ANTHROPOMETRY AND FACILITIES DESIGN VERIFICATION OF NEW DEVELOPED PRESCHOOL LEVEL BUILDINGS IN THE EDUCATIONAL SECTOR OF HERMOSILLO, SONORA.

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Resumen: Esta investigación nace de la problemática de la no existencia de tablas antropométricas de la población infantil principalmente en la edad de preescolar en México, las utilizadas por el Instituto Nacional de la Infraestructura Física Nacional no incluyen datos pertenecientes a infantes en edad de preescolar, las cuales se utilizan para la elaboración de mobiliario y dimensionamiento en el diseño de las instalaciones educativas (INIFED).

Antropometría infantil.

Abstract: This research comes from the lack of anthropometric charts for Mexican children in pre-school level, the charts used by the Instituto Nacional de la Infraestructura Física Nacional (National Institute for Educational Facilities) do not include data from pre-school level children; those charts are used to build furnishing and to determine the right size of the facilities (INIFED).

Children's Anthropometry

1. INTRODUCTION

Current situation in developing countries and economic growth, lack of in-house technologies and economic and technological dependence favor the use of models designed by other cultures (Oborne, 2007).

2. OBJETIVES

Check if design is within measurements found in the anthropometry charts in new pre-school level buildings in Hermosillo, Sonora during 2007 and 2008, since previously built schools show a lot of mistakes regarding the facilities' size and the furnishing causing a lot of discontents and troubles in teachers and family parents in pre-school level buildings.

3. METHODOLOGY

3.1 Programming stage

a) The aim of this anthropometric research must be very clear, specifying if data collected will be used for a new design, redesign or to create a general purpose database.

b) It is necessary to define the kind of anthropometric technique that will be applied, which can be “Static Anthropometry” or “Dynamic Anthropometry”. (Flores G., 1997).

Static anthropometry measures the body still. It measures the skeleton between specific anatomic points. Dynamic or functional anthropometry it’s the one which measures the body in motion, acknowledging that the actual reach of a person’s arm it’s not equal to the length of the arm itself, but it takes into consideration the additional reach provided by the movement of the shoulder and torso when a person is working (Ergocupacional).

c) Once that the kind of anthropometric technique has been chosen, all the measures that will be used need to be specified and for this we need to keep in mind our final goal. In order to choose the measures we need to take, we must refer to the general anthropometric set (static or dynamic), taking into account the name and standard reference points in order to keep the techniques systematization.
d) Once that the measures to be taken have been defined, the anthropometric chart to be used needs to be designed. A copy of the chart for each subject needs to be built.
e) Besides the good quality and accuracy of the measuring equipment, portability it’s important, since most of the time it will be necessary to go where people who will be measured is. The most basic equipment must include anthropometric chart, portable anthropometer, flexometer, and tape measure. (Flores G., 1997).

Figure 1. Anthropometric chart and portable anthropometer.

3.2 Sampling

In this stage it’s when individuals in new facilities start to be measured in order to collect raw data; this is 32 measures by each individual.

3.3 Statistics Analysis

Once that the data is collected, it is analyzed and an anthropometric chart is built; percentiles 95, 50, 5 come from this chart, those are used to build facilities and furnishing.

The impossibility to make a design for the whole population forces us to pick a segment which includes the data in between. Thus, highest and lowest values are left out and focus on the 90% of the population. As a norm, the practical totality of anthropometric data is expressed in percentiles. In order to make this research more effective, population is broken into percentages categories, sorted from lowest to highest according to a specific body measure. For example, the first height percentile indicates that 99% of the individuals measured would be above this dimension. In the same way, a percentile of 95% in height would state that only 5% of the individuals measured would be over it, since the remaining 95% would be just as tall or shorter. (Panero, 1993).

3.4 Steps to get percentiles

1. Summation of raw data is calculated In a spreadsheet (total of measures), mean or average is calculated using the following formula:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad (1)$$

□ = Data mean or average
ΣX = Summation of the values of all the measures.
n = Number of elements of the sample.

2. Standard deviation it's calculated, which defines the individual deviation of each measure regarding to the mean.

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x - \bar{x})^2 \qquad (2)$$

$$s = \sqrt{s^2} \qquad (3)$$

s^2 = Variation of the sample.
s = Standard variation of the sample.
x = Value of the measures.
□ = Mean of the sample.
n - 1 = Number of measures of the sample -1

3. Standard deviation of the unit it's calculated, which is called "z", where z equals to:

$$z = \frac{x - \bar{x}}{s} \qquad (4)$$

x = Random variable value
□ = Average distribution of the random variable.
s = Standard variation of this distribution.
z = Number of standard deviations of x regarding the mean of this distribution. (Navidi, 2006).

4. Percentiles are calculated

$$Percentil = \bar{x} + (s\ x\ Z\ value) \quad (5)$$

$$95\% = Mean + (Standard\ deviation\ x\ 1.65) \quad (6)$$

$$50\% = Median \quad (7)$$

$$5\ \% = Mean - (Standard\ deviation\ x\ 1.65) \quad (8)$$

(DINBelg)

4. RESULTS

Since this is an ongoing research, some of the necessary measures are still missing in order to conduct a full test of the facilities and furnishing, however, there is an anthropometric chart with the data collected so far and it is possible to get preliminary results in order to get the dimensions for facilities and furnishing.

In this example the dimensions of the sink and classroom chairs will be used.

In order to calculate height and width for the sink measures 949 (height to the waist) and 752 (distance from the wall to the center of the fist)

Results for 949
X = 61.55
S = 4.88
5 % = 61.55 – (4.88 x 1.65) = **53.498 cm** (9)

Results for 752
X = 46.26
S = 3.66
5 % = 46.26 – (3.66 x 1.65) = **40.221 cm** (10)

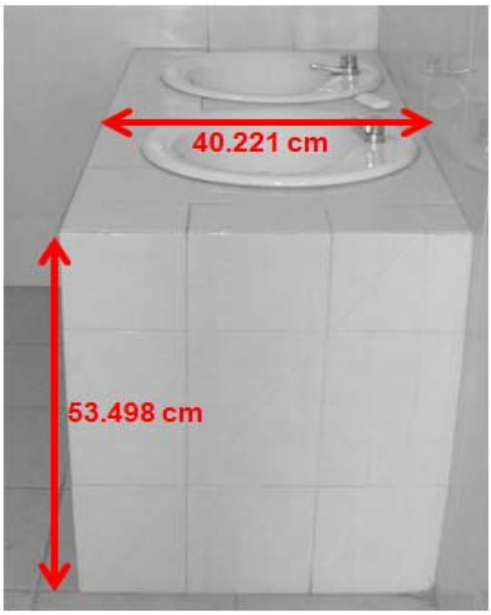

Figure 2. Sink dimensions

In order for most of the children to be able to use the sink without any problems percentile 5 from mean 949 and 752 was used.

Measures 200 (length from the back of the knee to the back of the chair), 678 (height from the ground to the back side of the knee), 459 (width of hips, sitting down), 25 (height from the seat to the shoulder) are used in order to get the dimensions of the chair.

Results for 200
X = 28.82
S = 2.13
5 % = 28.82 – (2.13 x 1.65) = **25.3055 cm** (11)

Results for 678
X = 28.98
S = 2.38
5 % = 28.98 – (2.38 x 1.65) = **25.053 cm** (12)

Results for 459
X = 22.09
S = 1.95
5 % = 22.09 + (1.95 x 1.65) = **25.3075 cm** (13)

Results for 25
X = 37.56
S = 2.54
5 % = 37.56 – (2.54 x 1.65) = **33.369 cm** (14)

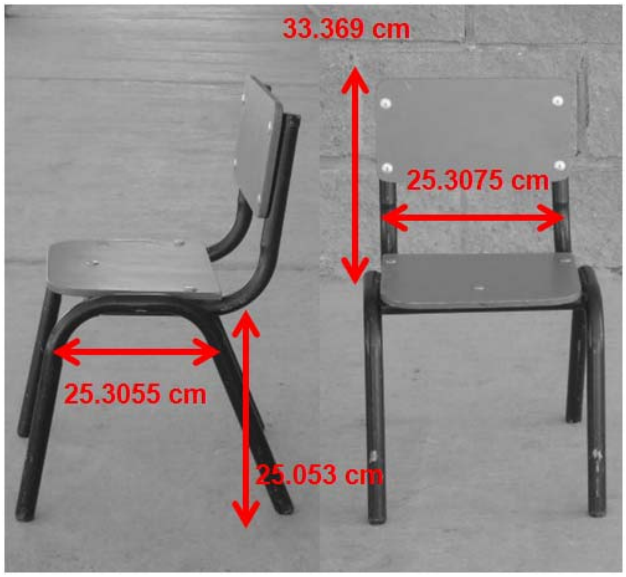

Figure 3. Chair dimensions

5. CONCLUSIONS

This research is extremely important since there are no anthropometric charts for pre-school level children in Mexico. These charts are used to build furnishing and determine the size of new schools buildings. This project aims to get the necessary information in order to build these charts.

6. REFERENCES

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