

Comparison between preschool tables used in kindergartens in Croatia, Macedonia and Bulgaria

Iliev, Boris¹; Domljan, Danijela¹

¹ Department for Furniture and Wood Products, Faculty of Forestry, University of Zagreb, Zagreb, Croatia

* Corresponding author: iliev_bor@yahoo.com

ABSTRACT

The pre-school period is a time of the children aged from 1 to 6,5 years, in which occur the greatest changes in psycho-physical growth and development. Therefore, preschool furniture especially tables used in kindergartens should meet requirements for proper growth and development of pre-school children, in addition to adjusting their residential environment. The tables must follow the anatomy and size of the child's body, as well as construction, material and safety needs. The aim of the research was to identify shortcomings through the collection and comparison of specific dimensional data of the existing furniture used by children in pre-school institutions. Focus of this research was on dimensions of preschool tables used in kindergartens in the capital towns in three countries: Zagreb (Croatia), Skopje (Macedonia) and Sofia (Bulgaria). The compared results will be used as the basis for solutions for improving the characteristics of the tables.

Key words: design, dimensions, furniture, kindergartens, preschool children, tables

1. INTRODUCTION

In urban areas with highly segregated population, language barriers and cultural differences, kindergartens provide an opportunity for the population to integrate, as children easily establish communication and social interaction (Iliev, 2011). Architecture can facilitate this process, acting as a social catalyst (Bajbutović, 1983). Therefore, designing preschool institutions, as well as furniture for their equipping, is a very sensitive process (Domljan, 2011). The end-users of these facilities, the children, need to identify with these institutions in order to encourage a rational, emotional and, above all, a personal attitude, so that they can feel the preschool object as if it were their second home (Ivanović Šekularac, 2000). On the other hand, through the educational process implemented in these institutions, they can more easily master and accept the tasks given to them by teachers. All this can be achieved only on the basis of the quality of the spatial ambient and the equipment in it.

The construction of new modern facilities intended for preschool education is a very expensive investment, therefore the quality and suitability of furniture is usually given secondary importance (Domljan *et al.*, 2015). Hence, it leads to the use of furniture that is unsuitable for children. When designing furniture for preschools, an extensive analysis needs to be made in which experts from different fields should be included. In addition to architects, designers and furniture designers, pedagogues, psychologists and parents should also be consulted, with the ultimate result of providing a suitable space for healthy and proper psycho-physical development of the children (Domljan *et al.*, 2015).

1.1. The aim of the research

The goal of the research is, through the collection of specific data on the existing furniture used by children in pre-school institutions in three different countries, to identify certain shortcomings which will be the basis for concrete solutions for improving the characteristics of the furniture. Another goal of the research is to provide a basis and impetus

for further research to improve the process of designing children's furniture, in which professionals from several fields should be involved interdisciplinary.

2. METHODS, POLIGONS AND SAMPLES

2.1. Research method

For the purpose of the research, in order to obtain complete information for achieving the goal, two types of methods have been used:

- Method of objective and direct measurement,
- Method of observation, recording and photographing.

2.1.1. Measuring the dimensions of the samples – the preschool furniture

The total furniture has been measured that is used in pre-school institutions only by pre-school children, namely in the playrooms.

The measurement has been performed with metal metro and calliper type mehanická 16090014 // - from (0-500) mm, by the company "KMITEX s.r.o." with calibration sheet "č. P540 / 16 ", with an error margin of ± 0.02 mm.

However the huger research of furniture measuring was done, in this article is shown the collected data of preschool tables. All furniture have been measured in height, depth and width. The measures were taken according to EN 1729-1 (EN 1729-1, 2015).

2.1.2. Photographing of the samples

Furniture in kindergartens, used only by pre-school children, has been digitally photographed.

2.2. Poligons

The research was done in several polygons over a period from March to September 2017.

The research polygons were kindergartens in three cities:

- I. Skopje, Republic of Macedonia (8 kindergarten);
- II. Zagreb, Republic of Croatia (4 kindergarten);
- III. Sofia, Reublic of Bulgaria (3 kindergarten).

The polygons were randomly selected. A permit to enter each of polygon was obtained from the municipalities or the institution that has jurisdiction over them.

2.3. Samples

The samples, which were analyzed and included in the research according to the methods performed are taken directly from the polygons (*Figure 1*). Most of the polygons have the same or similar furniture, depending on the manufacturers. They differ from each other according to the shape-constructive solutions, dimensions and materials used in their production (*Table 1*).

Table 1. Measured samples of the tables

Polygon	Table Type	Description
I	1	possibility to regulate height, metal legs, worktop made of plywood board, trapezoidal with ABS edge-trim, legs screwed to the worktop (table for 4 persons)
	2	possibility to regulate height, metal legs, worktop made of plywood board, circular with ABS edge-trim, legs screwed to the worktop (table for 4 persons)
	3	legs made of veneer beech press, , worktop made of plywood board, rectangular with solid wood edge-trim, Top (table for 4 persons)

	4	legs made of veneer beech press, worktop made of medium-density fiber boards, circular (table for 4 persons)
	5	legs made of solid beech wood, worktop made of plywood board, rectangular with ABS edge-trim, Top (table for 4 persons)
	6	legs made of solid beech wood, worktop made of plywood board, rectangular with solid wood edge-trim, Top (table for 6 persons)
	7	legs made of polypropylene, worktop made of plywood board, rectangular with ABS edge-trim, Top (table for 4 persons)
	8	legs and tabletop made of polypropylene, black caps on the bottom part of the legs with the possibility of regulation of height up to 3 cm, Top (table for 4 persons)
	9	legs made of solid beech wood, worktop made of plywood board, rectangular with solid wood edge-trim, Top (table for 8 persons)
	10	legs made of solid beech wood, worktop made of plywood board, semi-circular with solid wood edge-trim, Top (table for 8 persons)
	11	legs made of solid beech wood, worktop made of plywood board, circular with ABS edge-trim, Top (table for 8 persons)
II	12	legs made of solid beech wood, worktop made of plywood board, rectangular with 2 semi-circles rectangular with solid wood edge-trim, Top (table for 6 persons)
	13	legs made of solid beech wood, worktop made of plywood board, rectangular with solid wood edge-trim, Top (table for 4 persons)
	14	legs made of solid beech wood, worktop made of plywood board, circular with solid wood edge-trim, Top (table for 8 persons)
	15	legs and worktop made of polypropylene, top (table for 8 persons)
	16	metal legs, worktop made of plywood board, ABS trim, top (table for 6 persons)
III	17	legs and worktop made of plywood board, top (table for 4 persons)
	18	metal legs, worktop made of plywood board, ABS trim, top (table for 6 persons)
	19	metal legs, worktop made of plywood board, ABS trim, top (table for 4 or 6 persons)



Figure 1: Some of the tables (samples) finded at Polygons.

3.RESULTS OF RESEARCH

A total of 19 types of tables were analyzed, marked with an ordinal number from 1 to 19 (Table2).

Table 2. Results of measured samples of the tables (EN 1729-1, 2016)

Polygon	Table type	Dimensions(cm)									Marking (colours)	User guide
		h1	t1	w1	b1	L	h2,h4 , t2,t3	h9	y	z		
I	1	56	156/76	74	74	0,1406	/	/	/	21	/	/
	2	51	37	58	ø74	0,107	/	/	/	16	/	/
	3	50	80	80	80	0,16	/	/	/	15	/	/
	4	50	45	70,65	ø90	0,1589	/	/	/	15	/	/
	5	50	80	80	80	0,16	/	/	/	15	Y	/
	6	50	90	45	90	0,135	/	/	/	15	/	/
	7	52	40	62,8	ø80	0,1256	/	/	/	22	/	/
	8	52	62	62	62	0,0961	/	/	/	16,5	/	/
II	9	58	90	45	90	1,0125	/	/	/	24	/	/
	10	58	45	70,65	Ø90	0,1589	/	/	/	24	/	/
	11	48	45	70,65	ø90	0,1589	/	/	/	21	/	/
	12	52	80/30	40/ 35	60,ø60	0,1271	/	/	/	18	/	/
	13	50	80	80	80	0,16m2	/	/	/	16	/	/
	14	54	60	47,1	ø120	0,1413	/	/	/	19	/	/
	15	54	57	44,745	ø114	0,1275	/	/	/	22	/	/
III	16	56	100	50	50	0,083	/	/	/	26	/	/
	17	52	100	50	60	0,15	/	/	/	22	/	/
	18	56	100	50	50	0,15	/	/	/	26	/	/
	19	52	100/30	50/35	60	0,15/0,1	/	/	/	21,5	/	/

27

Legend: h1- depth of table top (cm); t1- depth of table top (cm); w1- width of top, per person at front edge, where pupils sit (cm); b1- Width of top surface; S- Surface area per person (min, m²); L- h2, h4, t2,t3- legroom (cm); h9- Height of footrest (cm); y- inclination of the table top (cm); z- vertical distance between the top of the table and the top of the seat (cm).

Various types of tables were found in the research, different indimensions and shapes, construction, mobility, use of materials and colors.

It was find out that tables in preschool institutions located in all three polygons are used for many different functions: eating, writing, reading, playing or performing a given task.

Adjustable dimensions and shapes

According to the possibility of changing the dimensions, there were found tables with the option to adjust the height of the worktops (types 1,2 and 8). The regulaton of the tables of types 1 and 2 is made possible with a system located on the legs, composed of two metal bars which enter (slip) into each other. The lower bar that is movable has a small protruding part and enters the upper bar that is fixed and has holes. At the desired height, the protruding part of the bottom bar enters the hole of the upper one. At the table type 8, the height is regulated in such a way that there are caps on the bottom part of the legs, which are wound up in them.

Tables that alter the dimensions according to the collection or assembly principle were found only in Polygon II (type 12). The worktop was consisted of a rectangular and two semicircular top plates. The semicircular plates are screwed with piano hinges on the rectangular plate, which is held by two movable metal bars that pull back and forth. When the metal bars are pulled in, the semicircular tops fall down, making the table decrease in dimensions.

Tables that have mechanisms for stretching the tops in width or length, as well as a mechanism for changing the angle of the worktop, were not found. According to the dimensions and founded condition on the spot, the tables can be divided into higher, i.e., those used in the playrooms for children aged 3 to 7, and smaller tables used for nursery age

children. Most often in one preschool facility there are tables of the higher type, which differ in size for several centimeters (maximum ± 5 cm), depending on the manufacturer.

The functional dimensions of the tables are given in Table 2, each measured and marked according to EN 1729-1 (EN 1729-1, 2016)

Shapes

Depending on the shape of the worktop there were detected:

- quadrangular (types 3, 5, 6, 8, 9, 13, 16, 17 and 19a)
- circular (types 2, 4, 7, 11, 14, 15)
- semicircular (type 19b)
- trapezoidal (types 1, 19c)
- a combination of multiple forms (types 12, 18).

The worktop is with outflows from all four sides, that is, longer and wider than the sub-construction it holds. They are made of plates with a thickness of 18 and 25 mm. The surface of the tables is made of plywood boards covered with melanin paper in several patterns and colors.

Mobility

According to the mobility, the tables that are divided into immovable, movable and easily movable – tables with wheels (Kjuchukov, 2004), there are only of the type of easily movable.

Materials

According to the materials used, distinguished was tables made of solid wood, wood materials, non-wood materials, and a combination of materials.

a) Tables of wood materials:

- Legs made of veneer press and worktop made of plywood boards, edge-trimmed with solid wood trim (type 3) and ABS trim (type 5).
- Legs made of solid wood and worktop made of plywood boards edge-trimmed with solid wood trim (types 6, 7, 10) or ABS trim (type 11).
- Legs made of veneer press and worktop made of medium-density fiber boards (type 4).
- Table completely made of plywood boards (type 17)

b) Tables made of non-wood materials are: plastic substances (types 8, 15).

c) Tables made of a combination of multiple materials:

- Metal legs and plywood boards worktop, edge-trimmed with solid wood trim (types 12, 13, 14) or ABS trim (types 1, 2, 16, 18, 19).
- Plastic legs and plywood boards worktop (type 7).

Construction

In terms of construction, the tables have been designed in the following manner:

- Tables on which the legs are directly screwed to the worktop, without carrier construction (types 1, 2, 7, 8, 15, 18, 19).
- Tables with a carrier sub-construction of metal bars in the form of a rectangle, welded together and screwed to the worktop. (types 12, 13, 14, 15).
- Tables with a carrier sub-construction of solid detail rails, connected with fixed connection with dowels and glue (types 5, 6, 9, 10- semicircular dowel, 11)
- A vertical sub-construction of veneer press, where the legs themselves make up the construction. They are composed of a single veneer press.

During the analysis of the tables, in none of them was found footrest and legroom.

Colors

In terms of color, the tables are all different. The legs most often retain the natural appearance of the material, if they are from wooden materials - beech natur, and if they are metallic - the metal finish. The worktops are in the range of white and beige tones, while those of MDF are painted in bright colors, red, green, blue or yellow

4. DISCUSSION AND CONCLUSION

The comparison of the research of tables carried out in all the three polygons with EN 1729-1:2016 is far from satisfactory. None of the tables in Polygon I meets the dimensional requirements that are prescribed by the standard. The width and length of the tables are within the permissible parameters, while the height and the space prescribed for one child per m² in more than half is out of the standard. In Polygon II, only two tables type 10 and 11 are within the prescribed standard, while in the case of the others at least one of the dimensions does not fit into the standard. In Polygon III, too, none of the tables is according to the standard. Here, besides the height, the depth is not met either.

The situation is the same with the comparison between the JUS (JUS.D.E4. 021, 1965) and the BDS (***, 1988). The samples compared to the JUS have great differences in the height of the tables, while in the width and depth there are no significant deviations. In addition to the height, there is deviation in the width with the BDS, both in width and depth.

According to the standard for performing preschool activities in the Republic of Macedonia (***, 2009), the situation is somewhat different. More than half of the tables are designed according to the parameters prescribed by the standards. From all of this, it can be concluded that only a few tables are dimensioned according to the standards. Incorrectly projected tables, compared with chairs, lead to improper growth and development of children.

In all preschools, two types of tables were found, one with a bigger height, and the other with a smaller one. The higher ones were used in the rooms where children aged 3 to 7 were resided, while the rest were in the rooms where the nursery units were, i.e., in the playrooms for children aged 2 to 3 years.

The European standard prescribes 4 heights of tables marked from 0 to 3. When inspecting and analyzing the data of the tables, the same conclusion is reached as with the chairs, whereby a height difference should be made in the tables in 4 categories according to the age of the children: from 2 to 3, from 3 to 4, from 4 to 5 and from 5 to leaving for school. From the inspection it was concluded that the lowest table is of a height of 48 cm, which enters the group 2, for children with a height of 1 080 - 1 210 mm. For children with shorter growth than this height, the tables are inadequate. According to the European standard, each height has its own color, after which the tables should be marked. It can be marked on the lower parts of the legs or on the underside of the worktop.

According to some authors, the height of the worktop of the table can be obtained through the height of the elbow in a sitting position, with the addition of 3 to 5 cm (Bylon, 1962; Troussier *et al.*, 1999). The anthropometric data for this population are very old or there are few in number. In the region, in this area in the last five years there is only one master thesis (Iliev, 2011), which provides some basic data. A big problem is precisely the lack of such anthropometric data.

Another important factor affecting inadequately designed furniture is the misuse of materials. When manufacturing the worktops, materials that are resistant to cleaning agents should be used and have a high coefficient of surface mechanical damage. Type 4 tables found in one of the polygons are made of MDF plates. In this type of tables, surface defects have been noted. The worktops of the tables that are made of plywood boards without exception should be edge-trimmed with abs trim of 3 mm. From the insight it was concluded that this is not the case with all the tables.

Regarding the shape, the tables should be rectangular, semicircular or quarter circle, with the possibility of joining them together and creating a larger working space when doing a group task (Domljan, 2011). In terms of the utilization of the material from which the worktop is made, bigger saving is made when the shapes are rectangular than circular.

Based on the data obtained from the overall analysis of the existing types of furniture, compared to the applicable standards and the established deviations found in preschools in all three polygons of research, by initiating some proposals for solutions to certain problems, an

attempt is made to contribute to the improvement of the process of designing preschool furniture, fully adapted to the needs of children. Contribution to this have also been the conducted conversations with the employed caretakers and teachers in preschool institutions as ones directly involved in the educational process. The suggestions of furniture designers should also be taken into consideration.

Based on the set goalit can be concluded that the existing preschool furniture does not correspond to the needs of the children according to valide standards. This can be confirmed:

1. The dimensions of the furniture do not correspond to children's anthropometric measures. There is a lot of inconsistency. Tables are either higheror smaller, there is no more sizes. Inadequately designed furniture affects the psycho-physical development of children. As a result, manifestations such as improper posture, back and neck pain, fatigue, and loss of concentration can be manifested (Schröder,1997;Knight and Noyes, 1999).
2. The dimensions of tables can be divided into four sizes, for children aged 2 to3 , from 3 to 4, from 4 to 5, and from 5 years old to starting school. Each of the sizes should be marked with a number or color, as shown in the European standard EN 1729-1. In the groups where children of only one age are staying, the application of the dimensions would be easier than in the groups where the age is mixed.
3. The use of appropriate furniture requires active education of the employees in the kindergartens
4. The furniture used does not fully satisfy the pedagogical standards either. They should be easily mobile and multi-functional, with an easy option to adapt to space.
5. Proper use of adequate materials during their design.
6. Existing regulations and rulebooksare too general and in some places ambiguous. This can lead to confusion among manufacturers, investors, teaching staff and others involved. With comprehensive analysis and inclusion of interdisciplinary teams of experts, the rulebooks and standards should be improved, which should be binding during the process of furniture design (Domljanet *al.*, 2015).
7. The procurement of furniture for the needs of preschool institutions is carried out in a procedure regulated by law, through a public procurement. Most often, the basic criterion for procurement is the lowest price, and not the quality of the furniture. In this case, the supplier's free choice is limited and determined.

The solution for all the problems listed above is complex and systematic and requires the involvement of several competent institutions and teams of various professions. When designing furniture for preschool institutions, interdisciplinary teams composed of architects, pedagogues, psychologists, sociologists, doctors, physiatrists, orthopedists, as well as professionals dealing with research of new materials should be included.

REFERENCES

- Bylon, M. (1962): *Školskezgrade*. Građevinska knjiga, Beograd.
- Bajbutović, Z. (1983): *Arhitektura školske zgrade*. Svjetlost, OOUR Zavod za udžbenike i nastavna sredstva, Sarajevo.
- Domljan, D. (2011): *The design of contemporary school furniture as a prerequisite for maintenance of pupils' health*. Doctoral thesis. University of Zagreb Faculty of Forestry, Zagreb
- Domljan, D., Grbac, I.; Jirouš-Rajković, V.; Vlaović, Z.; Živković, V.; Župčić, I. (2015): *Kvaliteta i tehnički opisi proizvoda od drva, Svezak I. Opremanje zgrada za odgoj i obrazovanje*. Sveučilište u Zagrebu, Šumarskifakultet, Zagreb
- Iliev, B. (2011): *Comparative analysis for the preschool institutions in Municipality of Centar with modern tendencies in designing and articulations of specific interventions in space as a result of the psycho-physical needs by the children*. Master thesis. "SsKiril and Metodius, Faculty of Design and Technology of furniture and interior, Skopje

- IvanovićŠekularac, J. (2000): *Predškolske ustanove i komfor*. Magisterskitrud. ZadužbinaAndrejevič, Beograd.
- Kjuchukov, G. (2004): *Design of furniture, doors and windows*. Matkom, Sofia.
- Knight, G., Noyes, J. (1999): *Children's behaviour and the design of school furniture*, Ergonomics, Vol 42, No. 5, 747 – 760.
- Schröder, I. (1997): *Sitting posture and physical activity*, Coll. Antropol. 21(1997)2, 397- 403, Zagreb.
- Troussier, B., Tesniere, C., Fauconnier, J., Grisons, J., Juvin, R., Phelip, X., 1999: *Comparitive study of two different kinds of school furniture among children*. Ergonomics 42: 516-526.
- БДС (BDS) 8475 – 88, (1988): Български стандарт. Функционални димензии на мебелите за деца од предучилишна възраст. (Bulgarian state standard)
- EN 1729-1 (2016): Chairs and tables for educational institutions - Part 1: Functional dimensions.
- ***, (2009): Rulebook on standards and norms for performing the kindergarten activity. Ministry of Labor and Social Policy of the Republic of Macedonia (Official Gazette of the Republic of Macedonia 35/2009).