Residential Light Needs to the Visual Impairment in pre-schooler

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Abstract. Residential light is the light human civilization spends from the morning to the night. It is the most basic light of people's daily life that affects people's physiological and psychological function greatly. Residential light is the most important light in people's living environment. With the development of society's diversification, people's caring for the special groups is reflected adequately in many aspects but the residential lights needed for the children's visual impairment are lacking. This article uses interior environmental design theories to discuss the visual impairment in pre-schooler as the research object. With the features of the majority of visual impairment in pre-schooler, this article deeply analyses the needs of the visual impairment in pre-schooler. The summary of their needs can be providing some enlightenment to the designers, with a complete guide for the details of the residential light design and beneficial to the special pre-schoolers.

Keywords: Residential Space; Visual Impairment In Pre-Schooler; Interior Light Environment.

1. Introduction

Visually impaired people are objective and large components of human organizations. Residential light is the light human civilization spends from the morning to the night. It is the most basic light of people's daily life that affects people's physiological and psychological function greatly. Residential light is the most important light in people's living environment. With the development of society's diversification, people's caring for special groups is reflected adequately in many aspects. At least 2.2 billion people around the world suffer from visual impairment or blindness, and tens of millions of people suffer from severe visual impairment according to WHO [1]. For the visually impaired population alone, the overall prevalence of moderate and severe visual impairment in China in 2019 was 3.23% (about 45.92 million) and 0.33% (about 4.67 million) respectively [2]. The needs of visual impairment have become increasingly prominent, it is imperative to carry out personalized design analysis of such visually impaired groups.

Visual impairment not only seriously affects the quality of life of individuals, but also brings a great burden to the world, especially the global economy. According to WHO, The cost of global production losses associated with vision impairment due to uncorrected myopia and presbyopia alone is estimated to be $244 billion and $25.4 billion per year, respectively [1]. This article aims to alleviate the visual deterioration of visually impaired groups from the perspective of light source design in indoor residential spaces to reduce the social and economic burden.

This paper will start with the definition analysis of the residential light environment and visual impairment in young pre-schoolers with several major elements such as physiological needs, emotional needs, cognitive activity needs, and safety protection needs. To obtain the best light source design scheme mainly based on the research of current case studies and different countries' governmental administrative rules or standards. On the other hand, the particular problems and inconveniences of pre-schoolers are also taken into consideration. Features that are vital to visual environment design for pre-schoolers are synthesized in this study as five basic features. They are slow-growing behavioral skills, restricted cognitive activity, slow language and mind development,

special personality psychological problems, and sensitive handicap sensation. It is argued that both the psychological and developmental needs of pre-schoolers should be focused on in the future.

2. The definition of interior light environment

2.1 residential interior light environment

According to Chinese government construction industry standards, the definition of the light environment is the combination of light and color with the shape of the room to form the physical and psychological environment within the room [3]. This standard shares the same conception of Ambient light is an important part of interior design independent of architectural colors, materials, furnishings, etc. This paper will divide it into two different light sources: natural light and artificial light, to better analyze the different light sources in the room.

The brightness of ambient light has a great influence on people's working efficiency. Lower working face illumination will increase the inclination of the body, at the same time, many studies have shown that light also has a certain influence on aggressive behavior, social altruism, moral decision making, self-control, conflict resolution, and self-disclosure [4, 5]. Residential interior light can also influence people's emotions. With the difference in illumination, color temperature, and wavelength, the effect of illumination on human emotion is different, and this effect will change with the duration of illumination, individual characteristics, and subjective preference. Light has a variety of mechanisms that affect moods, and light therapy has been developed based on the effect of light on emotion [6]. According to the research of CUI Zhe, the Light environment affects 21 kinds of emotions, it can be divided into four categories: fear, relaxation, excitement, and fun based on the factorial analysis, these emotions change with the brightness of the environment [7]. Of course, the classification method still has some limitations due to the limitation of experimental conditions. But it will be seen that all of these studies' classification method does not combine other psychological needs and is not aimed at young pre-schoolers [8]. Pre-schoolers may have other unique characteristics, and there may be a better way to classify them.

2.2 The Visual impairment in pre-schooler

Visual impairment also called vision impairment, vision loss, or blindness, refers to the sense of sight decline to a certain extent, resulting in that we can't use a general method to correct vision. The reason for vision impairment in pre-schooler is an uncorrected refractive error of the eye, Cataracts, and Glaucoma. The majority of visual impairment in pre-schooler mainly has five features, which will be discussed in the following paragraphs. They are slow-growing behavioral skills, restricted cognitive activity, slow language and mind development, special personality psychological problems, and sensitive handicap sensation.

The first one is their behavioral skill is growing slowly. In recent years, Reports showed that visual impairment children are growing slowly in action imitation. This situation is common in innate visual impairment children. The Comparison of the visual impairment of children's behavior skills and the Bayley Scales of Infant Development can draw a conclusion that in a series of the walking aspects the difference between early Visually handicapped children and normal children is not very clear, but the Visually handicapped children growing much slower than the normal peers over time.

The second feature deals with pre-schoolers' cognitive activities, which are often restricted. Due to the differences between the hand and the eye, Lead to the cognitive limitations like The feel of the hand and arms' length limitation, The cognition of the sense of touch is a surface line, local to the whole, and Touch is a slower cognition compared to visual, Touch needs initiative of children and The sense of touch, a complicated recognition needs special training.

Besides, pre-schooler are observed to suffer the condition that their language and mind development is slow. The missing clear visual causes the concept incomplete and inaccurate. This suffering is also intertwined with their special personality psychological problems. The circumstances of social and educational background inevitably create obvious characteristics: Temperament

tendency, Character, Interests, Special ability like Higher auditory discrimination, tactile ability, olfactory ability, Better language imitation ability, strong auditory memory, Weak response capability, Weak directional walking ability, and Weak social adaptability.

The last feature is about their sensitive handicap sensation. Most the visual impairment children have the capability of finding objects even though there is no sound or smell. They can sheer away from obstacles. The obstacle to interaction and social communication. They are introverted. Their visual problems cause them to be shy to communicate with others, owing to their sight problems, they can't intuitively feel the other's eye contact, facial expressions, or body language.

Many factors can contribute to the visual impairment in a preschooler, the cause of the disease can not only be attributed to genetic problems, brain problems such as stroke, preterm birth, or trauma. Research shows that bad habits of using eyes and the ignorance of correcting the way of looking are a non-negligible part of the reasons. But a good residential light can prevent the bad deterioration of the eyes growing and even improve the eyes condition. Therefore, rationally making use of natural light and artificial light in the residential, improve the light condition of using eyes, make them sensitive to light again, reach to the purpose easing the condition.

3. Developmental needs in the interior environment

3.1 Self-stimulate behavior

Most research support “self-stimulate” behavior including "stereotypic behavior” and “mannerism", which means this "self-stimulate" appellation is more apposite and more acceptable. There are many speculates about the reason how this behavior formed, there are three reasons that can be accepted by most people. They are the loss of sensation, the loss of social interaction, and the influence on children’s behavioral characteristics. The following paragraph will go through these three reasons.

The first reason is the loss of sensation. Visually Impaired Children are restricted owing to their visual defects, can't change their condition from one place to another place easily, only can meet their body activity needs in their moving range, so they lack the perception stimulates, their body becomes the stimulate environment mostly, they use their body to get activities or stimulates to compensate the lack of cognition. The second reason is the loss of social interaction. In the early stage, the lack of visual feedback can cause the "self-stimulate" behavior, but it is not the only reason: being separate in a long term, many chances are deprived, being short of interactions with others to obtain good activities, so the lack or deprive of social stimulates or environment is the main reason why the special children have that behavior. The third reason is the family's upbringing ways influences children's Behavioral characteristics. Hoshmand holds an attitude that their parents' over-prevention or deliberate isolation causes their children can't get proper attendance, lack of imitation to learn much normal behavior these conditions, lose the learning experience and chances, so their lack of social stimulation brings about the "mannerism”.

An educator Wan mingmei investigated 320 visual impairments children (155 amblyopia, 165 blinds, 90 multiple disabilities), 27% with the amblyopias, 42% with the blinds, and 75% with the multiple disabilities have this abnormal behavior, the number of the “mannerism” behaviors are more than half. With the deeper degree of the visual problems, their behavior degree of abnormality can be stronger, bigger, and weirder the range of motion becomes. Due to this observation, it is strongly recommended that a self-stimulated behavioral analysis is necessary for the interior environment design. The developmental needs of pre-schoolers should be understood as a supplementary solution in an interior light environment designed to help children who are treated with abnormal behavior.

3.2 Normal peers behavior needs in interior light

The light environment is a necessary part of the interior environment. The light environment can influence our physical and psychological health. Looking back at the research investigated, There is

still a lack of research on the normal visual preschoolers in the interior light environment area, so the next pages will take adult samples as a material example.

In some research, light perhaps involves self-control adjusting. Steidle and Werth find that bright light would enhance self-awareness thus inducing the reflecting and controlling self-regulation ways. They use 5 experiments to confirm this assumption, specifically, compared with people in dark rooms, the people in the brighter lightroom are subjectively reported qualified higher public self-awareness; Whether it is actual light environment manipulation or conception launch manipulation, brighter light can always induce people to use a more advanced degree of control and self-regulation strategies; moreover, brighter light can also suppress desire and a reasonable impulse, this reflects the higher level of self-control. After analyzing the gender, age, and Anonymity as covariants, these results still did not alter. Similarly, compared the normal with the visual impairments children, light and the self-control can be used in the preschoolers.

4. Environmental light's suggestive needs

4.1 Common interior light problems

As a defense, to design indoor light sources suitable for children with visual impairment, it is clear that priority lies in the characteristics of this group of people. By understanding these characteristics, it is also important to combine these characteristics to customize a special light source that is suitable for them. The author will further analyze their light source from two aspects of the natural light source and artificial light source and combine their special physiological needs, to get as suitable results as possible.

Natural light source plays an important role in indoor space lighting. Studies have shown that daylight can help reduce fatigue and improve sleep quality. Daylight also cured rickets, and daylight therapy was developed in the late 19th and mid-20th centuries to treat infections, blood sugar, blood pressure, cholesterol, tuberculosis, and skin conditions; Sunlight also affects the body's physiological, psychological, and biochemical processes, leading to the concept of the biological clock, or circadian cycle [8]. For visually impaired pre-schoolers, sunlight is very helpful in special care corresponding to their special psychological or developmental problems. To understand this, several experiments are taken place to figure out how to utilize the source of sunlight as the main solution for child care. Today, the use of natural light sources still holds great promise, as Sutapa Das said that the effort of illumination engineers to promote healthy lighting has not been fully complemented by architects in terms of building layout, spatial planning, and fenestration design [9].

4.2 the overuse of artificial light source

The indoor artificial light source is another important part of the indoor light source. Relevant studies show that We can more easily channel and modulate the power of light under artificial conditions, even matching the quality and color of sunlight; actually, Artificial lighting produces the best results that approximate natural lighting conditions [8]. In the indoor light source, the electric lamp has the characteristics of long life, stability, and low cost and it has become a relatively suitable tool for indoor lighting. In this regard, we can adjust various parameters of the lamp, such as wavelength and illuminance, to simulate the sunshine source and set the best parameter scheme for visually impaired preschoolers.

The exploration and cognition of the surrounding environment are one of the main sources for children to obtain information. Setting a suitable light environment can promote the exploration of space for visually impaired children. The research of Mary Ann Lang et al shows that the elements of setting up an environment for visually impaired children include: enabling children to more fully perceive the surrounding environment through various senses; Increasing environmental safety; Reducing mobility and interaction barriers; Arranging elements to help children integrate experiences; Increase the opportunities for children to interact with the space. In terms of light source selection, Xie Jun et al. showed that compared with fluorescent lamp incandescent lamp is more conducive to

protecting eyesight health; In terms of lighting, since visually impaired children are generally sensitive to light and slow to adapt to light and darkness, it is possible to provide a light source with adjustable light intensity below eye level and appropriate reduction of glare to better meet the needs of visually impaired children. In terms of promoting visually impaired children to explore space and increasing space security, light sources of various colors can be appropriately set up to prompt children and stimulate their interest. At the same time, due to the perceptual limitations of visually impaired children, they will more activities in fixed space, and timely change of light source position is also one of the methods to promote their spatial cognition.

Too much artificial light can lead to light pollution. There are many studies on the damage caused by light pollution, and the possible harm caused by light pollution to visually impaired children will be described here. Light pollution has a great impact on the visual impairment of children. Compared to other pollution problems, light pollution is relatively easy to solve. For the most part, light pollution is generated by decisions, and designers in the building industry have much less direct control over the sources of pollution; the problem is solved by ensuring that just the right amount of light is provided, that is, a certain amount of pollutants is acceptable, even desirable [10]. Therefore, the light pollution problem may not be well solved, for the time being, it will be solved one day.

Otherwise, Bright blue sunlight and appropriate spectral power distribution can be properly used in artificial lighting [9]. Multiple studies have shown that bright blue light effectively stimulates cortisol production, which regulates the body's internal clock and body temperature, while excessive cortisol production can lead to fatigue. Appropriate use of these elements might better adapt to human natural physiological needs. The questions do not stop here, for the need once been understood as both developmental and psychological, interdisciplinary collaboration is at hand. More research topics, such as space lighting arrangements, color hints, and obstacle awareness hints should also be put into one single solution for the visual impairment of pre-schoolers. In this research field, no matter whether it is a design or functional concern, or it is stemmed from the care for visual or even psychological impairment, all these concerns and efforts should work together. That is to say, for common adults, the interior light plan is a solution for health and pleasure, while for visual impairment of pre-schoolers, it is the priority that decides whether their chances to enjoy their life exist or not.

5. Conclusion

Light penetrates our life day and night, playing a major role in the physical, and emotional influence of our bodies. Residential light is an integral part of a residential room. Owing to the specialty of the visual disability in pre-schoolers, by analyzing some specific cases of them and contrasting ordinary people and the pre-schoolers, these special children should care for their physiological needs, emotional needs, cognitive needs, and safety protection needs. The parents of their children have the responsibility to make full consideration of their children's specialty and create a better private customized residential room for their children. In a few decades, the wish of a caring society in light aspect perhaps come true one day. By analyzing the cases of the children in pre-schoolers and the contrast with the visual impairment peers, as well as ordinary people's needs and the children's features, the residential light could be more humane, caring, and most importantly keep their eyes from deterioration even helps them recover from that.

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