# BOOK DESIGN FOR CHILDREN WITH DEVELOPMENTAL DISABILITIES

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## ABSTRACT

With the development of the times, the number of children with autism has been increasing year by year, and more and more people are paying attention to the physical and mental health of children. This study summarized and analyzed the cognitive characteristics and daily behaviors of children with autism through methods such as reviewing relevant literature, conducting in-depth school research on children with autism, and interviewing professional doctors. It was found that they are more sensitive in visual and tactile aspects, but their brain's logical thinking and emotional discrimination ability are weak. Based on this findings, the author designed a book that can help autistic children strengthen their cognition to a certain extent, address the congenital defects of autistic children by analyzing successful cases of relevant intenactive book models.

**Keywords:** Book Design, Interaction Design, Sensory Experience, Autistic Child

## 1. Introduction

In recent years, with the increasing attention paid to autistic children, the incidence rate of autistic children has increased year by year (Cheng, 2022) - Summarized according to the statistics of the Centers for Disease Control (CDC), The incidence rate of autism has more than quadrupled (Figure 1).Because there is no targeted drug for treatment at present, the symptoms can only be improved through special education (Xiong,2022). Through targeted behavioral intervention, their important symptoms can be alleviated, and they can have the opportunity to communicate and learn like ordinary children. Books are one of the teaching aids of rehabilitation schools and an important way of family learning. Due to the slow development of most autistic children (Li, 2021),it is relatively difficult to understand some books. Therefore, in the design of picture books for children with developmental disabilities, we should consider their particularity, and design books suitable for better development of autistic children according to their development advantages and behavioral characteristics.


Figure 1 Prevalence statistics of autistic child (CDC ADDM Autism, 2023)

Ordinary books lack a certain level of specificity for such children and cannot effectively improve their developmental barriers. The designer Lisa believes that people transmit and perceive information through their senses (Lisa, 2019). As the sensory development of autistic children is more sensitive than that of ordinary children, the author applies sensory experience to book design, which has improved the reading experience of autistic children in book learning to a certain extent(Figure 2). Due to the fact that many books are primarily focused on reading, which makes autistic children unable to concentrate, resulting in a lack of interest in book learning. The author adds interactive design to books to make them as vivid and interesting as toys, thus more interesting to read (Figure 3). Secondly, such children do not like to communicate with others, and do not understand the emotions and needs of others. The author added an emotional design to address this feature.

Autism may be related to a loss of touch, and most individuals with autism also have altered touch - they are usually highly sensitive to light touch and are at a loss for certain tactile sensations (Zhu, 2021) . In response to this symptom, the author combines books with tactile sensation to learn while being exposed to and recognizing different tactile sensations.

The abnormal psychological activities of children with autism can trigger their special behaviors, and they have emotional cognitive impairment and cannot control their emotions (Masgutova, 2016). They often only express their emotional state through crying, shouting, losing temper, and self injuring or aggressive behavior. A comfortable and safe rehabilitation environment can to some extent improve the abnormal psychological behavior of children with autism and regulate their negative emotions. When designing a space, it is important to respect the psychological preferences of children, including spatial colors, layout, and form, incorporating fun elements that children enjoy, and bringing them closer to children with autism.

Based on the above situation of children with autism, this study combines the existing research results with the physiological and psychological characteristics of children with autism, and then, it expolous and proposes the design of an interactive book that can effectively strengthen the logical thinking and emotional recognition ability of children with autism through sensory experiences from the perspectives of senses, thinking, and emotions.


Figure 2 Touch Book Case (Liaoning Children's Publishing House, 2019)

Figure 3 Interactive Book Cases (Fujian Children's Publishing House, 2019)

**2. Objectives of the study**

This article aims to design a book suitable for family training for children with autism, fully utilizing the characteristics of children with autism who are not expressive but have clear logic. Through some interactive and fun designs, it aims to achieve The goal is to enhance the cognitive, logical thinking, and emotional resonance abilities of children with autism, improve their growth environment, break down cognitive barriers, and provide a scientific and efficient choice for family training of children with autism.

**3. Materials and Methods**

3.1 Study on group characteristics

Research has shown that both children with autism and ordinary children have some particularities, and autism is not a defect but a unique cognitive style (Li, 2017). Children with autism are more special than ordinary children, and more people are paying attention to this group of children.

The author reviewed materials and articles to summarize the characteristics of children with autism, categorizing them into two aspects: psychological and physiological characteristics. Psychological characteristics are further divided into four aspects: cognition, behavior, language, and perception. Physiological characteristics were investigated and summarized from an emotional perspective (Figure 4).

Only by fully understanding the behavioral characteristics of children with autism can we better alleviate their behavioral deficiencies.


Figure 4 Characteristics of Children with Autism (The image is from the author, 2023)

3.2 Design research

In order to gain a deeper understanding of the group of children with autism, the author has collected and read a large number of research literature and data models related to the group of children with autism; The author also went to the Rehabilitation Center for Children with Autism to have an in-depth conversation with Dr. You, the director of child psychological rehabilitation, to interpret and study the characteristics and treatment directions of children with autism from the perspective of a doctor, in order to determine the research direction; At the same time, in order to better understand the problems encountered by children with autism in daily rehabilitation training and the real needs of families for rehabilitation products, the author conducted a month long survey and research at the Autism Children's Rehabilitation School(Figure 5) (Figure 6).By participating in the daily learning and extracurricular expansion activities of children with autism, the author observed the behavioral and psychological characteristics of children with autism more intuitively.

Figure 5 Contact with children with autism (The image is from the author, 2022)

Figure 6 Communicate with teachers at a rehabilitation school for children with autism (The image is from the author, 2022)

3.3 Design process

According to previous investigations, such children are sensitive to touch and Visual discontinuity. For example, they know that roses are red, but cannot contact apples that are also red. Such children unable to recognize emotions or express them, usually expressed through shouting. In addition, their brain development has defects. The author has designed for these three aspects.

3.4 Model Sketching

The first step in model production is to determine the form of the book, exploring two forms of books, the traditional book form and the card book form. The second step is to determine the chapters of the book and set up three parts for three different aspects.

3.5 Create a prototype

Choosing the form of a card book has created a set of interactive card books. The book is divided into three parts, namely touch, brain, and emotion. Using the visual cognition of children with autism to create illustrations and enhance the fun of books (Figure 7).

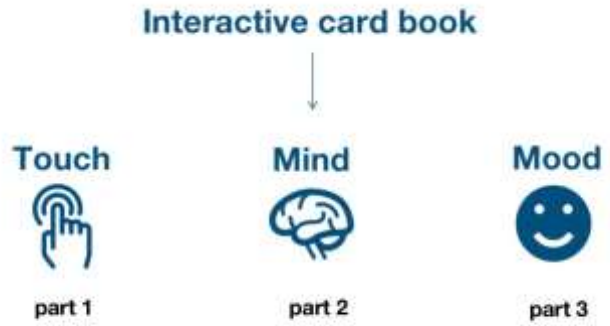


Figure 7 Three aspects of interactive books (The image is from the author, 2023)

**4. Results & discussions**

4.1 Book Content

4.1.1 Touch part

In terms of physiological characteristics, the group of children with autism is mainly manifested in two aspects: visual and tactile. Intuitively speaking, the group of children with autism is very sensitive to color and has their own special color preferences, but it is difficult to connect two objects of the same color. In terms of tactile perception, the group of children with autism has characteristics such as insensitivity to touch and rejection of external things.

Research has shown that the visual and tactile effects of common objects in daily life have a greater impact on children with autism and are more helpful in strengthening their cognition (Chen, 2020). In order to fully utilize these two characteristics, the author designed from both visual and tactile perspectives, selecting six common but tactile items in daily life for design and creating models, as shown in Figure 8.

The book card consists of two pieces of cardboard, one of which is hollowed out, and the middle layer is embedded with materials that provide different tactile sensations.

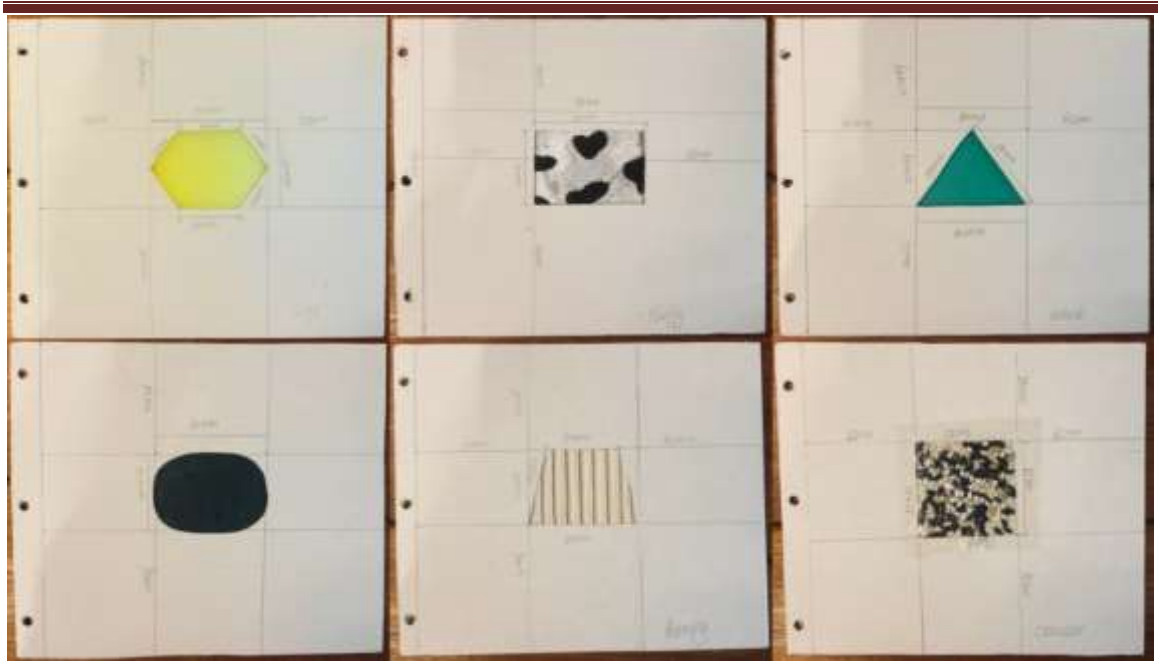

Figure 8 Six commonly used tactile models (The image is from the author, 2023)

The background color of the model is blue, and according to research, these children prefer cool tones (Yang, 2020). As shown in the figure (Figure 9), the front of the model combines vision and touch, while the touch part is made of materials that are as soft as the sofa. Together with the graphics on the cardboard, it forms a complete understanding of the sofa for children. On the back, other equally soft objects are listed to improve children's cognitive level and logical thinking ability.

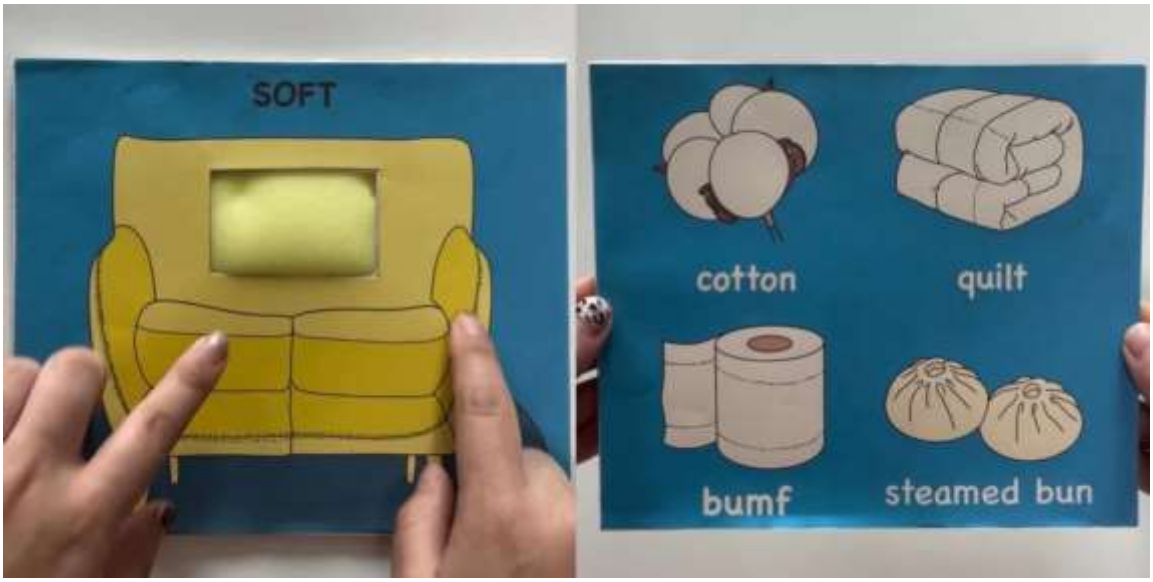


Figure 9 A model combining vision and touch (The image is from the author, 2023)

4.1.2 Mind part

Puzzle games are games that can simultaneously train children's thinking and hands-on abilities (Qiang, 2014). During the puzzle process, children with developmental disabilities can improve their various qualities, especially the coherence of logical thinking, by hands-on operation and thinking about the connection between the puzzles. The combination of puzzles and books not only increases the interactivity of books, but also significantly improves their readability and fun. The content of the puzzle is mainly focused on animals, and in order to enable children with autism to think more comprehensively based on images, the image design of the puzzle tends to be flat. As shown in the figure (Figure 10), animal jigsaw puzzles are created by digging out and cutting the side of the cardboard with animal images into different shapes. This design allows children to not only recognize the shapes but also complete their understanding of the shapes.

Figure 10 Example of a puzzle (The image is from the author, 2023)

4.1.3 Mood part

According to a survey and research, children with autism have problems in recognizing and understanding facial expressions from others and expressing their emotions appropriately (Yan, 2022). To solve this problem, a more effective way is to provide intervention training for children with autism during the teaching process, combining books with emotional cognition, so that these children can recognize, feel, and understand emotions during the learning process, Thus achieving a certain therapeutic effect. In the emotional module design of this book, the author drew different emotions for different children's facial expressions (Figure 11). By using Velcro materials to create an expression puzzle, it not only increased interactivity but also increased the fun of learning, enabling them to have a more intuitive and accurate understanding of emotions (Figure 12).


Figure 11 Facial expressions of different children (The image is from the author, 2023)

Figure 12 Expression puzzle made of Velcro material (The image is from the author, 2023)

4.2 Book format

In the early stages of the design of this book, the traditional form of book buckles connecting the pages was adopted. However, after the initial design and production, it was found that the book designed in this way was too cumbersome, not convenient and direct, and the form was not novel and unique enough. After repeated research and simulation, it was finally decided to design this book in the form of a card, in order to achieve convenience, simplicity, and practicality (Figure 13).

Figure 13 Cards in the Book (The image is from the author, 2023)

Add cover, table of contents, and introduction sections to make them more intuitive and complete. At the same time, a raised design was made on the first page of the book cards in different learning modules, and

corresponding chapter contents were marked on the raised book cards, making the book more convenient and durable during use (Figure 14).


Figure 14 Sample display of card books (The image is from the author, 2023)

4.3 Content Illustration

The illustrations in the first part of the book are mainly about the recognition of common items. The overall background color is blue, combining visual and tactile senses. Items with the same tactile sensation as the items in the picture are inserted in the interlayer of the book page, some with rough and some with soft tactile sensations (Figure 15), allowing children with autism to have a more intuitive and specific understanding and learning process.


Figure 15 A sofa with a soft touch (The image is from the author, 2023)

The illustrations in the second part mainly focus on the cognition of animals, with an overall background color of green (Figure 16). By concatenating animal images in different shapes, children with autism can achieve dual cognition of animals and graphics, thereby improving their graphic cognition and logical thinking level.

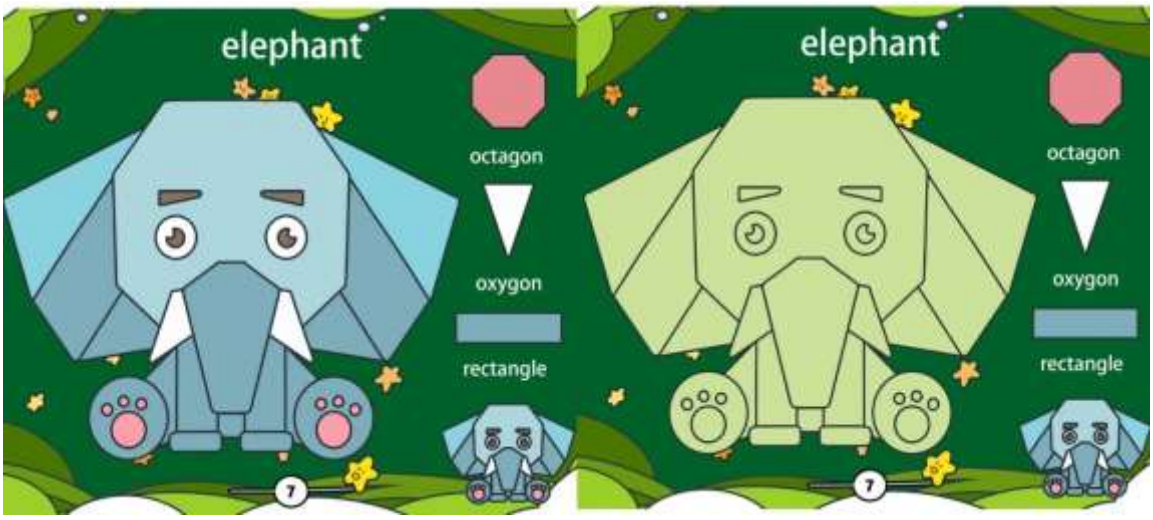


Figure 16 Elephants made by splicing different shapes (The image is from the author, 2023)

The illustrations in the third part mainly include emotional cognition cards, facial cognition puzzles, emotional cognition puzzles, and mirror parts, with an overall background color of light yellow (Figure 17). Mainly through the recognition, association, and splicing of different expressions, we aim to improve the emotional cognitive and expression abilities of children with autism.

Figure 17 Different facial expressions of children (The image is from the author, 2023)

At the end of each section of this card book, the same pattern and different colors are used to compose the picture (Figure18). Blue represents love and tolerance, green represents liveliness and vitality, yellow represents joy

and peace, the child sitting on the knee in the picture represents autistic children, and the stars represent hope for life. The overall meaning of this card is that children from the stars, wishing every autistic child a happy and healthy growth, Every family with autistic children can achieve their wishes and happiness.

Figure 18 Children from the Stars (The image is from the author, 2023)

4.4 Book packaging box

The external packaging of this book is a rectangular body, consisting of a wooden box and lid (Figure 19). This design is mainly designed to facilitate the storage and storage of cards, and better protect the book content from moisture or compression damage.

Figure 19 Book packaging box (The image is from the author, 2023)

4.5 Final product prototype

This set of books is mainly designed for children with autism over the age of two (Figure 20). All card designs in the book are double-layer cardboard, with built-in materials used for tactile or adhesive purposes to better present the corresponding content. This book mainly focuses on the slow cognitive development, sensitivity to touch, and difficulty in distinguishing emotions of children with autism. Three targeted parts of content are designed to assist

children with autism in cognitive learning, providing an efficient and feasible way for home practice and interaction for families with autism.

Figure 20 Final product prototype (The image is from the author, 2023)

This interactive card book mainly consists of a cover, a table of contents, an introduction, an introduction section, and a card book. The overall design is characterized by simplicity, strong interactivity, and durability, aiming to provide services within our capabilities for the treatment and learning of children with autism. The following image shows the final finished product image (Figure 21).


Figure 21 Card book finished product display (The image is from the author, 2023)

The method of using the first part of a book is to touch and feel materials during the cognitive process (Figure 22). Mainly through the tactile and visual effects of relevant materials, vivid and vivid expressions of soft, smooth, fluffy, undulating, rough, granular and other sensations are achieved.


Figure 22 Visual and tactile senses (The image is from the author, 2023)

The usage method of the second part is to use puzzles to recognize shapes and animal cognition (Figure 23). mainly using cute and highly recognizable animals such as elephants, giant pandas, pigs, parrots, foxes, and groundhogs, to improve the graphic cognition level, logical thinking ability, and hands-on operation ability of children with autism.


Figure 23 Different animal puzzles (The image is from the author, 2023)

The third part mainly focuses on the cognition and recognition of various emotions (Figure 24). By using materials such as Velcro in cards for interaction, children with autism can leap from recognizing emotions to understanding emotions, and improve their expressive ability in interacting with the outside world.


Figure 24 Cognition and recognition of different emotions (The image is from the author, 2023)

**5. Conclusion**

This project starts with a focus on the physical and mental health of children, and takes autistic children as an example for research and exploration. Because these types of children are more unique than ordinary children, early intervention and treatment can lead to better treatment outcomes.

The author focuses on children with autism who are two years old and above, exploring their characteristics and designing books on three aspects, aiming to achieve a healing effect during reading and learning.

This is an interactive card book, which is divided into three aspects: touch, brain, and emotion. The card book is combined with touch, and different tactile materials are designed in the book, allowing children to touch different tactile materials while learning, so that they no longer resist different tactile sensations. Combining card books with puzzles to exercise children's brains. Combining card books with emotions allows children to recognize different emotions, enabling them to understand emotions and express them accordingly. In addition, interactive books can cultivate children's hands-on ability, thinking ability, discrimination ability, etc. Finally, the box was designed to make the product complete. This book is the beginning of exploring the design of books for children with developmental disorders, providing reference for future design of books for children with other types of developmental disorders.

**6. Acknowledgements**

During my pursuit of a master's degree, Thank you to my advisor Ajarn tnop, is honored to be a student in the Ajarn tnop group. During the project process, I received a lot of advice and encouragement, which propelled me forward. Thank you to Ajarn Sridhar Ryalie, When I was confused about how to proceed with my thesis topic, give me timely help. Thank you Ajarn David for providing many good suggestions for the product, making it more complete. Finally, I would like to thank my family, boyfriend, and friends for their encouragement and support throughout the journey.

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