

Research on Introducing the Five Senses of "Vision, Hearing, Smell, Taste and Touch" into the Design of Picture Books for Autistic Children

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ABSTRACT

In the current field of education for autistic children, more and more teachers and parents pay attention to the education and teaching role of picture books for autistic children. So how to accurately design picture books according to the characteristics of autistic children has become an important issue. It has been proved that enhancing the sensory experience in picture books based on the five senses stimulation can greatly promote the teaching of autistic children.

Keywords: Five senses stimulation, Autistic children, Picture book design.

1. INTRODUCTION

Autism is a congenital developmental disorder of the nervous system with high frequency in recent decades. Children with autism mainly have the manifestations of impaired social skills and lack of ability to interact, communicate and exchange with others. Based on the above characteristics, education and rehabilitation training for autistic children mainly focus on core social skills.

The picture book covers many subjects such as fine arts, design, aesthetics, literature, pedagogy, psychology and so on, which is a very comprehensive art form. Picture books are good at transforming the context of pure art into one that is easily accepted by the public. Both words and pictures play an important role as "storytellers". Pictures have become the main body of books rather than the dependency of words. Some picture books even contain no words but illustrations, which convey information through pictures and expand the space of imagination in a specific aspect. [1]

Modern picture books originally originated in the UK. Special picture book theories and creation

techniques, refined text, independent pictures, and interesting story plots are very appealing, which sometimes trigger readers' reflection and are deeply loved by extensive readers. [1] Based on the above characteristics, picture books have become a good helper for teaching and entertainment for children who have not yet mastered characters, and play a great role in education, enlightenment, strengthening cognitive understanding and improving thinking ability of young children.

According to the characteristics of autistic children, they can be divided into visual learning type, auditory learning type and tactile learning type, among which visual learning type accounts for the largest proportion. Many children with autism have low oral ability, and have difficulties in input, conversion and processing oral language, but they have excellent visual ability and can understand information by looking at pictures. After picture exchange training, some children can and communicate with others through picture exchange in place of spoken language. Therefore, picture information in picture books provides great convenience for children of visual learning type. On the market, there are also picture books for children with special needs, including developmental disorders such as autism.

In addition to the visual learning type of autistic children, there are also a part of autistic children of

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auditory learning type, who learn things more through hearing than vision and take the first access to sound information. Some children are tactile type learners, who need to acquire information by touching, squeezing, groping, biting and other forms. Therefore, the design of picture books for autistic children should not only consider visual factors, but also give consideration to other senses and perceptions. While meeting the needs of visual learning children, giving consideration to auditory and tactile learning children is the content that needs to be expanded in picture book design.

2. SENSORY INTEGRATION THEORY AND TRAINING FOR CHILDREN WITH AUTISM

2.1 An Overview of Sensory and Perceptual Disorders in Autistic Children

Children with autism have different abilities and manifestations due to different degrees of nervous system damage. Generally speaking, children with autism whose IQs are around 70 or higher than 70 are classified as high-functioning autism, those with IQs around 45-65 are classified as medium-functioning autism, and those with IQs below 45 are classified as low-functioning autism. [2] However, regardless of IQ level, all autistic children are accompanied by sensory-perception disorders, and the lower the function is, the more serious the sensory-perception disorders and the more serious the movement disorders are.

In 1969, Dr. Ayres, an American psychologist, first proposed the Sensory Integration Theory based on the results of brain function research, clinical treatment and experimental research. According to Ayres, sensory integration refers to the combination of sensory information input from various organs by the human body and the integration of the brain to complete the internal and external perception of the body and make a response. From the perspective of neurodevelopmental model, human's high-level learning techniques such as cognition, language, attention, and functional sexual behavior depend on the development of the processing ability of multiple sensory inputs. Therefore, sensory integration is a learning process that every child must have as they grow up. Without sensory integration, neither the mind nor the body can develop. If sensory stimulation information cannot be combined effectively in the central nervous system for any reason, the whole body cannot coordinate effective action, resulting in sensory integration disorders,

manifested as action discoordination, attention deficit, low cognitive ability, communication difficulties, emotional disorders and other problems. [3]

According to Ayres, human sensory perception is mainly composed of "vision", "hearing", "smell", "taste", "touch", "proprioception" and "vestibular sense". Normal sensory perception can help children to establish an understanding of the outside world, so as to seek advantages and avoid disadvantages and learn various adaptive skills. Autistic children's sense and perception disorders, resulting in difficulties in understanding the outside world. For example, children with olfactory disorder may not recognize good or bad smell, or even have a special liking for the smell of the toilet. Some children are even happy to look for the smell of the toilet as long as they smell it, and linger in the toilet. A child with tactile disorder may refuse friendly touches and hugs, but may become attached to strong stimuli and feel no pain even after a bad fall. There are also children who deliberately bump their heads in search of pleasure. Of course, these are just a few extreme cases, and many children can improve with guidance and treatment. Children with autism are misunderstood and prejudiced by the outside world due to sensory and perceptual disorders. However, appropriate picture books can be designed to teach children in accordance with their aptitude by understanding their characteristics.

2.2 Sensory Integration Training for Autistic Children

Dr. Ayres originally developed the concept of sensory integration to help children with learning difficulties integrate their senses. In the 1950s and 1960s, more and more children in the United States had sensory integration disorders that affected their ability to learn. Dr. Ayers designed a series of training methods, targeted to improve children's "proprioception", "vestibular sense", "touch" and so on. That makes a great difference. Later, more and more autistic children participated in sensory integration training, which made sensory integration training become one of the important treatment methods for autistic children. Moreover, in practice, sensory integration training can significantly improve the behavior of autistic children. [4]

Nowadays, sensory integration training has become one of the ways for children aged 0-12 to develop their learning ability. It has a rich content, including sensory integration movement, sensory integration therapy and sensory integration games,

etc. Now many picture book designs also introduce the concept of sensory integration, help children with stimulation assistance of different textures, fabrics, materials and colors, stimulate children's interest in learning and improve their sensory perception and brain alertness.

3. MULTI-SENSORY EXPERIMENTAL PICTURE BOOK DESIGN

Facts have proved that the multi-sensory experience of picture book design can improve children's attention to picture books and stimulate children's curiosity and interest in learning. For example, the British children's book "Spot's Fun Day" ("Fig. 1") is a sound book. Each page of the book is equipped with a corresponding sound button beside it, which will make a sound when pressed. Vocal books are suitable for hearing children. Children can touch buttons repeatedly to make sounds, and combine "sight", "hearing" and "touch" to exercise learn knowledge with multi-senses.



Figure 1 Spot's Fun Day.



Figure 2 Changes of Light Projection.



Figure 3 Mom's Handbag.



Figure 4 MY FIRST BOOK.

In the book "Changes of light projection" ("Fig. 2"), each page has a different hollow-out pattern. Hollow-out patterns themselves can be used as painting templates to assist children to print various patterns on white paper. At night, they can also make the white wall of the home into an aquarium, garden and so on by changing the light and shadow when a flashlight is turned on in the dark. It is a very good multi-purpose picture book. In the change of light projection, it increases children's interactive game experience with the book, and exercises their spatial perception.

The interactive 3D book "Mom's Handbag" ("Fig. 3") breaks the line between books and toys completely. Once opened, the book is a miniature version of the handbag, a variety of daily necessities, skin care products, stationery, which can not only teach children how to store in life, but also broaden their scope of knowledge of children, who can learn going out skills through understanding the use of items in the bag.

Skill interaction design refers to the tool interaction in children's reading process to strengthen the learning and exercise in a certain aspect of life. This kind of skill intervention and interaction can enable picture books to guide children to engage in game learning of various skills, improve children's hands-on ability and stimulate brain development. [5]

For example, in "My First Book" ("Fig. 4"), each page has different skills training, such as doing up one's button and lacing up one's shoes. It promotes the hand eye coordination of children, exercises their fine movement, and is deeply loved by children.

The above picture books are designed with ingenuity. Although they are aimed at ordinary children, they are also excellent choices if used to teach autistic children.

3.1 Feasibility Analysis of Picture Books Providing Multi-sensory Experience

At present, there are many multi-sensory experiential picture books on the market. For children with autism, the choice is relatively broad. However, it needs to be noted that the picture books on the market are aimed at ordinary children and designed according to child development psychology, but not all the picture books are suitable for autistic children. Picture books for autistic children need to be systematically and specially designed according to the characteristics of autistic children.

3.1.1 Children with Autism Like to Imitate "Bad Behavior"

Many mothers of autistic children reported that their children imitated all the bad behaviors in the classic picture book, "No, David!". They keep doing bad behaviors such as destruction, shouting and making graffiti and so on. It has to do with the characteristics of autism. Children with autism have sensory and perceptual disorders and are often indifferent to smaller stimuli. Yet David's various bad behaviors are a strong sensory and perceptual stimulation to the child. Once the child learns to imitate, the parents often lose control and scold the child, and the strong reaction of these parents stimulates the child again, which gives the autistic child strong sensory satisfaction again. Therefore, it is not appropriate to choose ordinary picture books without understanding the physical and mental characteristics of autistic children.

3.1.2 Children with Autism Have Impaired Comprehension

Both high-functioning and low-functioning children with autism struggle to achieve cognitive understanding comparable to their peers. The design of ordinary picture books with rich content, broad knowledge scope, diverse painting style, and vivid

and winding plot is not necessarily suitable for autistic children. They often don't have the ability to process a lot of visual information, and have a hard time understanding whimsical storylines.

3.1.3 It's Hard for Children with Autism to Accept Change

Many autistic children have an inherent understanding of the world. For example, one child who had shredded pork with green pepper and soy sauce at home, and once he ate shredded pork with green pepper and white pepper without soy sauce at school. When the teacher told him it was shredded pork with green pepper, the child cried his eyes out. He could not accept change. In the design process of ordinary picture books, there are many elements seeking novelty and change, which will catch some autistic children by surprise.

Therefore, it is very necessary to design a multi-sensory experience picture book for autistic children.

3.1.4 Teaching Children with Autism Needs to Break Down Topics

As children with autism have limited ability to accept, large subjects need to be broken into small ones for repeated training so that they master them. Taking color learning for example, ordinary children can learn several colors at a time, strengthen the color discrimination through the contrast of different hues. On the other hand, autistic children need one week for the learning of one color and continue to generalize it in life until they master the color steadily before moving on to the next topic. Taking putting on pants for another example, while ordinary children can get the pants and put them on once, children with autism may need to practice lifting the pants from the hips to the waist first, and then learn to lift the pants from the legs after the skills are stabilized. However, it is impossible for the picture book design for ordinary children to decompose the subject to the most detailed degree.

To sum up, it is very necessary to introduce multi-sensory design into the design of specialized picture books for children with autism.

3.2 The Theme and Content of the Multi-sensory Experimental Picture Books

The theme and content of children's picture books are all-encompassing. All the content related to children's life and learning can become the theme and content of picture books. Compared with picture

books for ordinary children, the choice of picture books for autistic children should mainly consider the following aspects:

3.2.1 Close Relations with the Life of Children

The most accurate long-term rehabilitation plan should be made for children with autism from the early stage of diagnosis. And for children who are newly discovered with autism in the early stage, improving their cognitive understanding ability and learning cooperation is the top priority. Therefore, it is easier for children to accept and understand the problems of livelihood which is most closely related to children. For example, the pop-up book "My Body" uses different materials to show children's facial features, and body organs, etc. In the three-dimensional modeling of a doll's face, children can know their own body through pulling out their tongue from the lips, lifting the eyelids to observe the eyeballs and other three-dimensional experience. This content setting is also applicable to picture books for autistic children.

3.2.2 The Content Is Simple and Easy to Understand

Children who have just been diagnosed with autism in the early stage tend to lag behind in cognitive understanding, so it is more appropriate to choose a series of stories with content suitable for the junior and single themes. There are some suitable picture books, such as "Little Bears", "Nontan" and the "Mimi Series", especially the story of poop in "Little Bears", which is simple and vivid without unnecessary description. Different colors are used to represent different toilet doors, giving children a good color hint. However, when teaching autistic children, we can further refine the books, such as reducing the number of characters and introducing auditory and tactile elements. For example, the toilet seat can be designed to be liftable and the towel can be given a plush texture. This will make the book more interesting and interactive.

3.2.3 Using Subjects that Are of Interest to the Autistic Child

According to the survey, quite a number of autistic children like communication media very much. Therefore, picture books of transportation are popular among autistic children, especially boys. In the "First Discoveries Series", there are a lot of vehicles, where the door opens and one sees the

structure inside, and the hood opens and one sees how the engine works. It is rich in information and has a wide range of knowledge, which is very suitable for high-functioning autistic children. It would be even better if designers can design a series of rich experience targeted at most autistic children, content and relatively simple transportation books.

In order to know the interest points of autistic children, the interests and hobbies of autistic children can be collected through questionnaires.

3.3 Binding and Design

Many picture books on the market attach great importance to binding and design. The binding of picture books for autistic children should first be firm and hard to break. Children with autism are more destructive than normal children, and many like to bite. So in the material and binding should be safe and strong and not easily damaged.

In terms of design, creative picture books often leave a deep impression on children. Such as picture book chicken series "Guess Who I Am" is very innovative. After the children have opened the pages of animals, the last page turn out to be a small mirror, and many children enjoy the feeling of turning to the end to appreciate themselves. The mirror is made of safe material, which will not be damaged by falling and being gnawed. Children with autism have a weak sense of self, so it is necessary for them to look in the mirror to know themselves.

3.4 Materials and Colors

As mentioned above, many children with autism are tactile learners who like stimulation of different materials and tactile sensations. It is very necessary to use materials with various textures and fabric to meet these children's needs. For example, a picture book uses four surface materials that are smooth, rough, tight and soft respectively to make children learn adjectives by touch. This method is very suitable for the design of picture books for autistic children. A special material — transparent PVC is cleverly added into the picture book of Mr. Seahorse. In the work, PVC material and watercolor are combined with translucent effect image to show the flickering effect of the fish "hiding" into the water grass, adding wonderful fun to this wonderful picture book. [6] Many autistic children like to play with water, and the feeling of water flowing in PVC material satisfies their sensory needs. If we take this as an opportunity to design a set of water-related knowledge picture books to teach them about water

including how to use and treat water, and how to save water, it will be very effective.

There are innumerable picture books stands out for use of color design. But kids with autism tend to have color preferences. The cool colors of "blue" and "green" are often preferred by autistic children. In addition, shiny metallic colors often satisfy the visual stimulation of autistic children. Therefore, it is also a good choice to design picture books based on the color preference of autistic children. Taking the world-famous picture book "The Rainbow Fish" series ("Fig. 5") by Prister as an example, it uses the laser silver blanching technology in the text for the first time, which endows the rainbow fish with irresistible magic charm and reflects the visual beauty of the work with unique materials.

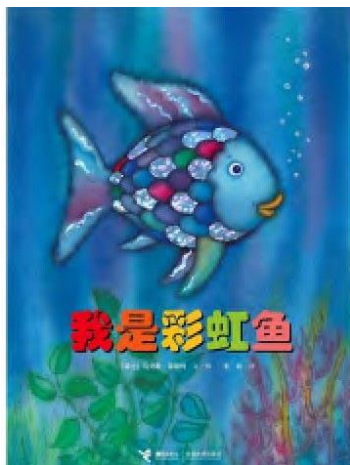


Figure 5 The Rainbow Fish.

3.5 Interactive Design

"Immersive experience" and interactive design are very important links in the design of contemporary picture books. At first glance, the "Eye opening, Dinosaur World Adventure" is nothing special, but the moment we put on the VR goggles, everyone was taken by surprise. It is so lifelike that these prehistoric animals, tyrannosaurus and brontosaurus run and hunt in the wildwood and the experience is just like watching the "Jurassic Park" blockbuster, bringing us into the wonderful world of dinosaurs. In addition, there is a 5-year-old VR companion in the book, and we experience the magical journey together. It's a very immersive experience.

In addition to the introduction of high-tech interactive design picture books, picture books of ordinary materials should also strengthen the interactive design. At present, the very popular children's book where one can tear off a lot of parts,

and then stick on, can provide a lot of learning opportunities for children. And the famous "Press Here" and "Mix It Up" all let children interact with the book by clapping, blowing, etc., and when children turned over to the next page, they will find that the colors and graphics really gather on the other side, as if they were really blown over. The interaction design is also fun and immersive. The aforementioned "Changes of Light Projection" creates a wonderful world of light and shadow through the interaction of light and picture books, and also helps children improve spatial awareness through the stimulation of light and shadow.

Picture books for autistic children also need to strengthen interactive design as much as possible, to enhance multi-sensory stimulation on the one hand and improve children's attention on the other.

4. CONCLUSION

At present, picture books based on multi-sensory experimental design are not rare, but multi-sensory experimental picture books for autistic children are still rare. Therefore, it is very necessary to strengthen the multi-sensory experimental picture book design for autistic children. Excellent picture books with precise design play an important role in improving the cognitive understanding ability and attention of autistic children, as well as helping them to know themselves and the world.

AUTHORS' CONTRIBUTIONS

This paper is independently completed by Lai Zhou.

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