, 1995) among others. Mvungi et al. (2008) also associated the observed working environment shortcomings with the presence of complaints made by 63% of respondents about pains in the upper backs, shoulders, and necks and; 44.4% of respondents who complained about tightness discomfort, stiffness or burning on the hands, wrists, fingers, and forearms or elbow.

These findings are also similar to others made by studies on computer ergonomics information needs like ones by Joshi et al. (2015) and Sirajudeen & Siddik (2017) conducted in India, and Kumah et al. (2016)) carried out in Ghana. The study by Joshi et al. (2015) was conducted among computer users at state agricultural universities students in India. The study indicated that majority of respondents did not have adequate knowledge about computer ergonomics including the risks related to improper computer usage. The study also has revealed a more or less similar situation to that pictured from findings from Sirajudeen & Siddik (2017) in which 34.4% of respondents were unaware of healthy postures related to elbow, wrist, and hand issues, 39.5% did not know about the positioning of a mouse, and 47.4% were not knowledgeable about the positioning of monitor with respect to eye. A study by Kumah et al. (2016) also indicated that almost half (50%) of respondents were unaware of monitors positioning despite working with computers while most (70%) of the respondents acknowledged not having knowledge of ergonomics, and all (100%) respondents noted that they did not have any ergonomic assessment of their workstations. Understandably, Mvungi et al. (2008) recommended that all computer users should be given relevant information relating to their health and safety in order to impart them with knowledge that will change their attitude towards possible problems emanating from computer usage. Mohan et al. (2019) add that dissemination of knowledge among employees and strict legislations and guidelines put in place by governments could be used as preventive, curative, as well as rehabilitative measures for those with complaints of ergonomic related problems.

Interpersonal communication, defined as communication between people whose lives mutually influence each other, might have been dominant because aspects like ergonomics problems are part and parcel of medical and personal concerns that most individuals would not like to share with anyone unless they are closely related. According to Hartley (1993), interpersonal communication does not simply mean the exchange of messages between two people; it actually focuses on the exchange and creation of meaning. Blake (1979) adds that without knowing someone, at times, one would not feel free to engage in interpersonal communication or getting into very personal concerns. This "openness" characteristic reflects the cultural influence of trust and warmth (Diop, 1978). This may also explain why informal discussions within established PhD clubs were second. PhD clubs appear to be considered instrumental in bringing together PhD scholars of certain academic units for academic discussions thus bringing them closer to each other. As a result, they can easily learn from each other by trusting one another to the extent of freely sharing information. According to Madzingira (2001), interpersonal communication is a part of the traditional structure of most African communities that save as communication networks for the kinds of contents that usually flow in a neighbourhood. This may imply that, the more the colleagues/ peers/family members have access to proper information related to computer ergonomics, the better.

Ranked third as an important source of ergonomic information, medical officers and physiotherapists play an enormous role of closely interacting with patients including PhD students faced with computer ergonomic related problems. This may also explain why they were rated high in the ranking. Social media and other internet sources followed. Madzingira (2001) argues that if the emergence of social networks is strategically taped, it will ubiquitously offer help to leverage the capability of interpersonal communication in computer ergonomics information exchange. Other sources including TVs, radio, information centres and library etc., ranked low. This finding sparked the attention of this study which resulted in urging responsible authorities to identify the right mechanisms for disseminating information related to computer ergonomics to targeted computer users in universities. The study thus advocates as per Mathiesen (2014) 5 facets of information access for the need to ensure that relevant computer ergonomics information is available, reachable, findable, comprehensible, and useable in order to meet PhD students' computer ergonomics information needs.

Besides, the study theorizes as per Kisusi & Masele (2018) that a combination of strategies should be used. For example, television broadcasts, radio broadcasts, exhibitions, composed stories, songs, dance, poems, and others methods should be used to offer positive results in efforts to protect users from dangers related to computer usage. Libraries, being essential components of any strategy aimed at improving information usage including promoting free flow of ideas and to maintaining, and increasing and spreading knowledge (UNESCO, 2001), should not be forgotten in the recipe. Social networks (such as Facebook, Twitter, blogs and Instagram), newspapers, health magazines, and other print media such as brochures, billboards, posters, pamphlets, and books may have positive results when properly used. In East Africa, social networks use has, among others, been boosted by the growing use of mobile phones which are affordable and easy to use for most people. As such, they require special attention when planning computer ergonomics information dissemination.

Conclusion and study implications

This study's findings have showed that PhD students lack information and knowledge in areas such as suitable technologies, suitable computer working environments, recommended

operational procedures, and side effects related to poor computer ergonomics. The study has also shown that dominants sources of information computer ergonomics for PhD students are interpersonal communication as well as established PhD clubs. Other prominent sources were medical officers or physiotherapists. Social media, including Facebook, twitter, WhatsApp, and Instagram and other internet sources have been reported as important ones followed by university unit systems administrators, TV medical sessions, public health exhibitions, radio, instructors and supervisors, and NGOs. In contrast, other sources such as information centres and libraries rated low. This study has number implications practically, theoretically, and policy wise.

The study strongly emphasizes the need to ensure that PhD students are well informed of what is expected of them with regards to computer usage as soon as they start their studies. This will be instrumental in the creation of awareness on computer usage safety. PhD hosting institutions should therefore formulate education/training and awareness creation programs appropriate for improving individuals' knowledge, insights, and attitudes on safe ways of using computers. The programs should also focus on enhancing understanding personal vulnerability associated with computer age and devising safety mechanisms. Therefore, computer ergonomics education needs to be provided right from when people start using computers. In support of this, Sirajudeen et al. (2017) argues that computer ergonomics education and training should begin preferably at the student level; a transitional period between education and working. Otherwise, people are more likely to enter their chosen profession with poor computer usage behaviours. With the help of information, PhD students will take active measures to ensure that their computer usage environments are safe enough to prevent health issues. Apart from that, establishing policies, laws, and regulations by governments and their responsible ministries and agencies can aid in influencing desired behaviour changes among PhD students. In addition, this recommends that every source of information must be optimized so as to meet diverse users' needs. In fact, strategies that will ensure feasible combinations of various computer ergonomics information sources to meet users' needs are highly recommended.

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