Research on the Design Strategies of Home Education and Entertainment Terminal Products

Jianan Liu[1,*], Lingyan Zhang[2], Chen Wang[1], Yichen Wu[1]
[1]School of Industrial Design, China Academy of Art, Hangzhou, Zhejiang, China
[2]Design Innovation Centre, China Academy of Art, Hangzhou, Zhejiang, China
**Corresponding Author.*

Abstract: This study focuses on home education and entertainment terminal products, aiming to explore the diverse trends and strategies in education and entertainment within contemporary households while promoting children's development and parent-child interaction. Through a combination of literature review and case study analysis, the paper defines these products, categorizes their key types, and explores their development trends in depth. The findings suggest that such products are evolving in four main directions: diversification and collaboration of carriers, scene fusion, seamless characteristics of products, and simplification of intelligence. Based on these insights, the study proposes three design strategies: centering design around the family, incorporating appropriate functionalities, and ensuring the technology alignment with real-world usage contexts. The results of this research offer both theoretical support and practical guidance for the optimization and innovation of home education and entertainment terminal products.

Keywords: Educational and Entertainment Terminals; Family Perspective; Parent-Child Interaction; Design Strategies

1. Introduction

The demand for education and entertainment terminal products in modern families is no longer limited to mere entertainment functions; instead, there is an increasing emphasis on their educational value and parent-child interactivity. Research shows that parents are increasingly concerned about their children's intellectual development and physical and mental well-being, leading them to favor education and entertainment products that can holistically promote children's growth [1]. The emergence of parent-child interactive furniture reflects this trend by creating an interactive play environment, providing strong support for joint activities between parents and children. These products not only meet the interaction needs among family members but also lay the foundation for building internal family relationships.

The application of digital technologies has shaped complex family interaction patterns, which in turn deeply affects the internal relationships within families, especially the behavior and development of children. For example, in digital games, the role of parents has gradually shifted from overseers to active participants. This change in role dynamics promotes more equal family relationships [2]. Children gain confidence in their growth through these interactions. At the same time, parents alleviate work-related anxiety and fatigue by witnessing their children's transformation, gaining a deeper understanding of their inner worlds, and enhancing parent-child relationships. This positive interaction not only helps to strengthen family bonds but also effectively mitigates the negative impact of technology on family relationships.

This paper will explore the design strategies for education and entertainment terminal products in the family context, divided into six sections. The second section provides a overview of the definitions and categories of family-oriented education and entertainment terminal products. The third section delves into the development trends of this product category. The fourth section proposes targeted design strategies to guide product optimization and innovation. The fifth section provides supplementary insights on key design elements. Finally, the research conclusions, significance, and limitations are summarized.

2. Product Overview

2.1 Product Definition

Home education and entertainment terminals are intelligent devices that integrate both education and entertainment functions, designed to provide efficient hardware and software services for families, while promoting interaction and resource sharing among family members [3]. In terms of educational functions, these terminals can integrate a wide range of educational resources, supporting remote education and interactive learning. For example, the digital home interactive education system based on IMS (Information Management System) enables resource sharing among family members and promotes collaborative learning through multi-screen interaction [4]. Furthermore, some terminals incorporate facial recognition technology to effectively manage the time children spend on electronic entertainment devices and encourage them to watch beneficial educational videos [5]. Regarding entertainment functions, television, as one of the most common entertainment media in households, allows users to watch various TV shows, cartoons, movies, and other content, catering to the entertainment needs of different age groups. These devices typically also integrate multiple gaming platforms, supporting local and online games, thus providing users with a rich gaming experience. In addition, family entertainment options also include music playback and home theater systems, further enriching the entertainment experiences of family members.

2.2 Product Categories

This study selected and organized 34 representative research cases, assigning a number to each case (N1-N34), as detailed in Tables 1 to 3. Based on different types of devices, home education and entertainment terminal products can be categorized into three types: robots, screen or non-screen devices, and spatial experience products.

Table 1. Representative Cases (Robots)

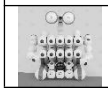
				
N4	N5	N6	N7	N8
				
N9	N11	N12	N16	N17

Table 2. Representative Cases (Screen or Non-Screen Devices)

				
N10	N13	N14	N15	N18
				
N19	N20	N21	N22	N23
				
N24	N25	N26	N27	N28
				
N29	N30	N31	N32	N33

Table 3. Representative Cases (Spatial Experience Products)

			
N1	N2	N3	N34

Robots refer to intelligent devices with educational or entertainment functions, which can be divided into humanoid, pet-like, and bio-mimetic types based on appearance. For example, "ClicBot" (N5) can be assembled into various types through modular reconfiguration. Screen and non-screen terminal products differ based on their interaction methods. Screen-based devices use a display as the core interface for user interaction through graphical interfaces. For instance, "KTC FlexiScreen" (N29) is a home-use mobile display that integrates functions such as a learning machine, fitness mirror, tablet, e-book reader, and smart speaker. Non-screen devices rely on voice, gestures, or sensors for user interaction, rather than visual means. For example, "Merge Cube" (N21) is an augmented reality device that allows users to interact with the virtual world through its built-in applications, exploring various subject areas. Spatial experience products focus on creating specific learning or entertainment environments to provide immersive experiences for users. For instance, "Kidsroom" (N3) uses sensory technology to transform an ordinary children's bedroom into a fantasy world, guiding children on adventure stories through images, music, narration,

lighting, and sound effects [6].

2.3 Preliminary Exploration of Trends

This study employs quadrant analysis, using "product state" and "hybrid state" as the horizontal axes and "education-oriented" and "entertainment-oriented" as the vertical axes, to categorize and analyze the selected cases. Here, "product state" refers to the physical form of the product, while "hybrid state" represents the result of merging two or more product states to meet specific scenario requirements [7]. The Figure 1 shows that the boundaries between education and entertainment are gradually becoming blurred, with their functions and values tending to merge. As a result, categorizing products as purely educational or purely entertainment-oriented is becoming increasingly difficult. Most cases are concentrated in the second and third quadrants, including various forms such as wearable devices, toys, and robots, demonstrating a growing trend of diversification. Additionally, a small number of cases display the characteristic of products gradually integrating with the home environment, breaking traditional boundaries between products and spaces. Notably, some products also show a design tendency towards reduced intelligence.

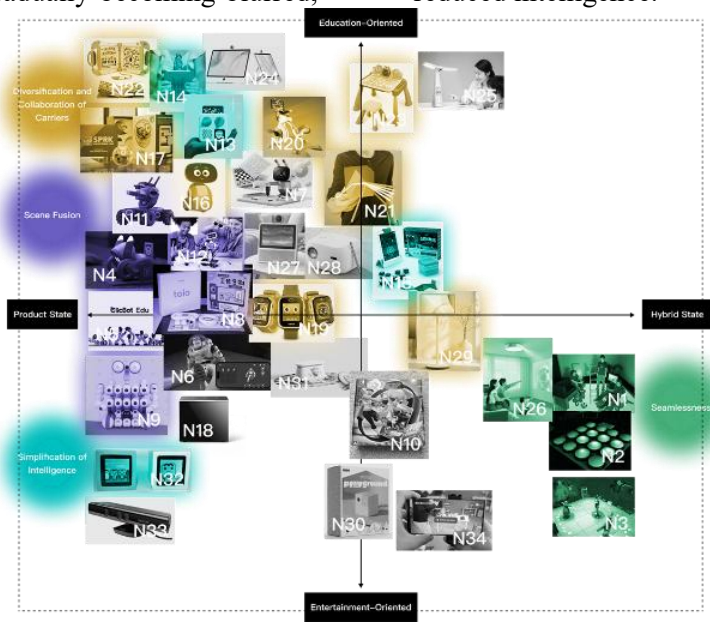


Figure 1. Product Trend Mapping through Quadrant Analysis

3. Development Trends

In summary, home education and entertainment terminal products are developing in four primary directions: diversification and synergy of carriers, scenario integration, seamless product design, and simplification of intelligence. These trends reflect not only the deep integration of technological innovation into family settings but also the importance of human-centered design in modern product development. The diversification and synergy of carriers drive innovation in product forms; scenario integration emphasizes the deep alignment of education and entertainment in everyday family life; seamless design enhances the coordination and aesthetic appeal of products within the home environment; and the simplification of intelligence focuses on addressing the operating habits and cognitive levels of different user groups in the experience design. The following sections will provide a detailed discussion of these development trends.

3.1 Diversification and Synergy of Carriers

With the rapid development of information technology, home education and entertainment formats are continuously evolving. In the family context, the traditional, singular functionality is being disrupted, with multiple terminal devices gradually forming collaborative synergy. Smart TVs, as the core for home education and entertainment, have evolved from traditional video players to central hubs for interconnecting family networks in modern society. Smart TVs not only provide rich digital content but also seamlessly connect with other smart devices such as smartphones and tablets, enabling

multi-screen interaction. This form of multi-screen interaction not only enriches the home education and entertainment experience but also breaks the limitations of traditional one-way television broadcasting, allowing family members to enjoy digital content on different devices within the same space [8]. The advancement of information technology has driven the interconnectivity between family devices. For instance, IPTV-based family entertainment interactive system terminal software enables interactive control of home entertainment devices, integrating the advantages of various devices and offering users a new family entertainment experience [9]. Additionally, distributed home entertainment systems demonstrate that integrating devices like smartphones, computers, and TVs can meet the demand for high-quality home entertainment [10].

However, despite the convenience brought by technological advancements, there are also challenges. For example, excessive reliance on technology may reduce face-to-face communication among family members, potentially affecting the harmony of family relationships.

3.2 Fusion of Scenario Values

The value of scenario integration in family education and entertainment is primarily reflected in two aspects: first, edutainment, and second, the emotional connection needs within family interactions.

Firstly, the edutainment concept regards entertainment as an essential tool for achieving educational goals. By combining learning with play, not only meets children's knowledge needs during their growth but also enhances the fun and efficiency of learning. For example, home education robots, by offering functions such as intelligent voice commands, nursery rhymes, storytelling, animation playback, video chatting, and early education applications, effectively meet the diverse needs of children during their development [11], facilitating the natural integration of education within entertainment, thereby significantly enhancing learning outcomes [12]. Secondly, the emotional needs in family interactions occupy a critical position in family entertainment scenarios. Research indicates that family activities such as physical exercise and homemade games can promote children's physical and mental development while effectively reducing parents' life pressures and work-related anxieties. Such interactive entertainment strengthens parent-child relationships while providing a platform for family members to share emotions and time together. Healthy family interactions play a crucial role in fostering children's trust and supporting their future psychological development [13].

Nevertheless, the fusion of education and entertainment functions also faces several challenges, such as how to balance educational and entertainment aspects and how to ensure the quality and accuracy of educational content. To overcome these difficulties, careful design and implementation of education and entertainment content are required to ensure that learners can effectively absorb information while family members enjoy the entertainment process.

3.3 Seamless Product Features

In recent years, home education and entertainment terminals have increasingly exhibited a seamless integration with the home environment and space, achieving a dual balance between functionality and aesthetics. This design philosophy minimizes the product's presence, allowing it to blend more naturally into living spaces and providing users with a more comfortable and tidy environment. For instance, embedded design integrates entertainment products into home systems [14], not only saving space and enhancing the aesthetics and tidiness of the home environment but also expanding the ways of family entertainment experience. At the same time, seamless design provides dynamic product and space solutions through hidden or adjustable forms, meeting the flexible needs of families and children for home space and demonstrating the transition of home education and entertainment terminals from functionality to experience. This trend offers innovative directions for integrating product design and home space.

3.4 Simplification of Intelligence

Simplification of intelligence is another significant trend in the design of home education and entertainment terminals, with its core aim being to simplify the level of product or service intelligence to provide a more user-

friendly experience for specific user groups. In the design of children's products, intelligence-reducing design does not diminish functionality but somewhat simplifies operational processes and reduces cognitive load, protecting children's physical and mental health from the erosion of digital information [15]. For instance, "Yotoplay," an interactive audio toy designed for children aged 3-12, plays audio-books or music by inserting cards, aiming to enhance physical interaction and minimize the role of screens (Case N13). Although highly intelligent products offer robust features, they may lead to overdependence on technology or harmful behaviors related to prolonged screen exposure in children. Intelligence-reducing interaction experiences, through more intuitive physical operations such as one-button activation or voice commands, allow children to master the product without complicated learning while preventing the weakening of their independence and manual skills. This design may seem restrictive, but it actually better aligns with children's physiological and cognitive development needs.

4. Design Strategies

4.1 Family-Oriented Design

Most current home education and entertainment terminals are centered around children, continuously enriching their software content to enhance their entertainment and educational functions. However, this design approach may have counterproductive effects in practical applications. While dazzling dynamic effects and rich patterns can attract children's attention, their overuse may negatively impact the development of children's cognition and imagination. Especially during infancy, excessive exposure to highly visualized graphics and content may hinder the development of abstract thinking and creative imagination [16], potentially having adverse long-term effects on future development.

Moreover, modern family values increasingly emphasize the collective needs and worth of the family unit. Parents and children should be considered as a whole, and focusing solely on the needs of children is no longer sufficient to meet the dynamic balance of the family. In this context, the role of parents should shift from being mere supervisors to active participants [17]. Although "hands-free" is a common desire among parents, it is not the only goal. More importantly, home education and entertainment terminals should not only meet the needs of parents but also convey correct educational and value concepts, promoting a side-by-side, co-growth educational model between parents and children, which is not only an innovative requirement for product design concepts but also a social responsibility that designers must undertake beyond functionality.

4.2 Moderate Functional Design

Intelligent home education and entertainment terminals primarily based on screen interaction come in various forms, providing modern families with convenient solutions. Take smart TVs as an example, such as Huawei's Smart Screen and Hisense products, which not only offer excellent picture and sound quality but also integrate a wealth of educational resources. Smart education tablets, such as the "Seewo Learning Machine", stand out in promoting learning and parent-child interaction with their diversified functions. Additionally, distinctive products like "KTC FlexiScreen" (Case N29) offer more options to the market. These terminals profoundly integrate screen interaction with intelligent systems, providing users with an efficient and convenient edutainment experience.

Nevertheless, while these products provide numerous conveniences, they also have certain limitations. For example, prolonged use may harm children's vision; entertainment content can easily lead to addiction; the quality of online resources varies, and privacy and security issues are concerning. From the perspective of parents, these products have positive significance in educational assistance and understanding children's behavior and can save effort to some extent [18]. However, at the same time, the burden of parental supervision and management may increase. Reasonable use and effective control are key to fully realizing their potential. For design practice, how to plan their functions based on the rhythm of children's physical and mental development and optimize the education and entertainment experience is an important topic worth further exploration.

4.3 Technology-Scenario Matching

Some product concepts attempt to enhance children's experience in educational and entertainment scenarios through intelligent technology, requiring analysis based on specific contexts. For example, certain smart devices are designed to serve particular scenarios, such as museums and centralized teaching environments, primarily targeting settings with large population bases. These products aim to address issues of resource scarcity and geographical limitations, using intelligent educational and entertainment functions to stimulate children's curiosity and enable them to perceive the world more realistically. This design is rational and necessary in specific contexts.

If introducing of intelligent technology is merely to increase costs or add selling points rather than being based on actual needs, then the design is unreasonable. Intelligence should not be superficial; it should focus on the value of the scenario and its practical significance. If the pursuit of technological innovation overshadows usability, it is easy to fall into the trap of ignoring user needs. For example, to pursue a high-tech appeal, some smart home products overlook user experience, resulting in complex functions that are difficult to operate. Therefore, it is necessary to clarify the positioning and role of education and entertainment terminal products in the home scenario to ensure that the design always serves real needs, thereby truly achieving a high degree of integration between technology and scenario [19].

5. Conclusion

This study focuses on home education and entertainment terminal products, clarifying their definition, summarizing their categories and development trends, and proposing three major design strategies. Home education and entertainment terminals integrate educational and entertainment functions, with categories including robots, screen-based or non-screen-based, and spatial experience products, meeting the diverse needs of families. Development trends show diversity and synergy of carriers, scene fusion, seamless features, and simplified intelligence, reflecting the integration of technological progress and a people-oriented philosophy. In terms of design strategies, a family-oriented approach requires considering parents and children as a whole, avoiding excessive focus on children while neglecting the overall family needs, and emphasizing the transmission of correct family concepts; moderate functional design should consider the rhythm of children's physical and mental development, addressing issues such as prolonged screen use, entertainment addiction, resource quality, and privacy and security; technology-scenario matching emphasizes that intelligent technology should be based on actual needs, avoiding innovation for the sake of innovation, and ensuring that design serves real family scenarios.

This paper provides theoretical and practical guidance for the innovation of future home education and entertainment terminal products, aiming to enhance the quality of interaction among family members and promote further development of home education and entertainment products. However, the study also has certain limitations. Initially, the application of digital technology in children's lives remains controversial, so product design needs to find a balance between education and entertainment to ensure that products play a positive role in the family context. Second, due to factors such as the high price of related categories and the uneven family structure and member literacy, most families still hold a cautious attitude towards these products. These issues limit the popularization and application of home education and entertainment terminals.

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