Research on the Design Method of Landscape Environment in Special Education Schools for the Characteristics of Children with Mental Retardation

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Abstract: Based on the concept of rehabilitation landscape design, combined with the current situation of campus landscape in special education schools and the characteristics and rehabilitation needs of students with intellectual disabilities, and drawing on the experience of campus rehabilitation landscape environment design cases, this paper discusses the design principles and design methods of rehabilitation landscape environment in special education schools for students with intellectual disabilities, so as to provide reference for the design of special education campus landscape environment. Methods The physiological and psychological characteristics of children with mental retardation were analyzed by reading literature. On-the-spot investigation of the current situation and shortcomings of the landscape design of the existing special education schools, combined with the analysis of the common points of the concept of rehabilitation landscape in the campus landscape design, put forward the landscape design method of special education schools for the characteristics of children with mental retardation. Based on Maslow's hierarchy of needs theory, it was analyzed that children with mental retardation had basic, emotional and rehabilitation needs for the landscape of special education schools. Combined with the physiological and psychological characteristics of children with mental retardation, three types of landscape design methods for special education schools for children with mental retardation were proposed, including safety design, perceptual design and participatory design.

Keywords: Rehabilitation Landscape; Mentally Handicapped Students; Special School Landscape; Design Principles and Methods

1. Introduction

As of 2022, China has built 117 special education ordinary high schools (include ministries and classes) and 161 secondary vocational schools (classes) for the disabled. According to the latest census data released by the Chinese government [1] and the sample survey data of the disabled in China, it is inferred that there are about 91.51 million disabled people in China, of which about 6.11 million are intellectually disabled. Special education schools mainly include three types of students: mental retardation, hearing impairment and visual impairment. Among them, students with intellectual disabilities are quite different from ordinary students in terms of intelligence, body and behavior. Their physiological and psychological characteristics determine that they need a special campus rehabilitation landscape environment. Therefore, combined with the characteristics and needs of students with intellectual disabilities, the concept of rehabilitation landscape is involved, and the research on the design principles and design methods of campus landscape environment for students with intellectual disabilities is carried out to meet the special campus landscape environment needs of students with intellectual disabilities, which is of great significance to their physical and mental health development.

2. Characteristics and Needs Analysis of Children with Intellectual Disabilities

2.1 Analysis of the Characteristics of Children with Mental Retardation

Intellectual disability refers to the person's intellectual activity ability is lower than the general normal people, and showed adaptive behavior disorder [2], usually according to the level of intellectual development is divided into mild, moderate and severe three categories, with the increase of the degree of intellectual disability in patients, the development of all aspects of the body showed a significant gap. Especially in children with moderate and moderate or above mental retardation, their vital capacity, muscle strength, body balance, body coordination and other indicators are significantly lower than those of normal children, seriously endangering their physical health and growth and development. Characteristics of children with different degrees of mental retardation as Table 1.

Table 1. Characteristics of Children with Varying Degrees of Mental Retardation

Defect degrees	Mild	Moderate	Severe
Needs care?	Not	Not	Yes
Nomenclature ability	Normal	Less	Little
Thinking ability	Normal	Normal	Flatness
Self-care ability	Almost possessed	A little possessed	Not possessed
Work ability	Possessed	Almost possessed	A little possessed
Learning ability	Possessed	Almost possessed	A little possessed
Analysis capability	Possessed	Almost possessed	A little possessed
Can accept education	Can	Can	Can not
Emergency handling ability	Almost can be solved	Almost can not be solved	Can not be solved

2.1.1 Physiological characteristics

Mentally retarded students generally have slow perception, small memory capacity, rigid pace and easy to fall; the language expression ability is poor, can only use simple words and sentences. Logic application thinking is weak, and it is difficult to correspond the knowledge learned with the things seen. Spatial perception and time perception are not differentiated enough, perception lacks initiative and enthusiasm, and behavior lacks purpose and flexibility.

2.1.2 Mental profile

Students with mental retardation have poor willpower and lack of initiative. Emotional instability and poor adjustment ability, poor self-control, easy to negative self-concept. Lack of self-confidence leads to poor social communication ability and difficulty in learning interpersonal communication; seriously distracted, attention span is very narrow, etc.

2.2 The Needs of Children with Mental Retardation for Campus Landscape Environment

Through field research on the campus landscape of special education schools, combined with Maslow's hierarchy of needs theory, the needs of children with mental retardation for campus landscape are divided into three levels: basic needs, emotional needs and rehabilitation needs, and the current situation and shortcomings of campus landscape are summarized as Table 2.

Table 2. The Present Situation and Shortcomings of Special Education School Campus

School	Objects of investigation	Present situation of campus landscape	Shortcomings of campus landscape
Hengyang Special Education School	Children with mental retardation & Teachers	Campus public facilites, plants, pavement design, etc., can only meet the basic needs.	(1) Lack of color matching (2) Lack of barrier-free facilities (3) Lack of horticultural facilities
Hengnan County Special Education School	Children with mental retardation & Teachers & Parents	There are few plant species in the campus landscape environment, the pavement is only hard material, the functional zoning is not obvious, and the barrier-free facilities are lacking.	(1) Lack of sensory garden (2) Lack of barrier-free facilities (3) Lack of soft pavement (4) Lack of entertainment facilities

Changsha Special Education School	Children with mental retardation & Teachers & Staff	The campus can basically meet the activities of students with mental retardation. The plant species are relatively rich, and the barrier-free facilities need to be strengthened.	(1) Lack of horticultural design (2) Lack of barrier-free facilities (3) Lack of rehabilitation facilities

2.2.1 Basic needs

The basic needs are manifested as security needs and accessibility needs. Students with mental retardation have poor balance and coordination ability due to slow perception, generally accompanied by behavioral disorders such as rigid pace and poor self-protection awareness, which is easy to cause safety hazards such as falls. The survey found that the sharp shape of public facilities, uneven ground, no ramp on the steps, and no handrails at the corner of the road in the campus landscape of the existing special education schools all reflect the lack of safety and barrier-free design, which seriously threatens the personal safety of children with intellectual disabilities.

2.2.2 Emotional needs

Emotional needs are manifested as social needs and respect needs. Due to the imperfect development of brain function, children with mental retardation have expression disorders such as weak language ability and emotional instability, which affect their social interaction. Considering that children with mild mental retardation have a good language foundation, they develop well in cognition, memory and other aspects, and they are eager to socialize. Therefore, the encouraging design for the social behavior of children with mental retardation can help to recover the mental trauma of students with mental retardation and make them feel respected.

2.2.3 Rehabilitation needs

Children with intellectual disabilities are prone to negative emotions such as low mood, fear and anxiety due to congenital defects and suffering from illness. Therefore, the rehabilitation needs of children with mental retardation for campus landscape are particularly prominent. The rehabilitation in the campus landscape, not only at the physiological level, can help it effectively alleviate negative emotions and release pressure; at the physical level, it can help them exercise, improve immunity, exercise sensory integration ability and so on. For example, sensory gardens, play therapy, horticultural therapy, etc., can not only enrich outdoor activities, but also promote students to communicate with others and promote rehabilitation.

3. Introduce the Rehabilitation Landscape into the Campus Landscape Design

3.1 The Concept and Classification of Rehabilitation Landscape

Therapeutic Landscape, also known as healing garden, healing garden, etc., emerged in the United States in the 1990 s. It is a landscape type that can promote people's physical and mental health. Mainly through the combination of landscape elements and medical functions, landscape facilities have become an auxiliary treatment tool, which in turn has the effects of improving physical function, reducing stress, lowering blood pressure, improving depression and promoting sleep. [3]

Rehabilitation landscape can be roughly classified according to service objects and participation methods. According to the different service objects, it can be divided into two categories. One is for healthy or sub-healthy people, such as sensory gardens, memorial gardens and other outdoor activities. The other is for patients or congenitally disabled people, such as hospitals, nursing homes, rehabilitation institutions and other ancillary garden landscapes. Secondly, according to the different ways of user participation, it can be divided into observation and participation. The former is mainly for viewing, and the latter is mainly for sports and horticultural activities.

3.2 The Significance of Introducing Rehabilitation Landscape

Watching natural scenery and long-term contact with nature can regulate people's mood. The theory of psychological situational therapy holds that a quiet, fresh, clean and beautiful healing environment can calm, cultivate sentiment, balance, relax and imply the

situation. Especially at the psychological level, it can not only reduce the pressure and achieve the purpose of relaxation, but also improve the patient's immune ability, reduce the patient's blood pressure and accelerate the patient's metabolism. Therefore, the intervention of natural elements such as sunlight, air, water, wind, and plant taste have an irreplaceable role in the physical and mental treatment of disabled patients.

Children with mental retardation are naturally fond of nature and close to nature. Introducing the concept of rehabilitation landscape into the campus landscape design of special education schools can improve the campus landscape environment on the one hand, and on the other hand, it can use the natural environment to assist in the treatment of children with intellectual disabilities and promote the physical and mental rehabilitation of children with intellectual disabilities. Therefore, it is of great significance to provide a rehabilitative campus landscape environment for students with intellectual disabilities. Rehabilitation landscape design uses the intervention of natural elements to play the role of healing as Figure 1.

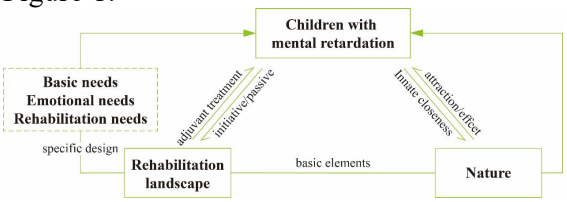

Figure 1. The Path of Rehabilitation Landscape to Promote the Physical and Mental Rehabilitation of Students with Intellectual Disabilities

3.3 Related Design Case Analysis

3.3.1 Sensory arts garden ELS center of excellence

Sensory Arts Garden ELS Center of Excellence (Figure 2) is located in Florida, USA. The area is about 1208 m2. The design fully meets the needs of children with intellectual disabilities, pays attention to the sense of experience, provides training and treatment for children with intellectual disabilities, and allows children with intellectual disabilities to explore and adapt to the environment in their own way. The functional zoning of the Center of Excellence of Sensory Art Garden College is reasonable. The designed ' garden room ' integrates a variety of sensory elements and can provide relatively dense multiple sensory stimuli. Other small spaces create a quiet atmosphere and provide an independent space for children with intellectual disabilities who like to be alone. The streamline design is clear, and the site is divided into two entrance activity spaces. The middle is the sensory garden, and there are two semi-enclosed quiet small spaces on both sides. In addition, all of the facilities here are custom-made accessibility facilities, furniture, sculpture elements and plants, etc., are also carefully selected, not only considering its safety and comfort, but also focusing on functionality. [4]

Figure 2. Sensory Arts Garden ELS Center of Excellence

3.3.2 American academy of art sensory art garden landscape design

The Sensual Art Garden of the American Academy of Arts (Figure 3) is located in the United States, covering an area of 13000 m2. It is an institution dedicated to the treatment of patients with physical and mental disorders. The project is located on the parking lot, and the garden is divided into three parts: vegetable garden, bonfire garden and small garden, which can bring different sensory experiences to patients respectively. The vegetable garden has designed a glass greenhouse, which can also provide planting land for patients in winter. There are several planting belts on the edge of the glass greenhouse, such as vegetables and fruit trees, which can provide patients with immersive planting labor experience. There is a bonfire garden on the edge of the glass greenhouse, and there are bonfire pots in the house. In winter, patients can gather and chat together. Secondly, the relatively hidden area of the small garden is dominated by semi-circular wooden benches. There are different flower plants behind the

wooden benches, which are rich in species and can stimulate a variety of senses of patients.

Through the case of Sensory Arts Garden ELS Center of Excellence and the American Academy of Arts Sensory Art Garden, the following characteristics are summarized and analyzed from five aspects: creating a natural environment, improving a safe environment, enhancing participation, and enriching functional areas as Table 3.

Figure 3. The Sensual Art Garden of the American Academy of Arts

Table 3. Landscape Design Case Analysis

	Sensory Arts Garden ELS Center of Excellence	American Academy of Art Sensory Art Garden
I. Create a natural environment (1) Light (2) Water (3) Air (4) Plants and animals (5) Color	(1) Outdoor open space large area of contact with the sun (2) Water installations increase the fun of interaction (3) Outdoor air circulation (4) There are abundant plant species (5) The natural color collocation is rich	(1) Glass material, semi-open space to introduce a large number of natural light (2) Have rainwater harvesting facilities (3) Design a large area of herbaceous plants to make outdoor air fresher (4) Tall trees and herbs with aviaries and bird boxes (5) Plants, flowers, soil and other natural color
II. Build a safe environment (1) Barrier-free design (2) Facilities without angle (3) The material is non-toxic (4) Soft material	(1) All facilities are barrier-free design (2) In line with ergonomics, each facility has no angle (3) Using environmentally friendly materials, non-toxicand harmless (4) Large use of soft pavementto avoid wrestling and injury	(1) Reasonable design, pay attention to safety (2) facilities without angle, round shape (3) Large use of wood materials. (4) Using grass, rubber and other paving, hard paving smooth
III. Enhance the sense of participation (1) Greenhouse and vegetable garden (2) Sensory garden (3) Interactive device (4) Game facilities	(1) In winter, patients can also experience planting activities (2) Stimulate the user 's hearing, vision, touch, smell, etc (3) Increase patient interaction with the garden (4) Design sound game device	(1) Let the patient eat their own food, stimulate the taste (2) Stimulate five senses and train sensory integration ability (3) Inspire the curiosity of patients (4) Design the hammock forest
IV. Rich functional areas (1) Rest area (2) Planting area (3)A communication zone (4) Game area	(1) Provide space for meditation and viewing (2) Exercise the patient 's ability (3) Promote patient communication (4) Enrich the entertainment life of patients	(1) Provide quiet and relaxing space (2) Immersive experience planting activities (3) Satisfy the social needs of patients (4) Relieving anxiety and releasing stress

4. The Design Principles and Design Methods of Rehabilitation Landscape Environment for Students with Mental Retardation on Campus

4.1 Design Principles

In order to better meet the physical and psychological needs of students with intellectual disabilities, we need to improve the campus landscape environment of students with intellectual disabilities. Through the above analysis, the following principles are summarized.

4.1.1 Ensure the safety of use

Safety needs are the basic needs in Maslow's hierarchy of needs theory. Students with

mental retardation have unbalanced and uncoordinated limb development due to congenital defects. They cannot move freely like normal children and are prone to fall and other safety hazards. Therefore, the primary principle of campus landscape design in special education schools is to ensure the safety of students with intellectual disabilities in the landscape.

4.1.2 Broaden the way of participation

Participating in outdoor activities can train students with intellectual disabilities in sensory integration, hand-eye coordination, and elimination of anxiety. [5] Participation methods are mainly divided into active interaction and passive viewing. The interactive type is mainly based on outdoor participation activities, so that students with intellectual disabilities are exposed to outdoor activities, such as plant planting, fruit and vegetable picking and other activities. The viewing type is mainly based on activities such as watching and meditation. Through the convalescent factors in the environment, students ' senses are stimulated and interacted with them to feel the tranquility of nature.

4.1.3 Enrich the partition level

Ensure the functional breadth and form depth of each functional partition in special education schools and enrich the partition level through the layout of ' point and line ' or ' point and point ' and provide a campus environment for students with intellectual disabilities to relax after class.

4.1.4 Enrich the partition level

Barrier-free design emphasizes that the planning of buildings, roads and facilities should fully consider the special groups with different degrees of physical disability and low normal activity ability, and provide them with safety, convenience and comfort. The accessibility of campus landscape environment design for students with intellectual disabilities requires clear layout, reasonable moving line, convenient facilities, etc., which can help students with intellectual disabilities remove physical conditions in the campus environment.

4.1.5 Create a natural atmosphere

Children are naturally curious about the various elements and characteristics of nature. In contact with nature, they can stimulate the creativity of students with intellectual disabilities and give them the spirit of exploring nature. At the psychological level, active contact with nature can help students with mental retardation reduce anxiety, improve negative emotions and other health benefits; At the physiological level, regular outdoor activities can improve the immunity of students with mental retardation, improve their physical condition and promote rehabilitation.

4.2 Design Approach

Through the above analysis, combined with the concept of rehabilitation landscape, this paper puts forward the design method of campus landscape environment of special education school serving the needs of students with mental retardation from three aspects: safety, rehabilitation and participation.

4.2.1 Security design

(1) Road planning rationalization

In terms of campus layout, students with intellectual disabilities are difficult to locate. They usually can only remember simple routes and generally can only act in familiar places. The traffic flow line of the school should be simple and clear, and the sight accessibility is strong. The rest area, rehabilitation training area and each area of after-school communication should be set up reasonably, and the visual connection between different spaces should be maintained to promote the communication and communication between students. For example, set up a U-shaped table and chair to build a semi-enclosed space; set up a reasonable private space to meet the personality needs of introverted students.

In terms of road design, the width of public sidewalks is at least 3m wide to avoid collisions. Most of the campus environment to use mild materials to prevent students from wrestling and injury, such as mats, plastic floors, rubber bricks, lawns, wood, etc. At the height difference of the road surface, the ramp should be used instead of the step as far as possible, and the guiding railing should be set at the height of 0.5 ~ 1m on the road surface. The road sign and indication design should be concise and clear, and important information can be emphasized through color comparison.

(2) Humanization of public facilities

In the design of landscape sketches, it is necessary to clarify the theme and highlight the campus culture and characteristics. Choose positive-oriented landscape sketches to encourage students with intellectual disabilities to face life optimistically, such as setting up

statues of inspirational celebrities such as Helen Keller and Beethoven to spread positive energy ideas.

In terms of lighting design, lighting design should pay attention to the distribution of light and shade to highlight the key points, clear hierarchy, in the school 's main roads, school gates and important building entrances and exits to focus on lighting, illumination value should reach 100 lx; Campus Avenue Square and so on need 50-75 lx illumination. Plants, lawns, leisure areas are not too strong illumination, 8-15lx can be. The entrances and exits of teaching buildings and dormitories are carried out with uniform lighting, 30-50 lx. In terms of light color, cold color is the main color, supplemented by warm color. Cold color and warm color in key areas can be used together and complement each other. Energy-saving lamps can be used, and lamps can be selected according to needs. They should be coordinated with the environment, and the light color and illumination should be coordinated, with a ratio of no more than 5:1.

(3) The popularization of barrier-free design

Barrier-free design is an indispensable part of campus space. At the entrance, in order to meet the needs of students who use wheelchairs and need auxiliary tools to walk, a drop-in and drop-off place and a canopy are set up; The guide handrail is set at the corner of the road and the upper and lower parts of the ladder. The handrail is about 0.6m high, the step is about 0.13-0.14m, and the ramp is about 1.6-2.2m wide. In the public toilets to set up accessible handrails, changing rooms, bathing facilities, space to meet the needs of students using wheelchairs. [6]

(4) Sports equipment design specialization.

In terms of sports equipment, to set up entertainment facilities, training facilities, sports machinery and so on. Rehabilitation equipment should be in line with ergonomic, to avoid the device angle clamping students, the risk of occurrence. The modeling of game facilities should not be too sharp to prevent safety accidents; Avoid the use of radioactive materials and components of too small size to prevent students from misappropriation. Such as balance beam, climbing, swinging and other recreational facilities with training. Rehabilitation training can repair some of the functions that have been degraded, thereby helping students with intellectual disabilities to achieve self-care, learn some life skills, and reduce family and social pressure.

4.2.2 Perceptual design

Multi-sensory experience is conducive to training the sensory integration ability of students with mental retardation. Sensory garden is one of the ways of perceptual design. Sensory garden design starts with vision, hearing, touch, smell and taste, and aims to relax and relieve anxiety by emphasizing sensory stimulation. Various natural factors in the outdoor environment can directly have a beneficial impact on students with intellectual disabilities. Create a sensory garden design approach for students with intellectual disabilities as Table 4.

Table 4. Rehabilitation Landscape into the Campus Landscape Design Case Analysis

Five senses	Method of application	Benefit of health
I. Vision (1) The shape of plants (2) Color (3) Water (4) Light	(1) Rational allocation of plants pecies, to ensure that the three seasons have flowers, the four seasons have scenery (2) Appropriately add the students' favorite natural plant color, rich campus landscape color collocation (3) Enrich the design form of water body in campus landscape (4) Rational use of light, reflecting the level of light and shadow in the campus landscape	(1) Enrich the color matching in the campus landscape and enhance the aesthetic value of the campus landscape. (2) Attracting students with intellectual disabilities to more outdoor environments is beneficial to physical and mental health
II. Hearing (1) The sound of rain and running water	(1) Introduction of animal elements (Bird houses, insect hotels, aquariums, etc.) (2) Introduction of water element	The introduction of natural sound effects can effectively alleviate the anxiety of

(2) Insects and birds chirping (3) The rustle of the wind blowing through the leaves hitting the stems or grass	(Fountains, pools and plunges) (3) Loudspeakers that mimic natural sound effects	children with mental retardation and create a quiet campus environment
III. Tactile sense (1) Textures of animals and plants (2) Sculpture or interactive device	(1) Provide different touch feelings through the surface texture of trees and flowers (2) Enrich the campus road pavement (sand, stone, wood, mud, plastic, etc.) (3) Add various types of interactive devices, and auxiliary sound, light effect, etc.	Through the tactile feelings provided by different materials, the way of cognitive world of children with mental retardation is expanded and the inner world is enriched
IV. Olfaction (1) The fragrance of flowers (2) The fragrance of plants (3) The fragrance of the soil	(1) Plant flowers with different fragrances (2) Planting herbaceous plants in different seasons	To stimulate the sense of touch of students with mental retardation through the different smells provided by plants, and to train students' sensory integration ability by using smell as guidance.
V. Taste sense (1) Fruits (2) Vegetable (3) Herb	(1) Plant edible fruits. (apples, strawberries, tomato, etc.) (2) Plant edible vegetables.(Chinese cabbage, pepper, pumpkin, etc.) (3) Edible herbs can clear heat and detoxify. (honey suckle, radix is atidis, etc.) (4) Planting edible plants can stimulate the taste buds. (mint, rosemary, etc.)	Aromatic plants can purify the air, relieve anxiety, promote human circulation and enhance human immunity and other rehabilitation effects, which is very suitable for planting in the campus.

4.2.3 Participatory design

In order to increase the interaction between students with mental retardation and campus environment space. You can design experiential farms, plantations, fishponds, small-scale zoos, etc. Let students with intellectual disabilities immersive experience the fun, training hand-eye coordination ability, exercise, improve immunity. The choice of plants to be non-toxic and spineless or with pharmacological or bactericidal anti-inflammatory plants or native plants can highlight local characteristics, and can also be edible fruits and vegetables, such as tomatoes, strawberries, mint, etc., can help students with intellectual disabilities understand nature, explore nature, and exercise their ability to live. [7]

5. Conclusions

In recent years, special education in China has received continuous attention, but the campus rehabilitation landscape design for special students still needs to be improved. Starting from the characteristics and needs of children with intellectual disabilities, Analyze and summarize the needs of children with mental retardation for campus landscape environment, Rehabilitation landscape design combined, It can provide a campus landscape environment that can meet the needs of rehabilitation for students with intellectual disabilities. It is hoped that this paper can provide some reference for the design of campus landscape environment in special education schools which are more in line with the physical and mental development needs of students with intellectual disabilities.

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