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The Perceived Effects Of A Sensory Garden For Individuals On The Autism Spectrum

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Abstract

The Autism Spectrum Disorder, abbreviated ASD, is a neurodevelopmental condition that manifests in difficulties with communication, social interaction and cognitive development. People on the spectrum typically struggle with over and understimulation. Up to 90% of people on the spectrum have atypical sensory experiences and this is why a semi-controlled, sensory stimulating garden was created. This space also served as a bridge to reconnect this population with nature. Humans have biophilia, an innate desire to connect with nature, and a lack of these interactions can have many mental and physical downfalls. This research addressed the question "What are the perceived effects of a sensory garden on individual well-being for participants on the autism spectrum?" A pollinator garden was created at the Autism Society of North Carolina in Asheville, North Carolina in the Summer of 2021. The hypothesis was that time spent in the garden would cultivate positive reactions in autistic participants. The data collection methods included pre and post surveys of caretakers from the Autism Society of North Carolina. The results indicated an increase in participants' positive reactions to nature in the garden. Previous studies have concluded that exposure to nature provides benefits to the well-being of school children, individuals in nursing homes and rehabilitation centers. However there had not been much data documenting these benefits to individuals on the autism spectrum. This research lays the foundation for future research on the correlation between the well-being of individuals on the autism spectrum and time spent in a garden.

1. Introduction

The Autism Spectrum Disorder (ASD) is a term that encompasses many subtypes of autism, including Asperger's syndrome, childhood disintegrative disorder and autistic disorder. Autism is very common, with 1 in every 68 people falling somewhere on the spectrum. It is typical for people on the spectrum to experience cognitive difficulties involving socializing, communicating, and focusing[1,2]. Individuals with autism are typically faced with social deficits, such as difficulty maintaining eye contact, pursuing and maintaining relationships and finding common interests amongst peers. These difficulties lead to fewer friendships and significantly reduced engagement in activities. Individuals with fewer verbal skills are less likely to maintain relationships. It is common for individuals on the autism spectrum to adhere to a very strict routine and disruption of this can often be triggering[2,3,]. Although there are many commonalities amongst the autistic community, no two people on the spectrum are the same nor should they be treated as such. This study was conducted with an individualistic, neurodiverse approach in which autistic behaviors were not limited or restricted. This vast array of expression of symptoms is correlated with comorbidity, or the presence of multiple medical conditions. Comorbidity is highly prevalent within this population, and is an explanation for the variety in symptoms and difficulties regarding care[4,5].

A recently added diagnostic criteria for autism within the DSM-5 is the frequency of over and under stimulation[1]. Individuals with ASD often experience overstimulation in schools, in public and even at home. In fact, recent studies have found that up to 90% of people on the spectrum have divergent sensory experiences[2]. The severity of these

symptoms vary, but nature therapy has been proven to assist with similar symptoms in other populations such as in nursing homes, rehabilitation centers and elementary schools[6,7,8]. This concept has only recently been applied to populations of children with special needs[6]. This sensory garden was created as a means to provide an environment that is more catered to the sensory needs of people on the spectrum. A garden provides a space for this as it is a quiet, calming environment with extra sensory tools (hand tools, wind chimes and sensory stimulating plants). However, there is limited research on adults with autism, especially with relation to the sensory aspects of gardening.

Gardening routines have been proven to improve self esteem and sense of belonging[6,9]. This is particularly important for individuals on the autism spectrum who frequently feel different from their peers due to their special interests. The development of hyper-fixated, specialized interests, or monotropism, is common for this population. The development of monotypic interests often takes time and causes individuals to lose focus on activities outside of their areas of preference[10,11,12].

The social benefits of interacting within a sensory, community garden is another factor that may improve participatory mental health. This reconnection with people and nature is necessary for providing a smooth transition back into the highly stimulating world that these participants have been almost entirely sheltered from for a year and a half. This garden will provide a space where language isn't necessary to form relationships, be engaged or have mental health benefits. Sensory stimulating tools and visual cues help with this. These cues are created in order to increase learning throughout a visual modality and usually include photos of desired activities, for example someone brushing their teeth or watering a garden[13].

Several prior studies within this population indicated that difficulty with social interaction correlated with hindrance to the processing of auditory and visual stimuli. This suggests the important role sensory perception plays in many aspects of an autistic individual's life[11]. Sensory overload is associated with social interaction complications on a behavioral, physiological and neural level. It is known to increase cortisol and physiological stress while decreasing tactile and verbal skills[12]. The presence of this sensory over-reactivity is correlated with both anxiety and autism. A 2020 study found that nearly 40% of people on the spectrum experience heightened levels of anxiety[4].

This study aimed to provide a social outlet within the adult neurodivergent community in Asheville, North Carolina, and a means to meet the human need to connect with nature. Humans have biophilia, an inherent love for and desire to be immersed in nature[14,15]. There is a rapid deterioration of green spaces occurring globally due to urbanization which limits the opportunities for nature exposure. The minimization of time spent in nature has physical and mental health consequences. Outdoor recreation has been proven to enhance cognition and social interaction while developing a greater sense of belonging within individuals. Nature experiences can arouse emotions of interest and affinity that produce environment-protecting actions[15]. Although these topics have been studied extensively in neurotypical populations, we aimed to broaden the scope of this research. It could be particularly important for people on the spectrum who can struggle with feeling isolated within their communities[5,10].

Within the Asheville, North Carolina autistic community there are limited opportunities for recreation and socialization. The COVID-19 pandemic only hindered this and isolated this community further. This was the first social program offered at the Autism Society of North Carolina (ASNC) following the quarantine caused by the pandemic. Prior to this research, ASNC had no usable outdoor space or activities. This study aimed to change this and provide a program geared towards improving well-being by creating a space for collaboration, socialization, learning and gardening. This study aimed to address the perceived effects on a sensory garden for individuals on the autism spectrum.

2. Methods

This study was conducted from June to September of 2021 in Asheville, North Carolina. It was conducted in an intentionally constructed sensory garden at a local organization to support individuals on the autism spectrum. The participating partner organization was the Autism Society of North Carolina. This organization is a statewide non-profit that provides advocacy, professional support and social activities for people on the spectrum[16]. In order to participate in this study, survey respondents needed to be currently employed by ASNC as a caretaker for a participant over the age of 18. Within this paper, caretakers will be referred to as survey respondents while the individuals they work with will be referred to as garden participants. I investigated the following research question: What are the perceived effects of a sensory garden on wellbeing for individuals on the autism spectrum? This was done using both qualitative and quantitative data collection methods within a case study[6].

At the beginning of the research period, individuals were introduced to the garden space and allowed time to familiarize themselves with a new environment without having to participate in organized activities[6]. The Autism

Society of North Carolina helped in assuring the surveys were ethically and anonymously collected, and the research protocols were approved by the Institutional Review Board (IRB) of the University of North Carolina Asheville before the survey was conducted. The individuals that helped design the survey had personal experience with the participants, and were experts in the field of autism care. A text message was distributed within the ASNC's messaging system in order to recruit survey respondents and garden participants. Survey respondents that replied with interest were assigned a respondent number by the partner organization. Researchers were not allowed access to the document that contained the assignments in order to reduce bias. These numbers were entered in both the digital surveys for anonymization.

Study respondents were pre-surveyed online to gauge a baseline of gardening experience and attitude, and provide descriptive data on behalf of their participants before gardening activities began. The surveys served to provide demographic information such as age range and level of assistance needed for garden participants. They also inquired how long caretakers have been providing services to their participants and how long their participant has been receiving services at ASNC. The answer choices of all multiple choice questions were randomized to limit bias in selected answers. Assistance needed was evaluated using a 5-point Likert scale by asking the question "How much assistance does your participant need on a daily basis?" Survey respondents could select an answer ranging from "1" which represented the participants needing minimal assistance with daily activities, while "5" represented assistance with nearly all daily tasks[17].

Paired comparison (PC) questions provided a gauge of the survey respondents' perception of their garden participant's attitude toward the garden project. Pre and post surveys included paired questions in order to note any differences that occurred throughout the study. All surveys were conducted virtually on Google Forms. Multiple choice and Likert scale questions were analyzed and summarized using bar graphs and pie charts, while open ended questions were textually analyzed and coded. Open ended questions were grouped by experience type. Some of these included responses to the environment, educational benefits and a sense of relaxation.[6] Age of participants was banded into the following age groups: 18-30, 31-49, and 50+.[8] Final surveys were compared to the baseline pre-survey. 12 pre-surveys and 11 post-surveys were conducted.

Qualitative methods were also used to analyze the responses to open ended questions provided in the post-survey. Survey respondents were asked to describe any incidents where being in the garden influenced their garden participant's mood as well as if they believed the program caused any changes in their daily lives. There was also an unprompted question in which the individuals were asked to freely respond on the impacts of the program. The answers to these questions were banded into experience type and textually analyzed[6].

Two 4 x 6 ft garden beds were built in May of 2021. A trail served as an entry way and signifier that the participants were entering the garden space. All poison ivy and invasive species were removed. Objects around the garden such as benches and picnic tables were painted with the participants in order to make the environment more collaborative and bright. Garden participants were viewed as co-creators and encouraged to be involved throughout all stages of garden creation. This was done in order to increase a sense of purpose in these individuals as well as a greater connection to the space in order to make it more sustainable and long lasting[18]. Plants were chosen intentionally in order to stimulate as many senses as possible, with an emphasis on textured, bright and scented plants[6]. Some of these included sage, lavender and passionflower. Participants were encouraged to touch, smell and engage with the plants. Invasive plant species were removed and pollinator species were planted to encourage engagement with nature and biodiversity. A majority of the site was shaded, while the area with the raised beds was in full sun. Shading was an important factor in assuring the space was comfortable for the participants.[6] The beds were located on the south side of the Autism Society of North Carolina's office building on a small, grassy hill that was amended with mulch. The entry to the garden was located on the front and side of the building, and included a flat area with picnic tables. The pollinator garden was planted at the entrance of the garden.

This project was conducted with a neurodiverse approach, with the intention to not change or minimize autistic behaviors, but instead to provide a safe space for individuals to fully express themselves in a semi-controlled, sensory stimulating environment[4,5]. A decompression zone was created away from the main section of the garden that contained a bench, wind spinners and chimes. The bench was situated with plants around it to allow for privacy and the ability for participants to ground themselves in the case of a trigger or overstimulation.[6] All sensory aspects of the garden were chosen with the intention of regulating the sensory systems of the participants[19].

The research included an initial planting day in June of 2021, where volunteers, participants and survey respondents participated in planting, watering, and weeding. A fall planting day occurred in August of 2021. In between plantings, participants engaged in garden maintenance and weekly garden instruction. Caretakers were asked to pay close attention to how their assigned participant interacted with the natural environment and encourage engagement within the space[6,12,18].

3. Results

Constructing an adapted sensory garden provided the opportunity to address the research question "What are the perceived effects of a sensory garden on individual wellbeing?" This was done by conducting pre and post surveys on respondents throughout their time in the sensory garden. The respondents in the study consisted of caretakers employed by the Autism Society of North Carolina and served to provide data on behalf of their autistic garden participants. The population for the pre-survey was N=12 while the post-survey contained N=11 participants. Within this population, it was found that garden immersion reduced frustration levels and was perceived as an overall positive influence on participant well-being. Quantitative data results are shown in pie charts while qualitative data are demonstrated through quotes[6].

3.1 Quantitative Data

Demographic information and the level of assistance needed for each participant was also reported in the pre-surveys. The average level of care needed for participants was "3" on a Likert scale, meaning they required help with most but not all daily activities. The mean amount of time these participants had been with ASNC was 5 years, while the mode was 20 years. The mean for working with their specific caretaker within the organization was 2 years, with 2 participants being with their caretaker for under a year. Over 50% of the participants were between the ages 31 and 49, while 3 participants were over 50, and 2 were between the ages of 18-30.

Figure 1 presents the perception of caretakers toward the program before it began. There was no reported anxiety or hesitancy amongst caretakers, and 54.5% of caretakers were excited about the program.

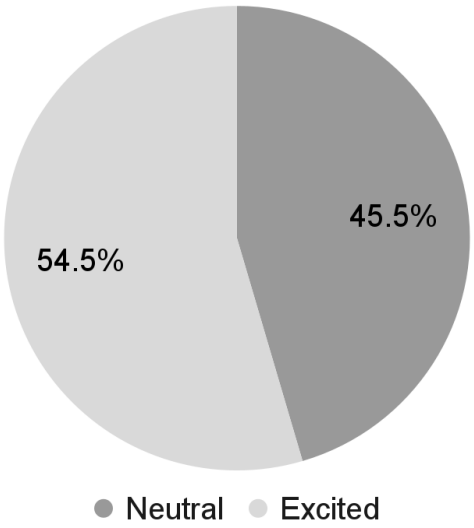

Figure 1. Caretakers' responses to the question "What is your attitude toward the garden program?" in the pre-survey.

Prior to the start of the project, caretakers were asked to predict their participant's attitudes toward the garden project. Of the caretakers surveyed, 54.5% reported that their participants had demonstrated excitement, while 18.2% of participants had indicated hesitancy, and 27.3% felt neutral. It is notable that both the caretakers and participant groups started with an excitement level of 54.5%.

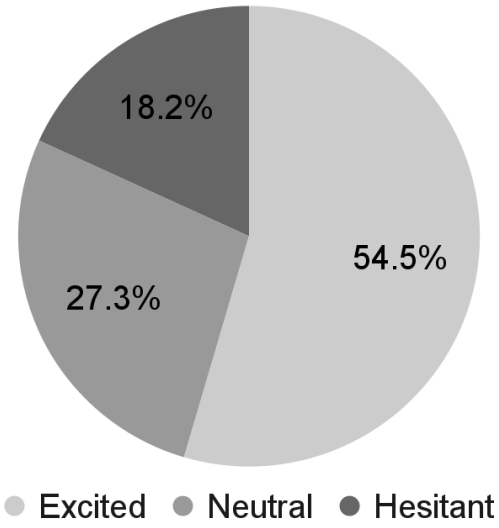

Figure 2. Caretakers' responses to the question “What is the perceived attitude of your participant toward the garden program?” in the pre-survey.

Figure 3 shows the caretakers’ answers to whether they were able to see change in the emotions in their participants due to the garden program. Regarding the emotions of their participants, 36.4% of caretakers reported an increase in excitement, while 36.4% of caretakers said their participants remained neutral in their feelings about the garden. Notably, 27.3% of caretakers reported an “other” feeling in their participant. This “other” category included sentiments of relaxation from being in the garden, and sadness due to paint or dirt getting on clothing. Caretakers were also asked if any sentiments decreased in their participants due to the garden, and 45.5% of caretakers reported that their participants had experienced a decrease in frustration.

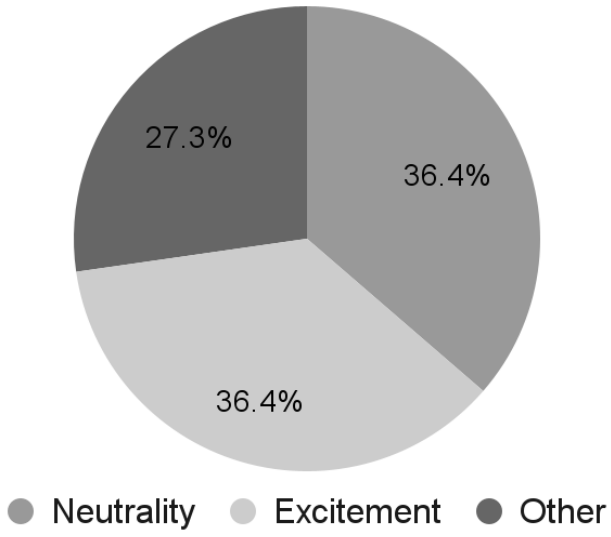

Figure 3. Caretakers’ responses to the question “Have you noticed increases in any of these feelings in your participant towards the garden program?” in the post-survey.

Figure 4 presents the responses of caretakers who were surveyed on their overall perception of the impacts of the garden program on their participants. Positive change was observed by 54.5% of caretakers.

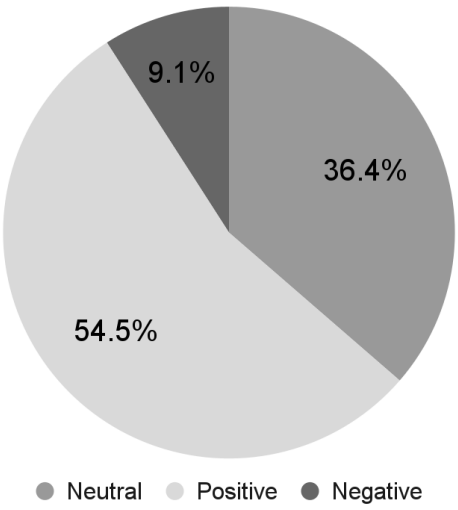

Figure 4. Caretakers' responses to the question "What effects on the wellbeing of your participant did you see in the garden this summer?" within the post-survey.

3.2 Qualitative Data

Qualitative data was documented in this study using open ended questions. These were textually analyzed and grouped by experience type. Emergent themes included the development of botanical interests outside of the program, being relaxed while in the garden, and the expression of sadness due to clothes or shoes becoming dirty. The sense of relaxation while being in the garden aligns with the lessened frustration results from the paired questions within the quantitative data. It should be noted that many participants had not left their homes during the quarantine. One caretaker said "My guys haven't gotten in this van to leave our group home since March of 2020. It was really difficult for us to provide stimulating activities for them this past year. This changes their routine." Many participants also gravitated towards alternative activities provided instead of gardening.

The negative sentiment with regards to being dirty was seen across multiple participants. One caretaker said her participant "got paint on their pants and [we] had to leave because she was very upset." This incident ceased this individual's participation in the program. Another participant thought "paint on their shoe was upsetting."

An emergent theme was the garden being viewed as a calming place for participants. It was viewed as a place to "calm their loud mind" and "become at ease." Another caretaker observed that "prior to coming to the garden we were having a bad day" but upon leaving their participant "became happy and at ease" This was seen within another participant a s"coming to the garden made him happier."

Another finding within this study was the development of botanical interests outside of the program. One participant "started a community garden at their group home" and their caretaker began to see that their "eyes light up about anything with plants or flowers now." This participant came to the garden frequently to water when organized activities weren't occurring and would ask for plants to take home with them.

Within this study 6 out of 11 participants expressed lessened frustration in response to the garden. This is seen within both quantitative and qualitative data collection methods. Some emergent themes included a sense of calmness and happiness within the garden, a sense of frustration or sadness due to clothing getting dirty and the development of botanical interests outside of the project. Most of the caretakers reported an overall positive impact of the program on their participants' wellbeing.

3. Discussion and Conclusion

This study addressed the implications of intentional, adapted garden design for autistic communities as a means to reconnect with nature. Within a small sample size, this study indicated that green spaces have positive influences on the well-being of individuals on the autism spectrum. One key result of my research was participants viewing the garden as a place to relax. Low participation could be attributed to many factors including the COVID-19 Delta variant, having a small community partner and being the first organized activity offered at this center after quarantine.

This study was conducted during the COVID-19 pandemic. An interview conducted with one survey respondent revealed that some of the garden participants had not left their group home at all from March 2020 to March 2021. This may have impacted participation and attitudes towards this project as it was likely difficult for participants to adapt to a new routine and environment after being away from the center for so long, but it also could have brought a new sense of habit and purpose to their daily lives. The importance of being accustomed to spaces and routines in establishing a sense of purpose has been proven throughout prior studies[7,8,9,12]. It may also have impacted the attitude of the survey respondents due to the increased stress caused by a lack of organized activities available during the pandemic[20]. Other factors that may have contributed to low participation include that the total number of participants at ASNC over 18 and currently receiving services was only 32. Further studies should be conducted with a larger community partner.

Many obstacles were encountered during this study. Institutional Review Board (IRB) approval took much longer than anticipated and research was postponed by nearly two months. This reduced amount of time spent in the garden could have caused less positive reactions to the garden atmosphere. It is possible that if garden participants had more time in the outdoor space that they would have developed a greater sense of belonging and connection with their environment[6,14]. Going forward, approval should be applied for, if possible, well in advance before research begins to allow for revision of methods and planning. Garden participants were unable to see the pollinator garden from planting day to bloom, but methods were revised by continuing the project into the fall. The original proposal for research included daily surveys from respondents and interviews of the garden participants. This was simplified to pre and post surveys of the respondents. Further studies should be conducted with the direct interviewing of participants with autism, with permission and trust established. Survey respondents likely had an influence over their garden participant's attitude and this factor could be reduced. This influence can be seen within this study as both groups started with a 55% level of excitement towards the project.

Many participants came to the garden and simply wanted to observe. A further developed garden would allow for more seclusion within nature, a greater sound barrier from nearby roads, and more access to seeing phenological or seasonal changes. After a garden is developed, phenological trends could be compared beside attitude shifts within the space. As plants were young, garden participants were not fully in privacy when at the decompression bench, which was created in order to decrease stimulation[6]. Recent studies have shown that noise plays a particularly important role in multisensory integration and sensory overload[11]. Developing a garden that is further away from a main road or allowing years for the plants to form a sound barrier is important as traffic noises can often be triggering and overstimulating for individuals on the spectrum[1].

3.1 Future Directions

More time and replication is necessary for this subject. More time would not only allow for the garden to further develop, but would leave adequate time for developing close, trusted relationships with the partner organization and participants[21]. This would also likely increase participation. People on the autism spectrum typically have specialized, hyper-fixated interests, or monotropism. These montropic interests take time to develop[8]. This is likely the reason many participants gravitated towards painting as it was more familiar to them than gardening. The shortened time frame could also explain why only 1 out of 12 participants was able to add gardening into their specialized interests[10]. Narrowed and specialized interests are partially responsible for the general lack of participation in extracurricular activities within this population. Adding gardening into one's special interests would be beneficial as participation in a variety of activities is crucial for the growth and development of all people. The involvement in an array of tasks helps build relationships, refine skills, create new neural pathways and foster a greater sense of purpose within one's life[12]. This being said, introducing gardening as a special interest has benefits outside of the biophilic aspect. All of these factors likely contributed to the low participation within this study.

Another way to increase garden participation is to create interactive visual cues. These would serve as a means to encourage engagement when organized activities are not occurring in the garden[13]. These could be as simple as a label

in front of a mint species that says “chew in my leaves, I taste like gum” or a photo of a weed within the garden bed that says “Please pull me up. I don’t belong here.” Laminated, flip books with photos of gardening activities would serve a similar purpose. These are not only geared to make the garden accessible and engaging at all times, but also for those who are introverted, anxious or have difficulties with sensory processing. There is significant evidence linking autism with heightened levels of anxiety[4]. Eliminating the element of spoken direction or need to switch from one sensory processing modality to the other could relieve stress and improve attention[11]. It would also be beneficial to have a means to track how often participants come to the garden in order to correlate the amount of times visited with the overall impact of the program. The high mean amount of time working with ASNC is also a contributing factor. It could have been increasingly confusing to return to a space they are used to and seeing it change or changing it themselves[4,6,18].

A factor that would be important to consider going forward is the texture of items, particularly gloves, used in the garden. Many participants wore their gloves backwards, and on further inspection, this was likely due to the rougher texture on the palm side of the gloves. Allowing individuals to choose their own gloves would help address the increased sensitivity to texture frequently experienced by people on the spectrum. This sensitivity can manifest as pain even in light touches and can cause overstimulation[1,4] Another suggestion would be to prime more diligently regarding the possibility of getting dirty. Out of the participants, 18.2% experienced some level of discomfort regarding their clothing becoming dirty, one of which no longer continued the program because of paint on their shoe. Priming is a strategy that serves as a preview for future activities as a means to reduce anxiety. It is also a means to redirect attention and reduce distraction from extraneous sensory stimuli[12]. Preparing for undesirable circumstances within the garden is crucial, as autism frequently co-occurs with anxiety on a neurobiological level. The anxiousness and hesitancy to be involved in new activities that occurred within this study align with previous evaluations of autism[4,10,18].

Ensuring that there are backup plans in place for all activities is important for consistent participation within this population. This accommodates for adhering to strict routines[10]. The disturbance of routine could be minimized by offering alternate activities that function when there are unfavorable weather conditions. A covered outdoor area would also be beneficial for this. Another disrupting factor that was introduced during this study was the Delta variant of COVID-19. This likely reduced participation.

With regards to continuing this research and creating more gardens, many factors need to be considered. The optimal space provides areas that contain shaded areas as well as those with full sun. While full sun is important for gardening, it is important that individuals are able to escape the sun in order to avoid overstimulation caused by heat[6]. When a garden is first created, plants that bloom early in the season should be incorporated to increase excitement and engagement within the garden. Species should be intentionally chosen with priority given to those that are more sensory stimulating[6]. However, it is ideal for a garden to be established while conducting this research in order for individuals to be able to be fully immersed in nature. Constructing raised beds that are wheelchair accessible would also be beneficial. As a majority of the participation within this project was directed towards gardening crafts and painting, offering more outdoor classes could increase participation going forward.

This study opens the door for future research to be conducted on this topic, as well as within other communities. The results of this study supported the hypothesis that sensory gardens have a positive mental health impact for individuals on the autism spectrum. This aligns with previous studies on this topic and those within other vulnerable populations. Studying this population with relation to the positive impact of community gardens provides the opportunity for unique therapy plans, satisfied biophilia and inclusive outdoor recreation[14,15]. An environment with semi-controlled sensory stimulation would likely be beneficial to other populations, including other vulnerable groups and even neurotypical individuals. The current environment we live in as humans contains almost constant stimulation and managing this is crucial for mental health across many, if not all, communities[6,7,8]. These methods could become more applied within different therapeutic contexts and as a tool for developing tactile skills, reducing overstimulation and creating a greater sense of purpose. Projects like this should continue with intentional, inclusive work. Individuals with developmental disabilities should have more access to sustainable gardening.

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