

# STUDY ON COMPATIBILITIES OF ANTHROPOMETRIC MEASUREMENT ON LEARNING DESKS AND CHAIRS WITH PRIMARY SCHOOL STUDENT IN MALAYSIA

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## ABSTRACT

In our daily activities of learning, 80% of the time spend by a student is by sitting on the chair and using desk, which makes 6-7 hours in a day. Based upon the findings of Savanur et al (2007) (Advance in Ergonomics in Design, Usability and Special Populations, Part II) said '*students spend about a quarter of the day (6hours) in school, and 60% to 80% of that time is spent in the classroom*'. Sitting on a chair for long period can cause some problems to the student, which will eventually decrease the uncomfortable and incompatibility issues. On the other hand if the chair and desk provided to the student is uncomfortable then the student will feel distracted and lose focus on learning and also have a high risk of developing trauma pain MSD - Musculoskeletal Disorder. Trauma pain is usually stems from an early stage and depends on the quality and use of the chair and desk by the student. In a study conducted by Nurrabiatul Adawiyah bte Jalaluddin (Assessment on Space and Furniture's Ergonomics for Children in Kindergarten) says, '*all the health problems experienced by adult starts from a young age, particularly in the early primary school children*'. The convenience and compatibility in the design of chair and desk with student play an important role in assisting student learning process more effectively. The main aim of the study is to improve the compatibility of chairs and desks use by primary school students. Thus, the corresponding study design of chairs and desks were done through the furniture size, body size and posture using anthropometric methods. The use of these methods can help us to minimize the risk of ergonomic problems experienced by students in the present and also have a great impact in the future. This study emphasizes on the planning and development of design chairs and desks that are appropriate to the anthropometric (size and shape of the physical size of the student body) and to produce the guidelines for the design of chairs and desks that are more ergonomic, practical and of good quality.

## Keywords:

Anthropometric, Ergonomics, Posture, Anatomy, Static, MSD, Trauma

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## **INTRODUCTION**

Primary school students spend most of their time sitting on chairs and using desks while studying at the school at any time and day of school. As you know, usually most of the subjects taught in school requiring students to interact with tables and chairs because they had to use a chair to sit while learning and need a desk for study purposes. Primary school students are also the same as adults. In their daily learning activities, they also require the use of chairs and tables that are appropriate in terms of comfort and usability. Generally, a product should have the ergonomic so that it is more user friendly and comfortable in practical. Likewise, the tables and chairs in school. For furniture as chairs and desks, ergonomic feature that needed is anthropometric aspects of the user. This is supported by the statement of Jan Dul and Bernard Weerdmeester (2001), which states that *'ergonomic design is a branch that studies the interaction between everyday life and work with objects used'*. However, few studies have focused on the effect of school furniture on the body posture of students when performing the tasks required in classroom (Soares, 1998; Siqueira et al., 2008). If the students using (sitting) on the chair in a long period that doesn't suit or match with their anthropometric aspects, this could make them feel uncomfortable and they find difficult in their learning activities and so on will affect their physical posture in the future. A study done by Scientists at the University of Waterloo, Canada showed in their article Safety Office – Ergonomics that, *'prolonged sitting can cause the spinal cord taut, increasing the risk of damage on the lower spine. This can cause back pain while sitting'*. In another study shows, sitting in long periods of time can also cause bone loss becomes abnormal posture, muscle tension and back pain.

## **LITERATURE REVIEW**

### **Primary Student**

Primary school students or also known as children between the ages of 7 and 12 years. Children are beginning the process of development into adulthood. The World Health Organization (WHO) officially defined as a child who is under the age of 18. The definition that has been used at world level and the age range is also adjustable in Malaysia. According to statistics released by the Department of Statistics, in 2010, a total of 31.7% of the total population between the ages of 1 and 14 years, which decreased from 32.6% in 2005. A child is going through a stage of dynamic development profiles different and needs. Ages baby is 0-1.5 years, for early-aged children ages prefix is 2 to 6 years old, of middle-aged children (primary school category) is 7 to 9 years age group for pre-teens or even as a stage the child is 10 to 12 years and ages of youth and adolescents are 13 to 18 years.

### **Primary School in Malaysia**

Primary school is an institution comprised of middle-level children (7 - 9 years) and pre-teens stage (10 – 12year). Primary schools in Malaysia are divided into two types, which are nationality primary schools and school types (Chinese and Tamil). Both types of schools do not have much difference in terms of education, co-curricular and examination, the only difference is only in terms of the language used by type of school. Primary education is a continuation of pre-school education. In primary school, students took forever 6 years and ends by UPSR - Primary School Achievement Test to determine the performance of the secondary school. Apart from reading, writing, and arithmetic, they will be exposed to other subjects such as science, physical education, skills in design, religious

education such Islam and moral education. In primary school, students are divided into two levels, level one which are from standard 1 - 3 and level two which is standard 4 - 6.

### **Chairs and Tables**

Chair is a kind of furniture to sit, usually for the use of one or more people. It has a backrest, and sometimes had armrest. Chair usually has four legs to support the seat on the floor. That no part of the seat back and armrest so-called bench. While the table is the required furniture to allow users to do any work on it. Examples are used to read as dining, cut goods, writing, learning and so on. In addition, the table is a piece of furniture between man and other products. Tables and chairs are the most important link that connected between students and their learning sessions in school. This requirement is to enable students to do school activities.

### **Ergonomics**

Ergonomic is an applied science concerned with designing and arranging things people use so that the people and things interact most efficiently and safely. Ergonomics has called also *biotechnology*, *human engineering*, *human factors*. Ergonomic is mean and purpose to ensure that any equipment, facilities, processes and systems used by humans in an activity or / and appropriate and compatible to interact with users. It aims to ensure that each task can be done comfortably, safely, and effectively. Most people understanding and relate ergonomics. In terms of ergonomics, children are different from adult's ergonomics. Therefore, the design of the furniture and facilities need to be examined carefully to avoid any risk or injury to the child such as muscle disorders, recurrent pain and trauma pain in the long run. Ergonomics focuses on the appropriate height for children's furniture, width, length, materials and design itself.

### **Anthropometric**

Anthropometry (from the Greek 'antropos' meaning humans, 'metron' meaning measure, literally meaning " human size"), in reference to the size of the physical anthropology of the human individual to determine the variation of human physical - (Wikipedia.com). Today, anthropometry plays an important role in various fields, especially in the manufacturing, design, ergonomics and architecture. In these fields, statistical data on the measurement of body dimensions of the population needed to produce an optimum product. In daily life style, nutrition and the changing composition of each community can result in changes in the size distribution of the body (for example in the form of an epidemic of obesity), and there should be periodic adjustment of anthropometric data collection. In a passage that is produced by 'Pheasant and Haslegrave, 2006' states "Anthropometry is the science of measuring the size of a human body comprising body size, shape, strength and the ability to work a combination of all the concepts will result in ergonomic products that can improve the comfort, safety, health and productivity as in the work environment or not working.

### **PROBLEM STATEMENT**

Based on early research, the study of Mohd Herman Bin Klivon (2010/2011) says' the school also is an "industry" that should be considered, especially in terms of comfort and safety. Schools also should not missed from ergonomic factor either classroom or school environment, as well as staffs or students. "Students spend their time more than 6 hours a day sitting, when in a sitting posture all heavy loads concentrated on the occupied seat. Directly seat students with no ergonomic features

can cause students having discomfort. At the same time, the discomfort endured by students can disrupt concentration of students towards learning, as non-conforming products can encourage students to feel tired and less productive. Besides, students can earn a negative impact if the tables and chairs that do not match in a long time. The impact was such students will experience lower back pain, muscle tension, muscle aches and joint pain in some parts of the body and can lead to certain MSD risk in the future (due to repeated use of posture).

## METHODOLOGY

The study was conducted through several methods. In the initial stage, the issue raised in the problem statement is obtained through reading (secondary). Among the available literature obtained through the journals, thesis and websites. Issues cited were concerned about the correspondence table and chairs anthropometric study with primary school children in Malaysia. The second method went through unstructured interviews. The selected respondents were primary school students, teachers, designers and furniture manufacturers. This method is carried out to obtain information for a table and chairs correspondence with students based on anthropometric studies. Followed by measurement of the student body, table and chairs are available for achieving a correspondence between a table and a chair with students. Next is a observation recording method of the environment and the use of tables and chairs by students.

## RESULTS AND DISCUSSION

Research was conducted in four schools at two states, which are Penang and Selangor. 480 students have been selected as respondents and were been measured on them to gather information in order to achieve compatibility of anthropometric with tables and chairs. This limit applies to students between the ages of 7 and 12 years who share the same dimensions in the design of tables and chairs. This research also focused on the existing tables and chairs desks in primary school which is limited to identify the weaknesses and problems that exist for the convenience of the students when to use them more ergonomic. In addition, this research examined the application of ergonomic assessment in primary schools in city and rural areas to find out the differences and level of exposure and awareness of teachers, parents and the manufacturer (furniture) on the importance of ergonomics to the students.

Table 1:

The anthropometrics reviews and data collection had been taken from four schools, two schools from city areas and two schools from rural areas.

<b>Student (Year)</b>	<b>City schools x 2</b>	<b>Rural schools x 2</b>	<b>Total</b>
<b>Standard 1</b>	40	40	<b>80</b>
<b>Standard 2</b>	40	40	<b>80</b>
<b>Standard 3</b>	40	40	<b>80</b>
<b>Standard 4</b>	40	40	<b>80</b>
<b>Standard 5</b>	40	40	<b>80</b>
<b>Standard 6</b>	40	40	<b>80</b>
<b>Total number of students :</b>			<b>480</b>



Figure 1: The existing tables that been used in Primary school in Malaysia



Figure 2: Types of existing chairs that been used in Primary school in Malaysia



Figure 3: Classroom environment when the learning and teaching sessions are held.



Figure 4: The usage and problems that encountered by students. Big sized students or high chair is not in accordance with the design provided because students felt uncomfortable when seated in a long time.



Figure 5 : Indicating a mismatch in the size of the anthropometric student body of different sizes with the existing school chair

Among the types of measures taken during the research process as anthropometric parameters are:

1. Height
2. Biacromial length
3. Arm length
4. Upper limb length
5. Leg length
6. Popliteal height
7. External Malleolus height
8. Hip width
9. Hip length
10. Weight

### Antropometric Measurement Body Part

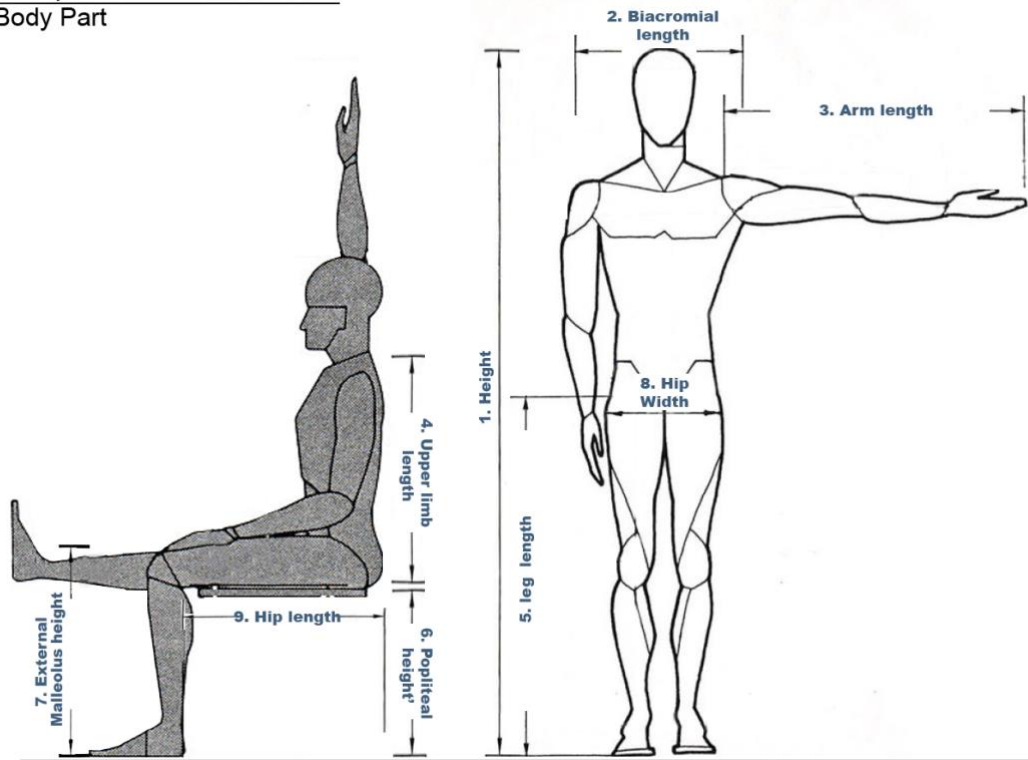


Figure 6: Body part that been measured as Anthropometric measurement

### **CONCLUSIONS**

In conclusion, this research examines the compatibility design problems with the size of tables and chairs for elementary school students in two states in India, namely in Penang and Selangor. The study was conducted by using anthropometric methods to design chairs and desks in conformance students. And some of the problems and risks that have been identified through the study, the problem is the incompatibility between the size of a desk with a chair and size of the student body according to level, other than that the design did not achieve at the same time the risk of illness by students, MSD. The objective of this study is to achieve equivalence of primary school students towards the use of chairs and desks. And it can also be a reference to certain parties such as the designer and the manufacturer to be used as a reference in terms of safety and comfort of the chairs and desks to avoid ergonomic injuries. This study is important because it can produce design guidelines that are more ergonomic and practical for students to use in the future.

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