



Sensory Garden for Occupational Therapy and Improving Quality of Life

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Authors' contributions

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Review Article

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ABSTRACT

A sensory garden is a self-contained garden or garden area that has a collection of plants that are appealing to one or more of the five senses. The major senses like sight, smell, sound, taste, and touch; are mainly enhanced in these kinds of gardens so that people of various ages can benefit from it and it can act as a therapy. This kind of garden has also been reported to be an amazing way for young people to explore their senses and learn about their surroundings and the people suffering from dementia and children requiring special needs. In both cases, it has proved to improve their overall health and decreased their agitation level to normal. The idea behind the sensory garden design was that the gardens should aim to stimulate users' senses and improve their physical abilities. These types of gardens have a huge impact on people's mental and physical health and it helps in improving their way of living as well. In this review paper, the elements and benefits of the sensory garden and its scenario in India have been discussed in detail.

Keywords: *Dementia; garden design; physical abilities; sensory garden; therapy; quality of life.*

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1. INTRODUCTION

A sensory garden is a self-contained garden area that has a collection of plants appealing to one or more of the five senses; sight, smell, sound, taste, and touch. According to Hussein [1], sensory gardens were derived from gardens for blind people. The idea behind the sensory garden design was that the gardens should aim to stimulate users' senses and improve their physical abilities [2]. Gülgün et al., [3] said that the sensory gardens have some psychological effects and they are designed to fulfill certain goals since they directly engage the human senses. The establishment of sensory gardens in major cities might help to increase the range of positive inputs [4]. The writer of the book, 'Landscape Design for Elderly and Disabled People, Stoneham stated that the initial idea of sensory gardens was derived from the horticultural therapy movement, which was developed in the United Kingdom in the 1970s [5]. Horticultural therapy was focusing on special environments, i.e., hospitals and rehabilitation units, thus, causing it to be developed more rapidly than sensory gardens. The Sensory Garden was made in 2003 at the impelling of Lord Burlington, the twelfth Duke's child, with plants that were picked for their effect on the five, detects - sight, smell, contact, hearing, and taste. These gardens are specially made to be available for all individuals to appreciate - debilitated and non-impaired and are especially engaged towards small kids and individuals with disabilities but are enjoyed by people of all ages [6]. These gardens have a wide range of educational and recreational applications and can be used in the education of special-needs students, including autistic people. The garden must contain highlights or features open to the debilitated individual and for stimulating senses, for example, scented and consumable plants, chiseled handrails, and water highlights intended to make sound and play over the hands, amplifying glass screens, braille, and sound acceptance circle depictions. These gardens typically have progressed foundation to work with wheelchair access and other availability concerns. A well-designed sensory garden should be characterized by the following distinctive characteristics.

- They should be designed with the intent to stimulate the human senses.
- They should form a complete whole, isolated from the surroundings.

- They should affect all the senses.
- They should also focus on non-visual stimulation.
- Apart from sense-stimulating plants, they should also feature other elements that stimulate the senses. Additional elements can be added to this list.
- They should be animal-friendly, as the presence of animals increases the scope of positive stimuli.
- They should be equipped with water features, because of their sonic properties and their importance for plants and animals.

2. ELEMENTS OF SENSORY GARDEN

Sight: The first thing that a person notices is through sight so it is the major component of our senses. All the components in a sensory garden should be soothing to one's eyes. The reflection of color and light contributes to the stimulation of the senses. In cool temperate climates, pale colors can be fully appreciated but vibrant ones cannot. On the contrary; in hot temperate climates, vibrant and warm colors can be seen properly, but pale colors cannot. The color of flowers is perceived best at noon. In sensory gardens warm colors such as red, orange, and yellow stimulate the senses; cool colors such as blue, purple, and white have a calming and soothing effect while cool colors such as blue and green are associated with water, sky, and forest which evokes relaxation and calm feelings [7]. Therefore, flowers of different colors should be added in a proportionate manner in a proper sequence. The color wheel plays a major role when it comes to the idea of creating a pleasing garden. A full-color wheel resembles a rainbow, with red and orange next to yellow, followed by green, blue, purple, and violet. They can be arranged in the form of monochromatic, analogous, and complementary designs. The 12 main colors in a color wheel are mentioned in Table 1.

Furthermore, the use of light can enrich the user experience in sensory gardens. Lighting fixtures, torches, and chrome gazing balls feature contribute to the sensory garden design [8].

Many researchers have demonstrated that the positive interaction between outdoor and indoor natural contact helps with stress reduction. Biophilic design is the concept of incorporating natural elements into the indoor environment

Table 1. Colour wheel – 12 main colors

| S. No. | Colour | Flower and ornamental crops |
|--------|---------------|---|
| 1 | Yellow | Marigold, calendula, chrysanthemum, coreopsis, zinnia, tulip, daffodil, pansy, portulaca |
| 2 | Yellow-orange | Marigold, zinnia, tulip, pansy, dahlia |
| 3 | Orange | Marigold, pansy, rose, tulip, gerbera, chrysanthemum, ranunculus, cosmos, alstroemeria, California Poppies, canna, zinnia, tulip, |
| 4 | Orange-red | Marigold, zinnia, tulip, pansy, California Poppies, canna |
| 5 | Red | Petunia, tulip, pansy, rose, salvia, garden poppy, chrysanthemum, gerbera, cockscomb, dahlia, carnation |
| 6 | Red-Violet | Petunia, tulip, pansy, chrysanthemum |
| 7 | Violet | Verbena, African violet, lavender, lupin, Petunia, tulip, pansy, iris, hydrangea |
| 8 | Blue violet | Petunia, ageratum, tulip, pansy |
| 9 | Blue | Petunia, ageratum, tulip, pansy, hydrangea, corn flower, iris, lupin |
| 10 | Blue Green | Hosta, tulip |
| 11 | Green | Summer cypress, bells of Ireland, green color variety of rose and chrysanthemum |
| 12 | Yellow- green | Zinnia, marigold, hosta, tulip |

in order to increase occupant connectivity to the natural environment. In recent years, this concept is in trend and many researchers reported the positive effect of biophilic design on human health, well-being and reducing stress and anxiety [9,10]. As stated by Hady [11], some landscape designs could be transformed into an integrated sustainable biophilic design with minor changes, resulting in positive impacts on users and increased landscape efficiency. Increasing the types of patterns and their various forms could easily activate our perception of biophilic design patterns and which would also have an effect on the user's health and well-being. Increasing the variety of patterns and their various shapes might readily activate our awareness of biophilic design patterns and it can stimulate the sight sense.

Sound: Sound plays a very important role when it comes to stimulation of senses, given the sound should be very calm and soothing. It can help in calming the nerves and also provides a sense of relief, especially for patients and disabled people. Leaves blowing in the wind, branches swinging, dried leaves on the ground, and animals and water enrich the human experience in a garden. Waterfalls, fountains, sprinklers, wind bells, and other components contribute to the sense of hearing. The sound of water can be a trickle of steam bed or it can be gushing like a waterfall. It depends upon the people what they prefer so it has to be placed at

different locations. Various musical instruments can be installed in the garden which could be modified to respond to wind, rain, etc. and it should also look very appealing and natural. Various plants such as gourd, bamboo, grasses, cattails, and eucalyptus can be planted for their sound-emitting characteristics. Some kind of wildlife should be introduced to the garden e.g., birds, toads, crickets, etc. Ratcliffe et al., [12], conducted an experiment with twenty adult participants to determine the effect of the overall role of birds' songs on stress recovery and attention restoration. However, not all bird sounds were found beneficial in these processes, but they reported that the bird song provides a healing effect and also aids in stress reduction. Birds can be attracted by installing bird feeders and shelters at different locations. These pleasant noises tend to bring people close to nature and make them feel relaxed. Wind chimes and bells can add a lovely accent. Tree, flower, and blossoming shrub species with prominent noise were found and recommended for usage in the sensory garden. It has been proven that the rustling leaf of large trees like the Amur lime, the Chinese ash, and the Mongolian oak, can aid the basis of sound, and trigger visual representations in the brains of blind persons. In the windy, spring, and summer weather, falling leaves form rustling noises, and the sound can travel long distances and blind individuals can also improve their hearing [13].

Table 2. List of plants emitting sound

| S. No. | Common name | Botanical name | Family |
|--------|--------------------------|--------------------------------|---------------|
| 1 | Balloon Flower | <i>Platycodon grandifloras</i> | Campanulaceae |
| 2 | False Indigo | <i>Baptisia australis</i> | Fabaceae |
| 3 | Pigsqueak | <i>Bergenia cordifolia</i> | Saxifragaceae |
| 4 | Switchgrass | <i>Panicum virgatum</i> | Poaceae |
| 5 | Love-in-a-Mist (Nigella) | <i>Nigella sativa</i> | Ranunculaceae |
| 6 | Greater quaking grass | <i>Briza maxima</i> | Poaceae |
| 7 | Chinese lantern | <i>Physalis alkekengi</i> | Solanaceae |
| 8 | Bamboo | <i>Bambusa vulgaris</i> | Poaceae |

Apart from the plants, non-plants like avians and non-living elements can also be used in the garden to add up the sound emissions. In this way we can invite the bees that produce the buzzing sound, the crickets that generates the chirping sound and the whistling sound emitted by humming birds and with the non-living elements like water splashes which generates the trickling sound and the mulched foot path which produces clattering sound and these sounds adds up the soothing effect to the ears and calm physically and stimulate mentally. In order to improve and invite the bird population, cricket population and bee population in the garden we can use some of the flowering plants to attract them. We can also include a raised scented or colourful flower bed for attracting pollinators. The lists of flowering plants used for attraction are mentioned in Table 3.

Smell: The sense of smell is mostly stimulated in every garden. Some plants have pleasant scents and some do not. So, care should be taken while selecting the plants according to their smell. In fact, during memory encoding, the sense of smell is more effective as compared to the sense of sight. Therefore, the two senses are not

opponents in the cognitive learning process, rather they support each other. A few plants discharge their aroma out of sight with the fieriness of the sun, while others discharge their fragrance just when squashed. The use of aromatic plants in therapeutic gardens aids in soothing the patients through the sense of smell [14]. Jo et al., [15], studied the physiological and psychological effects of floral scent on humans and evidenced that the benefits of plant contact are derived not only through visual perception but also through other sensory means such as olfactory perception. This clearly implies that for the best effect on physical, mental, and psychological health and by this way of smelling sense the plants can be used therapeutically. Diego et al., [16], conducted a study in which attentiveness and mood were measured in 40 people who were given 3 minutes of aromatherapy using either lavender (a soothing odor) or rosemary (a stimulating odor). Before and after the therapy, participants were given easy math problems to solve. Following aromatherapy, the lavender group showed greater beta power, indicating enhanced sleepiness, less sad mood, and reported feeling calmer, as well as doing math operations

Table 3. List of plants for attracting avians

| S. No. | Name of plants | Scientific name | Attracting bees/crickets/ humming birds |
|--------|-------------------|-------------------------------|--|
| 1. | Lavender | <i>Lavandula angustifolia</i> | Bumblebees |
| 2. | Abelia (Bee Bush) | <i>Abelia grandiflora</i> | Attract both honeybees and bumblebees. |
| 3. | Lilac | <i>Syringa vulgaris</i> | Bees |
| 4. | Blue Borage | <i>Borago officinalis</i> | Honey bees |
| 5. | Sunflower | <i>Helianthus annuus</i> | Humming birds |
| 6. | Petunia | <i>Petunia exserta</i> | Humming birds |
| 7. | Queens wreath | <i>Antigonon leptopus</i> | Humming birds |
| 8. | Coleus | <i>Coleus scutellarioides</i> | Cricket |
| 9. | Gypsophila | <i>Gypsophila paniculata</i> | Cricket |
| 10. | Chrysanthemum | <i>Chrysanthemum sp.,</i> | Cricket |

Table 4. List of plants emitting the smell

| S. No. | Common Name | Botanical Name | Family |
|--------|-------------|-------------------------------|----------------|
| 1 | Lavender | <i>Lavendulan officinalis</i> | Lamiaceae |
| 2 | Geranium | <i>Pelargonium spp</i> | Geraniaceae |
| 3 | Thyme | <i>Thymus vulgaris</i> | Lamiaceae |
| 4 | sweet pea | <i>Lathyrus odoratus</i> | Fabaceae |
| 5 | Gardenia | <i>Gardenia jasminoides</i> | Rubiaceae |
| 6 | Honeysuckle | <i>Lonicera japonica</i> | Caprifoliaceae |
| 7 | Roses | <i>Rosa damascena</i> | Rosaceae |
| 8 | Rosemary | <i>Salvia Rosmarinus</i> | Lamiaceae |

Table 5. List of plants for taste

| S. No. | Common Name | Botanical Name | Family |
|-----------------------|-----------------|---|-------------------|
| Vegetables | | | |
| 1 | Cabbage | <i>Brassica olearaceae var capitata</i> | Cruciferae |
| 2 | Lettuce | <i>Lactuca sativa</i> | Asteraceae |
| 3 | Brussel sprouts | <i>Brassica olearacea var gemmifera</i> | Brassica oleracea |
| 4 | Tomatoes | <i>Solanum lycopersicum</i> | Solanaceae |
| Fruits | | | |
| 1 | Strawberry | <i>Fragarai annassa</i> | Rosaceae |
| 2 | Raspberry | <i>Rubus idaeus</i> | Rosaceae |
| 3 | Cherries | <i>Prunus avium</i> | Rosaceae |
| 4 | Apples | <i>Malus domestica</i> | Rosaceae |
| Edible flowers | | | |
| 1 | Lavender | <i>Lavandula officinalis</i> | Lamiaceae |
| 2 | Honeysuckle | <i>Lonicera japonica</i> | Caprifoliaceae |
| 3 | Nasturtium | <i>Tropaeolum majus</i> | Tropaeolaceae |
| 4 | Chamomile | <i>Matricaria chamomilla</i> | Asteraceae |
| 5 | Rose | <i>Rosa spp</i> | Rosaceae |
| Herbs | | | |
| 1. | Garlic | <i>Allium sativum</i> | Amaryllidaceae |
| 2. | Basil | <i>Ocimum basilicum</i> | Lamiaceae |
| 3. | Chives | <i>Allium schoenoprasum</i> | Amaryllidaceae |
| 4. | Parsley | <i>Petroselinum crispum</i> | Apiaceae |
| 5. | Rosemary | <i>Salvia rosmarinus</i> | Lamiaceae |

faster and more accurately. The rosemary group, on the other hand, had lower frontal alpha and beta power, indicating that they were more awake. They also reported feeling calmer and attentiveness after following the aromatherapy session, although they were just faster, not more accurate, at performing math tasks. Assuming the garden will be utilized in the evening, incorporate plants that discharge their aroma around evening time, like jasmine. Fragrant plants close by garden seating is a characteristic blend. Unwinding with an assortment of scented plants nearby to appreciate is a straightforward joy. Likewise, in the event that we plant fragrant crawling spices, like thyme, among pathways, strolling or wheeling on them will deliver their smell. One ought to consider the circumstance of nursery support exercises remembering their

impact on aromas in the air. For instance, the smell of yard cutter exhaust is unappealing to most, yet the scent of newly cut grass can send numerous into joy.

Touch: Every plant has a unique shape and texture. It can be soft, needle leaved, coniferous, deciduous and evergreen. These help the people to have a sense of touch especially for the visually impaired. Lawn plays a major role in this as people tend to lay down on the grass to rest and could enjoy the sense of touch, so the lawn should be hardy in nature which can withstand any damage caused by the children and others. People will touch and feel the different textured plants such as woolly plants, moss, tree barks, sticky substances in plants, succulent leaves, vegetable pods such as beans, peas. Many

plants have different textures. Roses (*Rosa sp.*), have elegant and soft petals as well as thorns and some of the plants have needle and fluffy textured. The plants should be of non-toxic and thorn less variety as it might hurt the disable people and children as they lack proper sense of judgement and if they are to be planted, then it should be out of reach.

Taste: Fruits, vegetables, herbs, edible ornamental plants, and flowers can be planted in sensory gardens by following the principle and elements of landscaping. Different parts of the tongue detect sweetness, bitterness, sourness, and savories. Various activities can be organized for the people such as a small vegetable garden, picnic sessions, and cooking workshops so that people can get together and be involved in these activities which would keep them active. Various fruiting trees and vegetables should be planted in the garden so that people can taste various kinds of fruits, berries, and vegetables.

3. IMPORTANCE OF SENSORY GARDEN

A sensory garden is a perfect place for a wide range of people to explore their senses in a safe and fun environment. Those with differing sensory disorders can all take different positives from the sensory garden as well as those without sensory conditions – the benefit being they are all in one place and are combinations and individual sensations that they wouldn't normally experience. Sensory gardens are especially gainful to kids with tangible handling issues, like chemical imbalance and different handicaps. Therefore, there has been a developing pattern to remember tangible nurseries for schools and youngsters' clinics. It has additionally been displayed to assist with tension, squirming and consideration problems like Attention-Deficit/Hyperactivity Disorder (ADHD). These gardens also teach nonverbal children how to engage in enjoyable activities and improve their nonverbal relational abilities.

Ulrich, [17], conducted an experiment in the University of Delaware, United States. Total of 46 peoples were involved in the research. One group was given 50 images of nature landscapes with lots of greenery. The other group looked at 50 images that were devoid of natural components. The individual's states, or feelings, were measured both before and after the slide exposures, with the help of ZIPERS test the findings imply that people who were feeling stressed considerably better after being exposed

to environmental scenes rather than urban surroundings. Compared to the effects of urban scenes, nature exposures had the most significant effect, which included sentiments of attachment, friendliness, playfulness, and pleasure. Nature sights consistently induce an increase in good emotion and reduction in stress.

Beyer et al., [18], conducted an experiment in United States and examined the association between environmental green space and mental health outcomes in a study region. Their study area that encircled the wide range of urban and rural areas and they concluded that the higher levels of local green space were linked to considerably lower levels of depression, anxiety, and stress symptoms. Their findings show that "greening" is a technique for improving population mental health in the United States.

Bratman et al., [19], conducted an experiment and put the volunteers through a 35-minute memory test before randomly assigning them to one of two groups: one that walked through an urban environment and the other that went through an arboretum—both walks were 2.8 miles and took 50–55 minutes. After that, participants repeated the digit span backward challenge. The "arboretum" group performed better than the "urban" group on the memory/directed attention task by a wide margin. Positive affect (as judged by the PANAS) was also higher in the arboretum-walk group, according to the researchers. In a second trial, significant gains in working memory were also seen in natural group.

Bratman et al., [20], showed that a 90-minute walk in a natural environment reduces both self-reported depression and brain activity in the prefrontal cortex, but a 90-minute walk in urban surroundings has no such effects on self-reported or neural activity in healthy volunteers. This study revealed the mechanism through which exposure to nature might benefit mental health, and it implies that in our rapidly urbanising world, accessible natural spaces inside urban environments could be a valuable resource for mental health.

In 2017, a field study was conducted at the Elementary School in Stasin (Lublin province) converting the current school environment into a sensory garden. The purpose of the study was to learn about the impact of sensory garden on young children [21]. Research showed that the therapeutic effect of gardens on children brings

benefits in the form of: development of imagination and creativity, increased curiosity of the world and motivation to learn, improved memory, confidence, reduced stress and improved relationships with other children. Another results of experiments carried out in South Korea showed that the number of children, who were willing to leave the institution decreased where the gardening program was introduced. In adolescents, contact with the garden increases self-discipline, responsibility and shapes caring behaviours, which is associated with improved concentration, reduced overcoming difficulties in school and imprudent behaviour [22].

Kopeva et al., [13] conducted a research experiment in the town of Artyom, Primorsky Krai, on the effect of landscaping on the visually impaired children. From this research trial he concluded that spending time in natural settings and caring for plants has been shown the positive effects in blind and visually impaired children thus resulted in developing different abilities such as controlling emotions, and maintaining self-confidence. The suggested project might have a favourable therapeutic healing impact on school pupils being in nature, allowing mobility-impaired children to experience the same senses as other normal children during their walks.

Wajchman et al., [23] carried out an experiment in Poland; in this study they examined 15 gardens and a sensory path. From this study they concluded that gardens have therapeutic function that is based on the effect of plants on both the physical and mental well-being and the treatment might be passive or strong. Forest zones, which provide recreational opportunities as well as impacting individual well-being.

A study was conducted at continuing care retirement community for the people suffering from dementia by Collins, [24]. The researcher invited participants to engage with the plants in the sensory garden going through all the senses with the plant in front of them and then switching plants until everyone had interacted with each plant at least once. The interventions lasted 30-45 minutes three times a week. This multiple treatment single subject study found that people with dementia had improvements in quality of life and decreased agitated behaviours when participating in a sensory garden intervention for eight weeks. Averaged for all 66 participants, agitated behaviours decreased most during the

approximated outdoor sensory garden and quality of life improved and maintained better during the indoor sensory garden [25,26].

Another study was conducted on the influence of sensory gardens on the behaviour of children with special educational needs. The exploration discoveries of Rohde and Kendle, 1994, Malone and Tranter, 2003 and Maller and Townsend, 2005/2006, have demonstrated that furnishing school grounds with sensory stimulation can energize mental turn of events, wellbeing enhancements, passionate development and social reconciliation, as well as expanding the learning inspiration of the student [27-29].

4. SCENARIO IN INDIA

The concept of sensory garden is new to India, so a lot of research and development is needed to further promote it and make it available to people. Some famous sensory gardens in India include 'the garden of five senses' in New Delhi and 'Ritwik Sensory Garden' in Bhubaneswar. Recently in Mumbai, the sensory garden for children with special needs was built by the Navi Mumbai Municipal Corporation (NMMC). The NMMC sensory garden is split into three zones: a part where children can play games and sports; an open lawn, water body and a hall; and a meditation centre with an artificial pond. It has visually appealing plants such as coleus, crotons and flowering vincas; plants with leaves of varying tastes like stevia (sweet), oxalis (sour), peppermint (minty), curry leaves (spicy), ajwain (bitter); plants with distinct smells such as patchouli, garlic-smelling ivy and tulsi; and plants with leaves of various textures such as gynura (soft, velvety), parijatak (rough) and touch-me-not plants.

A therapeutic park with a sensory garden for special children has been established at the government medical college hospital in Vellore. Xylophones, drums, tone bells, metallophone require visual attention, hand-eye co-ordination and visual tracking which help children in detection of sound. 'Sand pit, bare foot path way activities' are there to integrate touch sensation. Playing in sand, feeling soft toys, running hands through cold water; aids children in exploring the environment through touch. The children learn to co-ordinate, organise, discriminate and interpret touch appropriately. Another feature at the sensory park is 'Olfactory: Sense of smell'. This helps children to recognise different smells whether they are dangerous, strong, faint,

pleasurable or foul. The 'Gestatory' system allows the children to recognise the five base taste sensations. This is meant to keep them safe from ingesting things that are toxic, spoiled or inedible.

5. CONCLUSION

A sensory garden is an amazing way for young people to explore their senses and learn about their surroundings. It is also a healthy learning environment that gets children outside. Children with disabilities are benefitted greatly from sensory gardens because they provide a therapeutic and safe environment for them to explore their senses. When designing a sensory garden, care should be taken in selecting the elements that will go into it, as well as the layout in terms of the height and reach of the plants and walkways, so that it is accessible to the children and/or adults for whom it is intended. In the recent years, many people have started to become visitors to sensory gardens due to their health problems or desire to be in tune with the nature. Considering the historical background of sensory gardens, design guidelines and criteria are yet to be defined. Therefore, every sensory garden design process relies on the designer's approach and experiences. However, recent researches and observations show that the essential point of designing a sensory garden is to offer sensory experiences to the user. Accessibility and safety are also the two principles that play a significant part in sensory garden design. Creating opportunities for sensory experience is more important than the design being an aesthetic entity. Garden with an assortment of sensory components is especially successful in relationship with medical care offices like nursing homes and emergency clinics, as well as school, parks, professional flowerbeds, and different establishments.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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