SITTING POSTURE AMONGST LEVEL ONE PRIMARY SCHOOLCHILDREN (LOPS) IN PERLIS, KEDAH AND PULAU PINANG

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ABSTRACT
This study is a continuous study of previous paper (Wahyuni Masyidah, Noor Azlina & Muhammad Fauzi 2015). Based on the quantitative result of mismatch between anthropometric and chair dimensions amongst LOPS show that over 96% did not fit to school chair dimension during learning session in the class, and only 4% were fitted to the school chair in class. Due to the mismatch result, the aim of this paper is to reveal the qualitative result of the study which frequent types of sitting postures that attribute to discomfort that have been identified amongst Level One Primary Schoolchildren (LOPS) in Kedah Perlis and Pulau Pinang. The qualitative analysis consist 12 respondent that randomly been taken between 7 to 9 years old from different primary school in Perlis, Kedah and Pulau Pinang. It can be concluded that the sitting postures amongst LOPS could lead towards permanent damage to the body and jeopardize the children's health.

Keywords: sitting postures, discomfort, LOPS, health.

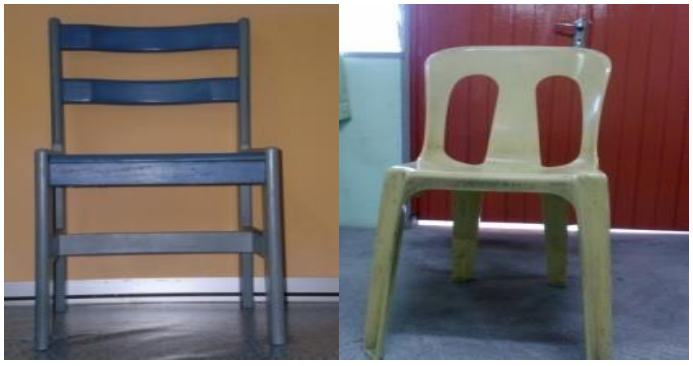
INTRODUCTION
Many studies have been done on the issues of mismatch between school children and classroom furniture, however, all the studies shared the same result which showed that there is a mismatch between the two variables (Wahyuni Masyidah, Noor Azlina & Muhammad Fauzi.,2013 & 2015, Mohd Azuan K. et al., 2010, Castellucci et al., 2009; Nurul Asyiqin et al., 2009, Lueder and Rice, 2008; Gouvali and Bondolos, 2006; Lipardo et al., 2006; Murphy et al., 2003). Mismatch between anthropometric and chair dimension could create several awkwardness of sitting position amongst schoolchildren which may lead permanent damage to the body (Lipardo et al., 2006). According to Wahyuni Masyidah, Noor Azlina & Muhammad Fauzi (2015) state that Department Standard of Malaysia considered chair is key requirement in school by issuing chair measurement in MS 1788:2005 Furniture Educational Institution Specification for Student, Chairs, Tables and Stools. However, Nurul Asyiqin et al (2009) state that even though MS 1788 : 2005 had been published, there is no specific explanation of furniture dimension for Malaysia schoolchildren, currently there is no standardization furniture dimension of Malaysia schoolchildren and the implementation concept of ergonomic design is still new practice in Malaysia. These statements in line with the result shown in previous study of mismatch between anthropometric and chair dimensions amongst LOPS by Wahyuni Masyidah, Noor Azlina & Muhammad Fauzi (2015) where it has been conducted at 12 different government primary schools in Perlis, Kedah and Pulau Pinang. A total of 108 LOPS aged between 7 to 9 years old were randomly selected after school and parents permission involved in the research. The result of the study shown as below (Table 1), that there are 13 different dimensions of chairs revealed and 2 types of chairs that used amongst LOPS,

namely wooden chair and plastic chair (Fig. 1). Wooden chair were used in all primary school, only 2 school were used plastic chair for LOPS of year 2 and year 3. Generally, the design of wooden chair of each school appears to have similar design to each other, however the dimension are varied. By adopting quantitative method of Gouvali & Boudolos (2005), the data of 13 chair dimensions and 108 anthropometric data of LOPS were analyzed by using SPSS, in order to find out the percentage of mismatch between anthropometric and chair dimension amongst LOPS of Perlis, Kedah and Pulau Pinang. Due to no standardization chair dimension of primary school, therefore, the figure (table 2) shown that LOPS are prone to have awkward sitting posture and exposed to back pain illness. The issues of mismatch do lead to possible negative implication of seating posture (Castelluci, Molebroek & Viviani, 2015; Parcells, Stommel & Hubbard, 1999).

Table 1 : Chair Dimension of Primary Schools (All Dimension are in cm)

Wooden Chair	Seat Height	Seat Width	Seat Depth	Backrest Height	Year (T)	School
A	33.7	38.5	38	31.5	Y1, Y3	SKMH
B	34	36.5	32	29	Y1	SKBG
C	36	38	35.4	31.5	Y1,Y2,Y3	SKDK
D	27	39	42	31.7	Y1,Y2,Y3	SKKS
E	38	38	38.5	32	Y1,Y2,Y3	SKSR
F	38	38	41	31	Y1,Y2,Y3	SKSM
G	38	37.7	38.3	32.5	Y1,Y2,Y3	SKJH
H	38	37.5	42.25	31.5	Y1,Y2,Y3	SKPM
I	38.5	38.5	38	31.5	Y1,Y2,Y3	SKBE
J	39	38.1	38.2	32	Y1,Y2,Y3	SKAJ
K	39.1	38.1	38.6	30	Y1,Y2,Y3	SKBBSL
L	39.1	38	38.5	30	Y1,Y2,Y3	SKS

Plastic Chair	Seat Height	Seat Width	Seat Depth	Backrest Height	Year(Y)	School
M	43.3	38.5	42	36.7	Y2,Y3 Y2	SKBG SKMH



(a) **(b)**

Fig. 1 : (a) Wooden chair (b) Plastic chair

Table 2 : Percentage of Match and Mismatch between Anthropometric and School Chair of Primary Schools amongst LOPS

Match between Anthropometric and School Chair				
Age	**Gender**		**%**	**Total of LOPS**
	Female	**Male**		
7 Years Old	**0**	**2**	**1.9**	**2**
8 Years old	**0**	**1**	**0.9**	**1**
9 Years old	**0**	**1**	**0.9**	**1**
Total	**0**	**4**	**3.7**	**4**

Mismatch between Anthropometric and School Chair				
Age	**Gender**		**%**	**Total of LOPS**
	Female	**Male**		
7 Years Old	**13**	**21**	**31.5**	**34**
8 Years old	**13**	**22**	**32.4**	**35**
9 Years old	**9**	**26**	**32.4**	**35**
Total	**35**	**70**	**96.7**	**104**

Based on the previous result, this paper is a continuous paper to reaffirm the quantitative result through qualitative data; by identified the frequent type sitting amongst LOPS in Kedah, Perlis and Pulau Pinang. The aim of this study is to establish frequent types of sitting postures that attribute to discomfort amongst LOPS in Kedah Perlis and Pulau Pinang.

RESEARCH METHOD

Video analysis

This research were conducted on the same respondent of the previous study, however only 12 respondent of LOPS were randomly taken after school and parents permission (Table 3). The usage of wooden chair were consists 3 respondents for each aged 7 to 9 years old, while the plastic chair usage consist 2 respondents of 8 years old of LOPS and only 1 respondent of 9 years old of LOPS. Each respondent is represented the usage for each dimension of chair during learning session (Table 1). Two video handy-camera were used to record 30 minutes of postural seating behavior video recording (Domljan, Vlaovij, & Grbac., 2010 ; Dhara, Khaspuri, & Sau., 2010) amongst LOPS during their learning session in the classroom. These videos have been analyzed thoroughly on the correlation of mismatch and awkward posture seating.

Table 3 : 12 respondent of LOPS were recorded in 30 minutes of seating postural during learning session by sitting on different sizes of school

Wooden Chair		
7 Years Old	**8 Years Old**	**9 Years Old**
Respondent A	Respondent D	Respondent G
Respondent B	Respondent E	Respondent H
Respondent C	Respondent F	Respondent I

Plastic Chair	
8 Years Old	**9 Years Old**
Respondent J	Respondent L
Respondent K	

RESULT

The video analysis reveal there are 6 types of sitting posture that frequently prevail amongst LOPS :

TYPES OF SITTING POSTURE	DESCRIPTION
	**Straddles sitting postures** Basically, this sitting posture were involved with the lateral movement while sitting. This sitting posture frequently happen due to the mismatch and non adjustable design of chair used by LOPS in school. It shows that school chair did not fit with children behavior sitting in the class. Sitting on the edge of the seat can cause discomfort at the feet due to the high compression under the thigh which allow interruption of blood flow and circulation and causes numbness at the muscle (Muhammad Fauzi,2010; Miller, 2002).
	**Sitting up straight posture** According to analysis, there are two main factors that influence Sitting up straight posture, namely : (a) Depth Seat dimesions greater than Buttock Popliteal Length dimension, (b) Sitting behaviour by placing school bag at the backrest. These factor cause depriving the sitter from the backrest to proper support the back while sitting which can cause pain, injury and discomfort at lumbar region for long term (Lueder & Rice, 2008; Tiedeman,2003). According to Pheasant, 1998, sitting up straight may reduce the impact of

	lordosis, but it cause tension and pressure in hamstring part.
	**Twisting body posture** Accordingly the analysis shows that LOPs frequently twist their body during class session. There are several factors that influence this sitting posture, namely: (a) pick up a book from the bag which placed at the back or on the floor due to no specific locker to keep the student's stuff, (b) layout of the class, (c) activity in classroom such as writing, drawing, reading and discussion, (d) mismatch between anthropometric and chair dimensions, and (e) non flexible design of chair in the class. According to Miller (2002), back discomfort occurred due to awkward or non-neutral postural of the spine such twisting, bending, flattening the lower back or seat on the flat surface which contributing to overuse muscle and ligaments. This awkward posture not only pressing the discs, in fact it also can rupture the cartilaginous discs between vertebrae. To make matter worse, the repetition of this posture can cause dwindling body rehabilitation.
	**Leaning forward sitting posture** Leaning forward sitting posture amongst LOPS due to mismatch between anthropometric and chair dimension. The sitting position of extending and forwarded position body cause the back slide away from the back rest which deprive the stability of sitting and proper support at lumbar region (Panero & Zelnik, 1979) and it can cause a slumped, kyphotic posture, therefore chair should have contoured back rest, fitting the natural spinal curves, stabilize the spine and reduce kyphotic posture (Panagiatopolous et al.,2003).
	**Folding leg sitting posture** This folding leg sitting posture amongst LOPs frequent happened during learning session in class. Tiedeman (2003), explained that this position of sitting can cause the risk of blood clotting inside the leg and flatulence at the lower feet due to weak blood circulation. Apart from that, the discordant spine position cause cervical bone swell due to back muscle tensions which involve shoulder and neck.

	**Reclined sitting** According to Breadfort and Stone (1899) stated that this position of sitting is mainly to reduce the pressure ligament at lumbar region and compression at the buttock. However, referring to the analysis show that chair in the class did not give proper support to the back and may not reduce the pressure and compression properly while sitting.

Prolonged static sitting posture can be very tiring. This posture contracted to static muscle usage where a muscle contracted for a period of time without movement as in holding a picture against the wall, sitting upright, stand for attention, and so on. This posture heavily squeezes the blood vessel next to it and reduces blood flow and body nutrient which led to toxic increase. It can cuts down the delivery of oxygen to the muscle and the removal of lactic acid from the muscle which led to muscular aches and pain (Ergonomic4schools, 2010).These awkward and static postures sitting occurred due to the mismatch between anthropometric and chair dimension which increase the risk of developing chronic musculoskeletal disorders amongst schoolchildren, particularly continues increase in general population. Due to discomfort while sitting, people tend to move more by changing the posture of sitting. This particular behavior known as "fidgeting" which is associated with forward oriented movement and posture that increase load on the soft tissues and spine (Humanics ErgoSystems, Inc, 1999). According to Miller (2002), state symptom of discomfort is frequently changing posture sitting, people tend to fidgeting after prolong sitting, therefore, they keep changing sitting to achieve stability of sitting namely to release muscles after prolong sitting. The frequency changing of sitting posture amongst LOPS within 30 minutes of learning lesson in the classroom show below (Table 4, Table 5, Table 6, Table 7, Table 8, Table 9 and Table 10) The numbers of changing sitting posture are high. These result indicate that LOPS in Perlis, Kedah and Pulau Pinang are "fidgeting" which lead to awkward sitting posture and they are greatly exposed to chronic musculoskeletal disorder.

Table 4: Frequency of Straddled Posture Sitting within 30 minutes of learning session by 10 respondents using wooden and plastic chair of different dimensions

Respondents of LOPS	Frequency	Percentage (%)
Respondent A	13	11.21
Respondent B	21	18.10
Respondent C	13	11.21
Respondent D	16	13.79
Respondent E	22	18.97
Respondent F	2	1.72
Respondent I	8	6.90
Respondent J	1	0.86
Respondent K	9	7.76
Respondent L	11	9.48
TOTAL	116	100.00

Table 5: Frequency of Sitting Up Straight Posture within 30 minutes of learning session by 12 respondents using wooden and plastic chair of different dimensions

Respondents of LOPS	Frequency	Percentage (%)
Respondent A	17	5.92
Respondent B	27	9.41
Respondent C	18	6.27
Respondent D	24	8.36
Respondent E	32	11.15
Respondent F	26	9.06
Respondent G	19	6.62
Respondent H	28	9.76
Respondent I	21	7.32
Respondent J	20	6.97
Respondent K	28	9.76
Respondent L	27	9.41
TOTAL	287	100.00

Table 6: Frequency of Leaning Forward Sitting Posture within 30 minutes of learning session by 12 respondents using wooden and plastic chair of different dimensions.

Respondents of LOPS	Frequency	Percentage (%)
Respondent A	18	5.86
Respondent B	13	4.23
Respondent C	14	4.56
Respondent D	26	8.47
Respondent E	39	12.70
Respondent F	34	11.07
Respondent G	27	8.79
Respondent H	28	9.12
Respondent I	23	7.49
Respondent J	20	6.51
Respondent K	33	10.75
Respondent L	32	10.42
TOTAL	307	100.00

Table 7: Frequency of Twisting Body Posture within 30 minutes of learning session by 12 respondents using wooden and plastic chair of different dimensions

Respondents of LOPS	Frequency	Percentage (%)
Respondent A	16	8.60
Respondent B	23	12.37
Respondent C	16	8.60
Respondent D	30	16.13
Respondent E	12	6.45
Respondent F	23	12.37
Respondent G	7	3.76
Respondent H	14	7.53
Respondent I	18	9.68
Respondent J	9	4.84
Respondent K	2	1.08
Respondent L	16	8.60
TOTAL	186	100.00

Table 8: Frequency of Folding Posture within 30 minutes of learning session by 5 respondents using wooden and plastic chair of different dimensions

Respondents of LOPS	Frequency	Percentage (%)
Respondent A	1	5.56
Respondent B	4	22.22
Respondent C	10	55.56
Respondent D	1	5.56
Respondent I	2	11.11
TOTAL	18	100.00

Table9: Frequency of Reclined Sitting posture within 30 minutes of learning session by 5 respondents using wooden and plastic chair of different dimensions

Respondents of LOPS	Frequency	Percentage (%)
Respondent A	13	33.33
Respondent E	4	10.26
Respondent H	8	20.51
Respondent K	6	15.38
Respondent L	8	20.51
TOTAL	39	100.00

Table 10 : Total Frequency of Changing Sitting Posture within 30 minutes of learning session by 5 respondents using wooden and plastic chair of different dimensions

Respondents of LOPS	Frequency	Percentage (%)
Respondent A	78	7.88
Respondent B	93	9.39
Respondent C	71	7.17
Respondent D	97	9.80
Respondent E	109	11.01
Respondent F	85	8.59
Respondent G	65	6.57
Respondent H	98	9.90
Respondent I	72	7.27
Respondent J	50	5.05
Respondent K	78	7.88
Respondent L	94	9.49
TOTAL	990	100

Table 4 show that only 10 of 12 respondents are frequently prevail straddle posture sitting while the other 2 of respondent prefer put their feet on bar table while sitting during learning lesson in the classroom. This frequent sitting posture happens due to incorrect dimension of seat height and seat depth. **Table 5** show that the entire respondent are expose to the Sitting Up Straight Posture which can cause stretch at the hamstring region (Pheasant, 1998). **Table 6** state that all the respondent are frequently change sitting to of Leaning Forward Sitting Posture can cause pressure at lumbar region and numbness at the leg. This posture occurred due to the incorrect dimension of seat depth and backrest. The function of backrest is to support back and upper body to achieve stability while sitting. **Table 7** indicate that all of respondents are expose to Twisting body sitting posture and the frequent of twisting body are very high amongst LOPS. This posture occurred due to static chair design concept which is not support the lateral movement sitting amongst LOPS, the repetition of this posture can cause dwindling body rehabilitation (Miller,2002). **Table 8** reveal only 5 respondent of LOPS are frequent folding leg while sitting, this behavior of sitting prone to cause backache, leg blood clotting shoulder and neck muscles tension due to the discordant spine position and weaken the blood circulation. **Table 9** show that only 5 respondent of LOPS frequently do recline sitting posture learning, according to Miller (2002) recline sitting posture can reduce 20% of sitting burden at lumbar region and distribute the body weight on chair if the chair design with adjustable backrest and armrest. This result indicate that recline sitting posture amongst LOPS without armrest and adjustable backrest only occur high compression at the buttock which cause compression to blood vessel and lead to numbness at the hip and buttock. **Table 10** explain that entire of respondent are highly frequent changing sitting posture within 30 minutes of learning lesson. This indicate that LOPS of Perlis, Kedah and Pulau Pinang are expose to discomfort of sitting during learning lesson in the classroom.

CONCLUSION

According to Ingraham (2013) state that good posture is can emphasizing change and movement. Apart from that ,it can maintain individual become active, allow postural change that frequent and maintain individual body alignment in good position. Whereas awkward posture is any habitual positioning of body that cause unnecessary strain on the body and tension to the body and muscle. In conclusion, the highest frequent sitting posture amongst LOPS within 30 minutes of learning session are Straddled Posture Sitting, Sitting Up Straight Posture, Leaning Forward Sitting Posture and Twisting Body Posture. Those posture may lead to musculoskeletal disorders amongst LOPS(Miller,2002; Tiedeman, 2003; Panagiatopolous et al.,2003; Wahyuni Masyidah, 2016)

The awkward position sitting occurred which not only cause back pain but it also can cause digestion and kidney problem (Daneshmandi, Ismaehzad & Hematiezhad, 2008). To make matter worse, these chronic phenomena can cause fatigue amongst LOPS. The effect of fatigue is weakening muscle strength slowly, it can explicable through various circumstances namely reduce focus of work, lack motivation (Lueder & Rice2008), delay and effect perception deform vision, reduce physical speed and mental performance, experience fatigue gloomy and prolonged anger. (Ergonomic4schools, 2010). Therefore, a proper chairs that fit to the students is very important to prevent permanent damage to the body amongst LOPs. Allsteel (2006), mentioned that there are several criteria for an ergonomic chair design, namely;(a) chair should provide proper contour back rest to maintain the neutral position of spine, (b) chair should allow movement while sitting, (c) chair should provide armrest to reduce pressure at the upper body and maintain the stability of sitting, and (d) chair should ease accessing while sitting. Hence, providing a proper standard dimension and design of chair that can fit each student in primary school could be a solution this problem.

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