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APPLICATION OF ERGONOMIC ARCHITECTURE IN CHILD-FRIENDLY FURNITURE DESIGN

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ABSTRACT
The state's commitment to ensure child protection in the Constitution No. 16 of 2016 concerning child protection, states that every child has the right to survival, growth, and development as well as the blessing of protection from violence and discrimination. Research conducted by Susenas and Riskesdas (2018), based on data from the National Socio-Economic Survey Integration, the analysis of *the Early childhood development Index* (ECDI) is known whether an early childhood has developed well according to its stages and age. These developments not only aim to ensure good literacy, numeracy, physical, social-emotional, and learning skills, but also pay attention to the fulfillment of health, nutrition, and care and nurturing aspects. However, it is different from the conditions in North Sumatra, based on data from BPS Medan City, where children aged 36-59 months have not developed physical abilities according to their stages. Therefore, this study was conducted to examine the application of ergonomic architecture in child-friendly furniture design as a form of needs to support children's learning and play activities. The method used is in the form of qualitative descriptive with a *design thingking method approach* and the application of ergonomic architecture in a child-friendly furniture design, data collected at a PAUD in Medan City to children with an age range of 0-6 years through observation and interviews. The results of this study show that child development through sensory can be optimized with furniture design that suits children's needs, the concept of child-friendly furniture design as a reference and an alternative approach to early childhood development with the application of ergonomic architecture in optimizing growth and development as well as a guide in educating children according to the growth period.

KEYWORDS: child-friendly, ergonomic architecture, furniture design, growth and development, physical ability

Komitmen negara untuk menjamin perlindungan anak dalam UUD No 16 tahun 2016 tentang perlindungan anak,menyebutkan bahwa setiap anak berhak atas kelangsungan hidup, tumbuh, dan berkembang serta berkat atas perlindungan dari kekerasan dan diskriminasi. Penelitian yang dilakukan oleh Susenas dan Riskesdas (2018), berdasarkan data Integrasi Survei Sosial Ekonomi Nasional, analisa Early childhood development Index (ECDI) diketahui apakah seorang anak usia dini telah berkembang dengan baik sesuai tahapan dan usianya. Perkembangan tersebut tidak hanya bertujuan untuk memastikan kemampuan literasi, numerasi, fisik, sosial emosional, serta kemampuan belajar yang baik, namun juga memerhatikan pemenuhan aspek kesehatan, gizi, hingga perawatan serta pengasuhan. Namun berbeda dengan kondisi di Sumatera Utara, berdasarkan data BPS Kota Medan, dimana anak usia 36-59 bulan belum mengembangkan kemampuan fisik sesuai tahapannya. Oleh karena itu, penelitian ini dilakukan untuk mengkaji penerapan arsitektur ergonomi pada perancangan furniture ramah anak sebagai bentuk kebutuhan aktivitas penunjang belajar dan bermain anak. Metode yang digunakan berupa deskriptif kualitatif dengan pendekatan metode design thingking dan penerapan arsitektur ergonomi pada sebuah desain furnitur ramah anak, data yang dikumpulkan pada sebuah PAUD di Kota Medan kepada anak-anak dengan rentang usia 0-6 tahun melalui observasi dan wawancara. Hasil penelitian ini menunjukkan perkembangan anak melalui sensori dapat di optimalkan dengan adanya desain furnitur yang sesuai dengan kebutuhan anak, konsep desain furnitur ramah anak sebagai acuan dan alternatif pendekatan perkembangan anak usia dini dengan penerapan arsitektur ergonomi dalam mengoptimalkan tumbuh kembang serta sebagai panduan dalam mendidik anak sesuai dengan masa pertumbuhan.

KATA KUNCI: *kemampuan fisik, arsitektur ergonomi, tumbuh kembang, desain furnitur, ramah anak*

INTRODUCTION

As a multi-cultured nation, Indonesia is committed to being one of the countries to realize a child-friendly environment. Therefore, every child is entitled to survive, grow, develop and obtain blessings while avoiding crime and other violent-related activities (UU No 16, 2016; Mastuinda & Suryana, 2014). Child-friendly environment consists of 3 things, namely safety, comfort, and stimulation created from outdoor and indoor activities (Rahadiyanti et al., 2021). Those aged 36-59 months develop their physical abilities (Cobb, 1993), however there is a possibility that their development differs from their age. For example, North Sumatra, (Central Bureau of Statistics, 2020) the 9th lowest province out of 35 others in Indonesia, shows a percentage of 96.8 percent in term of physical ability inappropriateness. This further also affects their physical development (Platokhina et al., 2016), with the proportion of disabilities according to their age at approximately 95.17 percent. This is slightly lower than non-disabled children at 97.80 percent, indicating that mothers' working status (Putrihapsari & Fauziah, 2020) does not have a major effect on development. The small difference in the proportion of children aged 36-59 months that are not in accordance to its age with working and non-working mothers are 97.75% and 97.9%, respectively (Central Bureau of Statistics, 2018). The problem associated with the need for supporting learning activities (Rathod, 2021) is the rapid physical growth and emotional development of children (Gaziulusoy, 2020). Therefore, it is imperative to utilize the furniture adjustment process during the development process (Stevenson & Prout, 2013).

The need for a special room to facilitate stimulation in children (Szymanski, 2002) is different from that of adults due to the large number of play activities (Nurulhuda et al., 2019). According to (Claudia & Grace, 2017), the need for one room furniture to work together with another space is different, therefore, the design needs to be adapted to the purpose of the activity, the user, and the appearance of the furniture (Claudia & Grace, 2017). Architecture and the built environment play an important role in creating child-friendly spaces (Radha, 2021) by analyzing variables that affect human behavior, such as space, size, shape, furniture, arrangement, color, and sound (Ardelia et al., 2019). The purpose of understanding the standard for the use of sizes in early childhood is to obtain the design of objects or furniture products that follow the needs of early childhood (Lai & Shu, 2014). This rule is significantly connected to children's growth and development needs, even in academic, social, and emotional interactions (Irawati et al., 2020). Therefore, associated with the condition of parenting in some families where all activities need to be done at home, the existence of furniture to support play and learning activities is a very important need.

Research that produces a model of designing furniture sets that aims to improve development with the Montessori method (Rimadiana, 2016). This is similar to Nurulhuda et al. (2019) and Fittryati et al. (2020), which states that child-friendly design in PAUD buildings (Tjahjono, 2017) is in accordance with the environment. Hasimjaya (2017), discussed furniture design in PAUD schools related to the application of ergonomic architecture through a child-friendly furniture design approach. From the latest scientific map, it is concluded that there is limited study on sustainability aspects in designing child-friendly. Furthermore, interdisciplinary research is needed to create child-friendly designs by considering the sustainability of the results (Said, 2017). Therefore, this study examines the design of multifunctional furniture to support children's activities to develop their abilities (Driediger et al., 2018). This research was conducted to design a thingking method (Amalina et al., 2017) and a prototype to explore the character and needs of children for optimal development.

The space to facilitate development and stimulation for children will be different from the room for adults as well as the need for furniture to support the needs of learning and play activities (Tjahjono, 2017). The problem that occurs in the needs to support learning activities is the physical growth and emotional development of children very quickly so that furniture adjustments must be considered based on these developments, so that learning and play facilities at home can be fulfilled optimally as when done outside the home. If at the age of 0-1 year, children need stimulation of physical development with the help of the elderly without furniture for bookshelves or toy shelves, but in children aged 3-4 years the furniture is needed, as well as in children aged 5-6 years with more needs and the activities carried out have been systematicized and well organized.

Therefore, the object of the research will focus on designing child-friendly furniture by considering the development of children from year to year and adjusting their needs with behavioral architecture approaches. In this design, the researcher will make observations on early childhood with an age range of 0-6 years, then analyze the need for facilities to support the needs of learning and play activities and make a multifunctional furniture design where the furniture can be used by children from 0-6 years old with several alternative changes according to the stage of age development and physical growth of the child. The design results are in the form of prototype design of innovative products that can later be used by PAUD (Early Childhood Education) schools as well as the needs of supporting facilities in households.

It also aims to determine the impact on the child's ability to develop later, such as thinking development, creativity, and independence (Milojković et al., 2019). In general, the essence of the problems to be studied will be explained, namely:

1. The limited knowledge of some parents in categorizing children's physical and emotional development according to the stages of development is guided by WHO and UNICEF, so that no development is missed in the child's golden age.
2. The problems faced by the community, especially parents who have to accompany their children's growth and development optimally at home without the help of teachers/educators.
3. The availability of space and facilities to support learning and play activities in residential residences that currently have not prepared alternative supporting facilities.

Furthermore, ergonomic architecture plays a role in the design of multifunctional furniture to meet the wishes of working parents to ensure adequate development of children's golden age.

METHODS

This is a descriptive qualitative approach with data collected through online surveys distributed openly in several sub-districts in Medan City. The research was conducted using Medan city ethnography to allow researchers to understand the culture of the community and visualize respondents' views on child development. The objects of the research are childhood within the age range of 0-6 years living in residential areas with the varying parental background. This research was leading to a thinking product (Amalina et al., 2017). Design thinking is a collaborative method that gathers many ideas from disciplines to obtain a solution. In this method, there are 5 stages/processes that allow us to obtain innovative outputs. The following are 5 developmental stages of the proposed model show as Figure 1.

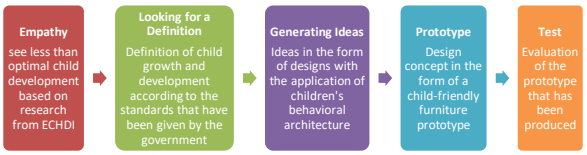


Figure 1. Stages of the method of approaching design thingking (Source: Author's Analysis, 2024)

A well-prepared environment is essential. However, for this method to be applied effectively, every children's room both at home and in public places needs to be designed to be easily accessible and safe. In the design process, several key principles should be used as a reference:

1. Simplicity. Children don't need much. Use soft colors and maximize natural light to create a cozy atmosphere.
2. Minimalism. Too many choices, both in the form of colors and toys, can confuse the child. Choose a few options so they can learn to make decisions with more focus.
3. Regularity. An organized environment helps children develop regularity in their thoughts and behaviors.
4. Accessibility. The space should be designed so that children can move and interact independently without always needing adult assistance. Even so, the presence of a sensitive adult is still needed to accompany.
5. Security. Children need a safe space to roam freely without the risk of injury. Therefore, it is important to create a completely safe environment for their activities.
6. Peace. A quiet space supports the development of children's physical and emotional independence, as well as helps them concentrate. Place this space in the quietest part of the house and avoid the use of electronic devices to maintain a calm atmosphere.

Analysis of Early Childhood Physical and Emotional Development

Early age is a golden moment of childhood development comprising rapid growth, holistic from cognitive, numeracy literacy, social-emotional, and physical development. All stimulus provided positive and negative results absorbed maximally by considering the child's brain development, which is 80%. Stimulus is not only for visible physical fulfillment rather it also enables a balanced intake of nutrients where environmental parenting prioritizes children's rights. The World Health Organization established a parenting framework known as "Nurturing Care," as shown in Figure 2. It comprises five components of parenting care, namely health, nutrition, protection, safety, and learning opportunities. The picture of parenting patterns as a consideration in a design is analyzed through the involvement of parents in the growth and development of children. UNICEF and its child development partner countries have developed an instrument to measure early childhood. The implementation process for the "nurturing care" framework in ECDI is used to measure and obtain a picture of children's behavior early. This process is categorized into four dimensions, namely Numeracy literacy, physical, social-emotional, and learning abilities.

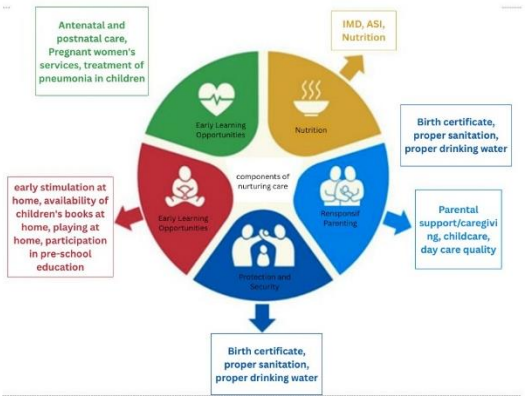


Figure 2. Nurturing Care
(Source: Early Childhood Development Index, 2017)

Analysis of Parental Involvement in Parenting Management

Parental involvement as the main support system is essential to achieve maximum development (Aura et al., 2021). Therefore, this study requires information from respondents to obtain information related to parents' knowledge of their children. A total of 23 respondents were willing to fill out questionnaires and interviews with the following results:

1. The respondents were dominated by working mothers with each working from 08.00 to 14.00 WIB to 17.00 WIB. Most of them leave their children in daycare and some others are entrusted to domestic assistants who go back and forth and do not stay overnight. From the general data obtained, each mother's working hours are different with the majority working from morning to evening, and are able to interact with their children for about 1-2 hours every day. Most of the care given to the immediate family is in accordance with the culture of the people of Medan City, where giving instructions to children is considered unnatural. Domestic assistant services are also not too dominant because these services are expected to ease household chores.
2. Parenting patterns. It can be inferred that parenting management based on observations is very dominant in child care by analyzing their involvement in preparing children's needs before going to work. However, from the observation, there is a phenomenon where parents are less prepared for their children's independence in terms of feeding, bathing, and sleeping.
3. Kids toys management, Most parents state that they don't have a specific budget to make purchases. The toys provided also varied by analyzing physical, cognitive, linguistic, social, emotional, and personality/religious development. Most of the respondents spent 15-30 minutes with their children, while others had no free time due to busy work schedules. For storage methods, parents choose to use boxes/baskets, cabinets, and special spaces. From the explanation above, it can be assumed that parents do not have a specific budget or time when buying children's toys based on it. Therefore, this has led to a surge in its presence with storage in boxes/baskets, custom wardrobes, and rooms.

Many needs related to child development can be met through a supportive environment, namely a safe and easily accessible environment, where children can move freely. Along with the increasing number of recent findings on child development, especially in the field of neuroscience, the concept of child independence is now receiving more and more attention. This is driving the growth of the market for supporting products such as study desks, chairs (ranging from simple designs to replica versions of famous designers), low beds, shelves, and more. Stairs and learning towers are also designed to help children reach higher areas, such as sinks. Ideally, the children's room should be designed in such a way that they can carry out activities independently and safely. This includes the use of furniture that is sturdy, does not shift easily, and is made from safe and toxin-free materials. Additionally, furniture design should avoid sharp corners to prevent injury. The ease of cleaning and caring for furniture is also an important aspect, not only for children, but also for the comfort of parents.

RESULTS AND DISCUSSION

Suitability and comfort for young children will be very different from that for adults. To understand suitability and comfort for young children, the first step that must be taken is identification. Next, the next step is to explore crucial things in early childhood. The main goal is to create objects or products that suit the needs of early childhood children (Figure 3). The following image provides an illustration of the differences in size according to the user.

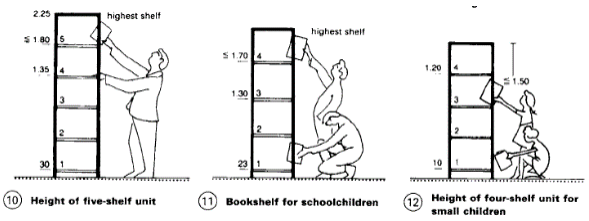


Figure 3. Illustration of the differences in dimensions of furniture for children and adults
(Source: Neufert, 2002)

The design concept is generated from observing the behavior of children aged 0-6 years with the application of behavioral architecture from interviews

with their parents. From the interview results, several things need to be established, such as the need for furniture that emphasizes the sustainability of users in the long term considering that the economy of the people of Medan city still earns below the minimum wage.

Furthermore, the furniture can also be used as a means of playing and learning. The design idea was obtained from the growth process and the child's body associated activities from 0-6 years old. The design concept illustration is based on the child's growth curve, as shown in Figure 4.

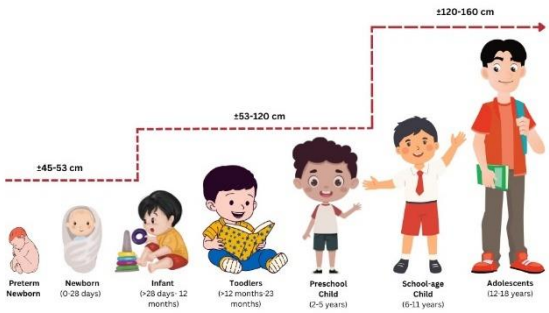


Figure 4. Illustration of the concept of ideas based on the curve and stages of a child's growth
(Source: author's analysis, 2024)

Meanwhile, the idea is expressed in a 2-dimensional image using the standard dimensions of the child's body, as shown in Figure 5.

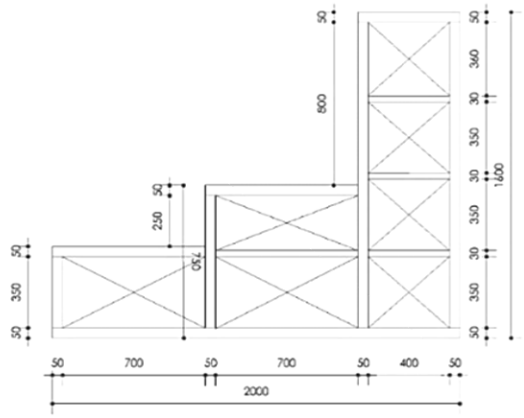
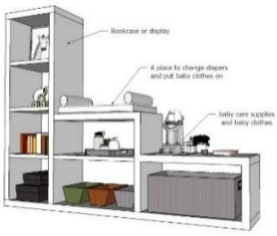
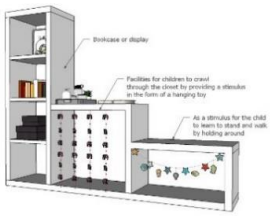
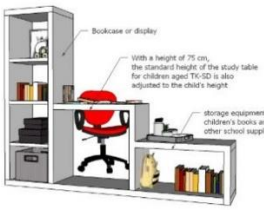


Figure 5. The concept of ideas according to the dimensions of the child's body in 2-dimensional pictures
(Source: Author's Document, 2024)

The idea is expressed in the form of a prototype capable of changing functions according to the child's age, as well as adjusting to the needs and multifunctional of other family members. The prototype form is designed in 3-dimensional images, as shown in table 1.

Table 1. Product Description

Development Stage	Product Description Based on User Functions and Behavior
0-1 years 	At 0-1 year, newborn babies cannot conduct activities, therefore parents need a place/space to store baby care products, such as diapers, clothes, etc.
1-2 years 	At 1-2 years, baby start crawling and walking. They also play "peekaboo," therefore, the middle shelf is removed for adequate movement. Furthermore, the lowest shelf is used as a handle for the baby to learn to walk.
2-3 years 	At 2-3 years, babies start exploring their physical strength by running and climbing. They also carry out motor activities by playing with tents as well as drawing and writing.
3-4 years 	At 3-4 years, some of them have entered the PAUD (early childhood education) and TK (Kindergarten) period with an increase in height. Therefore, learning activities can be carried out on the middle shelf by adjusting the chair's shape. It can also be used as a children's bookshelf.
4-5 years 	At 4-5 years, children have very rapid development and are independent. Therefore, this multifunctional shelf is used for shared storage with other family members. It can also be used for display on the middle shelf, the addition of a gallows can store an umbrella or jacket and on a small shelf. Furthermore, it also acts as an iron shelf and shoe rack.

CONCLUSION

The growth and development of children in each family is different with different problems. The basis in accompanying children's growth and development begins from pregnancy, the breastfeeding process and the developmental assistance period up to 6 years which is commonly called the golden moment. Growth and development assistance is most influenced by the presence of parents in accompanying children, and for working parents, especially mothers, the moments that are passed will certainly not be as optimal as mothers who do not work. However, in a survey conducted by several institutions in a study, the working status of mothers does not seem to have a big effect on the development of children's physical abilities. From this statement, it turns out that there are still many working mothers who can manage their time well so that working and accompanying children can be done optimally. In addition to the problem of suboptimal growth, other problems are present during the pandemic, so children's activities are limited only at home, without being able to feel playing with nature, socializing and so on.

Ergonomic architecture has an important role in observing this phenomenon to provide solutions by looking at the dimensions of the child's body, the movement space needed by the child, and the type of activity that stimulates the child's growth optimally even if it is only at home. With the design thingking method which starts from empathy, generating ideas, producing designs, prototypes to testing with the aim of providing knowledge to both working and non-working mothers so that children's growth can be optimal according to the child's age. An idea where architecture contributes to the development of children's growth and development during the golden moment with the concept of multifunctional design, namely designing child-friendly multifunctional furniture that can be used according to the growth of children from the age of 0 to 6 years old and can even still function for other family members. As a parent who has children in the growth period, of course, it is hard work that must be done with the sacrifice of time, energy and finances. However, to realize an intelligent, independent and well-meaning advanced generation, of course these sacrifices will be comparable. Therefore, striving for optimal child growth and development is an obligation for every family.

Even with working parents, there are many things that can be tried to meet this optimization, one of which is in the selection of child-friendly furniture. This design idea is one of the various ways to optimize children's growth and development, the most important in this optimization is the maximum time of children's togetherness (not limited by quantity but prioritizing quality). Where children have strong emotional bonds with parents. In addition to producing products, this research is also a means of educating parents to know the process of child development in their golden age so that at a certain moment there are activities that are not in accordance with the child's development track, parents can immediately improve or ask for the help of child growth and development experts.

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