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Landscape Organization of a Sensory Garden for Children with Disabilities

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Abstract. The paper investigates some design peculiarities of public green spaces used by mobility- and visually-impaired citizens. The subject of studying is a sensory garden as a tool enabling to acquire important knowledge, develop skills, control emotions, and maintain self-confidence by people with special needs. The paper aims at establishing the techniques of creating a sensory garden in a visually-impaired children's school area based on universal (inclusive) design concepts. To this end, the paper generalizes works on forming a universal design for mobility-impaired population; considers ornamental plant assortments and the effect of introducing ornamental flora in the south of Primorsky Krai (Region); a research project has been done on landscape arranging a visually-impaired school area in the town of Artyom, Primorsky Krai (Region). As a result, a sensory garden universal design has been created which takes into consideration emotional, sensual and physical needs of physically-challenged school students who cannot feel the same as other society members in public places due to their special needs. The proposed project solution may have a positive therapeutic healing effect on school students which results from being in nature and which would allow mobility-impaired children to experience the same senses during their walks as ordinary kids do.

1. Introduction

According to WHO estimates, over one billion of the world's population -15% - suffer from various disabilities, with 9.1% being blind and visually-impaired [1]. Russian legal documents use the term *disabled* along with *mobility-impaired groups* (MIG) describing physically-challenged people who meet with difficulties when walking on their own, receiving services and information, or while finding their bearings [2; point.3.2]. Creating a favorable and safe environment for MIG's life and rehabilitation including open urban spaces (OUS) is one of the Russian Federation's most important internal social policies. The landscape designers' task is observing legal standards of creating a safe accessible environment for MIG as well as making its elements aesthetically appealing and comfortable for all population groups irrespective of whether they are MIG or not. Nowadays, a



number of legal and technical requirements are observed in the field of architecture and constructions, such as SP. 59.133330/2016; SP 35-105-2002; GOST R 50918-96; GOST R 52131-2003; GOST R 52875-2007; GOST R 52871-2007; GOST R 51603-2000, etc. which enable to provide for an accessible environment for MIG.

For musculoskeletal patients, a great number of facilities which enable going around the city on their own have been established, such as lifts, elevators, ramps and extended stair landings, handrails, tactile surfaces, road markings and signs and so on whereas there is a considerable lack of facilities alleviating spatial orientation and mobility for the blind and visually-impaired. The universal design, or the inclusive design, which is also called "the design for everyone" can serve as a solution to the problem. At the stage of setting up the problem of the research and its relevance to the important scholarly and social issues concerned with creating OUS for visually-impaired MIG, a number of investigations on universal (inclusive) design techniques (Kopeva A., Ivanova O., and Zaitseva T. [3]; Lazovskaya N. [4]; Leontyeva E. [5]) and OUS accessibility provision (Norgate S.H. [6]) have been analyzed. The review of contemporary literature sources has revealed both a complex approach to the problem of creating an accessible environment for visually-impaired MIG (Hitter T. and Cantor M. (eds) [7]) in some countries and instances of a lack of concern about this problem in others (Perry M.A. and Devan H. (eds) [8]; Hassan S. and Soltani K. (eds) [9]). A number of papers deal with the ways of visually-impaired people rehabilitating through OUS landscape arrangement (Sholukh N. and Nad'iarna A. (eds) [10]) and creating sensory gardens (Dovganyuk A. [11], Hussein H. [12]).

In the paper, the authors lay emphasis on basic approaches to solving problems of school and preschool playgrounds landscape arrangement with consideration for visually-impaired children. Benzon N. [13] argues that "Disabled children, including learning disabled young people, are particularly marginalized as a result of their intersecting identity as both children and disabled people". Thus, properly equipped OUS can be used for the visually-impaired rehabilitation and socialization. As Gill T. [14] maintains, "spending time in nature is part of a 'balanced diet' of childhood experiences that promote children's healthy development, well-being and positive environmental attitudes and values". Investigations show that spending time in green spaces and taking care of plants help MIG, including the blind and visually-impaired, develop various skills, control emotions and maintain self-confidence (Ruiz-Gallardo J-R. and Verde A. (eds) [15]; Skinner E.A. and Chi Una [16]; Passy R. [17]).

2. Methods

Before determining basic approaches to the landscape arrangement of a sensory garden for visually-impaired children in a schoolyard, some research was done on ornamental plants in Russia's Academy of Sciences Far Eastern Branch Botanical Garden - Institute collections (A unique scientific collection of living open soil plants). The assortments of ornamental plants as well as the results of introducing Southern Primorye ornamental plants (Khrapko O. and Kalinkina V. (eds) [18]; (Denisov N. and Petukhova I. (eds) [19]; Pshennikova L. [20]) were analyzed in order to determine the greening techniques and elements which can serve as natural landmarks in a sensory garden for the visually-impaired; also, landscape arrangement of limited use areas (Khrapko O., Kopeva A., Ivanva O. (eds) [21, 22, 23]) schoolyards (Khrapko O., Kopeva A., Ivanova O. (eds) [24,25, 26]) and preschool yards (Khrapko O., Kopeva A., Ivanova O. [27]) were considered. On the basis of the analysis, plant assortments for a sensory garden were offered. At the stage of collecting and examining the initial materials, such methods as observation, photo fixation, descriptions of functional and aesthetic object features, and a questionnaire survey were used. On the basis of these data analysis, some fundamental landscaping techniques were determined for a visually-impaired children's schoolyard and further sensory garden project suggestions were worked out.

3. Results

"Visual disorders result in a considerable distortion of a worldview perception and communication with other people. It is because vision is responsible for 90 % of information received by humans."

[11, p. 37]. In connection with the impossibility of full compensation for vision losses, an important aspect of object landscaping for the blind and visually-impaired is transforming visual images into ones accessible for tactile and/or auditory perception" [1, p. 38]. Sensory gardens are beneficial for it to a great extent. Nowadays, much attention is being paid to the incorporation of sensory gardens into educational institutions for disabled children, healing institutions and botanical gardens both in this country and abroad. Sensory gardens are instrumental in restoring visual perception through using retained analyzers (hearing, touch and smell). In a sensory garden, visually-impaired children acquire skills necessary for their daily lives; they learn to orientate and move within space. The basic principle enabling to facilitate visually-impaired people's orientation within OUS is active "using their compensatory abilities together with providing certain tree, flower and blooming bush species as efficient natural landmarks" [10, p. 134]. It is in this case that a blind person's inner reserves of the organism and their latent compensatory abilities are used to the best advantage, with them being able to choose their way independently without any assistance from others.

In the course of research, tree, flower and blooming bush species with pronounced noise, aromatic and tactile and morphological characteristics were identified and recommended for further use as natural landmarks. It has been established that rustling foliage of big trees such as the Amur lime *Tilia Amurensis*, the Chinese ash *Fraxinus Rhynchophulla*, the Mongolian oak *Quercus Mongolica*, the Manchurian walnut *Juglans mandshurica*, and the trembling aspen *Populus tremuloides* can help stimulate visual images in blind people's brains on the basis of sound information. Their crowns serve as a source of sound signals in the windy spring and summer weather while their fallen leaves make rustling noises in the fall, and the sound can travel to great distances and is trapped by blind individuals' sharpen hearing.

Plants with a marked leaf texture such as conifers (the spreading yew, silver firs, junipers, firs, pine-trees, and larches), deciduous (lilacs, the shiny cotoneaster, magnolias, etc.) as well as trees and shrubs with a marked bark texture: the Amur cork tree *Phellodendron amurense*; the euonymus (*Maximowiczianus*, *Sacrosanctus*, *Verrucosus*); Manchurian, Asian black, Korean birches; chokecherry; the mountain-ash *Sorbus amurensis*; the English oak *Quercus robur*; the pine-tree (*Pynus sylvestris*, *Pynus funebris*); and the honeysuckle (*Maakii*, *Maximoviczii*, *Praeflorens*) can help stimulate visual images on the basis of touch.

Highly-scented shrub species as well as fragrant annuals and perennials help stimulate visual images on the basis of smell. Roses and lilacs are typical shrubs of this kind; such perennials as daffodils and phlox and such annuals as nasturtium, tagetes and sweet peas are also among them. Such bright profusely blooming shrubs with colorful foliage as the Korean maple *Acer pseudosieboldianum*, the Sargent cherry *Prunus sargentii*, the flowering almond *Prunus triloba*, the Weigela, the sweet mock-orange, the Vanhoutte spirea, and the border forsythia are important landmarks for moving visually-impaired individuals as well as colorful background for buildings. In the winter, evergreen Chinese juniper plantings stand out against white snow like stately columns. Using UD techniques, project suggestions for a visually-impaired children's schoolyard were worked out on the basis of the obtained data.

4. Discussion

In 2014, Vladivostok's city administration started implementing the *Accessible Environment* municipal program to be fulfilled in 2014-2019 with provision for a number of measures enabling disabled individuals and other low mobility groups to gain unhindered access to social infrastructure priority objects in the most important spheres of life [29]. In 2018, a sensory garden project was worked out in the Design and Technology Department, Vladivostok State University of Economics and Service (VSUES) for a III-IV type special boarding school yard in the town of Artyom, Primorye region, in which orphaned or abandoned children as well as children with special needs are taught. It is one of numerous practice-oriented projects carried out by VSUES students (Kopeva A., Ivanova O., and Zaitseva T [3]; Kopeva A. and Ivanova O. [30]).

The schoolyard functional and spatial landscape design was created with the special school teachers' and Vladivostok Blind Society experts' recommendations taken into account. These recommendations helped the designers allocate different use areas within the schoolyard to make a better spatial orientation for the students possible. These areas included an acoustic tunnel; tactile zones for hands and feet equipped with interactive Braille displays; a quiet game zone; a multi-functional active play zone; sports facilities and physical play zones; a vegetable garden; an orchard, and a stone garden.

For each of the above mentioned zones, landscaping techniques were determined which allowed a better spatial orientation. In their project suggestions, the designers went beyond recommendations for creating a safe and accessible MIG environment based on regulations. They applied UD techniques for creating a maximized special needs garden so as to promote visually-impaired students' engagement with nature and to place emphasis on children's enjoyment from using natural and artificial spatial landmarks.

It was offered to plant tree and shrub clumps and perennials used as natural landmarks which can help restore visual perception on the basis of retained analyzers (hearing, touch and smell) at main garden path intersections. Special sensory mini-gardens which help students to find their bearings while moving from one zone to another play an important part in the navigation around the schoolyard. Among these are: an orchard with round or irregular-shaped smooth or fuzzy-peeled fruits; an aromatic mini-garden of such spicy herbs as thyme, lemon balm, peppermint, etc.; a vegetable garden where children can take care after plants. A combination of pleasant emotions enticed from working in an outdoor vegetable garden, beneficial nature influence and possibility to use fruits of their labor results in a positive therapeutic effect. These sensory gardens will enable special needs children to obtain more information about a schoolyard and will increase the possibilities of their rehabilitation.

The project places special emphasis on the paving materials for the paths and playgrounds as well as the acoustic tunnel. The pavement of the main pathways are equipped with tactile guidance lines, some stretches of which are paved with resonant acoustic and blister tiles which serve as sound signs for the right direction as the sounds of footsteps and canes reflect from the tunnel surfaces, with echoes helping children get their bearings. The rest of the schoolyard area is paved with different materials such as soft gravel strips on asphalt pathways which mark turnings and notice boards. The project provides a complex system of tactile spatial orientation, an important component of inclusion education for visually-impaired children. Raised road signs such as a mural opposite the school entrance and several interactive mosaic Braille displays were also worked out.

5. Conclusions

The research allows conclusions that both natural and artificial landmarks should be considered as complimentary and equally important components in arranging for MIGs' unassisted moving around OUS. Sensory gardens, in which visually-impaired individuals can gain unhindered access to the surrounding environment created with the help of UD techniques, meet anthropometric, sanitary and hygienic, emotional and psychological as well as ecological requirements and provide every user's accessibility to all of their structural components without any adaptation needed.

References

- [1] World Health Organization 2011 The World Report on Disability Available online: http://www.who.int/disabilities/world_report/2011/report.pdf
- [2] SP 59.13330.2016 Accessibility of buildings and structures for low-mobility groups of the population Updated version of SNIIP 35-01-2001 Available online: <https://tiflocentre.ru/download/SP59-2016.pdf>
- [3] Kopeva A, Ivanova O and, Zaitseva T 2018 Application of Universal Design principles for the adaptation of urban green recreational facilities for low mobility groups (Vladivostok case-

- study) *IOP Conference Series: Materials Science and Engineering (MSE)* **463** (1) Available online: <https://doi.org/10.1088/1757-899X/463/2/022018>
- [4] Lazovskaya N 2015 Accessible Environment in Open Urban Spaces *Regional Art and Architecture Schools* **1** 54-9
- [5] Leontyeva E 2013 Accessible environment and universal design through the eyes of a disabled person. Basic course (*Ekaterinburg: Publishing House TATLIN*) 128p
- [6] Norgate S H 2012 Accessibility of urban spaces for visually impaired pedestrians *Municipal Engineer* **165** (4) 231-37
- [7] Hitter T and Cantor M (eds) 2016 Landscape Architecture Planning Proposal for Visually Impaired in Cluj-Napoca *ProEnvironment* **9** 53-61
- [8] Perry M A and Devan H (eds) 2018 Accessibility and usability of parks and playgrounds *Disability and Health Journal* **11**(2) 221-29
- [9] Hassan S and Soltani K (eds) 2012 Disabled Children in Public Playgrounds: A Pilot Study *Procedia - Social and Behavioral Sciences* **36** 670-76
- [10] Sholukh N and Nad'iarna A (eds) 2017 The dendrology analysis of territories of socially important city facilities regarding convenience of dimensional orientation of blind people: composition and planning and ergonomic aspects *Modern industrial and civil construction* **13**(3) 129-51
- [11] Dovganyuk A 2012 Medical and Social Rehabilitation of Visually-impaired Individuals by Creating Specially Landscaped Ecological Trails *Physiotherapy, Balneology and Rehabilitation* **2** 37-40
- [12] Hussein H 2012 The Influence of Sensory Gardens on the Behaviour of Children with Special Educational Needs *Procedia - Social and Behavioral Sciences* **38** 343-54
- [13] Benzon N 2016 Unruly children in unbounded spaces: School-based nature experiences for urban learning disabled young people in Greater Manchester, UK *Journal of Rural Studies* **51** 240-50
- [14] Gill T 2014 The Benefits of Children's Engagement with Nature: A Systematic Literature Review *Children, Youth and Environments* **24** (2) 10-34
- [15] Ruiz-Gallardo J-R and Verde A (eds) 2013 Garden-Based Learning: An Experience With «At Risk» Secondary Education Students *The Journal of Environmental Education* **44**(4) 252-70
- [16] Skinner E A and Chi Una 2012 Intrinsic Motivation and Engagement as "Active Ingredients" in Garden-Based Education: Examining Models and Measures Derived From Self-Determination Theory *The Journal of Environmental Education* **43**(1) 16-36
- [17] Passy R 2012 School gardens: teaching and learning outside the front door *Education 3-13 International Journal of Primary, Elementary and Early Years Education* **42**(1) 23-38
- [18] Khrapko O and Kalinkina V (eds) 2005 Far Eastern Ornamental Plants in Landscape Compositions. *Main Botanical Garden Bulletin* **3** (203) 148-53
- [19] Denisov N and Petukhova I (eds) 2005 Ornamental Trees, Shrubs and Vines in Primorye Region (*Vladivostok: Publishing House of BGI FEB RAS*) 211 p
- [20] Pshennikova L 2002 New Arboraceous Plants in the South of Primorye (*Vladivostok: Publishing House Dalnauka*) 48 p
- [21] Ivanova O, Kopeva A, Khrapko O (eds) 2017 Landscape Design (*Vladivostok: Publishing House of Vladivostok State University of Economics and Service*) 368 p Available online: <https://elibrary.ru/item.asp?id=30582959>
- [22] Kopeva A, Ivanova O and Khrapko O (eds) 2015 Environmental Design: Book 4, Part 1 (*Vladivostok: Publishing House of Vladivostok State University of Economics and Service*) 330p. Available online: <http://elibrary.ru/item.asp?id=26176482>
- [23] Kopeva A, Ivanova O and Khrapko O (eds) 2015 Environmental Design: Book 4 Part 2 (*Vladivostok: Publishing House of Vladivostok State University of Economics and Service*) 194 p Available online: <http://elibrary.ru/item.asp?id=26218029>

- [24] Kopeva A, Khrapko O and Ivanova O 2016 Basic principles of architectural and landscape organization of schoolyard *Modern technologies and development of polytechnic education: International Scientific Conference Proceedings* 551-6 Available online: [https://www.dvfu.ru/upload/medialibrary/f6a/Сборник%202016_политех%20\(1\).pdf](https://www.dvfu.ru/upload/medialibrary/f6a/Сборник%202016_политех%20(1).pdf)
- [25] Khrapko O and Kopeva A (eds) 2012 Landscaping of schoolyard (*Vladivostok: Publishing House of Primorsky Regional Institute of Educational Development*) 180p Available online: <http://elibrary.ru/item.asp?id=26279525>
- [26] Kopeva A, Khrapko O and Ivanova O 2017 Landscape Architecture of Schoolyards *IOP Conference Series: Materials Science and Engineering (MSE)* **262 (1)** Available online: <https://doi.org/10.1088/1757-899X/262/1/012145>
- [27] Kopeva A, Khrapko O and Ivanova O 2018 Landscape planning of preschool yards *IOP Conference Series: Materials Science and Engineering (MSE)* **463 (1)** Available online: <https://doi.org/10.1088/1757-899X/463/2/022017>
- [28] Municipal program "Accessible Environment" 2014 *Official website of the city administration of Vladivostok* Available online: http://www.vlc.ru/life_city/accessible-environment/
- [29] Kopeva A and Ivanova O 2011 A Practice-oriented Approach to Students' Landscaping Projects in the Design Department VSUES *On Urban Greening Problems: Conference Proceedings (Vladivostok: Publishing House of Far Eastern Federal University)* 210-13 Available online: <http://elibrary.ru/item.asp?id=26371309>