The Innovation Books for Children with Low Vision

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Abstract

In order to better study and design innovative extracurricular books for low-vision children, the existing problems in book design for them and their demand for book design are analyzed in the research. Meanwhile, relevant researchers have designed three kinds of book models for 11 low-vision children aged from 7 to 12, and such models are verified and assessed. In this research, field observation, one of qualitative research methods, is used to test the readability of three types of extracurricular books for low-vision children. To be specific, with the help of teachers, reading guidance, interest and ability are assessed successively through three reading forms (individual reading, group discussion and group reading) conducted by low-vision students. Here are the results as follows. To begin with, extracurricular books for low-vision children need to be designed in accordance with their cognitive characteristics and reading needs, which helps them boost their reading, language and academic abilities. Then, from the perspective of cognitive psychology, it is proposed that books for low-vision children should focus on reader-friendliness, cognitive experience and exploration, and book design, thus promoting the development of their reading comprehension. The results show that the target group is quite satisfied with the readability and functionality of the content and design of the representative books. On the one hand, the enhanced readability of books for low-vision children is able to meet their reading needs; on the other hand, books for low-vision children featuring innovation as well as interaction can also attract ordinary children to read, which has some practical importance.

Keywords: low-vision children, book design, reading needs

Introduction

Low vision refers to visual impairment that can not be improved by standard refractive correction, drugs or surgery. But it is possible for low-vision people to live and work via residual visual function (Lv Fan, 2021).

It is estimated that there are more than 83.2 million disabled people in China, about 6.4% of the total, including 12.33 million people with low vision. There are around 130,000 visually impaired children aged between 6 and 14 in China, 79.09% of who have received compulsory education in ordinary or special schools (Zhou Xiangtian, 2019).

Book is one of the main tools to develop the cognition of low-vision children. However, there are inadequate books for low-vision children, and such books are poorly designed. Up to now, books for children with visual impairment for sale pay little attention to the differences in cognitive psychology and reading habits of such children at different impairment levels and ages. Most of the special books are in the form of Braille or large print. Worse still, the montonous way of delievering information, unreasonable layout design, unattractive color matching, over emphasis on knowledge transmission, lack of interactive experience, and some other drawbacks dampen low-vision children's interest in reading, which reflects that such children' reading needs and psychological feelings have been neglected.

The proportion of low-vision children is big among visually impaired ones, but few books meet the cognitive rules and reading needs of such children. With the rapid development of science and technology, there are various ways for people to spread information and share knowledge, whereas, book is still the main material for reading, and also the chief educational tool for special groups.

In this paper, the research objects are school-age children with low vision and cognitive psychology is taken as the core. By analyzing the cognitive ways of low-vision children and their demand index for book design, the paper provides a certain theoretical basis and ideas for book design, finally designing innovative books for low-vision children, and integrating the thought of reader-friendliness into this type of books.

Resarch objectives

To design extracurricular books for low-vision children

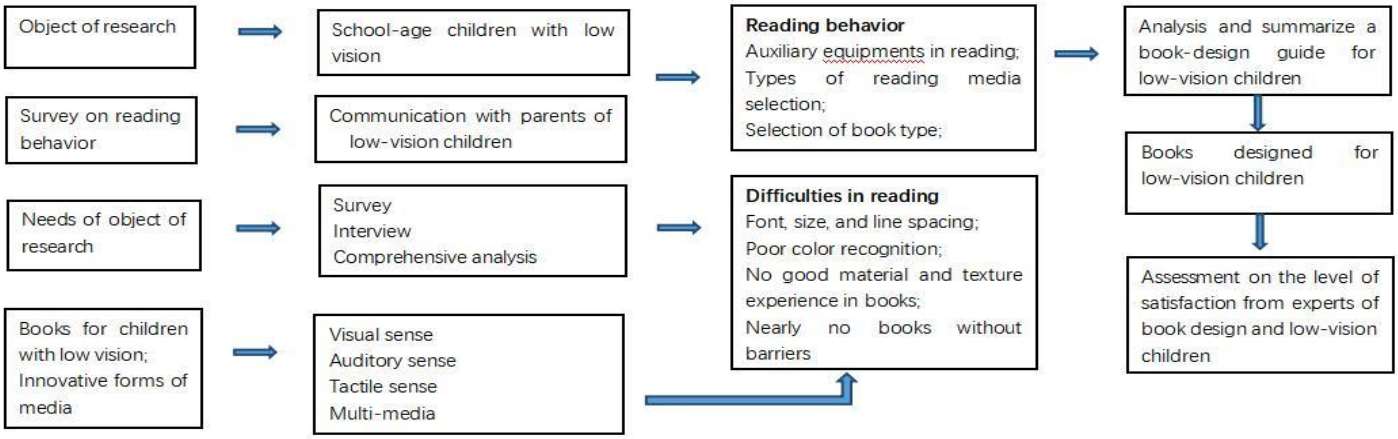
Literature Review

In the cognitive process of low-vision children, they have different cognitive characteristics. The information obtained by low-vision children in the process of visual exploration is evidently less than that of ordinary ones. Therefore, such children are different from ordinary children in the cognitive psychological development. But in terms of visual impairment, the difference between low-vision children and blind children is that vision (residual vision) still plays a leading role in their cognitive process. In general, the cognitive development of low-vision children follows the regular pattern of that of ordinary children, and the senses of sight (residual vision), hearing and touch play a major role in the process. Low-vision children have no essential difference from ordinary children in the cognitive and information processing processes, such as image formation, short-term memory, thinking patterns, problem-solving strategies, etc. But low-vision children may develop slowly or even stop developing in some parts (Wang Haiping, 2002).

With regards to cognitive psychology abroad, Jean Piaget's theory of cognitive development is widely applied in children's education. Based on this theory, Dr. Katz from the United States and Dr. Chad from Canada jointly put forward The Project Approach. Hans J.Eysenck, a British psychologist, published a book named *Cognitive Psychology*, which explained in detail the relationship between human behavior and the cognitive development of things from the perspectives of behavior and psychology. Besides, *The Black Book of Colors*, written by Venezuela's Menena Cottin and Rosana Faria, won more than a dozen awards, including New Horizons at the Bologna Children's Book Fair in 2007 and one of 100 Best Books to Read at the New York Public Library in 2008. Since the books of Chinese version were published in 2010, they have been well received. From the perspective of a blind child, the book describes the colors he feels from some senses such as smell, hearing, touch, and it is only printed in black. Each cross page, with braille on the upper left, Chinese characters on the lower left and raised patterns on the right, can help visually impaired children better understand the knowledge of the book when reading. One of the international conference papers named Alice and Her Friend: A Black "Picture Book" of Multisensory Interaction for Visually-Impaired Children, jointly written by Hiroki Nishino, Norihidayati Podari, Stefania Sini, Chamari Edirisinghe, and Adrian D.Cheok, discussed that picture books were considered to be conducive to children in many aspects (e.g., psychological development and language), but some children have less opportunities to get such benefits due to impaired vision. Based on this, Alice and her friend designed an interactive book for visually impaired children. Meanwhile, they proposed that people should improve the understanding of such children's needs, for there is distinct difference in the degree and type of visual impairment between two visually impaired people. Furthermore, MIT's digital laboratory has integrated modern technology into the field of book design for visually impaired children, and designed books in the form of multisensory interaction. Its most prominent design is that the book can make sounds when the content pops up, which can increase visually impaired children's interest in reading.

Relevent foreign scholars often effectively transform tactile information from the technical level, provide barrier-free auxiliary functions through software, and focus on the product, packaging and toy design of visually impaired children. Foreign book design with single sensory interation for such children started relatively early, but books in the form of multisensory interaction is still on trial. Besides, there is a lack of comprehensive research on book design for low-vision children based on the degree of visual impairment as well as picture books for them.

Figure 1. Theoretical framework



source: Qian Tian, 2022

Methodology

This research adopts the methods of qualitative interview and observation to test the design models.

1. Qualitative research method

The research focuses on the design of extracurricular books for these children, so as to better understand the reading cognition of school-age children with low vision and their feedback on book design. Two senior teachers of special education for low-vision students and one psychological tutor received qualitative interviews.

Through qualitative interviews, the three different forms of design models created by relevant experts are in line with the characteristics of cognitive learning of low-vision children. At the same time, the result show that such models have a positive impact on the children at the psychological level, improve their concentration and interest in reading with the help of teachers, and also promote their overall cognition of the content, so as to help them boost their reading ability.

2. Observation method

11 low-vision students from a special education school in Hainan Province were selected as reading objects to have reading training. Three different types of extracurricular books for low-vision children were read. Each reading duration lasted 45 minutes, and 9 times of reading training were carried out from April to June, 2022. Every young reader was required to register a reading account when participating in the training, which made the record of each reading process possible, such as reading materials, evaluation indexes of the readers' reading interest and ability.

Table 1 Evaluation results of reading interest and ability of low-vision children before training

Serial No.	Reading interest		Reading ability				Total points
	Attitude	Duration	Observation	Comprehension	Memory	Description	
1	3	3	2	2	2	1	13
2	4	3	2	2	2	2	15
3	2	2	3	1	2	1	11
4	5	4	2	3	3	3	20
5	3	3	2	2	2	2	14
6	5	4	3	3	3	2	20
7	4	4	2	3	3	2	18
8	3	2	2	2	2	1	13
9	2	3	3	2	3	2	15
10	4	4	3	3	4	3	21
11	3	3	4	3	3	3	19

In this research, it is found that school-age children with low vision have short reading time and their reading speed is relatively slow; moreover, they are easily tired when reading. Most low-vision children have significantly longer reading time and read faster after wearing visual acuity aids. Hence, the main purpose of visual acuity aids is to help the children increase reading distance, improve reading posture and prolong reading time. It can be predicted that when children grow up, the regulatory reserve of eyes will gradually decline, and the printed fonts of textbooks they are exposed to will become smaller and smaller. The existing textbooks can no longer meet their demand to acquire knowledge, so they will read other books with relatively small fonts to make themselves well-informed. In this case, they have to use visual acuity aids to help them better read extracurricular books and such aids will be widely used.

Table 2 Evaluation results of reading interest and ability of low-vision children after training

Serial No.	Reading interest		Reading ability				Total points
	Attitude	Duration	Observation	Comprehension	Memory	Description	
1	4	4	3	3	3	2	19
2	4	4	3	3	3	3	20
3	3	3	4	2	2	2	16
4	5	4	3	3	4	4	23
5	4	4	3	3	3	3	20
6	4	5	5	4	3	3	24
7	5	4	3	3	4	3	22
8	4	3	3	3	3	2	18
9	3	4	4	3	3	3	20
10	4	5	4	4	5	4	26

11	4	3	4	4	4	4	23

Here are some results below. First, most of the children have become more interested in reading and they have shown good concentration. Second, those with strong ability can read independently, and their reading duration increases. Third, group discussion in reading is very effective, which enables them to understand and memorize more knowledge for a long period of time. Fourth, the combination of sight, hearing, touch, interactive design and reading patterns effectively improve the understanding of low-vision children in books. Plus, they are more clear about the logical relationship between two pictures, and can also associate the content of the book with life, which has made their memory more profound. Fifth, on the basis of knowledge expansion, the extracurricular books read by the children are combined with the features of picture books, and introduce the overall knowledge from the beginning to the end. In brief, such books are reader-oriented and the wording has improved to a certain extent.

Conclusion

According to the actual research, the author has summarized and analyzed the users' questionnaires and the content of qualitative interviews with senior teachers of special education for low-vision students, and modified the feedback on the design of extracurricular books. In the evaluation and discussion, seven people including senior teachers for low-vision students, experts on book design and psychological experts assessed the satisfaction and feasibility about the three models from five aspects as follows (the highest score is 5 points).

Table 3 Assessment of satisfaction and feasibility about design model

	Product	Content	Multi-perception	Shape	interactivity	Producibility	Total point
		5	4	5	4	5	23
		5	4	3	3	5	20

		4	3	5	3	3	18

Research findings and assessment results are summarized below. First of all, this kind of extracurricular materials can be designed based on the cognitive characteristics and reading needs of school-age children with low vision. To be specific, Chinese traditional culture, 24 solar terms, ancient poetry can be included in such books, and low-vision children's concentration, memory, and advantages and disadvantages of existing books from the aspects of their sensory perception, color recognition, materials based on picture books need in-depth analysis. Additionally, three different types of extracurricular books are redesigned in accordance with the reading media from sight, touch to hearing, and the book shape from 2D, 2.5D to 3D, which strengthens the students' cognition of space and orientation, improves their overall integration ability, and converts lifeless words into multi-dimensional space so as to deepen their understanding and memory through rich imagination. This notion featuring tactile priority, auditory interpretation, olfactory assistance and gustatory association enhances the accuracy of knowledge transfer in books (Zhao Siqi, 2020), and it is consistent with the design idea of multi-sensory compensation in book design.

Second, in the process of reading guidance, the author realized the effectiveness of the combination between extracurricular materials and reading skills. Grasping effective reading patterns requires a lot of reading before use. It offers practical guidance to the reading methods that aim to stimulate visually impaired students' reading interest, conduct necessary narrative training and extracurricular reading to cultivate such students' independent reading ability, and share personal feelings and enlightenment in reading activities (Deng Meng, 2017). To start with, sound combined with pictures is a great way to better understand the text in reading guidance. Then, it is very helpful to boost one's speaking and writing through group discussion. The last one is to learn through exercises and interactions. Participatory learning is relatively effective, which reflects the importance of multisensory reading patterns in book design for low-vision children to cognitive level, memory, imagination, listening, speaking, reading and writing.

Third, from the perspective of cognitive psychology, it is proposed that books for low-vision children should be reader-friendly and focus on creating a multisensory experience for readers, and book design for such children need take the design concepts on interest, experience and emotion into account. In addition, it analyzes and assesses the constituent elements of book design for visually impaired children from the aspects of material, size, format, shape and so on. This is in line with the idea of summarizing the reading characteristics of low-vision children, further analyzing the impact of textual features on

reading, and showing great importance of precise design of large-type textbooks (Qiao Yueping, 2017).

The research results have been verified and assessed. The three kinds of books have their own advantages and disadvantages, which are comprehensively measured from the cognitive development of low-vision children, book design, and the degree of large-scale production. Among them, the three-dimensional book design of Scheme 3 is more suitable in the long run, and more emphasis is placed on scientifically activating the perception system of low-vision children to help them enhance their interest and spontaneity in reading so that they can fully enjoy reading.

In the future research on the design of extracurricular books for low-vision children, it is essential to introduce new technology and explore the rules of book design and reading guidance in more samples, so as to improve their concentration, observation, imagination and memory. It is hoped that the research on extracurricular books can truly help boost the reading, language and academic abilities of low-vision children.

Acknowledgment

I'd like to extend my gratitude to Faculty of Fine and Applied Arts Suan Sunandha Rajabhat University for their support. Meanwhile，Dr. Ekapong Inkua，Dr. Chanoknart Mayuzo，Dr. Phisit Pantien，Dr. Rotjana Chandrasa and many researchers have participated in this research and helped me a lot, and I really appreciate their hard work. Furthermore, Kanyanee, Puang Suea, and Chutima Ngampipat have offered some valuable advice on my paper and given me confidence in paper writing, which makes me feel so grateful.

References

Deng Meng. (2017). Development and Education of Visually Impaired Children. First Edition. Beijing: Peking University Press.

Lv Fan, Clinical Guidelines for Rehabilitation of Low Vision in China. (2021). Chinese Journal of Optometry and Vision Science, 23(3).

Wu Shuying, Guo Yuanfen, Li Xiaorong. (2007). Children's Low Vision Health. Tianjin Science and Technology Translation and Publishing Company.

Guo Xiaoyu. (2019). Research on book design for visually impaired children based on tactile memory. Xiangtan University.

Zhang Ningxin. (2018). Research on book design for visually impaired children based on cognitive psychology. Guangxi Normal University.

Qiao Yueping. (2017). Text setting standards for large-character textbooks for children with low vision. Shaanxi Normal University.

Gao Bingqian. (2016). On the Interestingness of Children's Book Design. Design, 23, 112-113.

Lin Ying. (2014). Research on Reading Problems in Visually Impaired Children. Library Theory and Practice, 8, 22-25.

Zhang Weiru. (2016). Development status of accessible interactive design for the visually impaired. Art and Design (Theory), 2(03), 92-94.

Wu Wenying, Shao Jinhua, Yan Liping, et al. (2017). Research on the effect of visual rehabilitation training on vision in children with low vision. China Innovative Medicine. 14(13), 124-127.

Cao Yang. (2014). The impact of the Marrakesh Treaty on the service of the visually impaired in public libraries. Chinese Library Journal, 40(1), 103-109.