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OPINION POLL ON NIGERIAN UNIVERSITY STUDENTS' AWARENESS OF THE HEALTH IMPLICATIONS OF INADEQUATE ERGONOMIC FURNITURE IN UNIVERSITIES OF SOUTH-EAST NIGERIA

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Abstract *This study examines the "Nigerian university students' awareness of health implications of inappropriate ergonomic furniture". It sought to determine how knowledgeable Nigerian university students are on appropriate ergonomic chairs, how ergonomically appropriate the student-centred facilities like lecture halls, libraries, laboratories, relaxation centres and examination halls in Nigerian public universities are, the extent to which the students experience symptoms suggesting musculoskeletal disorder, and their awareness of the health implications of inappropriate ergonomic chairs. Survey research method was employed while the questionnaire served as the instrument for data collection. The respondents chosen were students of federal universities selected from the southeastern states. 400 copies of the questionnaire were distributed while 386 copies were returned and found useable. Health belief model was also employed to determine the ways the respondents take health preventive actions against one-size-fits-all furniture ergonomics. Findings generally demonstrate that majority of the students do were not aware of the health implications of in adequate furniture. Also, majority of them do not report the symptoms of musculoskeletal disorder despite the fact that they experience such symptoms which arose as a result of their prolong usage of inadequate furniture. It is, therefore, recommended that the university management provide appropriate ergonomic chairs in order to reduce ergonomic injuries and an improved learning environment.*

Key words: Opinion poll, ergonomics, ergonomic furniture, Nigerian university students

INTRODUCTION

Chairs designed to suit a range of people are described as ergonomic chairs. A chair is ergonomic only when it specifically suits an individual's body dimensions, workstations or task that such individual performs. Mismatch of body dimension and the dimension of a chair can lead to some health consequences. This study explores stake holders' health information literacy with regard to the necessity of furniture ergonomics in a learning environment.

Ensuring the safety for workers and maintaining or improving productivity are two of the major concerns facing businesses today. Thus, it is necessary to establish a workplace for workers that are safe and comfortable by incorporating ergonomic concepts (Koide, 2005). In confirmation, Eunice (2010) noted that 'ergonomic workstations improves the concentration of employees and hence a reduction in sick time'. The lack of concern to incorporate ergonomic concept in the workplace may lead to increased risk of occupational accident and occupational diseases (Koide, 2005).

Many people sit for most of the time that they are awake. They sit while having breakfast, while going to work in cars or buses, in relaxation centres, at school classrooms, in meetings, in offices, during dinner, at home while watching television and so on. Many people also sit at work while operating computer machines for hours. Although sitting requires less physical effort than standing or walking, it can put a lot of stress on lumbar areas (Canadian Centre for Occupational Health and Safety, 2014). 'If mismatches exist among the human anthropometric data and equipment, tools and furniture, it may result to decreased productivity, discomfort, accidents, biomechanical stresses, fatigue, injuries, and cumulative traumas' (Mandahawi, Imrhan, Al-Shobaki, & Sarder, 2008.)

Figure1: *Ergonomic injuries*

According to Gerencher's (2010), the combined effect of a sedentary lifestyle and a job that requires sitting can lead to many health problems. Proper ergonomic design is necessary to prevent repetitive strain injuries and other musculoskeletal disorders, which can develop over the time and can lead to long-term disability (Nutalapati, Gaddipati, Chitta, Pinninti, & Boyapati, 2009). According to Scott (2014), 'Repetitive Strain Injury (RSI) is a potentially debilitating condition resulting from overusing the hands to perform a repetitive task, such as typing, clicking a mouse, or writing. A repetitive strain injury is a condition that occurs when repeated stress is placed on a joint and on tendons and muscles surrounding the joint.

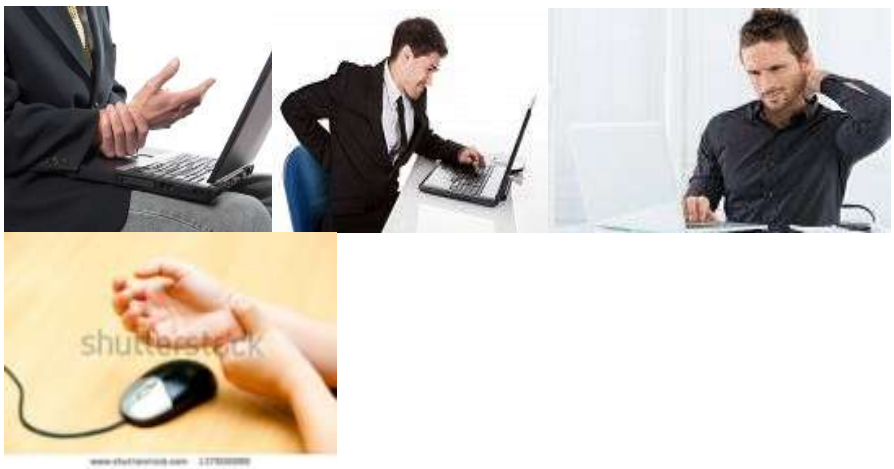


Figure 2: *Repetitive strain injuries.*

Grimes & Legg (2004), hold that a mismatch between the length of thigh and seat depth has been shown to be related to discomfort while a mismatch in seated elbow height and desk height is related to neck and shoulder pain. On the same note, Pascarelli & Quilter (2014) explained RSI in medical terms as:

> 'A cumulative trauma disorder (CTD) stemming from prolonged repetitive, forceful, or awkward hand movements .The result is damage to muscles, tendons, and nerves of the neck, shoulder, forearm, and hand, which can cause pain, weakness, numbness, or impairment of motor control. Injured muscles tend to contract, decreasing the range of motion necessary for stress free work. The sheaths that cover delicate tendons run out of lubrication because they aren't given time to rest, so tendon and sheath chafe, resulting in pain. Due to this abrasion, tendons become inflamed, and begin to pinch neighboring nerves. This can result in numbness, tingling, or hypersensitivity to touch. Unless this cycle is interrupted, it repeats itself over and over, and a long-term, chronic problem results.'

Repetitive strain injury is not limited to just the hands and wrists. It can lead to several neck and back injuries as a result of poor posture, eye strain as a result of long staring at a computer screen, and can also lead to arm and neck strain as well as spinal asymmetry as of a result of repetitive reaching for a mouse (Scott, 2014). RSI occurs when repeated stress is placed on a joints, tendons and muscles surrounding the joint.

Figure 3: common injuries on joints.

Sandström & Eaton (2008), listed the most common RIS to include:

- Tenosynovitis: An inflammation of a tendon sheath.
- Tendonitis: An inflammation of a tendon.
- Epicondylitis: An inflammation of a tendon where it attaches to the bones at the elbow.
- Carpal tunnel syndrome: A condition caused by compression of the median nerve in the hand and wrist.
- Cubital tunnel syndrome: A condition caused by compression of the ulnar nerve near the elbow
- Thoracic outlet syndrome: A condition caused by compression of the nerves and blood vessels in the neck and shoulder

It is also worthy of note that nerves could be damaged by RSI, while tingling feelings could be caused by the compression of nerves. Although nerves run through muscles, if muscle health is poor, so is nerve health and damaged nerves can heal but the process is extremely slow and most cases of persisting RSI have their basis in the nerves that run from the neck, down through the shoulders, and into the wrists and hands (Miller, 2013). These nerves, most notably the discs and facet joints in the neck, pass by many other structures and if the discs or muscles become damaged or tight - often due to a poor posture - then the nerves cannot move freely in the arm.

Figure 4: *Injuries of the nerves.*

Miller (2013, p. 56) further explained that when these tight nerves are used repetitively, such as when typing or in the process of working, they naturally become sore and inflamed and once the process is repeated before the nerve has recovered, the problem worsens. As a result, it could be difficult to perform any task afterwards, even lifting a coffee cup, without feeling pain.

University of Pennsylvania, environmental health and radiation safety (2007), highlighted the common ergonomic problems while evaluating workstations and possible solutions and prominent among them is twisting and leaning forward to view documents while working on the computer which causes awkward neck, back, and shoulder postures. This is illustrated in the figure below:

Figure 5: *Twisting and leaning forward to view documents while working on the computer*.

working on the keyboard or mouse which causes awkward wrist postures.

Figure 6: Resting *wrists on desktop when working on the keyboard or mouse.*
Wrong placement

The group also insists that sitting forward in the chair while working, provides no lumbar support. This implies that such support is essential at curtailing ergonomic problems while sitting down. The figure below exemplifies this point.

With no lumbar support

Figure 7: *Sitting forward in the chair while working.*

Another major ergonomic problem identified is the wrong placement of frequently used items which causes awkward arm and shoulder postures. It is therefore understood that since such items are frequently assessed, they should be at all times kept within the reach of the user, otherwise severe ergonomic problems would be inevitable.

Figure 8: *Wrong Placement of Pointing Device***.**

The group also posits that placing the mouse at the wrong position and reaching for it indiscriminately could cause awkward shoulder and arm postures. This implies that the mouse should be appropriately positioned directly in front of the user. Figure below, shows the point.

Figure 9: *Wrong positioning of the mouse.*

One other prominent ergonomic problem is reaching for items located on overhead shelves causing awkward arm and shoulder postures. This is illustrated in the diagram underneath.

Figure 10: *Retrieve items off a shelf.*

Also, sitting too low could cause awkward wrist postures when typing and using the mouse.

Figure 11: *Sitting too low.*

They further explained that Laptop computers do not allow the keyboard and monitor to be at the correct height, thereby causes awkward shoulder, neck and back postures. It is demonstrated in the figure below

Figure 12: *Wrong lap top usage.*

Keyboard Angle
It was pointed out that positive slope of keyboard tray causes awkward wrist postures. Figure below, explains this point.

Figure 13: *Wrong keyboard angle.*

According to Georgiou (2013), the primary symptoms of RSI are pain in the upper extremities which includes fingers, palms, wrists, forearms, shoulders. The pain may be burning, shooting or aching. It could be local, that is at the fingertips or diffuse, that is on the entire forearm. The pain could be increased after a long use of the computer. Pascarelli & Quilter (2014) holds that 'one could have severe RSI without experiencing pains. John (2011) stated the two main classifications of RSI; type 1 and type 2. Type 1 is an RSI condition wherein the symptom can easily be detected as the muscles and tendons are usually swollen. It is usually caused by repetitive tasks, but not always. Some people who do not perform repetitive tasks may have type 1 RSI. Examples of type 1 RSI include: carpal tunnel syndrome, tendinitis, and tenosynovitis. Type 2 cannot easily be detected as there is no pain

or obvious symptoms experienced by the patient. It is also called non-specific pain syndrome.

RSI is also associated with other musculoskeletal and nervous injuries such as repetitive motion disorder, cumulative trauma disorder, and regional musculoskeletal disorder because they all involve forearms, elbows, wrists and arms (Elumir, 2014). Musculoskeletal disorder (MSDs) affect the muscles, nerves and tendons. The three primary risk factors according to (Pascarelli & Quilter, 2014) are poor posture, poor technique, and overuse.

Figure 14: *poor postures.*

Oyewole, Haight, & Freivalds (2010) hold that 'the use of furniture dates back to the stone age when chairs and tables were carved from stones and rocks.' Classroom furniture can make learning easier or harder for students. Thariq, Munasinghe, & Abeysekara (2010) also noted that chairs are essential part of any learning environment which allow or contain movement, and either direct the student's attention straight ahead or allow the student to comfortably turn towards any direction.

Figure 15: *Ergonomic furniture for students.*

Studies by Ismaila, Musa, Adejuyigbe, Akinyemi (2013) have confirmed that students spend a greater part of their time in school in the seated posture. They contend that sitting in one position for a long period of time and static posture in a forward bending manner could be a major cause of low back pain. Goldtouch (2014) noted that ergonomic problems for students are caused by issues like one-size-fits-all furniture, backpacks weighed down by heavy books and outdated computer workstations. Goldtouch (2014) also holds that 'when students are distracted by their pain, they are far more likely to get frustrated with the task at hand and give up, eventually, causing disruptions that further distract other student in the classroom.' A mismatch between the length of thigh and seat depth has been shown to be related to discomfort while a mismatch in seated elbow height and desk height is related to neck and shoulder pain (Grimes & Legg, 2004).

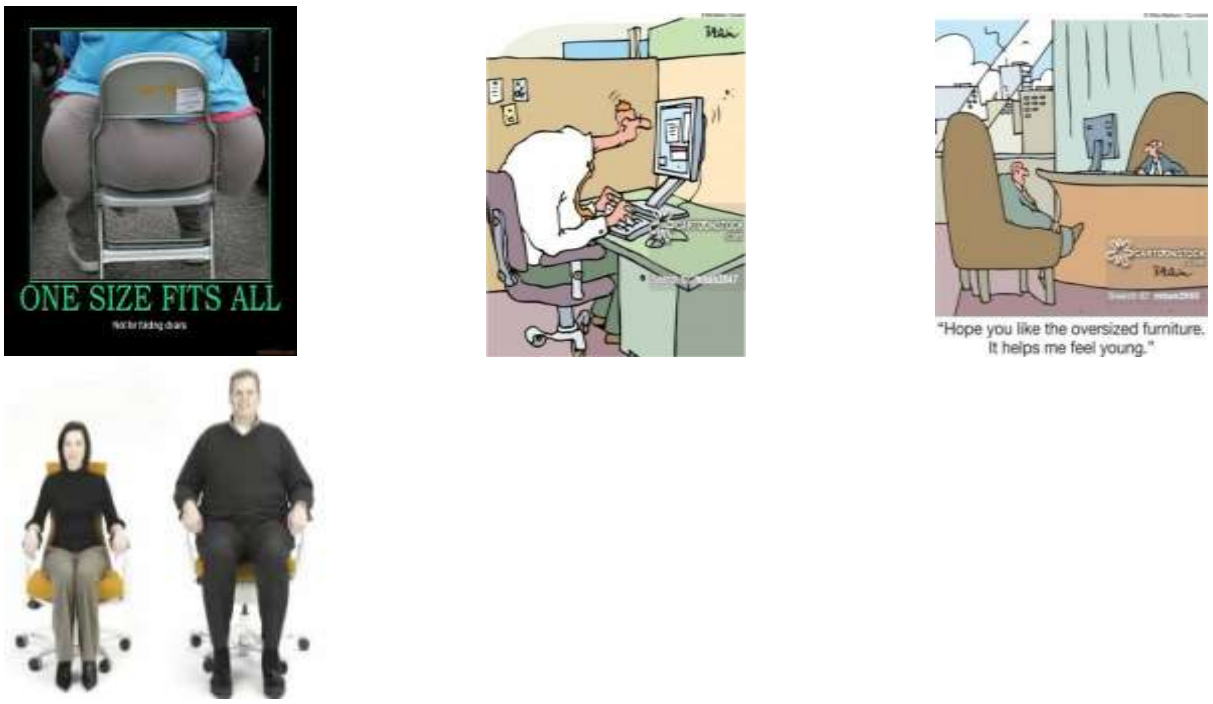


Figure 16: *Mismatch between the anthropometric data of people and chairs.*

Classroom furniture should be designed with an understanding of the need of students, considering the proper size and height of each student. Adjustability of school furniture is essential in ensuring increased comfort and decreased incidence of musculoskeletal disorders. Oyewole et al. (2010) noted that fixed-type furniture, to accommodate all users in the design of the seat, arms and backrests of most chairs, was still common, especially in developing countries where budget for education is paltry. The design of ergonomically compliant school furniture has not been given the attention it deserves in Nigeria. Smith (2014) positioned that 'ergonomic classroom furniture makes learning easier by removing physical hindrances, large and small, to allow the student to concentrate on the day's lesson.' Ergonomic Chairs help make learning environment more effective and help students concentrate.

The anthropometric measurements that are necessary to determine the dimensions of school furniture that will enable students to maintain correct sitting posture are popliteal height, knee height, buttock to popliteal length and elbow height (Parcells, Manfred, Hubbard 1999; Panagiotopoulou et al., 2004). The main anthropometric dimension and specification used in student furniture design is Popliteal height which is to determine appropriate seat height . In designing a chair to suit a population, the popliteal height is used to ensure that members of the population are able to sit with their feet supported on the floor, and without undue pressure behind the knees. Likewise, comparing the popliteal height of an individual to the seat height of the available chairs can assist in selecting the most suitable size for that individual. According to Parcells et al. (1999), school children are at special risk for negative effects from badly designed and ill-fitting furniture, due to prolonged periods of sitting during school. According to Grimes and Legg (2004), the combination of bad posture and poor seating coupled with long periods of immobility can lead to the development of lower back pain. (Chaffin et al. 2006)

emphasized the need for the feet to be firmly rested on the floor or foot support in order to prevent the thighs from supporting the weight of the lower leg.
Doll (2012) highlighted **s**ome of the characteristics of ergonomic classroom furniture to include:

- Chairs with the correct seat height that place both user's feet flat on the floor.
- Table height that places keyboards so users can type comfortably with arms slightly bent and fingers resting on the keyboard.
- A variety of chairs and tables of different heights available, or adjustable chairs and tables, particularly for computer workstations.
- Avoid resorting to a "one size fits all" philosophy of classroom furniture simply to save money.

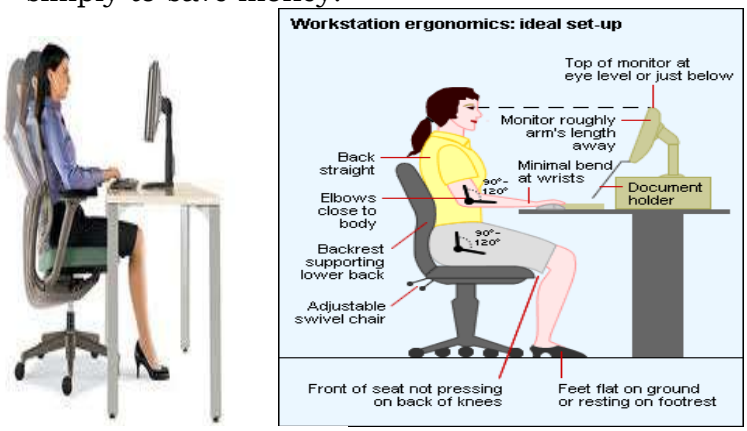


Figure 17: *Ergonomic furniture.*

Literacy is not limited to only people who can read and write. A person who cannot read or write but has the ability to solve problems could be said to be literate. The National Literacy Act of 1991 defined Literacy as a person's ability to read, write, speak, and compute and solve problems at levels necessary to function on the job and in society, achieve one's goals and develop one's knowledge and potential.

Health literacy is fundamental for people to properly manage their own health. Health literacy according to U.S. Department of Health and Human Services (2000); Healthy People (2010); Parker (2000) is the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions. People with limited health literacy often lack knowledge about the body as well as the nature and causes of disease.

Without this knowledge, they may not understand the relationship between lifestyle factors such as diet and exercise and various health outcomes.

Although many scholars points towards the need for appropriate ergonomic chairs as against the on-size-fits-all, this study assesses the health literacy of university managements towards providing the requisite ergonomic chairs, as well as the health implications of wrong ergonomic furniture.

This study sought to establish the possibility that students of the Nigerian universities might be aware of the health implication in the use of inappropriate furniture in their learning environments. It also sought to determine how informed and literate the students are on the use of appropriate ergonomics.

In order to give direction to this study, the following research questions were posed for investigation.

1. How knowledgeable are Nigerian university students on ergonomic chairs?
2. Against the back drop of appropriate and in appropriate ergonomics, how do students rate the seats in Nigerian public university lecture halls, exam halls, labs, auditorium, relaxation centres, libraries, cafeteria etc?
3. To what extent do these students experience symptoms suggesting musculoskeletal disorder?
4. Are the students aware of the health implications associated with the use of inappropriate furniture?

WHAT IS ERGONOMICS?

"Imagine how much richer and more effective learning will be when the physical environment is developed as a powerful learning tool" (Gee, 2006). Ergonomics is about 'fit': the fit between people, the things they do, the objects they use and the environments they work, travel and play in. Ergonomics is often defined as fitting the job to the personnel (OFSWA, 2003). If good fit is achieved, the stresses on people are reduced, they are more comfortable, they can do things more quickly and easily, and they make fewer mistakes (International Ergonomics Association, 2010). As it relates to learning spaces, ergonomics considers the entire environment and how it supports and interacts with the human body as people function in the space (Brown, 2006; Gee, 2006; McVey, 1996). To learn people must be able to function comfortably, safely, and effectively in the space. Ergonomics includes everything in the environment from:

- The lighting
- Visual sight lines sound
- Air temperature and quality
- Furniture comfort level and how easy it is to adjust or reconfigure
- Wall colour
- Pathways and how people move around
- Open access to equipment and supplies
- Ease of access to technology and other equipment
- And just about anything that affects how people will function in the learning space (Brown, 2006; Gee, 2006).

Appropriate ergonomic design promotes sensory comfort so that people can see and hear well (Gee, 2006). According to McVey (1996), appropriate ergonomic design means the room dimensions and physical layout accommodates different learning activities, such as collaborative group work, gives people a sense of personal space, and facilitates social interaction and communication. Appropriate ergonomic design means the learning space accommodates the "equipment, tools, and materials (such as a whiteboard, interactive smart board, personal computers) that are used in the space" (p. 1). And appropriate ergonomic design means these tools are implemented in a way that doesn't interfere with basic human sensory comfort. So the noise from a computer, the glare from windows or lights, or overbearing heat from equipment shouldn't interfere with the learning and teaching that occurs in the space. According to Brown (2006), the learning space should encourage people to get up and move around at any point in the learning or instruction process. It should also be easy for people to move around and move things around. Wide open pathways and flexible furniture promote this type of movement.

WHAT IS AN ERGONOMIC CHAIR?

According to the Canadian centre for occupational health and safety (2014, p, 1), Ergonomic chairs are designed for comfort of its users, although it is assumed that there is no guarantee that they will suit any one person in particular because the users could make necessary adjustments. For example, a chair that is too high and its arm, too far apart for a short, slim person, could be adjusted to suit the size of the person. It was further explained that a chair becomes ergonomic only when it specifically suits a worker's size (body dimensions), his or her particular workstation, and the tasks that must be performed there.

The Collins English Dictionary defines ergonomics as "designed to minimize physical effort and discomfort, and hence maximize efficiency. A chair that is well-designed and appropriately adjusted is an essential element of a safe and productive computer workstation. A good chair provides necessary support to the back, legs, buttocks, and arms, while reducing exposures to awkward postures, contact stress, and forceful exertions. "Appropriate ergonomics" means designing furniture to fit students, instead of forcing students to fit their furniture (Dull, 2012).

To ensure that the chair will provide adequate support, it is important that one tries different chairs before purchasing them (MacBride Office Furniture, 2014). Both chair height and the height of the arm rest make a big difference when it comes to the comfort of every worker (Artie, 2014). For this reason, Macphearson (2014) noted that any decent ergonomic chair should offer both an adjustable seat and adjustable arm rest. This is parallel to the position of Macphearson (2014) that ergonomic chairs are designed to keep a person comfortable while at work, so that they could focus on doing the best possible job. International Ergonomics Society similarly defined 'ergonomics' as the fit between people, the things they do, the objects they use and the environments they work, travel and play in. Gee (2006) equally observed that appropriate ergonomic design promotes sensory comfort so that people can see and hear well. According to Glass & Mills (2013), appropriate ergonomics means designing furniture to fit students, instead of forcing students to fit their furniture. This is reinforced by McVey (1996), that appropriate ergonomic design means the room dimensions and physical layout accommodates different

learning activities, such as collaborative group work, which gives people a sense of personal space, and facilitates social interaction and communication.

ADJUSTABLE FURNITURE

Worksafe Victoria (2006) stated that a chair is the main item of a workstation that provides adjustability for comfort and enables the work heights to be controlled. According to Jackson & Day (1996) a seat pan that is too wide or too deep may prevent the sitter from taking advantage of armrests and backrest. He suggested that a deep seat will prevent the chair back from being used as a backrest or, if the backrest is used, the seat edge puts pressure on the legs. Such pressure can reduce circulation in the blood vessels and restrict the nerves close to the surface in the sensitive area behind the knee. Jackson & Day (1996) also suggested that a deep seat presses on the back of the legs, while a shallow seat may make the chair unstable. For deep office chair, one will need to adjust the backrest forward, insert a low back support (such as a lumbar support cushion, a pillow or rolled up towel), or get a new office chair.

Considering the diversified sizes of the users, Straker, Pollock, & Burgess-Limerick, (2006) stated that workstations with adjustable seats are favoured, since people differ in size and postural preference. They insist that Adjustable chairs are preferred for school students or adults, to promote health and comfort in sitting. They further argued that seat height adjustability is the most important element of a workstation and is used most often. In synergy, Robinette (2006) supported that a product's ultimate success depends on how the variations in shape and size of the user population will be accommodated. In 2008, Toomingas and Gavhed conducted a study of call center operators, but found that optimal adjustment of the chair contributes to less frequent neck/scapulae and back pains. He further specified that Adjustability of school furniture is an important feature in ensuring equal educational opportunities, increased comfort, and decreased incidence of musculoskeletal symptoms.

In terms of the potential effects of poor ergonomics, previous research by Thariq, Munasinghe, Abeysekara (2010) stated that a mismatch between thigh length and seat depth is significantly related to general sitting discomfort, and a mismatch in seated elbow height and desk height is significantly related to reported neck and shoulder pain. According to Panagiotopoulou et al. (2004), Parcells et al. (1999), Evans et al. (1988), Chung and Park (1986) and Mandal (1994); the need for adjustable school furniture is becoming increasingly important.

ERGONOMIC IN THE NIGERIA UNIVERSITY SETTING

Many authors have tried to establish theoretical recommendations for the principles that relate school furniture design to children's anthropometry, and some have also attempted to define the "appropriate" dimensions for school furniture based on anthropometric measurements. Doll (2012), stated that increased adjustability ensures a better fit for the user, provides adequate support in a variety of sitting postures, and allows variability of sitting positions throughout the workday. Instead, a one-size-fits- all philosophy has been adopted in many

institutions and offices within Nigeria, because such furniture is less costly to manufacture and easier to sell at a lower price, and lessens the inventory problems for manufacturers and schools. Therefore a need is felt where the ergonomists have to treat the issue of furniture design for students as a necessity and educational institutes/universities should treat the selection of right kind of furniture as social responsibility towards the student community. Hira (1980) investigated fixed-type university chairs, and suggested that certain seats should be adjustable. Khanam, Reddy & Mrunalini (2006) studied fixed-type university furniture, including a mounted desktop chair, and observed that students preferred the furniture height to be adjustable.

Poor ergonomics while using the computer can lead to musculoskeletal symptoms that include fatigue, muscle discomfort, burning sensation, stiffness, aches and pains, soreness, weakness of muscles or numbness and tingling (Ortiz-Hernandez et al, 2003). The number of computer users in the university is on the rise, and this is expected to increase further in the coming years. In most departments, secretaries carry out secretarial jobs, which most times have to do with use of the computer (Aboyade, 1999). The increased use of computers by secretaries in various departments in the university is seen to pose a major health risk to them in terms of development of musculoskeletal symptoms. Secretaries constitute a particularly vulnerable group because most of the furniture they use is not designed or suited to their anthropometric dimensions, and most furniture is not even adjustable and when they are adjustable, they often are not adjusted (Bennett, 2001). As more workers spend more time working at the computers without due consideration and knowledge of computer ergonomics, they are putting themselves at risk for musculoskeletal disorders and other conditions that can result from overuse. Several previous reviews have indicated a possible causal relationship between computer work and musculoskeletal complaints in various parts of the human body (Hush, Mayer, and Refshauge, 2006; Woods, 2005). Back pain and other musculoskeletal pain have been observed to be common among computer users in Nigeria (Adedoyin, Idowu, Adagunodo, & Idowu, 2004). The increase prevalence has been linked to factors such as poor workstation design, duration of daily keyboard and mouse usage, and assumed posture during computer work (Kryger et al, 2003).

STUDENTS AND SCHOOL FURNITURE

The detrimental efforts of improper classroom furniture on the spine have known for a long time (zacharkwo, 1988). On the impacts of the chairs on children, (Parcells et al., 1999), specified that school children are at special risk for negative effects from badly designed and ill-fitting furniture, due to prolonged periods of sitting during school hours. Grimes and Legg (2004), on the other hand argued that the combination of bad posture and poor seating coupled with long periods of immobility can lead to the development of lower back pain. They further stated that with expectations and emphasis (in some sectors) on greater educational achievements, the duration of sitting is likely to increase. An uncomfortable sitting posture can lead to health related consequences, and also student's learning interest, even during the most stimulating and interesting lessons (Hira, 1980).

Children spend about 80% of their school time in the classroom performing various activities like reading, writing, drawing and other related activities, which requires them to sit continuously for long hours (Savanur, Ghosh, Dhar, & De, 2004). Hira (1980) similarly observed that four types of activities namely, listening, writing, calculating and miscellaneous were being carried out by the students in a classroom. So, children spend a major time on the chair and desk during school hours. Hence, it is necessary that the school furniture should fit the requirements of school children (Savanur et al., 2004; Gouvali, 2006). Therefore, the school furniture should be made on the basis of anthropometric dimensions of the user (school children) of different age groups. Design of this furniture should be different for male and female student, as (Jeong and Park, 1990) observed differences in the requirements of furniture dimensions for boys and girls.

The existing furniture in schools may not be suitable for the children as these are designed without considering their body dimensional requirements. In a study, (Chaudhary, Sharma, Grover, & Nainwal, 2004) showed that school furniture did not match up with the school children's anthropometric measures on an average. So, most of the time they have to spent in the classroom sitting for a long duration at a time confining themselves to traditional cumbersome sitting and writing furniture units (Chakrabarti & Das, 2004). Therefore, furniture induced postural problems associated with behavioral misfit become very common. Mismatch between students anthropometric dimensions and their school desk and chair is believed to be at the grassroots of many problems encountered by pupils in and outside school settings. Literature on the issue pinpoints the following consequences: back pain prevalence among children and adolescents (Trevelyan & Legg, 2006), musculoskeletal discomfort and low back pain (Trevelyan & Legg, 2003).

Saarni, Nyga, Kaukiainen, Rimpela (2007) and Ramadan (2011) indicated that there was a mismatch between school furniture and the anthropometrics of schoolchildren. Matching furniture to anthropometric measurements is an important factor that should be taken into account in school furniture design (Cotton, 2002; Ramadan, 2011). Specific measurements, such as popliteal height, knee height, butttock–popliteal length, abdominal depth and elbow height are necessary in order to determine school furniture dimensions that enable the correct sitting posture (Knight and Noyes, 1999; Parcells, Altekar, De, 1999; Miller, 2000).

Children remain seated at school for a considerable amount of time (Alnaser and Wughalter, 2009). Panagiotopoulou, Christoulas, Papanckolaou, Mandroukas (2004) and Gouvali and Boudolos (2006) proved that desk and seat height were bigger than the accepted limits for most children, while seat depth was appropriate for less children. Children's anthropometric measures vary widely across different age groups, within the same age groups, between genders and between different races (Jeong and Park, 1990). Children's dimensions vary not only between the different classes but also within the same class (Barrero and Hedgewith, 2002). Thus, it is unlikely that school furniture with fixed dimensions would be compatible with the majority of students. The need for adjustability in school furniture, in order to accommodate the variation in anthropometric measures is supported by the work of Evans, Courtney, Fok (1988); Jeong and Park (1990), and Parcells, Stommel, Hubbard (1999). The suggested sets in this research were

aimed at accommodating a wide range of students' sizes to enable the students to carry out their work effectively in a comfortable posture. Thus, a range of furniture sizes must be developed for Saudi standard to satisfy six primary school classes (ages approximately 6 to 12 years), three middle school classes (ages approximately 13 to 15 years) and three secondary school classes (ages approximately 16 to 18 years). Evans and Lee (1982) suggested that a range of five sizes of chairs and tables would accommodate Hong Kong school students from first primary class to the secondary seventh class, ranging in age from 6 years old to 18 years old. Oxford (1969) suggested that a range of six sizes of seats and desks would accommodate Australian school students from kindergarten to secondary in the age range from 4 to 20 years old. Considering economics, manufacture-ability and ergonomics views, four different sets‟ dimensions with adjustable chair heights and table heights were thought to be reasonable to be provided to schools.

Studies have shown that being confined in awkward posture for specific task demand at a given situation or as influenced by bad designed furniture for a long duration provokes psychological stress and imposes ill effects on human performance (Das & Chakrabarti, 2004). There are numerous medical problems that could result because of the use of school furniture that do not match the anthropometry of the school children. Wrongly designed school furniture induces improper posture leading to operational uneasiness and musculoskeletal and some physiological disorders among school children (Mououdi & Choobineh, 1997; Chaudhary et al., 2004).

SITTING POSITION

Frumkin, Geller, Rubin, and Nodvin (2006) said sitting is a means of changing posture and bringing rest. Sitting on an office work chair plays an important role in the field of work. It is estimated that about 75% of work in industrialized countries is performed while sitting (Croney, 1971). Adopting good sitting posture will enhance comfort and will not put a lot of stress and strain on the user's buttocks, back or arm muscles, and will allow the user's feet to be on the floor (Croney, Openshaw, & Taylor, 2006). The dynamics of sitting can best be understood by studying the mechanics of both the relevant body parts and the external support system involved. 75% of the total body weight is supported by only 4 inch2 (26cm) of surface when sitting (Tichauer, 1978). The seat alone is insufficient for stabilization and the use of the legs, feet, and back in contact with other surfaces, as well as muscular forces, are all necessary to produce equilibrium (Branton, 1969). Leg support is also critical for distributing and reducing buttock and thigh loads. Feet need to rest firmly on the floor or floor support so that the lower leg weight is not supported by the front part of the thighs resting on the seat (Chaffin and Anderson, 1991). He also explained that if the major weight is to be placed on the ischial tuberosities and the proximal half of the posterior thighs, seat support should occur under and anterior to the ischial tuberosities. To maintain the weight bearing over and anterior to eschial tuberosities, sacral and pelvis supports are needed which prevents or reduces backward rotation of pelvis and subsequent lumbar kyphosis, also known as posterior curve (Zacharkow, 1988). Lumber lordosis, the normal anterior curve of the lumber vertebrae, helps to transfer some

of the weight (as such as 25%) over the posterior thighs (Drummond, Narechania, Rosenthal et al., 1982)

Since flattening of the lumbar curve and posterior rotation of the pelvis occur when hips flex and the trunk–thigh angle narrows, Keegan (1953) recommended chairs with a rearward sloping backrest as a means of achieving a minimum trunk–thigh angle of 105°. For the same reasons, Mandal (1981) suggested that when one works at a desk, the seat should slope forward to accommodate a trunk–thigh angle 90° and still maintain the trunk in an erect position. Mandal also proposed that work surfaces be tilted toward the user, because this is more compatible with upright sitting and improved vision. In addition, lessening the need for users to flex neck and trunk for an improved viewing angle should also reduce lumbar flexion. Studies of sitting posture which evaluate postural accommodations of seats with forward slope angles have found that with increasing forward slope, the spine moves toward lumbar lordosis (Bridger R., 1988, 1989). In a study of trunk adaptation to forward inclining seats, Bendix and Biering-Sorensen (1983) noted that one third of the body's adaptation takes place in the spine and two thirds in the hip joints. Evaluations based on user comfort indicate a preference for 0° (horizontal) and 5° forward inclinations. While a forward-inclining seat seems to affect the lumbar spine in a positive direction, a sloping desk appears to accomplish the same and, in addition, improves the posture of the other parts of the spine (Biendix, 1987). (Chaffin et al., 2006) emphasized the need for the feet to be firmly rested on the floor or foot support in order to prevent the thighs from supporting the weight of the lower leg.

This is cognizance of the fact that non-adjustable school furniture forces the students to adapted poor sitting postures (Vikat, Rimpelä, Salminen, Rimpelä, Savolainen, Virtanen, 2000; Koskelo, 2007; Mokdad and Al-Ansari, 2009). Using furniture that promotes proper posture is more recommended at the early stage of one's life because it is at the young age that sitting habits are formed. Poor sitting habits acquired in childhood are very difficult to change later in adolescence or adulthood (Yeats, 1997). Sanders and McCormick (1993) pointed out that adjustable furniture is fundamental to development and maintenance of good posture. Several studies (Jung, 2005; Vos, Jerome, Congletona Moorea, Amendolab, Ringer, 2006; Acosta and Morales, 2007; Koskelo Vuorikari, Ha¨nninen, 2007; Savanur, Altekar, De, 2007) compared the traditional non-adjustable and the new adjustable school tables and chairs on the sitting postures, muscle tension and pain levels. When the students started to use their adjustable tables and chairs, muscle tension levels were reduced significantly in lumbar and trapezius muscles. The intervention corrected the posture much as expected, when the students were sitting in their new units. The intervention students reported that they experienced benefits from the adjustable tables and chairs. The results support the necessity of ergonomic approach in furniture planning of school classes and individual adjustment possibility of tables and chairs.

In order to sit up straight and regain lost lordosis, people must make a muscular effort to overcome the tension in the hamstrings (the effort probably comes from a muscle deep within the pelvis called iliopsoas) people cannot merely relax the hamstrings since their tension is a passive one caused by the stretching of tissue (just like an elastic band) rather than by actual muscular contraction (Nguyen,

2003). This implies that People should as well, activate their back muscles to support weight of their trunk, because the static muscle loading may become a major source of postural discomfort, particularly in someone who has a pre-existing tendency to suffer from back trouble (Pheasant, 1998). Floyd and Ward (1969) studied the most frequent postural positions adopted in classrooms and found that three types of behavior were most frequently observed: sitting without support from backrest (the backrest of a chair was not often used when only one arm was resting on the desk or when arms were not in contact with the desk at all); the trunk inclined forwards; and this forward inclination with both arms supported by leaning them on the desk. They further stated that the latter posture was adopted not only when writing but for a considerable amount of time during other activities, so that some pupils were spending up to 80% of their time in the forward sloping position. This is understandable given that writing activities occupy primary school children for about 30% for their desk time (Hira, 1980).

Similarly, Knight and Noyes (1959) emphasized on the two ways of sitting during each school day, leaning backward while resting or watching the activities at the backboard, and leaning forward when writing or reading. The time spent sitting is roughly distributed equally between backward leaning and forward leaning positions: a fact to be remembered when designing school furniture for the future (Storr-Paulsen and Aagaard-Hensen, 1994)

ERGONOMICS AND HUMAN FACTORS.

The two terms "human factors" and "ergonomics" are essentially synonymous because proper ergonomic design is necessary to prevent repetitive strain injuries and other musculoskeletal disorders, which can develop over time and can lead to long-term disability. Carroll (1997) further insisted that it is relevant in the design of such things as safe furniture and easy-to-use interfaces to machines and equipment. To this end, Sarter and Cohen (2002) equally believed that human factors and ergonomics are concerned with the "fit" between the user, equipment and their environments. It takes account of the user's capabilities and limitations in seeking to ensure that tasks, functions, information and the environment suit each user. To assess the fit between a person and the used technology, human factors specialists or ergonomists consider the job (activity) being done and the demands on the user; the equipment used (its size, shape, and how appropriate it is for the task), and the information used (how it is presented, accessed, and changed). Pleasant (1996) observed that the design should be empirical, that is, the needs of users should be investigated and analyzed so as to develop the product that will match the users' behavior, experience, mental and physical characteristics. After obtaining the empirical data, the product should be developed according to the need. It stressed further that the equipment in the workplace should match the operators' anatomy and physiology. It is therefore necessary that the user participate during the design phase in order to have the product tried out, especially for computer electronics and industrial appliances used in work places, because the product would be designed in such a way that it meets the user's needs. The product should also accommodate human diversity and, allow the interaction between the product and the user to take place (Pleasant, 1996).

Machines or tools that are not ergonomically designed results in a number of constraints experienced by users in the working place. The deficiency in computer workstation design tends so much on the user's health and posture of current practice in computing and information systems in typical offices, homes, cybercafé, business and publishing house, school laboratories and training centers, poor interaction, inappropriate adjustment and positioning of furniture or equipment in the computer room and work place (NCTE, 2007).

Meanwhile, Children, especially at elementary schools, these days could express readiness to adopt the use of computer as teaching and learning aid but the positioning of the device could cause an ergonomic disorder among the students. Even, almost all the modern-day characteristics of utility computing are associated with ergonomic parameters as found in both the public and private sectors; McCarthy (1960) thereby opined that "computation may someday be organized as a public utility" because as technology continually advances, health and safety measures should be inculcated in Information and Communication Technology communities through replacement of earlier model and obsolete computers with sophisticated devices that allow users to share infrastructural resources and networked applications from remote location called host or client. The recent development in computing emanates a postulation that the entire world would operate on dumb terminals powered by about fifteen large data centers (Douglas, 1966). Pleasant (1996) also considered ergonomics as the relationship between the user and the equipments in a work place, with the workstations having to be designed in such a way that the position of the operator is comfortable and conducive to work. It is seen that ergonomics; the sizes of the computer hardware and furniture do affect the users, particularly the adult learners (Ngcapu, 2006).

ERGONOMICS AND ICT

The peripherals attached to computer system and the installation of ICT infrastructures are the determinant factors on occupational health and safety in Information Technology industry (Ashraf and Mahmoud, 2007). The metallic elements and circuitry embodied by computer and digital electronics are very sensitive; their exposure to sunlight could generate excess dissipation thereby causing environmental pollution and poisonous breathing. NCTE (2007) stressed that adequate ventilation reduces the heat and temperature range thereby enhancing user's comfort.

Another dimension of ergonomics outside furniture is the placement of the technological devices which adversely affect some parts of the body, especially the eyes. For instance, the refraction of video display and rays of light goes in line with monitor direction which is pathological to sight deformation and eye strain. Hence, fitting the VDU and video devices with glare filters is advisable. Ngcapu (2006) observed that the monitor (VDU) should be put perpendicular to the windows to avoid glare. It should also be noted that putting the device at a reasonable distance where a user can be able to read text without straining the eyes and positioning them in straight line with the keyboard and the chair is one way of avoiding the problems associated with poor ergonomics. It is instructive to also note that working too close to the monitor causes strain to the eyes as it makes the eyes to

converge. NHS (2013) emphasized that "the top of the screen should be level with the users' eyes such that he could naturally look at the centre of the screen. Ozim (2012) then suggest that viewing the monitor from a long distance can be detrimental to the user as it causes one to assume an awkward posture by leaning forward.

HEALTH ISSUES RELATED TO ERGONOMICS

Pro- longed static posture puts an extreme physiological strain on the muscles, the ligaments and in particular on the discs (Bendix, 1987; Straker, Briggs, Greig, 2002). Researchers have also recently documented an increase in health problems related to poor sitting (Chung and Wong, 2007; Saarni, Rimpela, Nummic, Kaukiainen, Salminen, Nygard, 2009; Corlett, 2009). Neck, shoulder and back pain problems are common among school children (Taimela, Kujala, Salminen, Viljanen, 1997; Alnaser and Wughalter, 2009). Students experience such problems due to low-quality design school tables and chairs (Troussier, Tesniere, Fauconnier, Grison, Juvin, Phelip, 1999). Murphy, Buckle, Stubbs, (2002, 2004, 2007) identified the associations between ergonomics and other factors like back and neck pain among schoolchildren. Neck, upper back, and lower back pain were significantly associated with school furniture features (Wingrat and Exner, 2005). Correct sitting posture is an important factor for the prevention of musculoskeletal symptoms (Cranz, 2000; Gadge and Innes, 2007; Soares, Jacobs, Reis, Moro, Da Silva, Paschoarelli, Nunes Sobrinho , 2012).

LOW BACK PAINS

It has been recognized that low-back pain is a common phenomenon that affects public health (Maniakis and Gray, 2000). Although a less globally recognized problem, low-back pain has also been described as a public health problem in children (Olsen, Anderson, Dearwater, Kriska, Cauley, Aaron, and LaPorte, 1992), epidemiological evidence indicates that non-specific low-back pain presents during childhood. Estimates of lifetime prevalence for low-back pain in children vary from 13 to 51%, point prevalence ranges from 1 to 33% and prevalence of recurrent low-back pain ranges from 7 to 27% (Vikat, Rimpela, Salminen, Savolainen, and Virtanen, 2000). The prevalence of pain necessitating medical consultation varies from 8 to 16%, and pain interfering with activities such as school and leisure varies between 7 and 27% (Vikat et al., 2000). The variation in results between investigations may be more related to methodological differences than to population differences (Balagu Balague, Troussier, and Salminen, 1999).

Researchers in this field, have varied interests in the research approach and methodology as well as on the localization and definition of low-back pain.

Biannual nationwide surveys in Finland revealed that prevalence of low-back pain in children is on the increase (Vikat et al., 2000). And as such it appears that most of these cases were mild in nature; can be considered as a natural part of growing and represent little consequence to health (Burton, Clarke, McClune, and Tillotson, 1996; Salminen, Erkintalo, Pentti, Oksanen, and Kormano, 1999). In contrast,

some children suffer from recurrent low-back pain. These cases have a more chronic evolution, lead to greater disability and require increased medical attention (Salminen et al., 1992; Harreby et al., 1999).

Moreover, recurrent low-back pain during the adolescent years may be a precursor for chronic low-back pain during adulthood (Harreby et al., 1995; Salminen et al., 1995, 1999). It is also estimated that 70–85% of individuals experience Low Back Pain (LBP) during the course of their lives (Andersson, 1999). An onset of LBP is expected to occur at the mean age of 30 and peaking in occurrence between the ages of 45 and 60 years (Bratton, 1999). However a recent European survey of LBP reported that the 6- month prevalence in 17–25 year age group seems to be similar to older age groups (Leboeuf-Yde, Kyvik, 1998). In the general population, LBP prevalence rates are known to increase over the adulthood period (Jones & Macfarlane, 2005; Sjolie, 2004). Sit related Musculoskeletal Disorders (MSDs) are frequent and several studies like (Magnusson & Pope, 1998; Watson, Papageorgiou, Jones, and et.al., 2002) have pointed out an association between back pain and prolonged sitting. Students spend about 84% to 88% of their time in the sitting position (Farahani, Shakib, 2009). 41.6% of students experienced pain while sitting in the classroom and 69.5% of the back pain occurred after 1hour of sitting and increases with the duration of the sitting position at school (Troussier, 1999).

Some studies have shown a positive relationship between back pain and seat height (Yeats, 1997). University students constitute a large group of people who spend a lot of their time on the university chairs and desks in a static or awkward posture (Bendix, 1987). High prevalence of neck and upper extremity complaints among university students has been reported in the literature (Schlossberg, Morro, Llosa and et.al, 2004). Students sitting posture can be influenced by several factors such as the anthropometric dimensions of the students and design features of classroom furniture. Therefore, the mismatch between the students' anthropometry and furniture design can be one of the risks of MSDs (Yeats, 1997). Recent developments in ergonomics have heightened the need for good chair design. There have been several studies in school children anthropometry and most of which have only been carried out in age grouped 6 through 14 years old and there has been little attention to the design of university furniture, because the researchers (Farahani, Shakib, 2009; Castellucci, Arezes, Viviani, 2010) believe that using furniture that promotes ergonomic (appropriate) postures in childhood is more important than using it in adulthood. The main reason of this is that the sitting habits are formed at this young age and it will be too difficult to change them in adulthood (Yeats, 1997). Although studies like (Magnusson, Pope 1998); (Farahani, Shakib, 2009) have investigated mismatch between the anthropometric features and classroom furniture dimensions in schools and universities, they did not consider the mismatch between arm rest distance and elbow distance.

AN ERGONOMIC CHAIR

No classroom can be without chairs, and when recommending a classroom chair for students, the available literature suggests that an ergonomic chair be set up to help facilitate teaching and learning. This is in cognizance of the fact that students spend many hours daily in the classroom. Canadian Centre for Occupational Health & Safety (2014) identified how to select an ergonomic chair.

Step 1: Check the height.

Since Ergonomic chairs should have a height adjustable seat, Canadian Centre for Occupational Health & Safety (2014) posits that not everybody is one size, so people should look for the chairs that have those levers under them that allow for the proper adjustments. Usually, about 16 to 21 inches is a good standard height. This helps in having the users' feet flat on the floor at all times while they are seated. This is because their thighs have to be parallel to the floor and their arms up to the right height when compared with their desks.

Step 2: Check the width and depth.

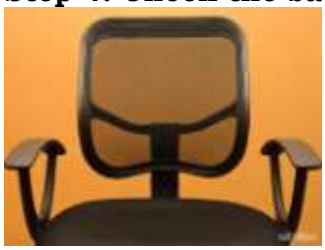
Canadian Centre for Occupational Health & Safety (2014) also suggested that when looking for an ergonomic chair, one need to look for one that is about 17 to 20 inches in width, the recommended standard with for and ergonomic chair. Depth usually refers to the space from the front of the seat to the back and not how deep a cushion goes when it is sat upon. Basically, when one sit down, one should have about 2 to 4 inches between the back of your knees and the front edge of the seat. This makes for very appropriate ergonomic chairs.

Step 3: Check the lumber support.

This refers to the support given to one's lower back and it is very important. Canadian Centre for Occupational Health & Safety (2014) argues that the lower

back is where most back trouble starts and one needs to have seats that will address this issue and prevent any further damage and that the chairs do not force one to slouch while seated. This will strain the lower spine. This means one need to find a chair to has adjustable lumber support for both height and depth.

Step 4: Check the back.



Canadian Centre for Occupational Health & Safety (2014) also states that, a good chair should have good overall back support and 12 to 19 inches in width of the back rest should do the trick. If the back rest is not part of the chair completely, this means one should find the chairs that are adjustable. Again, it is attention to the spine that is important here and the best ergonomic chair makes sure that this is well attended to.

Step 5.

Figure 19: *An ergonomic Chair Dimensions.*

Finally, Canadian Centre for Occupational Health & Safety (2014) suggests that If one find any of these features missing or just plain not working, then he should either return to the chair in exchange for another kind of chair, or you can exchange the defective one for one that dose serve its function well as an ergonomic piece of office furniture.

It is of course difficult to have to look for different types of chairs of different sizes just to suit the many people in your office. Also there is no such thing as the best fit for everyone. After all, everybody have their own preferences for comfort. This is the reason why you should try your chair first before actually purchasing them. Keep in mind that as long as the chair has good back and neck support for the average height of a person and as long as it is sturdy but allowing for a good length from a person's knees to the ground, it could be ergonomic chair. And it could be the best chair for one to invest in.

THEORETICAL FRAMEWORK

Health communication are usually based on theory, some implicitly and others explicitly. Early communications relied on the assumption that giving the right information about the need for the use of appropriate ergonomics will educate and improve health conditions. This thesis basically subscribes to the Health Belief Model because students in tertiary institutions are expected to take preventive actions (risk-reduction behaviors) when susceptible to a health challenge, as in this case, one size fits all furniture which could lead to severe health problems among them. This is because when the management does not take precautionary measures to avoid ergonomic problems, the students would not avoid the dangers of the one size fits all furniture.

The Health Belief Model (HBM): An Overview

The Health Belief Model (HBM) is one of the most widely used conceptual frameworks for understanding health behaviour. It was developed in the early 1950s by social psychologists, Hochbaum, Rosenstock and Kegels, who were working in the U.S. Public Health Services and the theory posits that individuals will take preventive actions (risk-reduction behaviour) when they are susceptible to a disease (self-perception of risk) and acknowledge the consequences as severe; they believe that taking preventive actions will be beneficial in reducing the threat of contracting the disease. The model was developed in response to the failure of free tuberculosis (TB) health screening programme. The model has been used with great success for almost half a century to promote greater condom use, seat belt use, medical compliance, and health screening use, to name but a few behaviors.
The HBM can be an effective framework to use when developing health education strategies. The HBM-based programs focused on a variety of health actions. The results of the meta-analysis provided substantial empirical support for the efficacy of the HBM.

The health belief model proposes that a person's health-related behaviour depends on the person's perception for four critical areas:

1. The severity of a potential illness.
2. The person's susceptibility to that illness.
3. The benefits of taking a preventive action
4. The barriers to taking that action.

The model postulates that health-seeking behavior is influenced by a person's perception of a threat posed by a health problem and the value associated with actions aimed at reducing the threat. HBM addresses the relationship between a person's beliefs and behavours. It provides a way to understanding and prediction how clients will behave in relation to their health and how they will comply with health care therapies.
According to the HBM, the perception of a personal health behaviour threat is itself influenced by at least three factors: general health values, which include interest and concern about health; specific health beliefs about vulnerability to a particular health threat; and beliefs about the consequences of the health problem. Once an individual perceives a threat to his/her health and is simultaneously cued to action, and his/her perceived benefits outweighs the consequences of not taking

action, then that individual is most likely to undertake the recommended preventive health action.

The HBM revolves around six constructs (Glanz, Rimer, & Lewis, 2002):

- **Perceived Susceptibility –** Each individual has his/her own perception of the likelihood of experiencing a condition that would adversely affect one's health. Individuals vary widely in their perception of susceptibility to a disease or condition. Those at the low end of the extreme deny the possibility of contracting an adverse condition. Individuals in a moderate category admit to a statistical possibility of disease susceptibility. Those individuals at the high extreme of susceptibility feel there is real danger that they will experience an adverse condition or contract a given disease.
- **Perceived Severity –** This refers to the beliefs a person holds concerning the effects a given disease or condition would have on one's state of affairs. These effects can be considered from the point of view of the difficulties that a disease would create. For instance, pain and discomfort, loss of work time, financial burdens, difficulties with family, relationships, and susceptibility to future conditions. It is important to include these emotional and financial burdens when considering the seriousness of a disease or condition.
- **Perceived Benefits of Taking Action –** Taking action toward the prevention of disease or toward dealing with an illness is the next step to expect after an individual has accepted the susceptibility of a disease and recognized it is serious. The direction of action that a person chooses will be influenced by the beliefs regarding the action.
- **Perceived Barriers to Taking Action –** Action may not take place, even though an individual may believe that the benefits to taking action are effective. This may be due to barriers. Barriers related to the characteristics of a treatment or preventive measure may be inconvenient, expensive, unpleasant, painful or upsetting. These characteristics may lead a person away from taking the desired action.
- **Cues to Action –** An individual's perception of the levels of susceptibility and seriousness provide the force to act. Benefits (minus barriers) provide the path of action. However, it may require a 'cue to action' for the desired behavior to occur. These cues may be internal or external.
- **Self-Efficacy –** This was added by Rosenstock in1988, it has to do with the confidence in one's ability to take action.

In situating the theory to this study, since Health Belief Model posits that individual take health actions when susceptible to health challenges and considering the health implications of one-size-fits-all furniture, students who frequently sit on the furniture and might have experienced some discomfort, are assumed to report and instigate the university management to take proactive measures towards providing appropriate furniture that would suit all body sizes. Hence the model looks at the level at which the students take proactive actions to spur the management into providing the appropriate furniture.
The core essence of this model as applicable in this work is the promotion of comfort and prevention of health hazards of inappropriate furniture. While the students report and woo the management into action, the management could

possibly consider the need for proving the ergonomic furniture that can accommodate all the students' sizes.

METHODOLOGY

This study utilized the survey design. Survey was used to gauge the views and responses of the students of South-East universities. The suitability of the survey method had been informed by the need to collect data from students of the federal owned universities within the South East geopolitical zone of Nigeria. Data collected from the target audience were in regard to their knowledge of ergonomic chairs, perception of classroom furniture in the universities, experience of musculoskeletal disorder and awareness of the implications of inappropriate ergonomic chairs. The population for this study comprises all undergraduate students in federal government owned universities in South-East Nigeria, with a total population of 134,801 respondents. These federal owned universities are: Federal University of Technology, Owerri; Michael Okpara University of Agriculture, Umudike; Nnamdi Azikiwe University, Awka, and University of Nigeria, Nsukka.A study sample of 400 was drawn from the population of study by looking at the different sample sizes prescribed by Meyer (1973) for population that ranges from 1000 to infinity at 95 percent confidence level and by using the Taro Yamane's formula for determining sample size. This sample size was drawn from the population of about 134,801.

Table 1: *Respondents' Distribution for Federal Government-owned Universities in the Southeast*

S/N	NAME OF UNIVERSITY	LOCATION	STUDENT POPULATION
1.	Federal University of Technology, Owerri	Owerri	32,678
2.	Michael Okpara University of Agriculture, Umudike	Umudike	28,923
3.	Nnamdi Azikiwe University, Awka	Awka	34,650
4.	University of Nigeria, Nsukka	Nsukka/Enugu	38,550
TOTAL			134,801

Source: The registries of the institutions reflected

For the undergraduate students, a multistage sampling procedure was used in this study. The first stage involved the selection of universities. Five states represent South-east zone of Nigeria, four states out of these five have federal universities. One federal university was randomly selected to represent each of the states. University of Nigeria, Nsukka (Enugu State); Michael Okpara University of Agriculture; Umudike (Abia State); Federal University of Technology; Owerri (Imo State); Nnamdi Azikiwe University, Awka (Anambra State), were the chosen universities.

The second stage involved selecting the faculties from the chosen universities. Two faculties were randomly selected to represent each of the universities. University of Nigeria Nsukka (UNN) had the faculties of Social science and Management sciences selected. Michael Okpara University of Agriculture, Umudike (MOUAU) had the College of Agricultural Economics, Rural Sociology and Extension and the Collage of Natural and Applied Sciences selected. Federal University of Technology, Owerri (FUTO) had Faculty of Science and Faculty of Engineering selected. Nnamdi Azikiwe University, Awka (NAU) had Faculty of Management Sciences and Natural sciences selected.

The third stage involved the random selection of one department from each of these faculties that had been chosen. The Faculty of Social Science (UNN) had the Department of Sociology selected, while the faculty of Management Sciences (UNN) had the Department of Accountancy selected. The College of Agricultural Economics (MOUAU) had the Department of Rural Sociology and Extension selected, while the College of Applied Natural Sciences (MOUAU) had the Department of Microbiology selected. The Faculty of Science (FUTO) had the Department of Computer Science while the Faculty of Engineering (FUTO) had the Department of Chemical Engineering selected. Faculty of Management Sciences (NAU) had the Department of Business Administration while the Faculty of Natural sciences (NAU) had the Department of Agriculture selected.

Overall, 100 students per institution were selected from each of the four selected institutions used in this study, giving a total of 400 students, who were given the questionnaire.

DATA COLLECTION INSTRUMENT

Data were collected by administering a questionnaire containing a total of 23 items to students in the four federal universities spread across Southeastern Nigeria. Three trained research assistants were engaged for this purpose. They distributed and collected back copies of the questionnaire from the various institutions assigned to them, though some copies of the questionnaire were not returned. Total copies of 386 questionnaires were returned.

The questionnaire served as the instrument for data collection. These were reflective of the research questions of the study. The questionnaire was divided into 2 sections: 'A' and 'B'

The first section comprises of section 'A', which sought the respondents' demographic data such as: sex; age; study level; height; and body mass index (BMI) of the respondents.
The second section which is the section 'B' of the questionnaire consists of 20 question items (6-23).

From the above discussion, the data for this study were collected from participants using the questionnaire which was prepared, and revised beforehand.

RESULTS

A total of 400 copies of the questionnaire were distributed. One hundred copies were given respectively, to the four selected universities in Southeastern Nigeria. Out of 100 copies of the questionnaire distributed to respondents at Federal University of Technology, Owerri, 95 were returned. At Michael Okpara University of Agriculture, Umudike, out of 100 copies distributed, 98 were returned. From Nnamdi Azikiwe University, Awka, 96 were returned while University of Nigeria, Nsukka returned 97. The total number of copies of the questionnaire returned (N = 386). This is illustrated in the table below:

Table 2: *Questionnaire Distribution*

Universities	Copies Distributed	Copies Returned	Percentage Return
Federal University of Technology, Owerri	100	95	95%
Michael Okpara University, of Agriculture, Umudike.	100	98	98%
Nnamdi Azikiwe University, Awka.	100	96	96%
University of Nigeria, Nsukka.	100	97	97%
Total	**400**	**386**	**97%**

Meanwhile, against the backdrop of Myer's sample of 384, and the calculated sample of 399, using Taro Yamane's formula; plus, the suggestions of Stack and Hockings (1999) and Nwuneli (1991), this response rate was considered manageable enough to provide the necessary data for this study.

Demographic Variables

The respondents' demographic variables were measured using question items 1-5 in the questionnaire (see Appendix A). Data generated from their responses were presented in the following pie charts and accompanying tables.

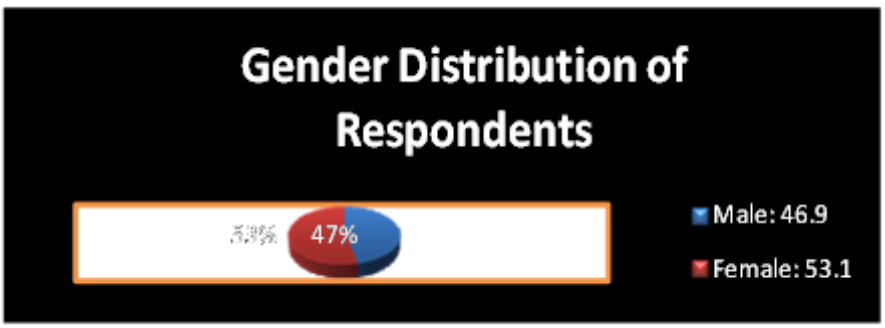


Figure *20: Respondents Gender*.

The figure above shows the ratio between the male and female gender among the respondents. Out of 386 respondents, 53 percent were female and 47 percent were

male. This is therefore indicative of greater representation of women within the universities.

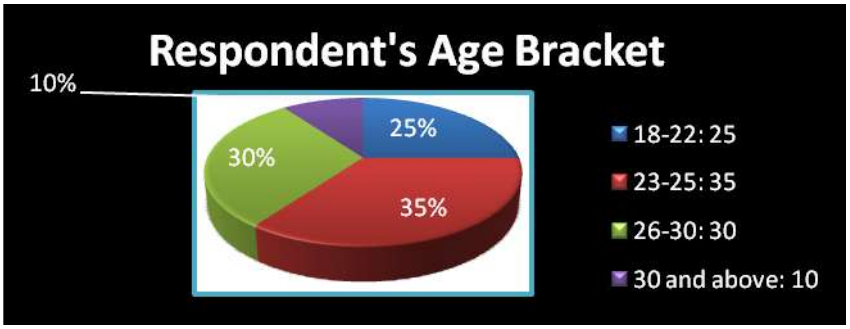


Figure 21: *Respondents Age Brackets.*

As shown in Figure 21 the respondents within the 23-25 age brackets were predominant at 35 percent, more than any other age bracket. They were closely followed by those between 26-30 age brackets at 30 percent. Those from 18-22 years made up 25 percent of the respondents while the remaining 10 percent went for those between 30 and above. Deductively, majority of the students are young adults who could be assertive of the health implications of inappropriate ergonomic furniture.

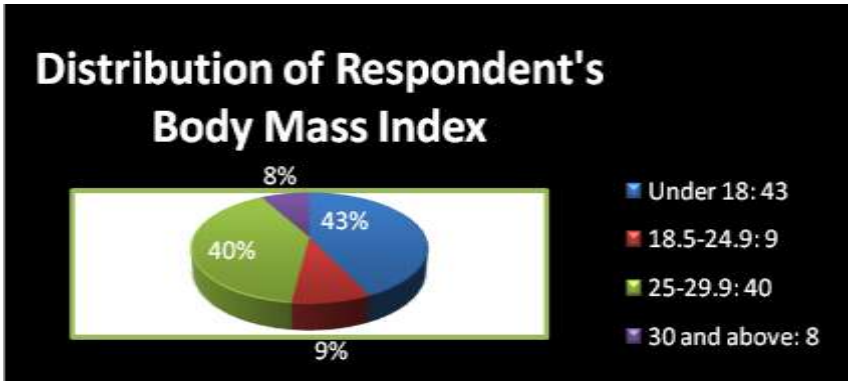


Figure 22: *Shows the ratio of the body mass index among the respondents.*

Out of 386 respondents, only 43 percent were under 18. This is closely followed by those within 25-29, with 40 percent while, those within the range of 30 and above had 8 percent. This therefore implies that those under 18, had greater ratio of body mass.

4.1 Knowledge and Discomfort Associated with Inappropriate Ergonomic Furniture:

At this point, an attempt is made to establish the knowledge and discomfort associated with inappropriate ergonomics as it relates to the respondents. This was measured by asking the respondents questions related to their knowledge and the nature of ergonomic facilities in their universities and the data generated were presented in the following tables using questions 12, 6 and 7.

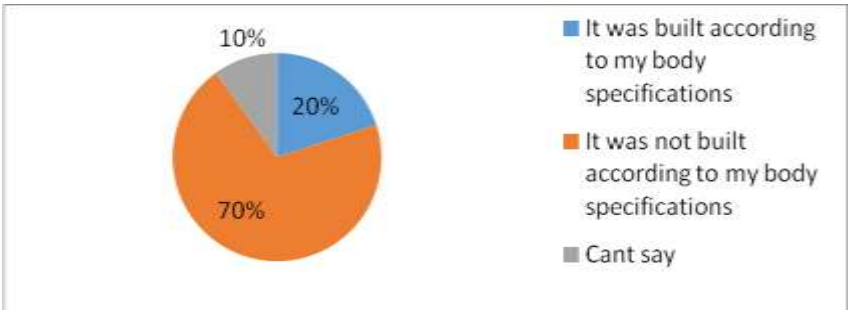


Figure 23: *Knowledge of school ergonomic furniture*

The above figure indicates that only 10% of the students are not knowledgeable about how appropriate furniture ergonomics should be designed and whether it suits their body sizes. The remaining 90% of them who were knowledgeable show varying views on how appropriate the funiture are.

Table 3: *Descriptive Statistics of Similar Scale Items of the Suitability of Ergonomics*

Suitability Indicators	**Percentage of Respondents**					
	V.U	**U**	**C**	**V.C**	**Mode**	**Std. Dev**
How would you describe the chairs in your lecture halls?	43.0	42.0	15	0.0	1.0	1.07
How would you describe the chairs in your school library?	48.0	52	0.0	0.0	2.0	1.24

V.C- Very Comfortable; C –Comfortable; U – Uncomfortable; V.U – Very Uncomfortable. Note: Some Figures are rounded off to next higher decimal.

The second item in Table 4, shows that the modal score is 2.0 indicating respondents' agreement that the chairs in their lecture halls are uncomfortable. The standard deviation 1.24 indicated that the variation is about one mark from each individual respondent's score. Likewise, the items that have modal score of 1.0 and 2.0 are indicative that respondents consent their view in strong terms of very uncomfortable and uncomfortable on the items about the nature of chairs in their lecture halls with 48 and 52 percents respectively.

Table 4: *Respondent's Reactions to ergonomic facilities in the university.*

Reaction Indicator	Frequency	Percent
Very uncomfortable	165	43%
Comfortable	58	15%
Uncomfortable	163	42%
Total	386	100.0%

The analysis in Table 5 measures the state of the respondent's reaction to ergonomic facilities in the university. From this table, only 15% of 386 respondents confirmed that they were comfortable with the schools' ergonomic facility while 42% were uncomfortable and 43% very uncomfortable. This therefore illustrates that majority of the students attest to the existence of inappropriate ergonomic furniture in their schools.

Table 6: *Relationship between Nature of Lectures Chairs and the Academic Levels of the Respondent's*

Academic Level Indicator	The Nature of Chairs in Lecture Halls		
	Very uncomfortable	Uncomfortable	Comfortable
100	35%	7%	0%
200	18%	45%	3%
300	27%	22%	0%
400	7%	22%	64%
500	2%	3%	5%
600	11%	1%	28%
Total	100% (N=165)	100% (N=163)	100% (N=58)

X^2=197.7; df 10; p<.403

Table 6 also attempts to find out if there is any relationship between ergonomic suitability and the academic levels of the respondents. However, the table shows that 64 percent of the respondents who are in their 400 levels are comfortable with the state of ergonomics in their institution. 35 percent of those in their 100 levels confirmed that they are very uncomfortable with their chairs. Again, 45 percent of 200 level students maintained that the state of ergonomics in their school is uncomfortable for them. From this presentation, it suggests that there is a significant difference between the students' study levels and their reactions to the nature of ergonomics in the universities. This was so based on the statistical significance of .403 at difference 10.

Rating the Ergonomic Furniture in Lecture Halls, Exam Halls, Labs, Auditorium and Relaxation Centers.

Here, an attempt was made to find out how suitable the furniture in student-centered facilities accommodates their different body dimensions. This was represented with the following charts below.

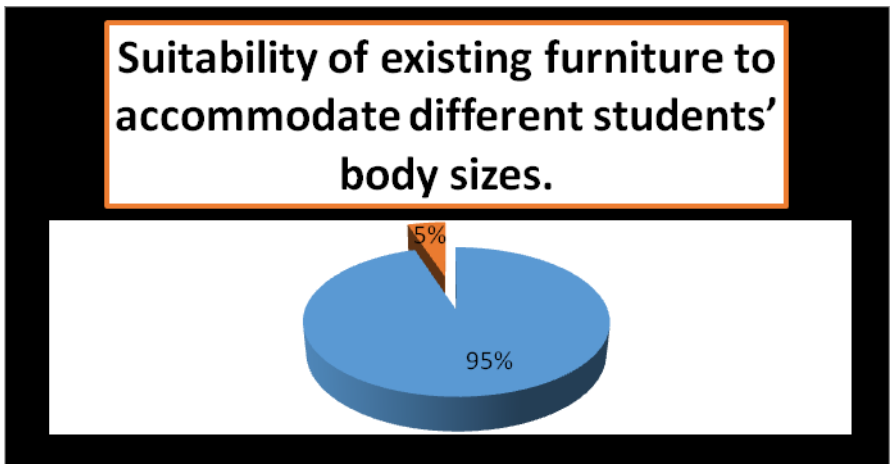


Figure 24: *Suitability of existing furniture to accommodate different students' body sizes.*

The figure above shows the suitability of the existing furniture in the university, to accommodate different students' body sizes. Results show that while only 5% of them consider the existing furniture ergonomics as suitable, 95 % of them insist that the furniture is unsuitable and therefore needs adjustments. This conforms to the argument of Mrunalini (2006) that students prefer adjustable furniture as against the one size fits all furniture.

Table 7: *Relationship between the classroom chairs and Body Mass Index of the Respondents*

Body Mass Index Indicator	The Nature of Chairs in Lecture Halls		
	Comfortable	uncomfortable	Very Uncomfortable
Under 18	57	10	70
18.5-24.9	0	10	10
25-29.9	43	70	10
30 or greater	0	10	10
Total	100% (N=58)	100% (N=163)	100% (N=165)

X^2=160.1; df 6; p<.005

Table 8 tries to find out if there exist any relationship between the classroom chairs and the body mass index of the respondents. However, the table shows that 70 percent of the respondents between 25-29.9 body mass index, are uncomfortable with the school's ergonomic facilities. Again, 70 percent of those under 18 body mass index claimed being very uncomfortable with their chairs while 57 percent in this same order stated that they are comfortable with that. This therefore suggests that there is no significant difference between the students' body mass index and their reactions towards the ergonomic facilities in the universities. This was so based on the statistical insignificance of .005.

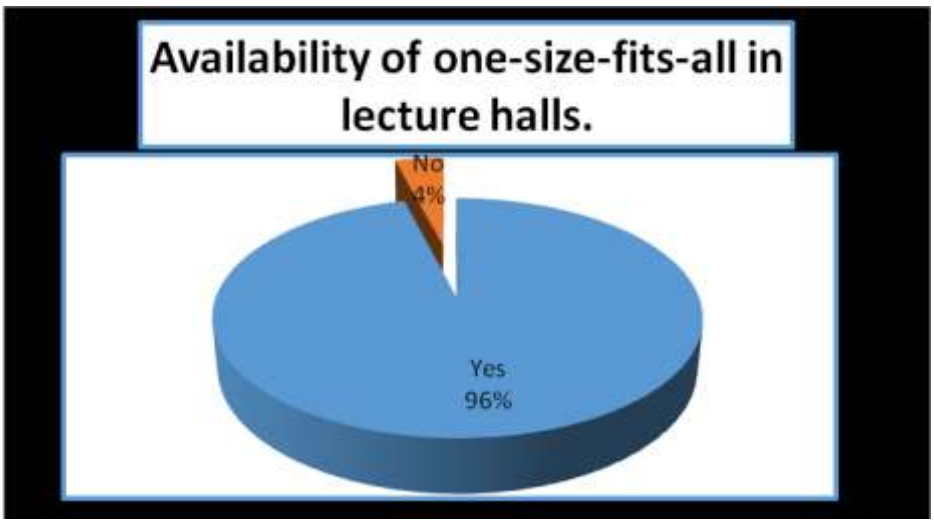


Figure 25*: Availability of one-size-fits-all in lecture halls.*

Figure 25 indicates that about 96 percent of the students confirmed the availability of one-size-fits-all ergonomics in their respective institutions. This ratio may be an affirmation of the type of sits found in most of the schools which are always in wooden forms that accommodate up to five sitters at the same time irrespective of their different body mass.

Experiences on the symptoms suggesting musculoskeletal disorder.
This section is set to primarily determine the students experience on the symptoms suggesting musculoskeletal disorder. This was measured by asking the respondents questions on their report of ergonomic injuries they might have experienced in the past. And the questions on this issue were measured using question items 13-19 in the questionnaire (see Appendix). The data generated from the variables are as presented below.

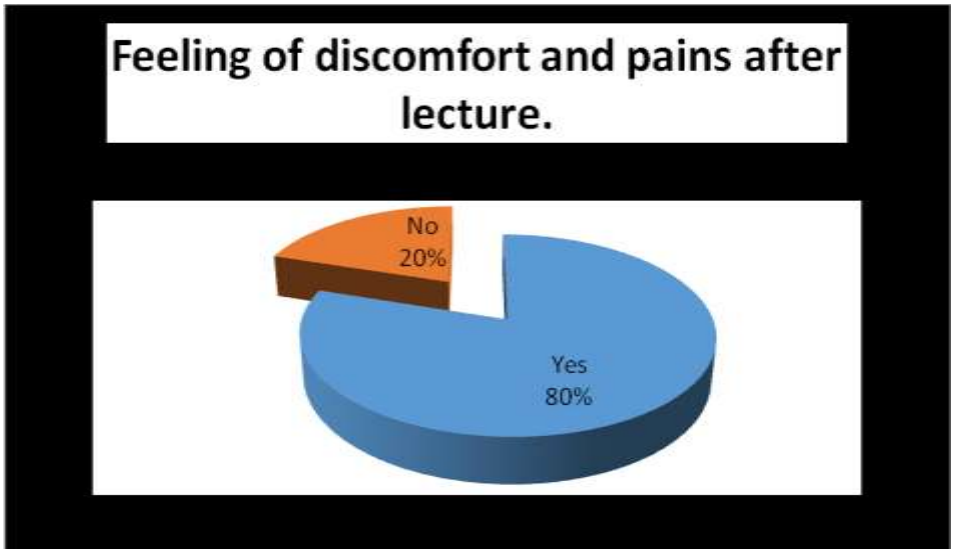


Figure 26: *Respondents data of the discomfort and pains they feel after lectures.*
The figure above presents that 80% of the students experience discomfort and pains after using the ergonomic facilities in their schools. This is also a

confirmation of the health implications associated with one size fits all which Parcells (1999) argues to be causing severe health challenges for students who utilize poor furniture for prolonged periods of time especially during school hours. For instance, prolonged static posture put extreme physiological strain on the muscles and ligaments (Bendix et al, 1987). Neck, shoulder and back pains problems are also common among school children and students (Troussier, 1999).

Table 8: *Frequency of Discomfort after Sitting on Lecture Chairs*

	Frequency	Percent
All the times	**255**	**66%**
Sometimes	**66**	**17%**
Cant say	**65**	**17%**
Total	**386**	**100**

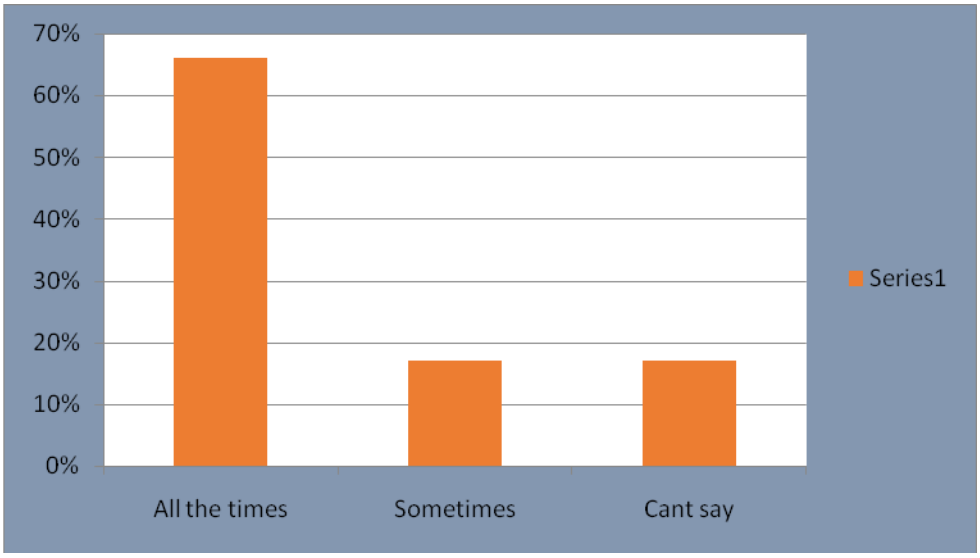


Figure 27: *Frequency of Discomfort after Sitting on Lecture Chairs*

Figure 27 and table 8 aims at measuring discomforts like pains in the shoulders, neck and upper or lower back associated with nature of the respondent's lecture ergonomics. In this order, 255 respondents, made up of 66 percent said they frequently experience discomfort after sitting in lecture halls meaning that they are uncomfortable with the one size fits all ergonomics. However, 17 percent said they sometimes experience discomfort while the remaining 17 percent could not identify whether the furniture are appropriate or inappropriate

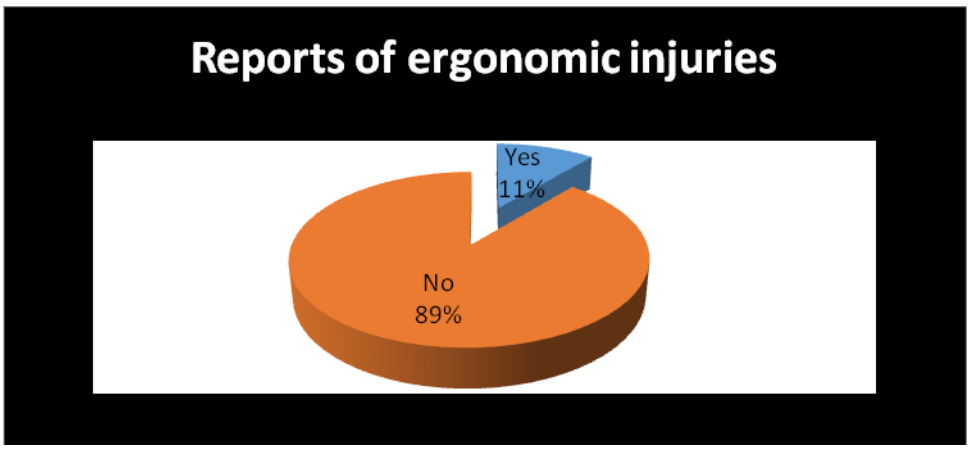


Figure 28: *Respondents reports of ergonomic injuries.*

Figuure 28 above revaels the level to which the students report symptoms associted with inappropriate ergonomics. The data shows that majority at 89% do not report the symptoms while only 11% do so. This indicates that despite the existence of poor furniture, students hardly take congnizance of the need to report sympoms of inappropriate ergonomics.

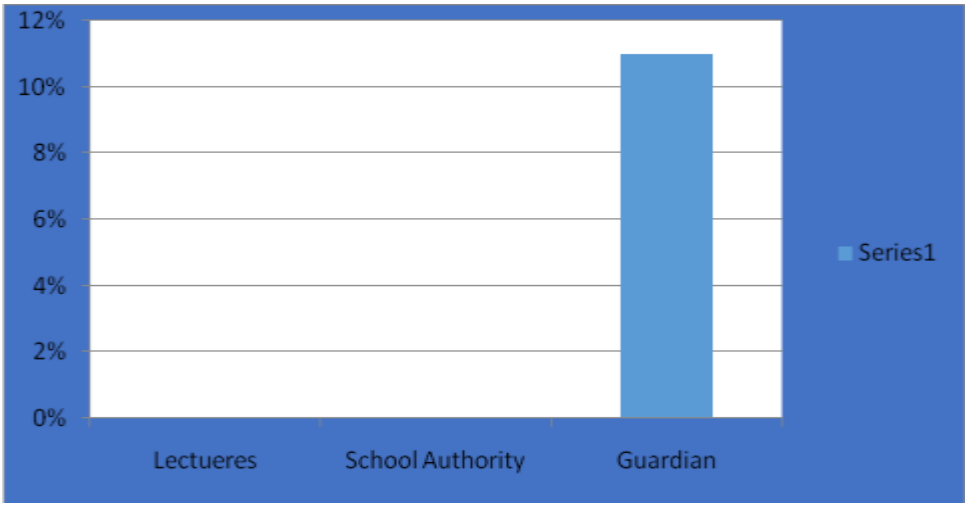


Figure 29: *The frequency of who the students report to.*

Having established that only 11% of the students report symptoms of inappropriate ergomomics, data presented in the above figure shows that they all report the symptoms to their guardians.

The Students Awareness of the Health Implications Associated with the Use of Inappropriate Ergonomic Chairs.

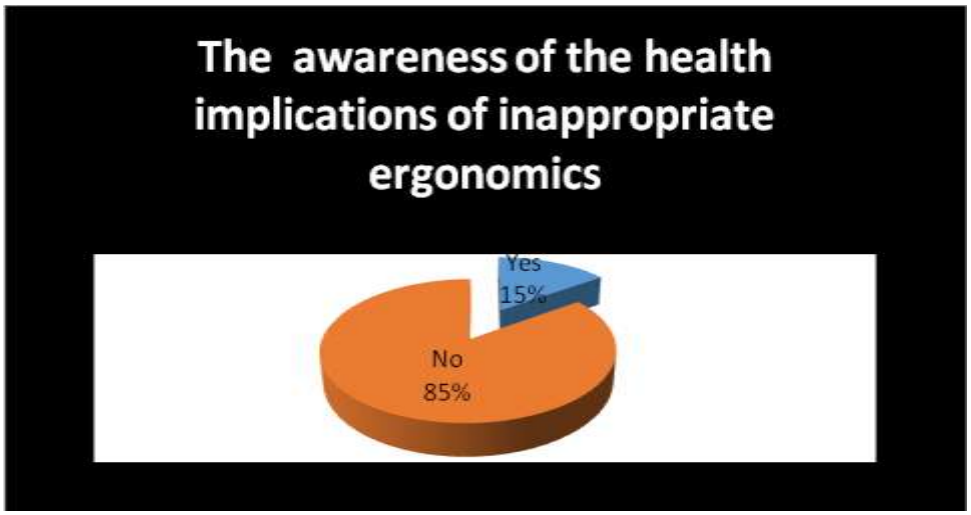


Figure 30: *Respondents awareness of the health implications of inappropriate ergornomics*

The figure above ascertains the students' awareness of the health implications associated with inappropriate ergonomics. While 85% of them are unaware, only 15% of them are aware of the health implications associated with inappropriate ergonomics.

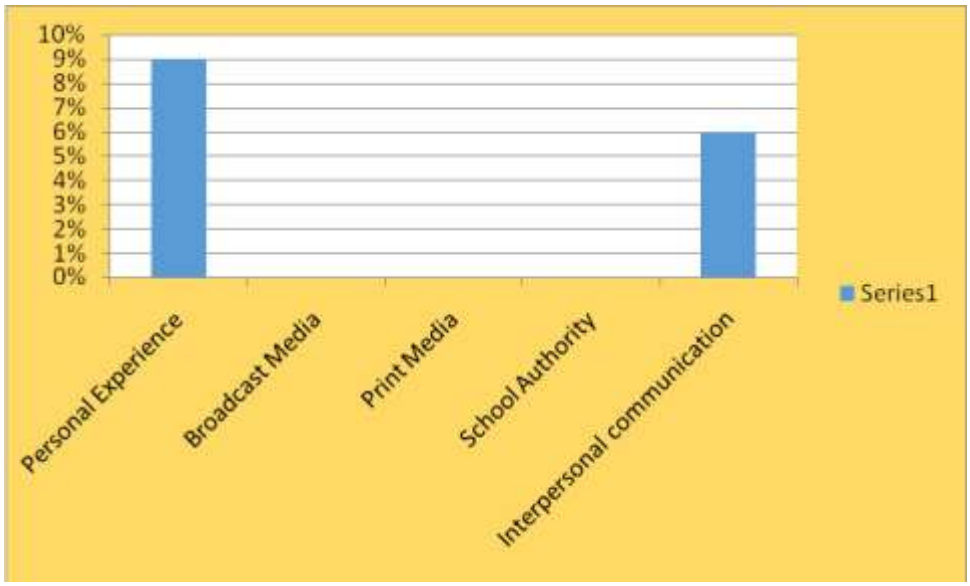


Figure 31: *The medium through which the respondents became aware of the health implications.*

In terms of the medium through which the students became aware of the health implications associated with inappropriate ergonomics, out of the 58 students, representing 15%, who are aware of health implications of inappropriate ergonomics, only 9% acquire the information through personal experiences while

6% of them acquire theirs through interpersonal communication. This illustrates that personal experiences and interpersonal communication, dominated as the source of the respondents awareness of the health implications associeted with inappropriate ergonomics.

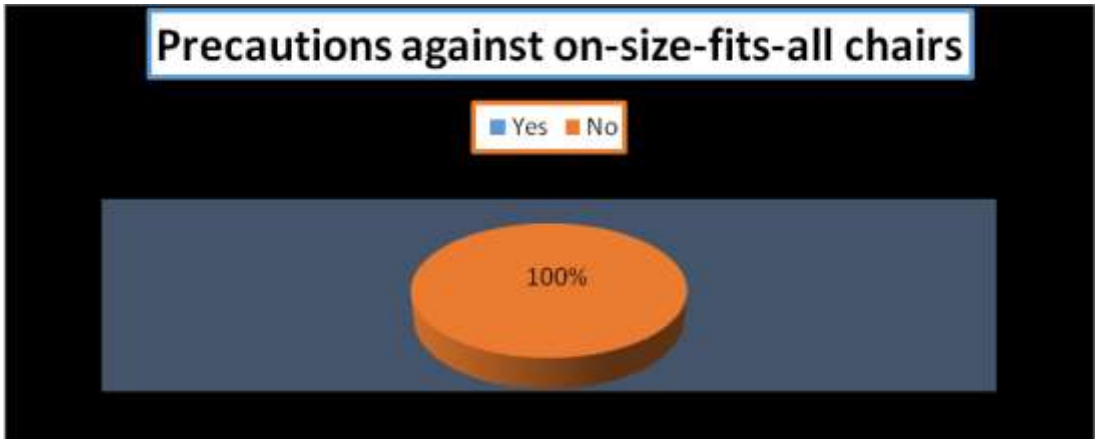


Figure 32: *Respondents precautions against one-size-fits-all chairs.*

The study further ascertained the level to which the students apply any precausionary measures against the one size fits all. Data presented above shows that all the students do not apply any precausions against inappropriate ergonomics. This indicates that students take no action to adress the problem, despite their high level awareness of the health implications associated with the one size fits all.

ANALYSIS OF RESEARCH QUESTIONS AND DISCUSSION OF FINDINGS

This study basically sought to determine how informed and literate the students are on the use of ergonomics. It is also targeted to establish the possibility that students of the Nigerian universities might be aware of the health implications in the use of inappropriate furniture ergonomics in their learning environments. The following research questions were carved in line with the objectives and research problem earlier raised in the study:

1. How knowledgeable are Nigerian university students on ergonomic chairs?
2. Against the back drop of appropriate and inappropriate ergonomics, how do students rate the seats in Nigerian public university lecture halls, exam halls, labs, auditorium, relaxation centres, libraries, cafeteria etc?
3. To what extent do these students experience symptoms suggesting musculoskeletal disorder?
4. Are the students aware of the health implications associated with the use of inappropriate ergonomic chairs?

The first research question of this study sought to determine whether the respondents are knowledgeable of ergonomic furniture. Determining their knowledge and discomfort to ergonomic facilities was necessary in order to understand the health effects such chairs would have on them. Analyses of the

findings in Tables 4 & 5 and figure 23 gave an overall picture of respondents' knowledge, accessibility of chairs as well as the discomfort they feel sitting on them. Although 90% of these respondents are knowledgeable of appropriate and inappropriate furniture, only 10% of them are not knowledgeable of ergonomic furniture, Also, 15 percent of them confirmed that they were comfortable with the schools' ergonomic facility, 43 percent of them confirmed they are very uncomfortable with their ergonomic facility while 42 percent of them were uncomfortable with the furniture. This discomfort and pains observed by the students is reflective to the findings of (Yeats, 1997) that "the mismatch between the students' anthropometry and furniture design can be one of the risks of MSDs."

The second research question of this study sought to know how the students rate the seats in Nigerian university lecture halls, exam halls, labs, auditorium, relaxation centres, libraries, cafeteria etc. The analysis of the respondents tries to sort out how the students rate the student-centered facilities in their respective institutions. Data in Figure 24 observed that 95 percent of the students facilities are unsuitable for them while 5 percent feels otherwise. Also, figure 25 indicates that about 96 percent of the students confirmed the availability of one-size-fits-all ergonomics in their respective institutions while just 4 percent thinks otherwise. This ratio may be an affirmation of the type of sits found in most of the schools which are always in wooden forms that accommodate up to five persons at a time irrespective of their different body sizes. This implies that poor furniture ergonomics are rampant within the schools. This also confirms the statement of (Doll 2012), that one-size-fits- all philosophy has been adopted in many institutions and offices within Nigeria, because such furniture is less costly to manufacture and easier to sell at a lower price, and lessens the inventory problems for manufacturers and schools.

The third research question in this study addressed the symptoms students' experienced suggesting musculoskeletal disorder. Figure 26 shows that 83% of the students experience discomfort and pains after using the ergonomic facilities in their schools. This is also a confirmation of the health implications associated with one size fits all which Parcells (1999) argues to be causing severe health challenges for students who utilize poor furniture for prolonged periods of time especially during school hours. From table 8 and figure 27, 255 respondents, made up of 66 percent said they frequently experience discomfort after sitting in lecture halls meaning that they are uncomfortable with the one size fits all ergonomics. However, 17 percent said they sometimes experience discomfort while the remaining 17 percent could not identify whether the furniture is appropriate or inappropriate. This implies that majority of the students have experience musculoskeletal disorder associated with the use of inappropriate ergonomics in their respective institutions. This could also describe why Murnalini (2006) stated that students preferred their furniture height to be adjustable. Figure 28 which revaels the level to which the students report symptoms associted with inapprpriate ergonomics, shows that majority of the students do not report the symptoms while only just 11% do so. This indicates that despite the existence of poor furniture, students hardly take congnizance of the need to report sympoms of inappropriate ergonomics.

The fourth research question looked at the students awareness of the health implications associated with the use of inappropriate ergonomic chairs. Eighty five percent of them were unaware, while only 15 percent of them are aware of the health implications associated with inappropriate ergonomics.

In general, this study found out that the low level of awareness of the health implications associated with inappropriate furniture ergonomics despite the high rate of symptoms experienced by the student as a result of using them.
This finding calls for the need to organize workshops, seminars, conferences etc aimed at sensitizing the students and management on the need to provide appropriate furniture. For instance, the various health institutions and media in collaboration with NGOs can organize such communication to sensitize both the students and management of higher institutions on the dangers of inappropriate furniture ergonomics.

CONCLUSION

Based on the results of this study, it was concluded that the design, dimension and combination of furniture in each of the lecture theaters is ergonomically unsuitable for the students in South-Eastern Nigeria, thereby leading to various health problems. The universities have the same designs of furniture which is not appropriate for conducive learning and the prevention of musculoskeletal disorder. The results of this study provide baseline information on the unsuitability of one-size-fits-all furniture ergonomics on students.

RECOMMENDATIONS

Based on the findings of the study, the following are recommended:

1. The university management should regularly provide appropriate furniture ergonomics that would accommodate various students' body dimensions or sizes.
2. The government alongside the NGOs should help sensitize the public on the dangers of one size fits all furniture ergonomics.
3. Health workers in the Nigerian government hospitals should always advice the management of various institutions of higher learning and their students on the need to provide and use the right ergonomic chairs for conducive learning environment and healthy living.
4. Student should be careful on their use of the furniture while the management provides the appropriate furniture ergonomics.
5. School management should invest in ergonomic chairs.

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