

The Role of Smart Furniture in Child Development: A Study Based on Parents' Opinions in Primary Schools

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Abstract

This study investigates the impact of smart furniture on the physical, cognitive, and psychosocial development of primary school children, based on parental perspectives. Focusing on items commonly used in educational and home environments—such as adjustable desks, ergonomic chairs, and interactive systems—the research employs a qualitative methodology. Data are gathered via a structured questionnaire and analyzed using the TOPSIS method to prioritize multidimensional parental evaluations. Findings suggest smart furniture supports posture, learning engagement, and organizational skills. However, concerns arise over increased screen exposure, decreased physical activity, and high costs limiting accessibility. The study recommends integrating movement-oriented design and promoting affordable, inclusive smart furniture solutions for broader educational equity.

Keywords: Smart furniture, child development, ergonomics, technology, interior design.

Akıllı Mobilyaların Çocuk Gelişimindeki Rolü: İlkokullardaki Velilerin Görüşlerine Dayalı Bir Çalışma

Öz

Bu çalışma, akıllı mobilyaların ilkököl çocuklarının fiziksel, bilişsel ve psikososyal gelişimleri üzerindeki etkisini ebeveynlerin bakış açılarına dayanarak araştırmaktadır. Eğitim ve ev ortamlarında yaygın olarak kullanılan ayarlanabilir sıralar, ergonomik sandalyeler ve interaktif sistemler gibi öğelere odaklanan araştırma, nitel bir metodoloji kullanmaktadır. Veriler yapılandırılmış bir anket aracılığıyla toplanmış ve çok boyutlu ebeveyn değerlendirmelerini önceliklendirmek için TOPSIS yöntemi kullanılarak analiz edilmiştir. Bulgular, akıllı mobilyaların duruşu, öğrenme katılımını ve organizasyon becerilerini desteklediğini göstermektedir. Bununla birlikte, ekrana maruz kalma oranının artması, fiziksel aktivitenin azalması ve yüksek maliyetlerin erişilebilirliği sınırlaması gibi endişeler ortaya çıkmaktadır. Çalışma, daha geniş eğitim eşitliği için hareket odaklı tasarımın entegre edilmesini ve uygun fiyatlı, kapsayıcı akıllı mobilya çözümlerinin teşvik edilmesini önermektedir.

Anahtar kelimeler: Akıllı mobilya, çocuk gelişimi, ergonomi, teknoloji, iç tasarım.

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1. Introduction

In contemporary interior design, technology has increasingly permeated children's living environments, emerging as an important factor influencing spatial organization and developmental outcomes. Especially the so-called "smart furniture", furniture with increased technological features and functionality, has become widespread in many children's environments from homes to schools. Since primary school children are in a period of rapid growth and development, the environmental factors they are exposed to during this period have a great impact on their development. Child developers have emphasized that children's interactions with their physical environment play an important role in their learning and personality development (David & Weinstein, 1987; Dudek, 2005; Freeman & Tranter, 2012).

Smart furniture is the specific subject of current research (Topal & Arpacioğlu, 2020; Torun, 2022; Yan et al., 2023; Fewella, 2024). Also, smart furniture offers a new experience in children's rooms by integrating technology into interior design. This furniture includes sensors, adjustable mechanisms or digital displays. For example, there are various types of smart furniture, such as computer-assisted work desks, internet-connected smart boards or play tables with augmented reality applications. In this way, children's rooms can be transformed into an interactive learning environment. Ergonomically, tables and chairs that can be adjusted according to the child's body size support correct posture and protect spinal health. Cognitively, furniture that can offer interactive and digital content can make learning more fun and engaging. From a psychosocial perspective, smart storage units that encourage the child's ability to organize their own space can help develop feelings of responsibility and self-management. Krejcar et al., 2019; Frischer et al., 2020; Blazevic et al., 2021; Mohamed et al., 2021; Logo & Orbulov, 2021; Wulanda, 2024; Maulana et al., 2024; Yu et al., 2024).

This research aims to comprehensively examine the developmental effects of smart furniture on elementary school children (6-9 years old), especially through the lens of parents' observations and experiences. Positioned at the intersection of interior architecture, developmental psychology and educational sciences, the study adopts an inherently interdisciplinary framework.

With the increasing integration of technology into domestic spaces, smart furniture, defined as technology-enhanced, multifunctional and adaptable design elements, has become a prominent feature in children's living environments. These objects not only serve physical functions such as storage or seating, but also interact with children's cognitive and behavioral patterns by influencing spatial perception, attention spans and engagement levels. By collecting and analyzing parents' views through structured data collection methods, the research aims to understand how such furniture contributes to or hinders children's physical, cognitive and psychosocial development.

Furthermore, the study aims to bridge the gap between technological innovation and developmental appropriateness by providing evidence-based recommendations. These findings will be valuable not only for parents who want to make informed decisions about their children's living spaces, but also for designers and educators working to create supportive, engaging and developmentally beneficial indoor environments for children.

1.1. Child Development and Learning Environments

The primary school years, typically spanning ages 6 to 9, constitute a crucial stage in children's overall development, marked by rapid and interconnected progress in the cognitive, physical, emotional and social domains. During this formative period, children begin to establish greater autonomy, develop basic academic skills and develop social relationships beyond the immediate family context. As they gain a clearer sense of self and spatial awareness, their interactions with both their peers and their physical environment become more purposeful and meaningful. From a developmental psychology perspective, the environments in which children learn and grow - especially those designed for regular use, such as bedrooms, classrooms, and playgrounds - play a central role in shaping their behavior, motivation, and emotional well-being (Piaget, 1970; Vygotsky, 1978). A stimulating and developmentally appropriate environment not only enhances attention and creativity, but also supports the emergence of self-regulation, responsibility and confidence. Therefore, the integration

of child-centered design principles into spatial planning is not only aesthetic, but fundamentally linked to children's learning experiences and developmental outcomes.

1.2. Interior Design, Color and Arrangement for Children's Spaces

Interior design for children requires a nuanced understanding of both aesthetic principles and developmental needs. Basic spatial variables such as color, form, scale, circulation patterns and lighting play an important role in shaping how children interact with and perceive their environment (Ciravoğlu, 2004; Gür & Zorlu, 2002; Kim et al., 2017; Burkut & Köseoğlu, 2022; Tam et al., 2025). Among these elements, color stands out as one of the most influential factors on children's emotional and psychological states. Research in environmental and developmental psychology has shown that vibrant and warm color palettes (e.g., red, orange, yellow) tend to stimulate energy, creativity, and positive emotions, while cooler or pastel hues (e.g., light blue, soft green, pale pink) promote a sense of calm, focus, and emotional regulation. Beyond aesthetics, color and form are integral to establishing a sense of identity and belonging within space, especially in early and middle childhood, when children begin to express individual preferences and take ownership of their personal environment. In this context, parents often serve as co-designers, choosing décor, themes and furniture arrangements that match their children's interests, temperaments and developmental stages. This collaborative personalization not only enhances the child's comfort and attachment to the space, but also contributes positively to self-esteem, autonomy and emotional security. Therefore, interior design decisions for children's spaces should be made with both visual appeal and developmental appropriateness in mind, recognizing the role of spatial aesthetics in mediating behavioral and psychological outcomes. Figure 1 shows some images of smart furniture for children (Figure 1).



Figure 1. Smart furniture for children (Images created with Midjourney by the authors)

1.3. Ergonomics and Health in Children's Furniture

Children's furniture, design, materials and ergonomics are very important considerations in children's living environments. The number of researches on this subject has increased with the development of technology (Uğur Yavuz et al., 2017; Wen & Pashkevych, 2023; Zhang & Kosenko, 2024; Sejdiu et al., 2024; Alli, 2024; Lin & Kosenko, 2025; Khairuni et al., 2025). Ergonomics is the most important point of furniture design, especially for growing children. Since children's skeletal and muscular systems develop rapidly, postural disorders may occur in the long term if the size and shape of the items they use such as tables, chairs and beds are not suitable for them. For this reason, school and home furniture should be sized according to the child's anatomy. Adjustable desks, smart chairs with back support and flexible seating units designed for growing children offer maximum physical comfort for children while studying or doing activities.

1.4. Smart Furniture Technologies and Their Use in Education

Smart furniture are products that incorporate advanced technologies such as sensor technologies, artificial intelligence and augmented reality (AR). This furniture can respond to user interaction, collect data and automate certain processes. The use of smart furniture in education can be considered part of the "smart classroom" concept, and there have been many recent publications on smart furniture

in the literature (Saini & Goel, 2019; Zhang et al., 2019; Kwet & Prinsloo, 2020; Mimoso et al., 2025; Gharamohammadi et al., 2025; Diab, 2026; Shehan, 2026). The use of smart furniture has potential drawbacks as well as benefits. There are warnings that a learning environment intertwined with technology can lead to distraction or overstimulation. In particular, it has been stated that prolonged exposure to screens can lead to focusing problems at a young age and reduce interest in traditional games (Christakis et al., 2004). In relation to this, Figure 2 shows some images of smart furniture for children (Figure 2).



Figure 2. Smart furniture for children (Images created with Midjourney by the authors)

2. Material and Method

This study was conducted using a quantitative research design in order to evaluate parents' perceptions regarding the developmental effects of smart furniture used by primary school children. The research focuses on technology-supported furniture systems frequently used in home and educational environments, including ergonomic desks, adjustable seating systems, modular storage units, and interactive furniture components.

The study sample consisted of 66 parents who had at least one child between the ages of 6 and 9. Participants were selected through convenience sampling, and data were collected via an online questionnaire distributed through school parent groups and social media platforms after ethics committee approval had been obtained.

The questionnaire was developed based on the relevant literature on child development, ergonomics, educational environments, and smart furniture design. Survey items were structured using a five-point Likert scale ranging from 1 ("Strongly disagree") to 5 ("Strongly agree"). The questionnaire evaluated parental perceptions under three main dimensions:

- Physical and ergonomic effects
- Cognitive and learning-related effects
- Psychosocial and behavioral effects

In addition to descriptive statistical evaluation, the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method was employed to comparatively evaluate the survey items according to their relative closeness to an ideal positive condition. TOPSIS was preferred because the study aimed to examine multiple evaluation criteria simultaneously and determine which smart furniture-related features were perceived more positively by parents within a multidimensional decision-making framework.

In the TOPSIS analysis process, each survey item was treated as an evaluation alternative, while parental response tendencies represented the decision criteria. Mean response scores obtained from the Likert-scale evaluations were used to construct the decision matrix. Since all survey items were

evaluated on the same measurement scale, normalization procedures were applied to ensure comparability among variables.

Two negatively worded items (Question 3 and Question 6) were reverse coded before the normalization stage in order to maintain consistency in the direction of evaluation. Equal weighting was assigned to all criteria because no prior theoretical or expert-based weighting hierarchy was established within the scope of the study.

The TOPSIS procedure consisted of the following stages:

1. Construction of the decision matrix
2. Normalization of the data
3. Formation of the weighted normalized matrix
4. Determination of positive and negative ideal solutions
5. Calculation of separation measures
6. Computation of relative closeness coefficients

The resulting closeness coefficients were interpreted to identify which smart furniture characteristics were evaluated more positively by parents. Higher TOPSIS scores indicate stronger alignment with the ideal evaluation condition.

2.1. Data Collection: Data Questionnaire and Participant Profile

The questionnaire was applied online with Google Forms - After approval from the ethics committee, the form was shared in school parent groups - The questions aimed to measure the physical, cognitive, design and technological effects. The research process workflow is shown step-by-step in Table 1.

Data were collected using a structured online survey designed to ensure ease of access for participants. The survey was distributed through social media platforms and school parent groups. The survey included closed-ended items based on a five-point Likert scale ranging from 1 = "Strongly disagree" to 5 = "Strongly agree". The survey items were developed in line with three main dimensions defined in the literature: physical (ergonomics, health, spatial organization), cognitive (learning, attention, productivity) and psychosocial (responsibility, emotional state, socialization). A total of 10 core questions were included. Ethical approval was obtained from the Scientific Research and Publication Ethics Committee prior to data collection (Decision No: 2025-47/05).

Table 1. Research process workflow

Stage	Process Name	Tasks & Steps
STAGE 1	Planning and Design	• Define purpose, scope, targets • Focus: 6-9 y.o. children's development • Method: Qualitative + TOPSIS
STAGE 2	Preparation and Ethical Approval	• Develop 10-item Likert questionnaire • Google Forms setup • Obtain ethics approval
STAGE 3	Data Collection	• Identify 66 parent participants • Distribute survey via school groups
STAGE 4	Data Analysis	• Conduct TOPSIS analysis • Reverse-score negative items • Generate objective rankings
STAGE 5	Evaluation and Interpretation	• Analyze TOPSIS scores/rankings • Compare with existing literature
STAGE 6	Conclusion and Reporting	• Develop recommendations for: - Designers - Parents - Future research • Report on smart furniture's impact

2.1. Data Analysis: TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) Method

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) is a method used to solve multi-criteria decision making (MCDM) problems. It was developed in 1981 by Hwang and Yoon. Its main purpose is to rank alternatives according to their distance from the ideal solution. The closer an alternative is to the positive ideal solution and the farther it is from the negative ideal solution, the more preferable it is considered. This method is preferred by researchers in current academic research. (Syamsudin & Rahim, 2017; Kungwola, 2020; Peng et al., 2021; Uzun et al., 2021; Chakraborty et al., 2023; Struzikiewicz et al., 2024; Yu et al., 2024).

TOPSIS creates a preference ranking of alternatives by calculating the geometric distances of the alternatives evaluated in decision problems to the positive (best) and negative (worst) ideal solutions. The weight of each criterion is taken into account and thus a more objective evaluation is made. For each question, the distribution of participants' responses (percentages from strongly disagree to strongly agree) was calculated. This analysis was presented in tables and graphs in order to reveal the general tendencies and differences of opinion of the parents. For example, the statements with which parents strongly agreed and those with which they disagreed were identified at this stage.

A different analysis was conducted using the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method. The TOPSIS method allows for a ranking by calculating the closeness of each alternative to the "ideal" solution in evaluations with more than one criterion (Hwang & Yoon, 1981).

Each survey question was treated as a "criterion" and the criterion used to evaluate these criteria was the average scores of the parents' responses. Briefly, the following steps were followed in the TOPSIS analysis:

1. *Creating a Decision Matrix:* The mean values for the 10 criteria (questions) were calculated by averaging the Likert scores given by 66 participants to each questionnaire question. These average values are between 1 and 5 and show how positively each criterion is evaluated at the group level.
2. *Normalization:* In order to eliminate the scale effects of different criteria, the averages were normalized over 1. At this stage, a higher mean is considered better for positive statements, while a lower mean is considered better for negative statements. In our study, since two of the survey statements were formulated negatively (Question 3 and Question 6), the scores of these items were reverse coded in the analysis.

This method, the survey answers became interpretable in this research. The findings are presented in tables and supported by graphs.

3. Findings and Discussion

This section presents the findings from the survey and the results of the TOPSIS analysis. First, the general distribution of parents' responses to the survey questions is analyzed, followed by the question-based scores calculated by the TOPSIS method (Rezaie et al., 2022; Struzikiewicz et al., 2024; Yu et al., 2024). The TOPSIS method used in this study, as one of the multi-criteria decision-making techniques, is widely used especially in rating user evaluations. A similar methodology was applied to evaluate educational environments in terms of user satisfaction. In this context, in the presented study;

- Each question was scored according to its proximity to the ideal solution
- Negative questions were reversed
- Average TOPSIS score: 0.61
- Highest score: 0.81 / Lowest score: 0.
- Most appreciated areas: aesthetic design, layout and movement space

3.1. Descriptive Findings

The distribution of the responses obtained from the 66 parents who participated in the survey is summarized in Table 1. Table 1 shows the abbreviated version of each statement in the questionnaire, the related development dimension and the percentage distribution of the parents' responses to the five-point Likert scale. In general, it is seen that parents are highly supportive of the statements regarding the positive effects of smart furniture, while they are more cautious or undecided about the statements regarding the possible negative effects.

3.2. TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) Analysis Findings

The “closeness to the ideal solution” scores obtained from the TOPSIS analysis applied to evaluate the survey results summarized above are presented in Table 2. These scores quantify the extent to which each survey question is perceived by parents to be close to an ideal situation. The closer the score is to 1, the better it is in terms of parental evaluations; the closer it is to 0, the worse it is. As a result of the analysis conducted with the TOPSIS method, it is seen that parents' general perception of smart furniture is positive (Table 2).

- In particular, the contributions offered in terms of ergonomic features, aesthetic design and space organization are frequently emphasized.
- Participants stated that thanks to the modular structures of the furniture, children can personalize the space and their responsibility behaviors are supported.
- On the other hand, some reservations were expressed about screen-supported furniture, emphasizing that such products may increase distraction.

Table 2. TOPSIS analysis results

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	TOPSIS Score
Question 1	1	5	7	31	31	0.76
Question 2	2	0	9	24	31	0.81
Question 3	6	10	20	20	10	0.43
Question 4	1	2	9	24	30	0.80
Question 5	1	1	6	32	26	0.78
Question 6	9	13	19	14	11	0.33
Question 7	5	11	14	24	12	0.74
Question 8	5	5	17	24	15	0.77
Question 9	3	7	19	26	11	0.70
Question 10	0	4	9	22	31	0.74

3.3. Findings Related to Material and Spatial Properties of Smart Furniture

This section presents a quantitative analysis of parental perceptions regarding the spatial efficiency, material quality, and ecological sustainability of smart furniture used in children's rooms. The following five items (questions 1–10) were assessed using a 5-point Likert scale, and responses were visualized through pie charts (Figure 3, Figure 4).

Figure 3 shows the pie chart of the survey results for questions 1 and 5 (Figure 3).

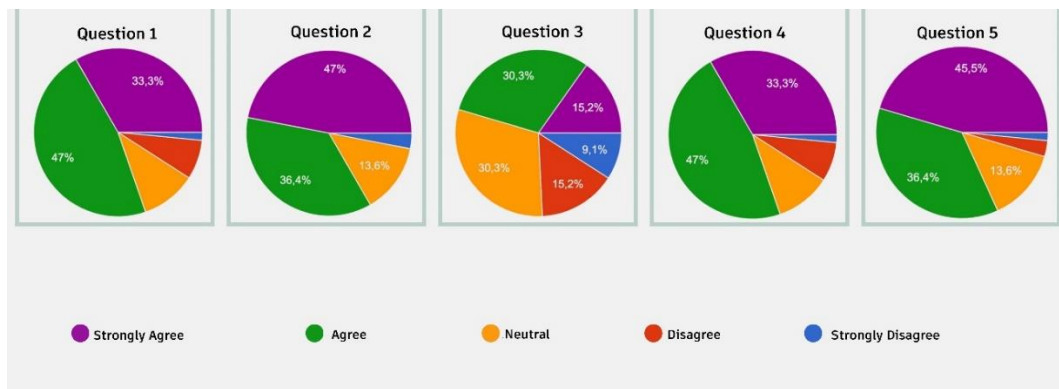


Figure 3. Pie chart of survey result

Question 1. *“The color and pattern options of smart furniture create a room design that aligns with my child's personal preferences.”*

The majority of participants expressed agreement that the color and pattern options offered by smart furniture contribute positively to the personalization of children's rooms. According to the data, 47% of respondents agreed and 33.3% strongly agreed that these customizable elements align with their children's personal preferences, helping to create a more individualized room design. This suggests that the aesthetic flexibility of smart furniture plays an important role in satisfying both the functional and emotional needs of users, particularly in terms of supporting children's self-expression.

Question 2. *“The modern and minimalist design of the furniture creates a calm and organized atmosphere in my child's room.”*

Smart furniture is also widely perceived as effective in promoting a calm and organized atmosphere through its modern and minimalist design. In this regard, 47% of respondents strongly agreed and 36.4% agreed that such designs help establish a serene environment in their children's rooms. The minimal use of visual clutter and the clean lines typically associated with modern design appear to facilitate spatial and psychological order, which is especially valuable in spaces dedicated to children's development and rest.

Question 3. *“The design of smart furniture moves my child's room away from a childish appearance appropriate to their age.”*

Opinions were more divided regarding whether smart furniture causes children's rooms to lose their age-appropriate, childlike character. While 30.3% agreed and 15.2% strongly agreed with this statement, an equal proportion (30.3%) remained neutral, and 24.3% (15.2% disagreed, 9.1% strongly disagreed) opposed the idea. This distribution indicates a degree of uncertainty or ambivalence among parents regarding the emotional and developmental suitability of modern smart furniture designs for children, highlighting a potential area for further design research or user education.

Question 4. *“The positioning of the furniture in the room enables my child to move around comfortably.”*

The spatial arrangement of smart furniture is largely seen as facilitating ease of movement for children within their rooms. A combined total of 80.3% of respondents (47% agree, 33.3% strongly agree) supported the view that the positioning of furniture allows children to move comfortably. Only a small fraction of participants disagreed (6%). These results underline the importance of ergonomic and spatially aware design principles in furniture intended for children's use, reinforcing that functional mobility is a key consideration for parents.

Question 5. *“The arrangement of smart furniture optimizes the room's lighting and airflow.”*

Lastly, the placement and layout of smart furniture are considered effective in optimizing both natural light and air circulation in children's rooms. A total of 81.9% of respondents (45.5% strongly agree, 36.4% agree) affirmed this benefit, indicating a strong consensus about the environmental performance of smart furniture systems. The findings support the notion that intelligent spatial

planning not only enhances comfort but also contributes to the health and well-being of children by improving indoor environmental quality.

Questions 6 and 10 are shown in Figure 4, which shows the pie chart of the survey results (Figure 4).

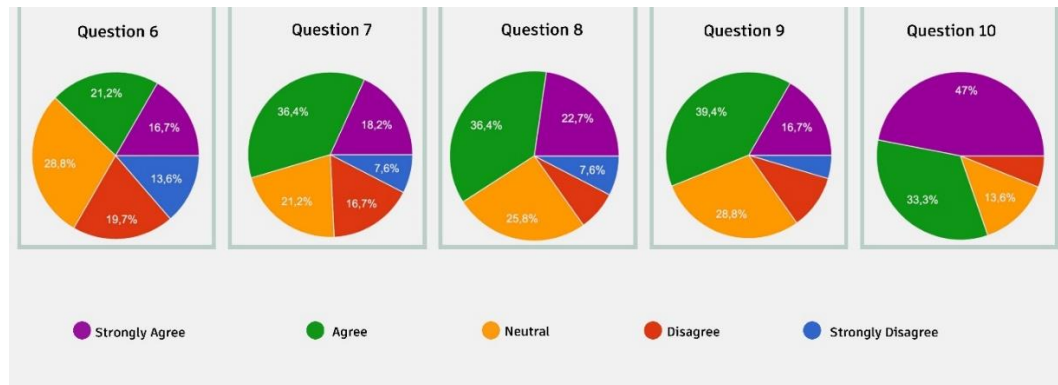


Figure 4. Pie chart of survey results

Question 6: *“The dimensions of the furniture take up more space than necessary in my child’s room.”*

Responses indicate that 28.8% of participants were neutral, while 33.3% expressed disagreement (19.7% disagree, 13.6% strongly disagree), suggesting that nearly half of the parents view smart furniture as potentially space-consuming. Conversely, only 21.2% of respondents agreed, highlighting the need for more compact and spatially efficient designs.

Question 7: *“I find the materials (e.g., wood, plastic) used in smart furniture safe for my child’s health.”*

A total of 54.6% of parents (36.4% agree, 18.2% strongly agree) expressed confidence in material safety. However, 24.3% indicated varying degrees of concern (16.7% disagree, 7.6% strongly disagree), reflecting a need for enhanced transparency in material sourcing and certification.

Question 8: *“I believe the furniture materials are durable and long-lasting.”*

58.8% of the participants (36.4% agree, 22.7% strongly agree) considered smart furniture materials to be durable, while 25.8% remained neutral and 15.2% expressed doubt. This implies that while durability is generally perceived positively, further communication on product lifespan is essential.

Question 9: *“The materials used in smart furniture are produced through environmentally friendly manufacturing processes.”*

This item received 56.1% agreement (39.4% agree, 16.7% strongly agree), with 28.8% neutrality and a small minority expressing disagreement. The results suggest growing environmental awareness among parents but also highlight uncertainty regarding manufacturing transparency.

Question 10: *“The fact that the furniture is made of recyclable materials affects my purchasing decision.”*

This item showed the strongest consensus, with 80.3% of parents (47% strongly agree, 33.3% agree) indicating that the use of recyclable materials significantly influences their purchase behavior. Only 13.6% were neutral, and 3% disagreed, emphasizing the critical importance of sustainability in consumer choices.

4. Discussion

The findings are largely in line with the existing literature. In parallel with the participants' views, previous research has also revealed that smart furniture contributes positively to factors such as physical development, learning motivation and spatial organization. There are various studies in the literature that address the effects of smart furniture on child development in a multidimensional way. Theories emphasize how children's relationship with space can be strengthened with interior architectural solutions. Also, it examined the effects of school furniture on children's behaviors with quantitative methods and stated that furniture arrangements are directly related to children's

academic success. Researcher draws attention to the fact that innovative approaches in children's furniture strengthen decision-making skills and personal responsibility awareness. From the perspective of developmental psychology, in the literature investigated the effect of technological furniture on children's attention spans and revealed that these products can increase learning efficiency if used in a controlled manner. Current studies states that artificial intelligence and automation-supported designs increase children's interaction levels and make a positive contribution if they are compatible with pedagogical content.

The findings of the study are largely in line with previous academic studies. For example, 78% (n=39) of the participants stated that ergonomic features contribute to children's posture. This finding is in parallel with current publication on ergonomic designs for children's health. Of the responses, 68% (n=34) reported that smart furniture increased the attention span of children. This result is supported by Yılmaz & Dirimeşe (2026) study showing the contribution of technology-supported furniture to learning motivation. On the other hand, 42% (n=21) stated that screen-integrated furniture may cause distraction in children.

The fact that smart furniture creates a calm and organized atmosphere in children's rooms was evaluated as an important achievement by parents. It is understood that these furniture produced with a modern and minimalist design approach provide spatial order by reducing visual clutter and allow for a more organized placement of items. This finding supports Ciravoğlu's (2004) study emphasizing the principles of "simplicity and order" in children's spaces. It is thought that environments with excessive stimuli (multi-colored, multi-object) can distract children's attention, while a simply designed space can facilitate focusing.

Parents' positive approach to modern and functional designs may stem from the fact that they see an order in children's living spaces that is free of unnecessary details and conducive to learning and play. This situation can be considered as the reflection of spatial features that support the learning process to the home environment, as Yıldırım et al. (2015) stated in their study on classroom design. The order and simplicity provided by smart furniture may contribute to children's more focused and peaceful activities at home.

In this research, parent feedback on material safety and sustainability is another important topic for discussion. Although most of the parents approved of the safety of the materials used, a significant number of participants expressed various concerns in this regard. In particular, factors such as electromagnetic fields emitted by electronic components in smart furniture and battery safety are among the factors that increase parents' level of concern.

There is still debate in the literature on the effects of long-term exposure of young children to low-level electromagnetic fields. While it is important that these devices are manufactured in accordance with current safety standards, it has been observed that parents take a "cautious approach". Therefore, it is important for manufacturers to transparently disclose product safety test results and material content to the public in order to increase user confidence and comply with sustainable design principles.

Within the scope of the research, the issue of sustainability was highlighted by the parents in a remarkable way. Most of the participants stated that they tend to prefer furniture made from recyclable materials. This shows that parents act with the responsibility of leaving a more livable future to their children and adopt environmentally sensitive consumption behaviors. The increase in environmental awareness, especially among individuals with children, creates both an opportunity and an area of responsibility for smart furniture manufacturers. According to Bronfenbrenner's ecological development theory, the child develops in a multi-layered and interactive system (Bronfenbrenner, 1979); the physical environment at home is an important component of this system. In this context, parents' positive attitudes towards sustainable and functional furniture may contribute to children's more conscious and efficient use of these products. The findings of the research generally coincide with the literature and reveal that smart furniture requires a multidimensional design approach. This situation emphasizes the necessity of cooperation between disciplines such as interior architecture, industrial design, child development, ergonomics and environmental sciences.

5. Conclusion and Suggestions

This study examined the effects of smart furniture on elementary school children in line with parents' views, and the data obtained revealed that such furniture affects child development in a multidimensional way. Smart furniture should be considered as functional tools that accompany children on their growth and learning journeys, rather than being mere objects.

According to the experiences of parents and the findings in the literature, such furniture enhances children's quality of life, supports their learning skills, improves their physical comfort and helps them develop a sense of responsibility. However, it should be kept in mind that there are points to be careful in the design and use of smart furniture, otherwise developmental risks may arise. In conclusion, it can be said that well-designed and well-balanced smart furniture are important tools that can support children's multidimensional development.

This study has some limitations. First, the study was limited to a group of 66 participants. This may reduce the power of the findings to represent the entire parent population. In addition, the generalizability of the results may be limited as the cultural, socioeconomic and geographical characteristics of the participants may affect parental views. Another limitation is that the data were collected using the self-report method. The statements obtained through this method may not correspond to the actual behaviors and learning outcomes of children.

Future research in this area could focus on several different axes. First, it is important to examine the smart furniture experience from a child's perspective. How children use these furniture, which features they like or have difficulty with, and their effects on their developmental processes can be investigated both quantitatively and qualitatively. Secondly, learning environments with and without smart furniture can be compared through experimental designs. Thus, the effects of smart furniture on children's cognitive, emotional and physical development can be evaluated more concretely. Considering the findings of the research, recommendations for both smart furniture design, development processes and its use are presented:

- *Child Participation in Design:* Children, as primary users, should be involved in the design process. Incorporating their preferences will increase acceptance and engagement.
- *Scale and Spatial Compatibility:* Designers should create flexible and space-saving furniture solutions. Foldable units, corner-utilizing L-shaped designs, and expandable modular systems are suitable for small rooms.
- *Ergonomic Validation:* All products should be tested by child ergonomics specialists before market release. Features such as posture support, adjustable dimensions, and size suitability must be verified. Manuals should clearly indicate the recommended age and height ranges.
- *Educational Use and Guidance:* Detailed user manuals should be provided for parents, including usage instructions and best practices. Post-sale support services are also essential to guide effective use.
- *Home-School Integration:* Smart furniture at home should be compatible with school-based smart classroom systems. Synchronizing digital content can reinforce learning continuity across environments.

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Author Contribution and Conflict of Interest Declaration Information

All authors contributed equally to the article. There is no conflict of interest.

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