ANTHROPOMETRIC EVALUATION OF THE KINDERGARTEN CHILDREN FURNITURE IN TURKEY

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Abstract: The dimensions of the used spaces, buildings, any kind of material and different riggings should be designed for the users' anthropometric measures. The first provision in system designing from ergonomic respect is the measures of the human who uses the system and who takes part in that system. Because of this, anthropometric measures are the most used ergonomic data during the design processes.

In this research, according to the anthropometric data, it is tried to organize a new datum foundation for the children who will use these equipments in kindergartens in health. The results of the measurements of 18 anthropometric characteristics of children were used as a set of basic data for the design of functional space, material and furniture in the kindergartens.

At the same time, in this research various dimensions of furniture and equipments used by children in kindergartens were measured so that compare with existing furniture dimensions and optimum furniture dimensions based on the anthropometric datum. As a result, equipments used in kindergartens were designed according to the anthropometric measures of the users, and also it is presented some ideas and suggestions to the designers.

Key Words: Anthropometrics, kindergartens, design, furniture, Turkey

I. Introduction

It is necessary to know the body dimensions of the potential user while designing products. That is important for service sectors such as schools, hotels and banks as well as producing and manufacturing sectors. On the other hand, small changes, if made to the required physical dimensions of the workspace can have considerable impact on worker productivity and occupational safety and health. Therefore, the user characteristics and specifically the structural anthropometrics dimensions should be known for design of an effective workstation (Das and Kozey, 1999).

During the past decade, research in ergonomics has led to heightened interest in the technology of work and furniture design based on the biomechanics of the human body. The debate, building on early work in the field by

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Branton (1969) and Keegan (1953), has been especially active concerning the recommendations of new principles for the design of furniture in the workplace (Parcels, et al., 1999). As the design of furniture is generally not different from the other industrial products, the expectations from furniture define the design of the product. The expectations would be summarized as aesthetical, economical, functionality and originality. The functionality of furniture is based on its comfort, safety and usefulness. And this is relevant to the anthropometric characteristics of the user and the suitability of materials used in furniture design.

Mandal (1985) noted the importance of furniture specifically designed for a child's body proportions and recommended different sitting postures for different activities (Harper, et al., 2002). Without proper design, sitting will require greater muscular force and control to maintain stability and equilibrium. This, in turn, results in greater fatigue and discomfort and is likely to lead to poor postural habits as well as neck or back complaints (Parcels, et al., 1999). Health care providers can be instrumental in focusing attention on environmental influences that impact health. While good posture facilitates lung expansion and reduces organ crowding and strain on soft bones, tendons, and muscles (Chaffin and Anderson, 1991), accidents may occur due to incorrect product dimensions and sizes that do not meet the children's dimensional requirements and health problems such as musculoskeletal, visual and circulatory (Prado-Leon, et al., 2001).

Classroom furniture from manufacturers is typically not designed to accommodate the dimensions of the individual user. Including many developed countries as well, this problem is quite widespread in many places of the world. Instead, a one-size-fits-all philosophy has been adopted in the industry, because such furniture is less costly to manufacture and easier to sell at a lower price, and lessens inventory problems for manufacturers and kindergartens. Instead, each company based their designs on specifications from the American Furniture Manufacturers Association and the National Standards Board to decide "seat width, belly room, and prohibited combustible materials". Existing designs have basically been unaltered for years (Parcels, et al., 1999).

On the other hand, it is known that though manufacturing and inventory expenses are significant topics, there are besides expenses involved in products that do not reveal designs ground on appropriately selected anthropometric data and ergonomics. At the same time, not surprisingly, observations and measurements of body alignments indicate that furniture designed to accommodate the task and the individual's size is more acceptable to users than standardized styles.

It is observed that a beginning was done for fitting more of ergonomic necessities on design and products, done recently. This trend is improving by getting faster especially in European countries like Denmark, Sweden, Germany, France and Switzerland (Mandal, 1982). As for Turkey, it is known

that, there are serious problems in this respect. This situation resulted from both lack of anthropometric data and design and product problems. On the other hand, especially it is known that there are a lot of ergonomic problems in the schools in Turkey and this could increase effectiveness and health problems. (Ozok, 1981; Kayis, 1990; Karakas, et al., 2004).

Therefore, the aim of the study was to meet the urgent need for anthropometric data from Turkey and to examine possible mismatch between the individual body dimensions of children and the kindergartens furniture they use.

II. Methods

A. Sample and Study Design

The research area is including kindergartens located in the centre of Trabzon. 44 numbers kindergartens were determined which have been active between 2001-2002 years to calculate optimum furniture dimensions. Measurement was taken in 16 kindergartens selected by random method. For using random method, references were given some researches used this method before (Yadav, et al., 1997; Bolstad, et al., 2001).

First of all in this research, anthropometric measures were taken from total 288 children (144 male, 144 female) who were 6 year group attending to kindergartens to calculate optimum furniture dimensions. These measurements are in sitting and standing positions and are 18 numbers in total (see appendix Table 1).

After taken anthropometric measures of the children, depth, breadth, and height of furniture used in kindergartens were measured. Then, these measurements were displayed together in a table to compare with optimum furniture dimensions calculated according to children anthropometric dimensions (see appendix Table 2).

After measuring existing furniture, optimum measures of furniture were calculated based on the anthropometric datum which got before (see Table 2).

While calculating optimum furniture measures, dynamic or static anthropometric measures, minimum and maximum values and also functions of furniture were taken into consideration. So, all of the furniture was divided in to two groups as reach and volumetric function based on main criteria of anthropometric design. The formula of calculating the optimum furniture dimension is as follow:

Maximum values were calculated for volume measurements:
Furniture dimension = X_{mean} + SD x Z
Minimum values were calculated for reach measurements:
Furniture dimension = X_{mean} − SD x Z

Because of some anthropometric values of female can be more from values of male, suitable male or female values were used in the calculating processes.

B. Measuring Procedure

In this research, various dimensions of furniture and equipments that children used in kindergartens were measured. The aim of this is to compare with existing furniture dimensions and optimum furniture dimensions based on anthropometric datum (see appendix Table 2).

Depth, height and breadth of the furniture that are used very often and have dominant characteristics were measured in the kindergartens. These furniture are table, chair, washbasin, WC Pan, Mirror, TV Table, coat hanger, Shoe/Toy and Equipment Cupboards. Afterwards, it was formed as a table by finding mean, standard deviation, minimum and maximum values of these determined values (see Table 1), and thus a comparison could be done with calculated optimum values.

Table 1. Statistics of existing furniture (all measurements are in millimeters).

Furniture Measurements	Mean	Std. Deviation	Minimum	Maximum
Table Depth	613,75	124,88	350	850
Table Breadth	1098,63	437,36	520	1990
Table Height	511,88	35,40	445	570
Chair Depth	254,20	67,24	300	313
Chair Breadth	281,60	25,49	245	330
Chair Height	281,27	17,46	255	310
Coat hanger height	1036,15	186,17	820	1530
Shoe cupboard height	759,69	352,28	160	1500
Washbasin depth	202,31	51,01	130	320
Washbasin height	596,88	104,55	440	790
Mirror height	1017,86	176,59	800	1250
WC Pan depth	330,50	44,63	280	440
WC Pan breadth	288,00	33,68	250	375
WC Pan height	317,00	34,82	280	405
TV height	1014,29	286,12	630	1370

III. Results

Calculations about the depth, height and breadth of the furniture and equipment which are considered to be used rather frequently by children were done. Anthropometric data of children were used when calculating the measurements. Consequently, calculated values and existing furniture

measurements were compared in a table and suitability of the optimum measurements with the existing was discussed (see Table 2).

Table 2. Comparison table of means of calculated optimum furniture dimensions with the mean values measured. (All measurements are in millimeters)

Furniture	Depth (mm)		Breadth (mm)		Height (mm)	
	mean	calculated	mean	calculated	mean	calculated
Table	614	430	1099	475	512	550
Chair	254	286	282	279	281	266
Coat hanger	-	-	-	-	1036	1094
Shoe cupboard	-	-	-	-	760	912
Washbasin	202	358	-	-	597	593
Mirror	-	-	-	-	1018	912
WC Pan	331	289	288	187	317	266
TV Table	-	-	-	-	1014	661-TV Height/2

A. The Tables

In sizing tables sitting facing one another and sideways and easy acting of knee and elbow are necessary in determining suitable dimensions.

1. The calculating of Table Height

Minimum value of sitting height and maximum value of two-calf thickness were used in calculating of table height. The reason of this is to ensure easy acting of knee on horizontal and vertical ways and the connection between elbow and table (see Figure 1).

Table Height (max. value) = Sitting height (female-mean) + SD x Z + Two calf thickness (max. value) (male-mean) + SD x Z
Table Height (max. value) = 29.41 + 1.41 x 1.96 + 17.13 + 2.93 x 1.96 = 55 = **550mm**

2. The calculating of Table Depth

Maximum value of buttock-knee depth was used in calculating of table breadth (see Figure 1).

Table Depth (max. value) = Buttock - knee depth (male-mean) + SD x Z
Table Depth (max. value) = 38.44 + 2.32 x 1.96 = 43 = **430mm x Per Person**
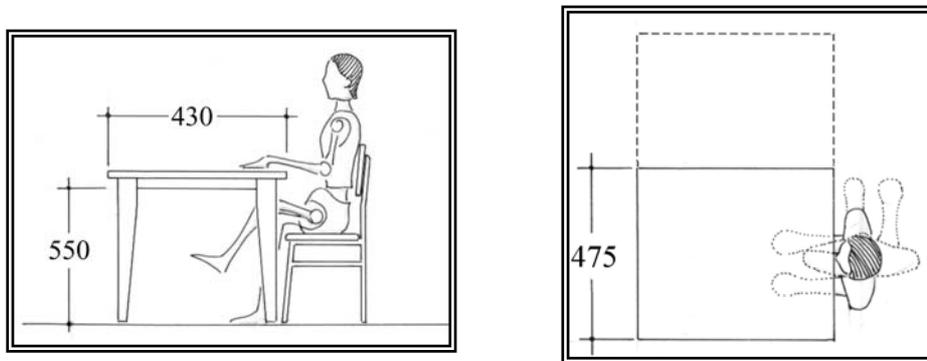
Figure 1 Table depth, breadth and height

3. The calculating of Table Breadth (For one person)
        Maximum value of forward elbow reach is used in calculating of table depth for one person (see Figure 1).

Table Breadth (For one person) (max. value) = Forward elbow reach (male-mean) + SD x Z
Table Breadth (For one person) =41.20 + 3.19 x 1.96 = 47.5 = **475mm**

B. The Chairs
        In sizing chairs, sitting height, chair depth and breadth are necessary for a comfort and healthy sitting.

1. The calculating of Chair Height
        Minimum value of sitting height was used in calculating chair height. Because feet must touch to ground and calf must be rest while sitting (see Figure 2).

Chair Height (min. value) = Sitting height (male-mean) - SD x Z
Chair Height (min. value) = 29.38 – 1.41 x 1.96 = 26.6 = **266mm**
Chair Height (max. value) = Sitting height (female-mean) + SD x Z
Chair Height (max. value) = 29.41 + 1.41 x 1.96 = **32.2 = 322mm**

Actually, chairs have to be adjusted between minimum and maximum values. If this kind of chairs doesn't be used, minimum height could be preferred.

2. The calculating of chair Depth

　　　Maximum value of buttock- knee depth was used in calculating of chair depth. (see Figure 2). Chair depth should be 2/3 of buttock-knee depth (Neufert, 1983) (see Figure 2).

Chair Depth (max. value) = (Buttock-knee Depth (male-mean) + SD x Z) x 2 / 3
Chair Depth (max. value) = (38.43 + 2.31 x 1.96) x 2 / 3 =28.6 = **286mm**

3. The calculating of chair Breadth

　　　Maximum value of hip breadth was used in calculating of chair breadth (see Figure 2).

Chair Breadth (max. value) = Hip Breadth Sitting (male-mean) + SD x Z
Chair Breadth (max. value) = 22.85 + 2.60 x 1.96 = 27.9 = **279mm**
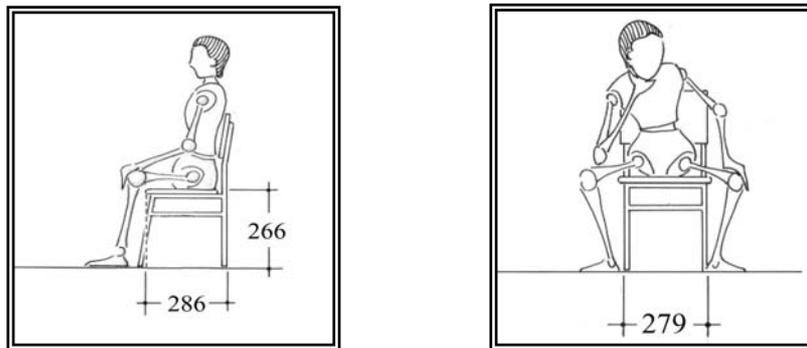
Figure2 Chair height, depth and breadth

C. The Washbasins

1. The calculating of Washbasin Height

　　　　Minimum value of elbow height in standing position was used in calculation of washbasin height (see Figure 3).

Washbasin Height (min. value) = Elbow height (female-mean) – SD x Z
Washbasin Height (min. value) = 66.42 – 3.62 x 1.96 = 59.3 = **593mm**

2. The calculating of Distance of Tap to Person (Deep of the washbasin)

　　　Tap distance from the person is necessary in tap dimensions. Minimum value of forward elbow reach was used in calculating of distance of tap to the person for reaching out for water easily (see Figure 3).

Distance of Tap to Person (min. value) = Forward elbow reach (female-mean) - SD x Z

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Distance of Tap to Person (min. value) = 40.90 – 2.61 x 1.96 = 35.8 = **358mm**
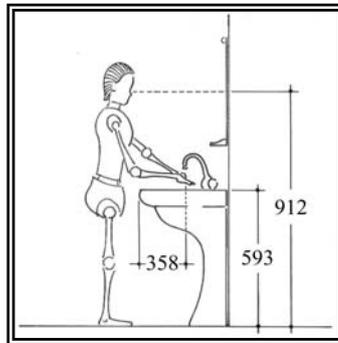


Figure 3. Washbasin/Mirror Heights and Distance of Tap to Person

D. The Mirrors
1. The calculating of   Mirror Height
        Centre point height of mirror must be known for mirror height. Minimum value of eye height in standing position was used in calculating of mirror height (see Figure 3).

Centre Point of Mirror (min. value) = Eye height (female-mean) - SD x Z
Centre Point of Mirror (min. value) = 100.73 – 4.86 x 1.96 = 91.2 = **912mm**

E. The WC Pans
1. The calculating of   WC Pan Height
        Minimum value of sitting height was used in calculating of WC pan height (see Figure 4).

WC Pan Height (min. value) = Sitting height (male-mean) – SD x Z
WC Pan Height (min. value) = 29.38 – 1.41 x 1.96 = 26.6 = **266mm**

2. The calculating of WC Pan Depth
        Minimum value of buttock- calf depth was used in calculating of WC pan depth (see Figure 4).

WC Pan Depth (min. value) = Buttock-calf depth (male-mean) – SD x Z
WC Pan Depth (min. value) = 33.27 – 2.21 x 1.96 = 28.9 = **289mm**
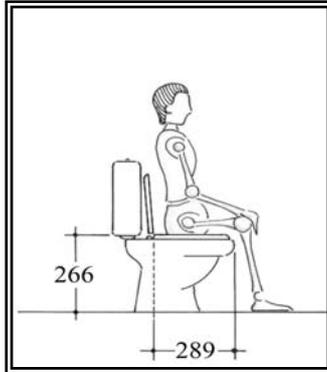
Figure 4. WC Pan Height and Depth

3. The calculating of WC Pan Breadth

Minimum value of hip breadth was used in calculating of WC pan breadth (see Figure 5).

WC Pan Breadth (min. value) = Hip Breadth Sitting (female-mean) – SD x Z
WC Pan Breadth (min. value) = 22,12 – 1.73 x 1.96 = 18.7 = **187mm**
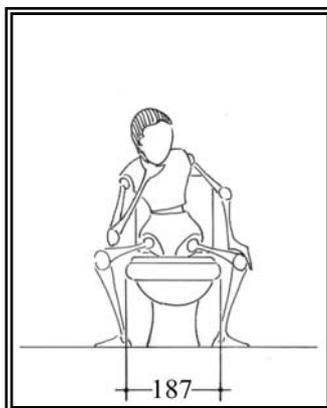
Figure 5. WC Pan Breadth

F. The TV Tables

The most important measurement in the design of TV table is the eye height in the sitting position for getting a perfect view. This height was accepted to be the centre point of the TV height and the table height was calculated according to this situation.
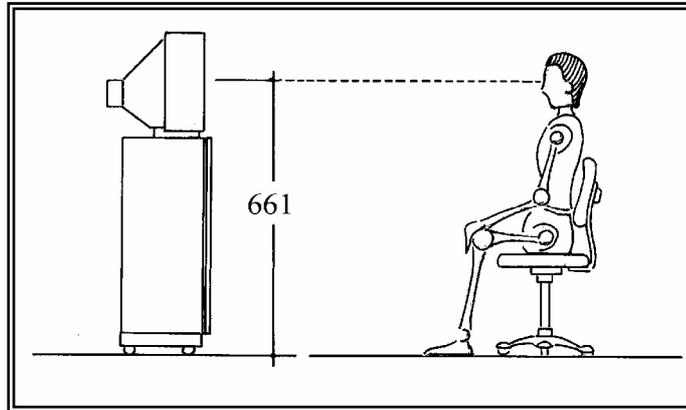
Figure 6. Centre Point of TV Height

1. The calculating of Centre Point of TV Height

      Minimum value of eye height in sitting position was used in calculating of centre point height of TV (see Figure 6).

Centre Point of TV Height (min. value) = Eye height, sitting (female-mean) – SD x Z
Centre Point of TV Height (min. value) = 73. 08 – 3.54 x 1.96 = 66.1 = **661mm**

2. The calculating of TV Table Height

      Centre point height of TV value was used in calculating of TV table height (see Figure 6).

TV Table Height (min. value) = 661 mm – TV height / 2

G. The Coat Hangers
1. The calculating of Coat Hanger Height

      In calculating of coat hanger height, arm is considered to make 45° with the coat hanger while using it. According to this, the formula below was used to calculate the minimum value of coat hanger.

Coat Hanger Height (min. value)=Shoulder Height (min. value) + X
First Step
$\sqrt{2}x$ = Forward arm reach
X= Forward arm reach / $\sqrt{2}$

Forward arm reach (min. value)=Forward arm reach (female-mean) – SD x Z
Forward arm reach (min. value) = 54.27 – 3.28 x 1.96

Forward arm reach (min. value) = 47.84
X= Forward arm reach/√2 = 47.84/ √2 = 33.93
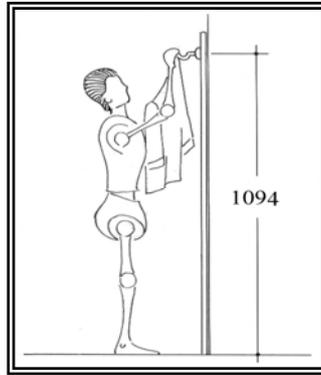
Figure 7. Calculating Coat Hanger Height

Second Step
Shoulder height (min. value) = (Maximum vertical reach (min. value) – SD x Z)
– (Forward arm reach (min. value) – SD x Z)

Shoulder height (min. value) = (137.8 – 7.37 x 1.96) – (54.27 – 3.28 x 1.96)
Shoulder height (min. value) = 123.35 - 47.84 =
Shoulder height (min. value) = 75.51

Third Step
Coat hanger height (min. value) = Shoulder height (min value) + X
Coat hanger height (min. value) = 75.51+33.93
Coat hanger height (min. value) = 109.4 = **1094mm**
(See Figure 7 and 8).
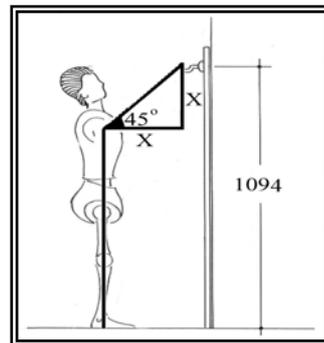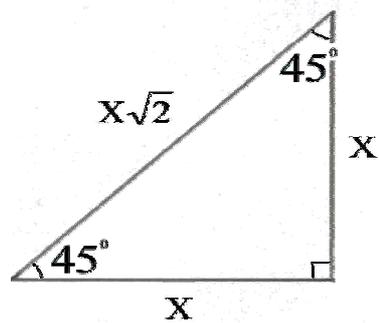
Figure 8. Coat Hanger Height

H. The Toy, Shoe And Equipment Cupboards

Cupboard height is important in designing of shoe, toy and equipment cupboard. Minimum value of eye height in standing position was used in calculating of cupboard height. (See Figure 9).
Because of the bending forward will take a short time while using toy and equipment cupboard, minimum shelf height wasn't calculated.

1. The calculating of Shoe, Toy and Equipment Cupboard Height
Cupboard Height (min. value) = Eye height (female-mean) – SD x Z
Cupboard Height (min. value) = $100.73 – 4.86 \times 1.96 = 91.20 = \textbf{91.2} = \textbf{912mm}$
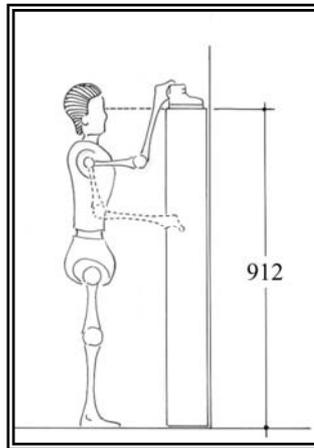
Figure 9. Shoe, Toy and Equipment Cupboard Height

IV. Findings

Anthropometric measurements of human form the data base which is required for sizing furniture. For this aim, the study is based on the anthropometric data of children in sizing furniture which have to be existing in the kindergartens. Calculated optimum measurements of the furniture that are considered to be used rather frequently and existing furniture measurements were compared in this study. Thus, suitability of usage of the existing kindergarten furniture is opened for discussion.

Table 2 Comparison table of means of calculated optimum furniture dimensions with the mean values measured. (All measurements are in millimeters)

Findings of existing furniture measurements and optimum measurements are as below (see table 3, 4, 5), calculated optimum measurements are shown in bold:

- Table: It is observed that existing table height is lower than optimum measurement (512<**550mm**), and existing table depth is insufficient for opposite use (614<**430x2mm**). Existing table breadth is seen to be wide for two person and narrow for three person (1099>**475x2mm**).
- Chair: It is considered that existing chair depth is lower than optimum measurement (254<**286mm**) and it is also considered that this situation could play a negative role for the comfortable sitting. Sitting breadth (282>**279mm**) and height (281>**266mm**) are upper than calculated measurements.
- Coat hanger: It is observed that existing coat hanger height is lower than optimum measurement (1036<**1094mm**).
- Shoe cupboard: It is observed that existing shoe cupboard height is lower than optimum measurement (760<**912mm**).
- Washbasin: It is observed that existing washbasin depth is lower than optimum washbasin depth (202<**358mm**), and existing washbasin breadth and optimum washbasin breadth are in a near values /in similar values (597>**593mm**).
- Mirror: It is observed that existing mirror height is upper than optimum mirror height (1018>**912mm**).
- WC pan: It is observed that existing WC pan height (317>**266mm**), breadth (288>**187mm**) and depth (331>**289mm**) is upper than optimum measurement.
- TV table: It is observed that existing TV table height is much upper than optimum measurement (1014>**661-TVHeight/2**).

Table 3. Compare of depths of existing furniture measurements and calculated measurements.
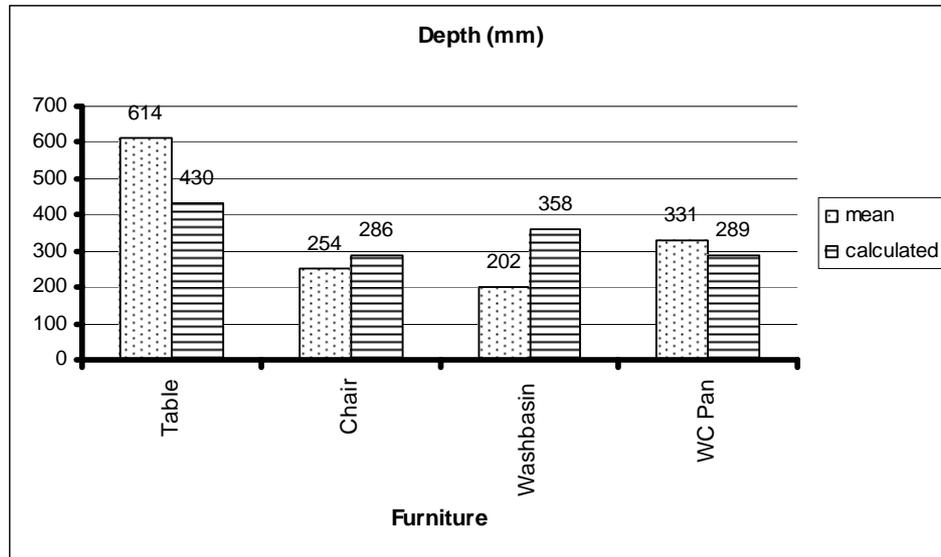

Table 4. Compare of breadths of existing furniture measurements and calculated measurements.
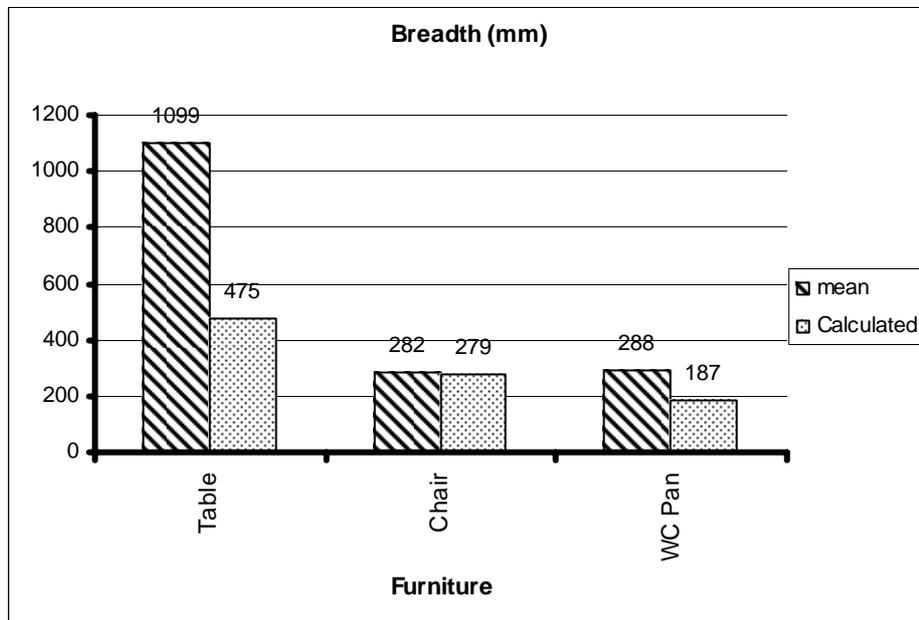
Table 5. Compare of heights of existing furniture measurements and calculated measurements
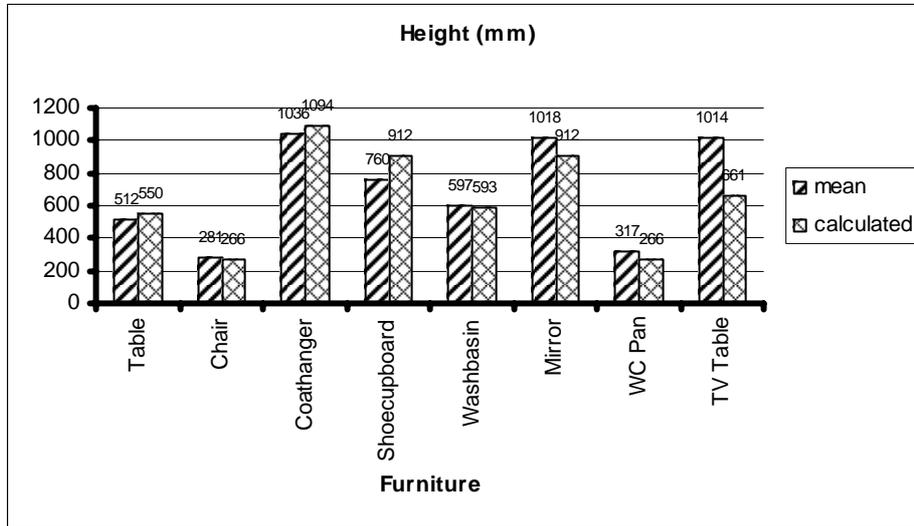
V. Discussion

The deviations between the existing and optimum furniture measurements were written in percents as can be seen on the Table 6. Thus, the strength of the differences between the existing furniture and calculated values were perceived rather quiet.

Table 6. The deviation ratios and directions of existing furniture measurements from calculated optimum values.

Furniture	Depth (mm)		Breadth (mm)		Height (mm)	
	(+) Deviation	(-) Deviation	(+) Deviation	(-) Deviation	(+) Deviation	(-) Deviation
Table	%43	-	%16	-	-	%7
Chair	-	%11	%1	-	%6	-
Coat hanger	-	-	-	-	-	%5
Shoe cupboard	-	-	-	-	-	%17
Washbasin	-	%44	-	-	%0.7	-
Mirror	-	-	-	-	%12	-
WC Pan	%15	-	%54	-	%19	-
TV Table*	-	-	-	-	-	-

* Because of the height of TV table is changeable according to the dimension of selected TV, the standard deviation of it wasn't calculated.

- **Table:** It was determined that the existing table height was 38 mm shorter than the optimum measurement. This situation could cause some problems for children as they are sitting, standing and moving on the table. In addition to this the calculated optimum measurement of table depth is only for one using side, but existing tables are used with two sides. The existing measurements are relevant for using only one side. So measurement is not enough for using two sides. Existing table breadth was more exceed 149 mm than the optimum measurement. Even this excess is not matter for using furniture; it can affect the circulation area negatively.

- **Chair:** It is determined that the existing chair height was 15 mm longer than the optimum measurement. This difference isn't considered to make cause to big problems for children. Existing chair breadth was almost same with the optimum breadth and no problem was observed. The chair depth was 32 mm shorter than the optimum measurement and it is considered to affect the comfort of sitting negatively.

- **Coat hanger:** Existing coat hanger height was 58 mm shorter than the optimum measurement and it is not considered to be uncomfortable.

- **Shoe cupboard:** Existing shoe cupboard height was 152 mm shorter than the optimum measurement but it is not considered to be uncomfortable.

- **Washbasin:** Existing washbasin depth was 156 mm shorter than the optimum measurement and it is considered that it can be cause problems as washing hands. Existing washbasin breadth was almost same with the optimum breadth and no problem was observed.

- **Mirror:** Existing mirror height was 106 mm higher than the optimum measurement and because of its negative effect to the functionality of the furniture, it is considered to be uncomfortable.

- **WC Pan:** Existing WC pan height was 58 mm and breadth was 101 mm higher than the optimum measurements and it is considered to be uncomfortable. In addition to this existing depth of WC pan was 42 mm higher than the optimum but this is not considered to be uncomfortable as the other ones.

- **TV Table:** Existing TV table height was very higher than the optimum measurement and it was observed to be uncomfortable. This situation could cause to fatigue and etc. problems at neck muscles and eyes.

Consequently, the problematic points related the kindergarten furniture is displayed in Figure 10.

Very problematic ⬛

Problematic ▨

No problematic ☐

Furnitures	Depth (mm)	Breadth (mm)	Height (mm)
Table	⬛	▨	⬛
Chair	▨	☐	▨
Coathanger	-	-	▨
Shoecupboard	-	-	▨
Washbasin	⬛	-	☐
Mirror	-	-	▨
WC Pan	▨	⬛	⬛
TV Table	-	-	⬛

Figure 10. The problematic points of the exist kindergarten furniture

The data in this study indicate a substantial degree of mismatch between the furniture measure in kindergartens and the optimum kindergarten furniture available to them. Most children are using furniture that are too high, too deep or too breadth (wide-extensive). For example, some differences which are considered to cause problems for the comfortable use were found out as following measurements; depth and height of table, depth of washbasin, breadth and height of WC pan and height of TV table. The only positive finding is that chair breadth and washbasin height was not a problem for any children.

While the findings of this study are suggestive, they are based only on data from a convenience sample in a single kindergarten district. There may also be systematic variations in body dimensions, based on ethnic/racial characteristics of the children that were not captured in this study. Finally, our definition of mismatch focused on only a few furniture dimensions, such as height, depth and breadth   may make to the fit to body dimensions.

VI. Conclusion

It is known that there are a lot of ergonomic problems in the schools in Turkey and this could increase effectiveness and health problems. Thus, the set of anthropometrical data obtained should be used for the design or adaptation of interior design and furnishing as well as the design of places for variable actions

such as sleeping, studying, playing, eating and etc. In this context, this study is putting forward the optimum-optimal measurements of kindergartens furniture according to the anthropometrical characteristics of kindergartens children in Trabzon, Turkey. And it is accepted that the continuity of this kind of studies is necessary for the researches as well as the producers and everyone relating with this concept.

This kind of studies would also put forward the differences between the optimum furniture measurements of children living in different regions in Turkey and the other countries. Finally, because of the optimum furniture measurements were based on the data that taken from the children and those will change by the time, this kind of study would be repeated in every decade.

VII. Acknowledgements

Özet: Kullanılan yüzeyler, binalar ve her türlü materyal ve donanımın boyutları kullanıcıların antropometrik ölçülerine göre tasarlanmalıdır. Ergonomik açıdan sistem dizaynında ilk dikkate alınan o sistemi kullanan yada sistemde yer alan insandır. Bunun nedeni antropometrik ölçülerin sistem dizaynında en çok kullanılan ergonomik veriler olmasıdır.

Bu araştırmanın amacı, anaokullarındaki çocukların oradaki ekipmanları sağlıklı bir şekilde kullanabilmeleri için bir antropometrik veri tabanının oluşturulmasına katkı sağlamaktır. Çocuklara ilişkin 18 antropometrik özelliğe ait ölçülerin sonuçları, anaokullarındaki mobilyaların, eşyaların ve diğer işlevsel alanların tasarımı için temel bir veri tabanı olarak kullanılmıştır.

Aynı zamanda, bu araştırmada antropometrik verilere bağlı olarak belirlenen optimum ölçülerle karşılaştırılmak üzere, çocukların anaokullarında kullandıkları mevcut ekipmanlar ve mobilyaların ölçümleri de yapılmıştır. Sonuç olarak, anaokullarındaki ekipmanlar kullanıcıların antropometrik ölçülerine göre tasarlanmış ve tasarımcılar için bir takım fikirler ve öneriler sunulmuştur.

Anahtar Kelimeler: Antropometrik, anaokulu, dizayn, mobilya, Türkiye

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Appendixes

Table 1 Measurements of anthropometric characteristics of the children (**in groups, 1.00 means female and 2.00 means male**)

Characteristics in the standing position	Group	Mean	Std. Deviation	Characteristics in the sitting position	Group	Mean	Std. Deviation
Stature	1	112,99	4,77	Sitting Stature	1	84,57	3,44
	2	114,89	5,21		2	85,53	4,15
Max. Vertical Reach	1	137,80	7,37	Eye Height	1	73,08	3,55
	2	140,39	7,69		2	73,82	3,82
Eye Height	1	100,73	4,87	Elbow Height	1	40,57	2,26
	2	102,52	5,14		2	40,44	2,87
Elbow Height	1	66,43	3,62	Hip Breadth	1	22,12	1,73
	2	67,00	3,82		2	22,85	2,61
Forward Elbow Reach	1	40,90	2,61	One Calf Thickness	1	9,87	1,33
	2	41,20	3,19		2	9,79	1,67
Forward Arm Reach	1	54,26	3,28	Two Calf Thickness	1	15,97	2,36
	2	55,49	3,60		2	17,13	2,93
Shoulder Breadth	1	28,33	1,71	Buttock-calf Depth	1	33,47	2,07
	2	29,06	2,28		2	33,27	2,21
Elbow to Elbow Breadth	1	29,70	2,19	Buttock-knee Depth	1	38,30	2,16
	2	30,72	2,74		2	38,44	2,32
Waist Depth.	1	15,85	1,34	Sitting Height	1	29,41	1,52
	2	16,21	1,65		2	29,38	1,41

Table 2 Furniture dimensions measured in kindergartens (all measurements are in millimeters)

	Table depth	Table breadth	Table height	Chair depth	Chair Breadth	Chair height	Coat-hanger height	Shoe cupboard height	Wash-basin depth	Wash-basin height	Mirror height	WC pan depth	WC pan Height	WC pan breadth	TV height
1	485	768	555	225	275	275	820	905	250	450	-	-	-	-	1000
2	850	1480	570	235	245	265	1040	960	145	540	815	330	320	300	-
3	605	1305	530	300	300	290	-	600	220	710	-	310	305	280	650
4	650	1200	545	305	270	284	900	160	130	790	-	320	310	280	-
5	790	790	510	270	249	275	870	1105	187	635	1200	440	405	375	1270
6	520	885	520	245	285	270	1150	765	190	545	-	280	320	270	1030
7	695	695	520	295	275	310	1140	550	240	650	-	-	-	-	1370
8	595	735	525	270	300	285	1030	1000	195	485	800	300	295	290	-
9	515	1020	530	285	330	310	950	1500	200	440	1100	310	335	265	-
10	690	1190	525	313	310	255	920	445	320	640	950	310	280	250	-
11	490	1900	450	-	-	-	1530	560	170	525	-	-	-	-	-
12	685	1990	445	285	315	270	-	515	180	590	-	-	-	-	-
13	600	600	500	240	280	310	1160	1090	170	510	1010	-	-	-	-
14	600	1100	460	290	270	285	1060	240	190	640	1250	360	290	280	1150
15	700	1400	505	265	275	265	900	1020	290	760	-	-	-	-	-
16	350	520	500	260	245	270	-	740	160	640	-	345	310	290	630
Total	16	16	16	15	15	15	13	16	16	16	7	10	10	10	7