

Accessibility, Easy and Comfort of Using Sanitary Devices by Preschool Children: Pre-design Studies

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Abstract. Using the standard bathroom facilities and equipment designed for adults by small children presents numerous difficulties. Due to the smaller size of the child, its motor space (particularly space of reach and grasp) is also reduced. For this reason, the use of standard full-size sanitary devices intended for adults is uncomfortable and dangerous for the child, and usually requires a help of parents or caregivers, what in turn results in limited development of the child self-reliance and independence. Actions taken during design hygienic-sanitary rooms used by preschool children should include the possibility of creating favorable conditions for the availability, safety, and adaption of them to the needs and demands of small users in terms of entire functional-spatial structure and individual functional elements of equipment. The bathroom facilities should also be friendly, cozy and inviting aesthetically. The paper will be presented the motor-space analysis associated with the use of bathroom devices by children of preschool age. The work will also be discussed ways to introduce facilitations and additional improvements in the bathroom for small users. The possibility of introducing to the bathroom devices with reduced dimensions adapted to the needs and motor skills of small children, as well as additional support elements will also be considered.

Keywords: Ergonomics · Architectural design · Interior design · Bathrooms design · Toilets design · Hygienic-sanitary facility · Kindergarten bathroom · Sanitary devices · Preschool children · Motor skills · Accessibility · Safety · Comfort · Well-being

1 Introduction

Hygienic and sanitary spaces because of its utility character is a special place in the house structures, as well as in public institutions. Comfortable bathroom, which is convenient, safe and allows optimal psychophysical condition for users, to a large extent determines its functionality. The layout, size and equipment of the bathroom and its location should be adjusted to ensure maximum comfort and safety of all users, regardless of differences in age and physical fitness, including children of all ages, also toddlers and preschoolers that require special extra care. Therefore, already at the design stage, the possibility of bathroom adaptation to diverse and ever-changing needs of all users

should be considered. Convenient and easy implementation of hygiene activities and physiological functions by children, both in the home bathroom, as well as in other hygienic-sanitary places, such as kindergarten bathroom, requires properly arranged space, adapted equipment, comfortable psychophysical terms and conditions associated with the sense of safety. In order to accomplish the above tasks, it is necessary to fulfill certain ergonomic criteria, among other things, related to the characteristics and motor skills of children, selection of sanitary devices and ensuring adequate health conditions and terms affecting the safety of the bathroom.

2 Ergonomic Criteria for Accessibility, Ease and Comfort of Using Bathroom Equipment by Children

Accessibility of bathroom equipment intended for adults and use of the standard bathroom facilities by small children is associated with numerous difficulties and can be a serious problem for them. These inconveniences are usually caused by too highly placed sanitary devices. Due to the smaller size of the child, its physical, motor space is also reduced and limited. These limitations include particularly space of handling - space of reach and grasp. For this reason, using the standard equipment of bathroom and full-size sanitary devices is uncomfortable and dangerous for the child, and usually requires a help of parents or kindergarten teachers, what in turn results in limited development of the child self-reliance and independence.

Ergonomic actions taken during design hygienic and sanitary spaces and rooms used by preschool children should include the possibility of creating favorable conditions for the availability, safety, and adaption of them to the needs and demands of small users in terms of functional and spatial. Providing friendly, ergonomic bathroom space for kids can guarantee not only their comfort and safety, but also willingness to use, which may contribute to their interest in taking care of hygiene from an early age. Therefore, if it is possible, insertion into the bathroom sanitary devices with reduced dimensions designed for children, is advisable. Adapting the bathroom to the needs of children is also possible with the help of additional elements that facilitate the use of various pieces of equipment [1, 2, 5].

3 Spatial-Motor Requirements of Preschool Children Using Hygienic-Sanitary Space and Devices

Analysis of spatial-motor requirements of people with diverse physical fitness and motor skills is the basis for shaping the hygienic-sanitary and its equipment. Therefore, in designing the hygienic-sanitary space used by children and the selection and arrangement of sanitary devices should take into account the following demands:

- determining the range of reach and grasp space on the basis of the characteristics and motor skills of children of preschool age,
- taking into account the specific requirements of space and movement in preschool children, whose mobility is limited due to the still undeveloped full physical fitness,

- considering that kids due to head proportions relative to the whole body, which differ from the proportion of adults, have the center of gravity shifted towards the head,
- taking into account the lack of children's sense of distance and their vulnerability to accidents,
- considering the possibility of application of the elements supporting the use of sanitary facilities.

4 Use of Hygienic and Sanitary Devices - Analysis of Spatial-Motor Requirements Based on the Characteristics and Motor Skills and Abilities of Children of Preschool Age

In order to determine the extent of reach and grasp space with respect to the use of individual sanitary devices it is necessary to examine the characteristics and motor abilities of users - children of preschool age. The spatial-motor analysis in relation to the anthropometric features of preschool children (4-year-old, 50th centile) that use sanitary devices (washbasin and toilet bowl) are presented in Sects. 4.1. and 4.2. Different types of activities, different positions and different phases of the movement were examined. The results of the analysis provide a basis to determine the extent of reach and grasp space - dimensions of movement surface in horizontal and vertical views. Different ways of functions realization were compared (using the full-size and the small-size sanitary devices), their advantages and disadvantages were identified. Also, the possibility of the use of additional facilities and support elements were taken into account [3, 4].

4.1 Use of the Small-Size and the Full-Size Washbasin - Analysis of Spatial-Motor Requirements Based on the Characteristics and Motor Skills and Abilities of Children of Preschool Age

Figures 1, 2 and 3 show the spatial-motor analysis of the child (about 4-year-old) using the washbasin. Figure 1 presents the approximate dimensions of the child (about 4-year-old), its spatial-motor requirements and the extent of its motor skills and capabilities - the extent of reach and grasp during activities related to the use of washbasin. Figure 2 shows the spatial-motor analysis of 4-year-old child using full-size washbasin located at the standard height - 85 cm, with the help of the children's stool with height of 22 cm. Figure 3 presents the spatial-motor analysis in relation to the use of the full-size washbasin located at the standard height - 85 cm by a 4-year-old child, with the help of universal stool with height of 17 cm. The analysis includes the following range of activities performed by the child:

- standing at the washbasin,
- setting children's stool,
- getting on the children's stool,
- turning on the tap,
- washing face.

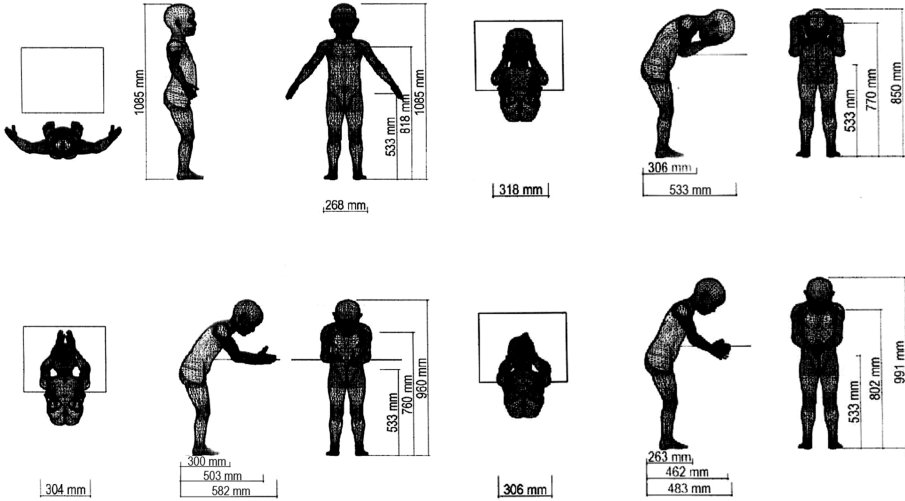


Fig. 1. The approximate dimensions of the 4-year-old child, its spatial-motor requirements and the extent of its motor skills and capabilities - the extent of reach and grasp in relation to the use of washbasin. (Source: own work)

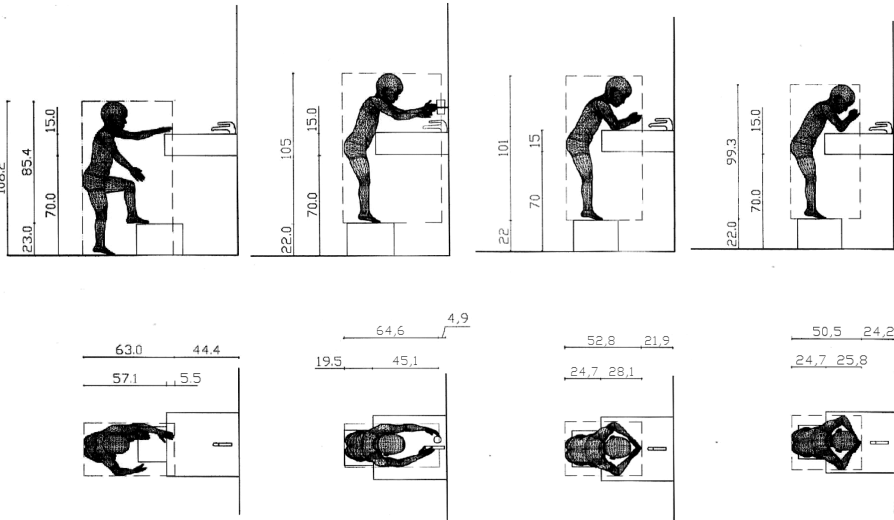


Fig. 2. Spatial-motor analysis in relation to the use of the full-size washbasin by a 4-year-old child – getting on the children’s stool (22 cm), turning on the tap, washing face. (Source: own work)

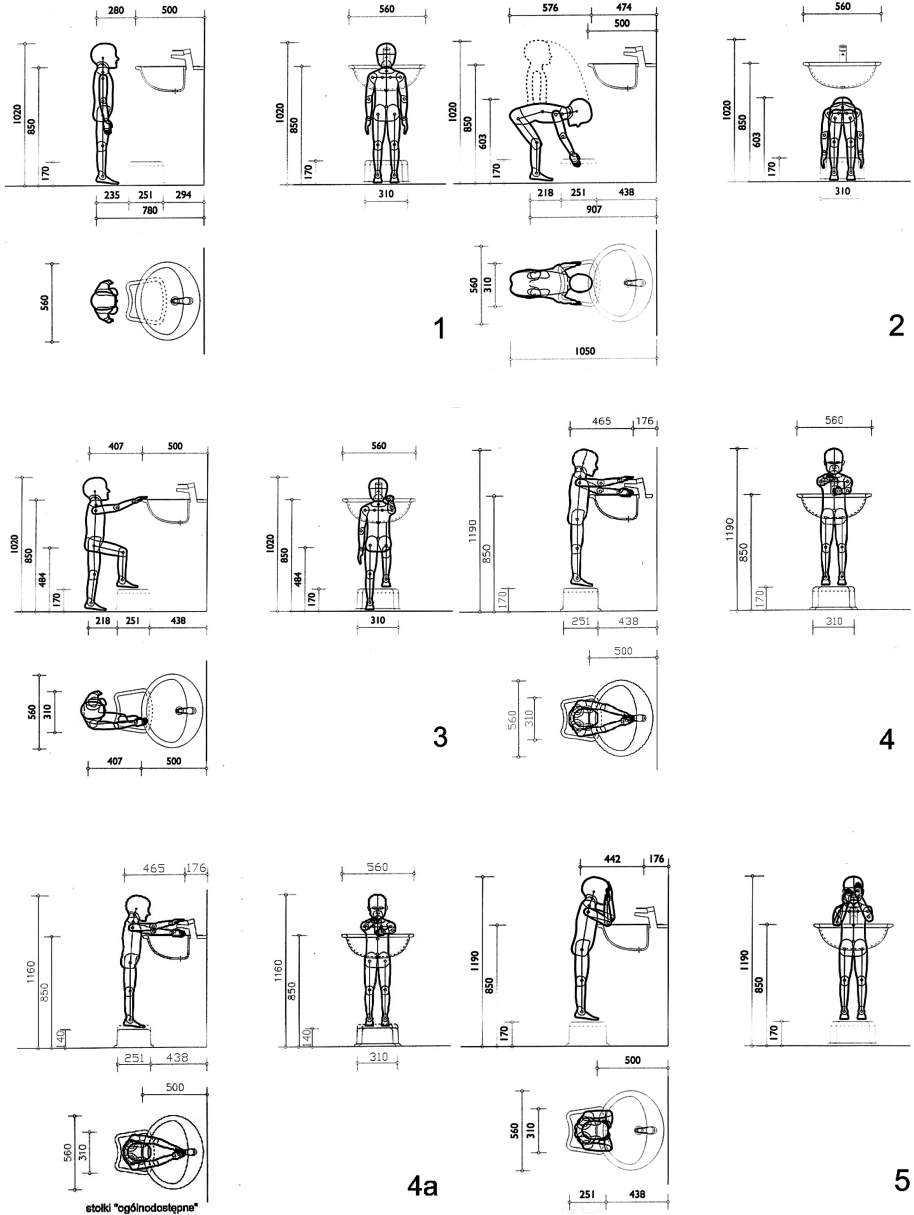


Fig. 3. Spatial-motor analysis in relation to the use of the full-size washbasin by a 4-year-old child – getting on the children’s stool (17 cm), turning on the tap, washing face. (Source: own work)

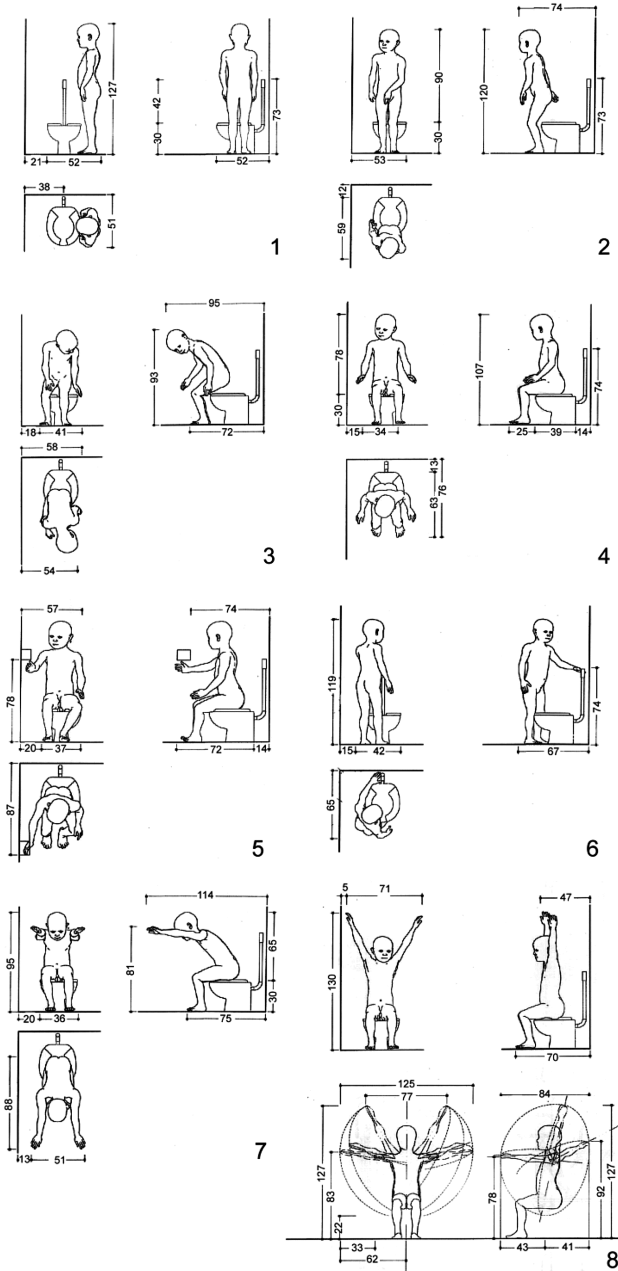


Fig. 4. Spatial-motor analysis in relation to the use of the small-size toilet bowl by a 4-year-old child - sitting down and sitting on the toilet seat, reaching for toilet paper, flushing, the range of motion space. (Source: own work)

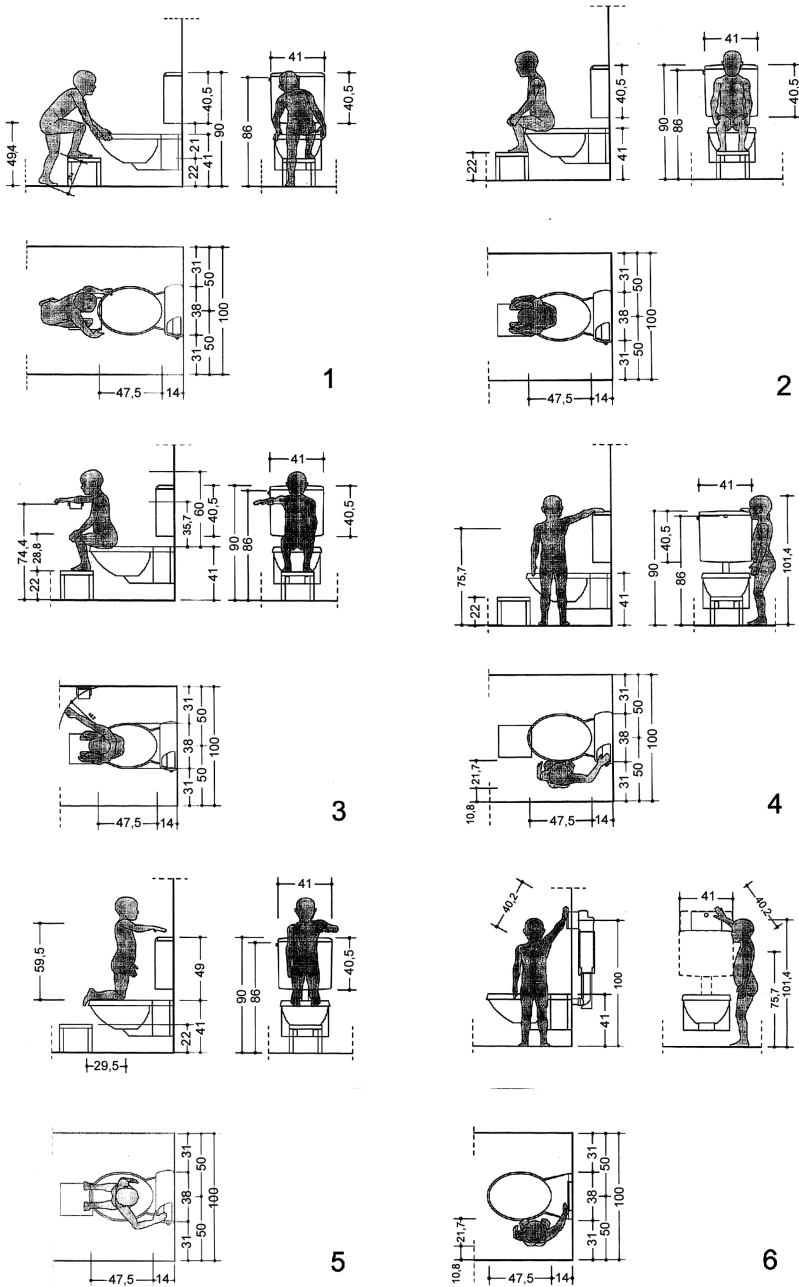


Fig. 5. Spatial-motor analysis in relation to the use of the full-size toilet bowl by a 4-year-old child - sitting down, sitting on the toilet seat, reaching for toilet paper, flushing. (Source: own work)

4.2 Use of the Small-Size and the Full-Size Toilet Bowl - Analysis of Spatial-Motor Requirements Based on the Characteristics and Motor Skills and Abilities of Children of Preschool Age

Figure 4 presents the analysis of spatial-motor requirements in relation to the characteristics and skills of a 4-year-old child that uses the small-size toilet bowl (height 30 cm, length 39 cm). It includes the following steps (functions):

- sitting down on the toilet,
- sitting on the toilet,
- reaching for toilet paper,
- flushing.

Figure 5 shows the spatial-motor requirements and the range of motor skills of children (4-year-old) using the standard full-size bathroom facilities.

Figure 5 shows the spatial-motor analysis of 4-year child that uses the toilet bowl hung on a standard height of 41 cm (with a flush tank suspended at a height of 90 cm and with a flush tank flush mounted at height of 100 cm) using a children's stool with a height of 22 cm. The analysis covers the following:

- sitting down on the toilet,
- sitting on the toilet,
- reaching for toilet paper,
- flushing (2 ways - kneeling on the bowl, standing at the flush tank - 2 variants).

5 Conclusion

Based on the analysis and the measurements it was found that for spatial-motor reasons, small-sizes sanitary devices (with reduced dimensions) should be implemented into the bathroom used by preschool children:

- suitably shaped a small washbasin (e.g., with dimensions of 49×42 cm or even smaller with dimensions of 40×33 cm) installed at a level corresponding to the child's height allows the child to comfortably and safely use of it,
- recommended installation height of washbasin is 55–65 cm above the finished floor,
- mounting height is also important for additional equipment: mirrors, dispensers for soap, dispensers for paper towels, hangers, holders,
- small toilet bowl, e.g. with a width and a height of 30–33 cm and a length of about 40 cm provides comfort to use of it even for the smallest children,
- a 33 cm high toilet bowl will eliminate the necessity of a child climbing on “adult” toilet bowl,
- in addition, the small size of the toilet bowl increases the safety of use, for example, by reducing the risk of falling child into the toilet bowl - proportions of child head relative to the whole body differ from the proportion of the adult and the center of gravity is shifted towards the head,
- preschoolers have different dimensions and adjusting the size of the toilet bowl by using a special children's toilet seat can be useful,

- location and mounting height of the toilet paper dispenser should be convenient for small children (approx. 75 cm above the floor),
- the minimum distance between mounted sanitary devices or between the device and the wall should be approx. 20–25 cm,
- in the case of the opposite arrangement of devices to each other or to the walls, the distance between them should be 75 cm [1, 2, 5] (Fig. 6).

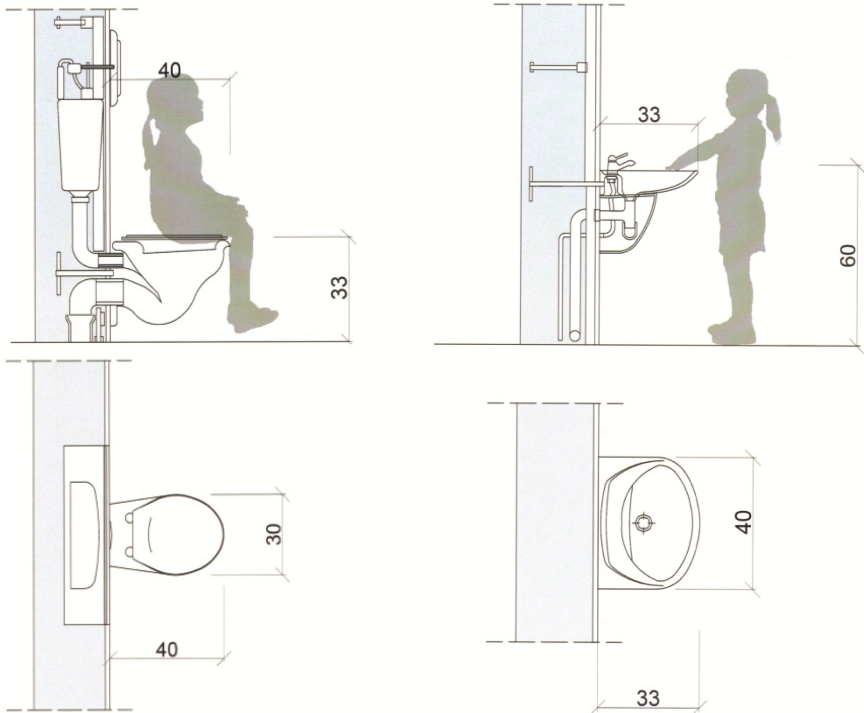


Fig. 6. Examples of sanitary facilities adapted to the needs of a preschooler. (Source: own work)

The bathroom, in which for various reasons is not possible to install devices intended for children should be equipped with other simple facilities and improvements. Thanks to them, the daily activities related to taking care of hygiene will be much safer, more comfortable and enjoyable at the same time:

- special children's toilet seat for adjusting the size and shape of the toilet seat, combines the functionality and safety of use toilets,
- low, wide tabletop under the washbasin can be mounted to provide better accessibility,
- convenient children's stool or platform (with a height of about 20 cm) finished with a soft rubber, on which the child can safely stand and reach for the tap, should be easily and directly accessible,
- special shelf for the bath toys can be located within the child,

- hangers and towel holders should be located on two levels - higher for older and lower for younger family members.

The necessity of adapt optimal height of locating sanitation to children's needs should be considered, taking into account that bathroom will be also used by adults and that children grow very quickly. The location and installation of bathroom equipment in a way that they can be used both by adults and children is a compromise. For example, the use of low-tabletop under a high washbasin is a universal solution. It will be located at the standard height - 85 cm above the floor, while the low tabletop will facilitate use of washbasin by child that with the help of a children's stool or platform will be able to reach the tap, propping up safely on the tabletop. In this situation, stable mounting of the washbasin is very important. The tabletop under the washbasin should be fairly wide - it will facilitate supporting the child, and at the same time it can be used to store toiletries and rubber toys [1, 2, 5].

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