ANTHROPOMETRIC TABLES OF INDUSTRIAL DESIGN STUDENTS OF UAEM

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Abstract: Within the research project entitled "Aulic workstation for industrial design students" with register at the Secretaría de Investigación y Estudios Avanzados of Universidad Autónoma del Estado de México (UAEM), registration number 2510/2007U, it was required to obtain anthropometric tables of the students of this university with useful information for the design of this workstation. The objective was to get the anthropometric tables with anthropometric percentiles 5th, 25th, 50th, 75th and 95th, for the design of an aulic workstation ergonomically suitable for the development of skills of industrial design students. The investigation was limited to a sample of 183 students, representing the campus belonging to the UAEM which provides a degree in Industrial Design (three Campuses). The method began with an analysis to identify the physical dimensions of the user involved in the furniture, determining the dimensions which new data were needed. An anthropometric survey was carried out, and processed the data collected to obtain the percentiles for each dimension and gender. The result was the tables of percentiles 5th, 25th, 50th, 75th and 95th, segmented by gender and one mixed, of the twenty-six dimensions required for the design of the workstation. An interesting finding of the project was that the sample studied showed a trend different from a standard population, which had to analyze information in a semi-manual way to get the percentiles.

Anthropometrics, Industrial design, Furniture.

Resumen: Dentro del proyecto de investigación titulado "Puesto de Trabajo Áulico para el Discente de Diseño Industrial" con registro ante la Secretaría de Investigación y Estudios Avanzados de la Universidad Autónoma del Estado de México (UAEM) número 2510/2007U,

se requirió de obtener tablas antropométricas de los discentes de esta universidad con datos útiles para el diseño de este puesto de trabajo. El objetivo fue obtener las tablas antropométricas con los percentiles 5º, 25º, 50º, 75º, y 95º, para el diseño de un puesto de trabajo áulico ergonómicamente adecuado para el desarrollo de competencias del discente de diseño industrial. La investigación se circunscribió a una muestra de 183 discentes, representativa de los organismos pertenecientes a la UAEM donde se imparte la licenciatura en Diseño Industrial (tres Campus). El método seguido inició con un análisis para identificar las dimensiones físicas del usuario, involucradas en el mobiliario actual, determinando las dimensiones de las que se requerían nuevos datos; se realizó un levantamiento antropométrico, y se procesaron los datos recopilados para obtener los percentiles por cada dimensión y género. Como resultado se obtuvieron las tablas de los percentiles 5º, 25º, 50º, 75º, y 95º, segmentados por género y en forma mixta, de las veintiséis dimensiones requeridas para el diseño del puesto de trabajo. Una conclusión interesante del proyecto fue que la muestra estudiada mostró una tendencia diferente a una población estándar, por lo que se tuvo que analizar la información de forma semi manual para obtener los percentiles.

Antropometría, Diseño Industrial, Mobiliario.

1. INTRODUCTION

The research reported in this paper was directed to obtain the anthropometric tables needed in the project “Aulic workstation for industrial design students” registered at the Secretaría de Investigación y Estudios Avanzados of Universidad Autónoma del Estado de México (UAEM), with registration number 2510/2007U. The research was located in the three campuses where the UAEM offers the degree in Industrial Design: Centro Universitario UAEM Valle de Chalco, at Valle de Chalco, Estado de México, Centro Universitario UAEM Zumpango, at Zumpango, Estado de México, and the School of Architecture and Design, at Toluca, Estado de México, all of them schools of UAEM.

Previous to the research, it was made an analysis to get the physical dimensions of the students involved in the actual furniture, determining in this way the twenty-six dimensions in which it’s required new data and then made an anthropometric survey at the mentioned institutions. Actually these skills are constrained by the furniture they have, because of a non ergonomic and uncomfortable design, and by a degenerative and abnormal curvature of the spine that the furniture favors, as well as by the shared facilities with other undergraduate students, with whom it does not exist the same needed furniture.

2. OBJECTIVES

The main objective was to obtain results in the form of anthropometric percentiles for the design of an aulic workstation ergonomically suitable for the development of skills of industrial design students. The percentiles needed was the anthropometric percentiles 5^{th}, 25^{th}, 50^{th}, 75^{th} and 95^{th} of the twenty-six dimensions required for the design of the aulic workstation.

The secondary objectives was: first, to do an anthropometric survey to a representative sample of the students of Industrial Design at the UAEM; second, to analyze the data of the

survey to get the needed percentiles; third, to get anthropometric tables with the founded percentiles segmented by gender, and a mixed table with the two genders, all of them ordered by the sequence followed in the anthropometric survey; and fourth, to recommend anthropometric dimensions useful in the design of the aulic workstation.

3. METHODOLOGY

First, it was calculated a sample from a universe of 539 students of the three campus of the UAEM where the industrial designer degree is offered using the probabilistic sample method commented in Hernández (2003:305-306). With this method the sample was determined in 183 students. Then the sample was stratified according to the same author (Hernández:2003) by gender and school.

After this, there was designed an anthropometric form with the twenty-six required dimensions. The dimensions are shown in the table 1.

Table 1. Required dimensions.

Nº	Dimensions in sitting position (cm)	Nº	Dimensions in standing position (cm)
1	Height	1	Weight (kg)
2	Shoulder height	2	Height
3	Height of the bent elbow	3	Height of Eye to the floor
4	Height to the thigh	4	Height of shoulder to the floor
5	Popliteal Height	5	Height of elbow to the floor
6	Maximum body width	6	Femur depth
7	Width of elbow to elbow	7	Front reach of the arm
8	Width of hips		
9	Abdominal depth		
10	Distance of hip to collarbone		
11	Distance of collarbone to elbow		
12	Distance of elbow to wrist		
13	Distance of knee to femur		
14	Distance of buttock to popliteal		
15	Distance of the femur to the lower back		
16	Distance of buttock to knee		
17	Distance of ankle to the tip of the foot		
18	Distance of wrist to first phalanx		
19	Distance of wrist to the tip of middle finger		

With the anthropometric form there was conducted the anthropometric survey. In this survey was used the technique commented by Flores (2001) gathering the information in three stages: 1) Personal and institutional data recollection; 2) Measures in standing position; 3) Measures in sitting position. There was used the following measurement instruments: a bascule, 3 extensible callipers, a height anthropometer, an adjustable height bench specially designed and fabricated for this survey, and a support table for the forms.

The data analysis was made in two stages: first it was obtained the measures of central tendency, and second it was obtained the percentiles. Originally it was proposed to use the betas' procedure commented in Mondelo(2001:56-57). But the results of the analysis of the measures of central tendency showed a non-standard population trend, and the original method was changed to an interpolation method.

4. RESULTS

The objectives of the research project were covered. The anthropometric survey was made with seven people in four days at the three campus of the UAEM where there are students of Industrial Design, one day at Valle de Chalco, one day at Zumpango, and two days at Toluca.

The data was analyzed in a semi-manual way and the anthropometric percentiles 5^{th}, 25^{th}, 50^{th}, 75^{th} and 95^{th} of the twenty-six dimensions required was found. The anthropometric tables was made and ordered according to the objectives, and segmented by gender, and got one mixed table of the two genders. The three tables can be found at http://www.disenoempatico.com/tablasantropometricasproyecto.

Respecting to the forth secondary objective, the recommended anthropometric dimensions useful in the design of the aulic workstation are the shown in tables 2 and 3. The specific dimensions for the recommended percentiles can be found at the mentioned webpage.

Table 2. Sitting position.

Dimensions	Recommended percentile
Height	95
Height of the bent elbow	5
Height to the thigh	95
Popliteal Height	5
Width of elbow to elbow	95
Width of hips	95
Abdominal depth	95
Distance of knee to femur	95
Distance of buttock to popliteal	5
Distance of buttock to knee	95
Distance of ankle to the tip of the foot	95

Table 3. Standing position.

Dimensions	Recommended percentile
Weight (kg)	95
Height of Eye to the floor	50
Front reach of the arm	5

5. DISCUSSION

An interesting finding of the survey was that the sample studied showed a trend very different from a standard population. For this reason, it was required to analyze the information in a semi-manual way to get the percentiles. This is, the percentiles can not be calculated by the betas' procedure commented in Mondelo(2001:56-57) because the statistical analysis of the measures of central tendency, mean, mode, median, showed a non-standard population trend.

So it was not an obstacle because it was used the interpolation method, a mathematic procedure used to predict the value of a percentile. With this method, and the help of the spreadsheet Excel, the percentiles were calculated for all the twenty-six measured dimensions.

At this moment, the project is running, it has passed the creative phase and the workstation is in the detailed design stage, where the information obtained from this research its being very useful.

6. REFERENCES

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