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STAKEHOLDERS' PERSPECTIVE OF NATURE EXPO THERAPY ON THE ENHANCEMENT OF SENSORY INTEGRATION ABILITY OF CHILDREN WITH AUTISTIC SPECTRUM DISORDERS[i]

Melem Linda Fangwi[1ii],
Tchombe Therese[2]
Dr.,
Department of Educational Psychology,
Faculty of Education,
University of Buea,
Cameroon

Abstract:
Absence of exposure to nature can lead to deficiencies in several aspects of life. For many children with autistic spectrum disorders, these limitations manifest in areas such as language and collaborative skills, imaginative abilities, attention span, and a sense of wonder, all of which are crucial for lifelong learning, health, and overall lifestyle. This study aimed to investigate the impact of nature exposure therapy on enhancing sensory integrative abilities in pupils with autistic spectrum disorders in the Buea municipality. Employing a qualitative approach, the study utilized interview guides and observational checklists for data collection. Purposive sampling was employed to select 15 participants, including 5 pupils, 5 teachers, 3 parents, and 2 caregivers of children with ASD. The findings indicated that learners with autism benefited from exposure to various therapeutic natural environments, including horticultural, pet, and aquatic zones, all of which positively influenced their sensory integration abilities. Moreover, it was observed that most children with autism, whether exhibiting hyper- or hypo-reactivity, showed moderate reactivity to nature after undergoing nature expo therapy. However, several barriers to this intervention were identified, such as fear of the unknown, poverty, natural disasters, insecurity, and overprotective parenting. Despite these challenges, the nature expo therapy led to significant improvements in various aspects of children with autistic spectrum disorders, including attention, motor skills, cognitive function, anxiety reduction, agility, and coordination. In conclusion, the study highlighted the diverse positive impacts of nature expo therapy on learners with autistic spectrum disorders, particularly in enhancing sensory integration abilities. It was recommended that teachers,

[i] PERSPECTIVE DES PARTIES PRENANTES CONCERNANT L'EFFET DE LA THÉRAPIE DE L'EXPO NATURE SUR L'AMÉLIORATION DE LA CAPACITÉ D'INTÉGRATION SENSORIELLE DES ENFANTS ATTEINTS DE TROUBLES DU SPECTRE AUTISTIQUE

[ii] Correspondence: email mfangwi@gmail.com

school administrators, parents, and other stakeholders incorporate outdoor activities into the lives of children with autism to facilitate their engagement with nature.

Keywords: autistic spectrum disorders, enhancement, integration, nature-expo therapy, sensory, perspective, stakeholders

Résumé :
Le manque de temps passé dans la nature entraîne des déficiences dans plusieurs domaines de la vie. Pour la plupart des enfants atteints de troubles du spectre autistique, ces insuffisances sont observées dans des domaines tels que le langage et les compétences de collaboration, les capacités imaginatives, l'attention et le sens de l'émerveillement, qui sont vitaux pour l'apprentissage tout au long de la vie, la santé et le mode de vie. Cette étude a cherché à examiner l'effet de la thérapie d'exposition à la nature sur l'amélioration des capacités d'intégration sensorielle chez les élèves atteints de troubles du spectre autistique dans la municipalité de Buéa. L'étude a adopté une approche qualitative et a utilisé des guides d'entretien et des listes de contrôle d'observation pour la collecte des données. La technique d'échantillonnage par choix raisonné a été utilisée pour sélectionner 15 participants (5 élèves, 5 enseignants, 3 parents et 2 personnes s'occupant d'enfants atteints de TSA) pour l'étude. Les résultats ont révélé que les apprenants autistes étaient exposés aux environnements naturels suivants, identifiés comme zones thérapeutiques : Zone thérapeutique horticole, Zone thérapeutique animalière et Zone thérapeutique aquatique. Ces trois zones ont eu un impact positif sur la capacité d'intégration sensorielle des apprenants autistes. Il a également été constaté que la plupart des enfants autistes (hyper et hypo) présentaient une réactivité modérée à l'environnement naturel après l'exposition à la nature, plutôt qu'une hyper ou hypo réactivité avant l'utilisation de la thérapie d'exposition à la nature. Cependant, il existe des obstacles majeurs à cet exercice tels que la peur de l'inconnu, la pauvreté, les catastrophes naturelles, l'insécurité, la nature surprotectrice des parents, et bien d'autres encore. On s'est également rendu compte que l'expo nature a permis d'améliorer considérablement les aspects suivants chez les enfants autistes : l'attention, la motricité, les fonctions cognitives, la réduction de l'anxiété, l'agilité et la coordination. Il a été conclu que la thérapie de l'expo nature a un impact positif sur les apprenants atteints de troubles du spectre autistique de diverses manières, y compris sur la capacité d'intégration sensorielle. Il a été recommandé que les enseignants, les administrateurs scolaires, les parents et les autres parties prenantes intègrent des moments en plein air dans la vie des enfants autistes et leur permettent de vivre dans la nature.

Mots clés : troubles du spectre autistique, amélioration, intégration, thérapie nature-expo, sensorielle, perspective, parties prenantes

1. Introduction

Autism Spectrum Disorder (ASD) is a highly prevalent disorder with significant psychosocial burdens. It encompasses a heterogeneous group of neurodevelopmental disorders characterized by common behavioral traits that impact social communication, including restrictive and repetitive stereotypical behavioral patterns and interests. This term encompasses various conditions, such as idiopathic autism, Asperger syndrome, pervasive developmental disorder, childhood disintegrative disorder, and certain genetic disorders like Rett syndrome. According to the World Health Organization (WHO) (2022), approximately 1 in every 100 children worldwide displays symptoms of autism.

Traditionally, ASD has been associated with impairments in speech, social interaction, and the presence of repetitive or restricted behaviors. However, it is also linked to numerous psychological and physiological comorbidities. Onset typically occurs in childhood, with diagnosis often made by age 3. Signs of ASD before age 3 may include a lack of response to one's name and discomfort with maintaining eye contact, indicative of sensory disintegration. Sensory integration refers to the ability to perceive and understand sensory information from the environment and the body, whereas sensory disintegration describes deficits in interpreting sensory input, often leading to difficulties in academic or neuro-motor learning, particularly prevalent in individuals with autism spectrum disorders. Many children with ASD are deprived of nature experiences due to parental concerns about social stigma.

Research indicates that a deficit in nature exposure can have detrimental effects on physical and mental well-being, potentially leading to serious illnesses and disorders. Life stressors seem to have less psychological impact on children raised in high-nature environments compared to those in low-nature settings, as highlighted by Richard Louv in "Last Child in the Woods" Additionally, Professor Irva Hertz-Picciotta's 2009 study demonstrated a seven-fold increase in autism rates, suggesting that environmental factors may contribute to this rise.

In light of this evidence, this paper aims to demonstrate how exposure to natural environments can promote the development of sensory integration abilities in children with Autism Spectrum Disorders.

2. Background

Green, Chandler, Charman, Simonoff, Baird (2019) hold that sensory integration is an essential part of every human development as it helps define everything from the way you see and hear in the world, to the way that your body exists in space and more. Sensory integration is the process by which the brain recognizes and responds to information our senses provide. It's the way humans integrate things that they see, taste, smell, touch, or hear as well as the way that the human body exists in space. It refers to the processing, integration, and organisation of sensory information from the body and the environment, experience, interpretation, and reaction to (or ignoring) information

coming from our senses. Sensory integration informs our daily activities, such as getting dressed, eating, moving around, socialising, learning, and working. Sensory information or signals are received from the eight human senses, which include: Sight (vision), Hearing (auditory system), Touch (tactile system), Taste (gustatory system), Smell (olfactory system), Proprioception (senses of body awareness and position), Vestibular (awareness of movement, balance, and coordination), Interoception (our internal sensory system that tells us what is happening inside our body, for example, hunger, needing the toilet, fatigue, emotions, etc).

Parham and Mailloux (2015) believe that sensory integration (SI) is a theory propagated by Jean Ayres in the 1960s, that sensory integration is a relationship between human behaviour and brain functioning. The normal process of SI begins before birth and continues throughout life with most of it occurring before the early teenage years. SI becomes more refined and effective with the aging process as it determines how well motor and speech skills and emotional stability develop. While the process of SI occurs automatically and without effort for most, but for others, the process is inefficient. Extensive effort and attention are required in these individuals for SI to occur, without a guarantee of it being accomplished. When this happens, goals are not easily completed resulting in sensory integration disorders (SID). Some individuals may experience the sensory inputs as overwhelming and upsetting, leading to sensory overload. Individuals may be over-sensitive to sensory input, under-sensitive, or both. It is common for humans to occasionally feel under-sensitive or oversensitive to sensory inputs such as loud music, and bright light, feel uncoordinated, or find it hard to focus when tired. However, these feelings are temporary and would not normally affect their day-to-day functioning in the long- term. Sensory integration difficulties are long-term and have a big impact on everyday life and learning.

Pastor-Cerezuela, Fernández-Andrés, Sanz-Cervera, & Marín-Suelves (2020), hold that the brain forms a combined picture of the information received from the senses in order for the body to make sense of its surroundings and react appropriately to them. When the SI process is disordered a variety of problems in learning, development, and behaviour becomes obvious. Persons with sensory integration dysfunction may be unable to respond to certain sensory information by planning and organising what needs to be done in an appropriate manner. This often causes a survival technique that originates from the primitive brain which are the 3Fs; frights, flights, and fight or withdrawal response. These responses are often extreme and inappropriate for the particular situation. SI can occur in three dimensions: the brain's inability to receive messages due to disconnection in the neuron cells, inconsistency in the reception of sensory messages, and poor connection between sensory messages. When the brain poorly processes sensory messages, it results in inefficient motor, language, or emotional output.

It is worth noting that sensory integration difficulties are different from sensory impairments such as hearing loss, although sometimes the two result in similar behaviours. Schoen (2019) citing the Sensory Integration International (SII) Corporation

(2002) concerned that the following are indicators of sensory integrative disorders: oversensitivity to touch, movement, sights or sound, under reactivity to touch, movement, sight, or sounds, the tendency to be easily distracted, social and or emotional problems, activity level that is unusually high or unusually low, physical clumsiness or apparent carelessness, impulsive, lacking in self-control, difficulty in making transitions from one situation to another, inability to unwind or calm self, poor self-concept, delay in speech, language, or motor skills, delays in academic achievement. Sensory integrative problems according to Baranek, Little, Ausderau, and Sabatos (2014) are found in up to 70% of children across ages, socioeconomic groups, and intellectual levels however, children born prematurely, with autism and other developmental disorders, Learning disabilities, attention deficit hyperactivity disorder (ADHD). It has been proven that autism and ADHD are the biggest contributing conditions to sensory disintegrative disorder.

According to Kawakami & Otsuka (2021), every individual has four patterns of sensory processing which can form the basis for the classification of sensory integration difficulties:

- **Low registration:** A child identified to have low registration does not recognize or process all of the incoming sensory information, and does not compensate by trying to gain more sensory input to meet their needs. They may seem uninterested, and inattentive to their surroundings.
- **Sensation seeking:** A child classified as sensation seeking does not recognize or process all of the incoming sensory information, but contrary to low registration, they actively try to gain this sensory input to meet their needs. They may be hyperactive, touch others often, or engage in unsafe activities like jumping from heights.
- **Sensory sensitive:** A child classified as sensory sensitive feels overwhelmed by sensory information, but they do not actively try to avoid the overstimulation, instead they may just display frustration. They may be easily distracted, and irritable, cautious, and uncomfortable in loud or bright environments.
- **Sensation avoiding:** A child that is sensation avoiding feels overwhelmed by sensory information and will actively avoid the stimulation. They may run away from loud, busy environments, cover their ears when overstimulated by noise, or wear gloves to avoid touching certain materials such as paint.

3. Understanding sensory integration dysfunction in children with ASD

Sensory integrative dysfunction is the inability for sensory inputs to be integrated or organised appropriately in the brain thereby producing varying degrees of problems in development, information processing, and behaviour. Children with autism as well as those with other developmental disabilities may have dysfunctional sensory systems where one or more of their senses either over or under-react to stimulation this is referred to as sensory integration disorders in ASD. This could be the underlying reason for the

exhibition of unjustifiable age-inappropriate behaviours such as rocking, spinning, and hand flapping. The receptors for these senses are well located in the peripheral nervous system but not functioning as they should.

The Diagnostic and Statistical Manual of Mental Disorders, 5th edition certifies these assertions by stating that the hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment for most children with ASD is indicative of sensory disintegration. Studies such as Kawakami & Otsuka (2021), Ide, Yaguchi, Sano, Fukatsu, Wada, (2019), Woynaroski, Kwakye, Foss-Feig, Stevenson, Stone, Wallace, (2013); conducted on sensory dysfunctions in people with ASD, reported that as many as 95% of children with ASD have some degree of sensory dysfunction. Most of the studies conducted used the total score of the short sensory profile. Also, experimental studies like Bebko, Schroeder, Weiss (2014); Taylor, Isaac, Milne (2010), and Williams, Massaro, Peel, Bosseler, and Suddendorf (2004), certify that atypical behaviours in people with ASD are observed not only in a single sensory modality but also in the integration of multiple sensory modalities.

Individuals with ASD show elevated sensory modulation symptoms across ages and levels of severity. There are also reported sensory differences between ASD and typical groups are highest for participants aged 6–9 years, raising an important issue for school staff who provide learning environments for children. Because sensory information forms a component of higher-order social and cognitive functioning, atypical sensory processing in children with ASD is not only a new additional component of the diagnostic criteria but also an important cornerstone for characterizing and understanding ASD (Schaaf, Lane, 2015; and Ben-Sasson, Hen, Fluss, Cermak, Engel-Yeger, Gal, 2009).

4. Understanding nature as a therapy

Louv (2008) construed nature as being beyond restrictive terms and saw it as any natural element accessible to children, such as their green schoolyard. Nature can be considered as a domestic-managed-wild continuum, with the presence of some natural process as the common denominator, and can be classified into four categories: Domestic nature (indoor plants, companion animals), nearby nature (parks, gardens, urban greenery), managed nature (forests, zoos, fisheries), and wild nature, include remote areas (the open ocean) (Clayton and Myers, 2009). Nature has various definitions across disciplines and studies based on the context in which nature is operationalised and measured. Within the school context for instance nature can be defined as any natural element accessible to children, such as their green schoolyard. The diverse conceptualisation of nature implies that nature can be experienced in various ways, across settings, and over various forms of contact (Clayton & Opotow, 2003). However, the sound of running water, wildflower meadows, and the life of the entire neighborhood has great effects on the social and psychological behaviours of learners. There is a sense of positive effect on children where birds and butterflies filled the air with their beautiful sounds and colours.

Sandra Hofferth conducted a study in 1997-2003 and reported in Richard Louv's *Last Child in the Wood*, that there is a 50 percent decline in hyperreactivity in the proportion of autistic children nine to twelve who spent time in outside activities like hiking, and walking, fishing, beach play, and gardening. It's been proven that our physical, mental, and emotional health are codependent on interactions we have with our natural environment. Regular exposure delivers restorative benefits while a lack of it brings detrimental consequences. Engagement with nature provides sensory motor skills, and emotional and social benefits for most children with autism. Nature has the potential to calm down hyperactivity in autistic children while regularising and increasing the engagement capacity for hypoactive autistic children. It builds their observation capacity (Hofferth, 2003).

Interacting with animals is another encouraging nature connect exercise for persons with ASD. Family pets can be used as home therapy for children with ASD and their social behaviour will experience an improvement. Self-directed nature play builds creativity and problem-solving skills in ASD children. It can be a flower bed, a backyard tree, or even some sticks and leaves. Start from where you and the child are both comfortable and plan for incremental steps. Different kinds of wildlife from varied standpoints can build incredible skills in ASD children. Set up a birdfeeder or watch for squirrels. Let them count the number of butterflies or how many kinds of weeds they can find growing in the crack of the sidewalk. Nature is all around us even in urban areas and besides we can create picture gardens where it is impossible to find real gardens. Go on a nature scavenger hunt. Plan a trip to pick fruits apples mangoes and more. Find a constellation in the night sky, watch butterflies emerge, create a windowsill garden, plant a tree, erect a small hut, and collect different colour leaves. Simple interaction with nature can bring both immediate and long-range therapeutic benefits to children with ASD (Nedovic & Morrissey, 2013).

In recent times our natural world is depicted in ways that prevent children from establishing bonds with the natural environment. Nature is painted as a treacherous place this has become so ingrained in many children's young minds that they often do not even realize it. The notable effect, however, is that children are no longer compelled to enjoy the great outdoors activities which prevents them from receiving its vast benefits. With this decreasing relationship between children and the natural environment, a multitude of negative impacts have been observed, specifically, a reduction in children's physiological and psychological senses (Dinan, Stanton, & Cryan, 2013).

Natural playgrounds are different from artificial ones in several ways; the terrain is more varied and uneven and has a wide range of unique irregular obstacles that make the physical environment challenging and meet for the cultivation of fitness and motor skills. The natural environment is dynamic, disordered, inherently complex, and is close to other creatures which provide mental and sensory stimulation through its multiple avenues for diverse activities, exploration, divergent, thinking, imagination, and creativity (Pellegrini, 2005, Faber Taylor, Kuo, & Sullivan, 2001).

Naturally green space is known for its ability to foster the development of imaginative, play abilities that are functional such as running, climbing, or creative symbolic drama, and role-playing and constructive abilities such as building huts and objects This has been empirically supported by several studies on school grounds, residential courtyards, and childcare centers where children's behaviour was observed in different settings (with less or more vegetation), or before and after a site was green-designed (Cloward Drown & Christensen, 2014, Kuh, Ponte, & Chau, 2013; Luchs & Fikus, 2013).

The social and cultural context into which we are born and grow up significantly influences the way we respond to specific things. The socio-cultural context of development in recent times is full of threats and insecurity, especially in Cameroon. Many children are aware of these global threats and environmental insecurities which hinder and fade their physical contact and intimacy with nature. In an attempt to keep children safe through avoidance and sensitisation of the environmental happenings, we have created in children discouragement and incapability to want to have direct experience of nature. Nature which is supposed to be seen as a place of wonder and solace, is today seen as a place of the dangerous unknown. Thus, Louv observes in his book *The Last Child in the Wood* that our institutions, urban/suburban design, and cultural attitudes unconsciously associate nature with doom and disassociate outdoor activities from joy and solitude. The modern anthropocentric lifestyle, however, blinds us from this reality and misleads us to disregard the natural environment. Without a healthy wilderness, we cannot thrive or even survive. There is a need for us to revert and go back to the days when we appreciated and protected the natural environment and children had adequate time to exploit the natural environment.

This study was based on two main theories: the Attention Restoration Theory (ART) of (Kaplan, 1989, 1995), and the Stress Recovery Theory (STR) of Ulrich (1983/1991). ART focuses on directed attention which is an effortful process to focus or concentrate on objects or events while at the same time blocking out distracting stimulation. It holds that directed attention is a limited resource that can be depleted after long and or intensive use but that a certain natural environment is capable of supporting the full recovery from the state of attention depletion. This is because nature is rife with fascinating stimuli that capture one's attention in an automatic bottom-up manner which reduces the demands of effortful attention and consequently allows this capacity to rest and restore. This means that mental fatigue and concentration can be improved by time spent in nature. The capacity of the brain to focus on a specific task is limited and results in direct attention fatigue. ART proposes that exposure to a natural environment encourages more effortless brain function thereby allowing it to recover and replenish its directed attention capacity.

For this to happen the four components in the natural environment must occur which are:

- Extent (scope to feel immersed in the environment),
- Being away (providing an escape from habitual activities),

- Soft fascination (aspects of the environment that capture attention effortlessly),
- Compatibility (individuals must want to be exposed to and appreciate the environment).

STR holds that certain environmental features and patterns elicit rapid affective reactions that occur without conscious processing. These features include vegetation, water gross structures depth and spatial cues smooth texture a deflected vista, and the absence of threat. This theory acknowledges restoration as an adaptive need that provides a breather from stress and restores energy to sustain behaviour to exploit food water or other advantages of the area. STR also maintains that modern humans might have a biologically prepared readiness to quickly and readily acquire restorative responses concerning many unthreatening natural settings but have no such preparedness for most urban or built content and configurations this implies that natural environments have a restorative advantage over built-up environments. Being in an unthreatening natural environment or viewing natural elements such as vegetation or water immediately activates a positive emotional response and a decrease in blood pressure and heart rate indicators central to the stress response sustained attention is evoked which blocks negative thoughts and emotions. Children with ASD, have inattentiveness and difficulty in regulating emotion as core deficiencies, but exposure to nature may restore attentional capacity and provide opportunities for enhanced cognitive and behavioural performance.

5. Statement of the problem

The absence of time in nature results in a deficiency in sensory integrative capacity as it limits the effective building of cognitive abilities such as creativity and observation. Lack of or inadequate play in a natural environment limits the development of language and collaborative skills especially in children with ASD. Moreover, children's imaginative abilities, attention, and sense of wonder capabilities which are very important in life-long learning, health, lifestyle, and learning, diminish as they are starved of interaction with nature. Isolation and lack of intrapersonal as well as interpersonal skills are the order of the day for most children with ASD due to inexperience with nature.

Children with autism often exhibit problems with sensory integration which is attributed to be the root cause of problems with development, information processing, and behavior. They face challenges in making connections between tactile, vestibular, and proprioceptive sensory systems. The connection could be overactive or not active enough as they interact with their environment. This is because their brain reacts differently than expected when sensory input is given, they either fail to integrate or organise new information appropriately. Research has it that to curb sensory integration difficulties stimulating the environment rather than changing processes is most helpful. It is in line with this that this study wishes to establish the link between a natural multisensory stimulating environment and the development of sensory integrative abilities in children with ASD.

6. Methodology

This research employed a qualitative paradigm to chart the various types of natural environments children (6-11 years) with ASD are exposed to, the benefits associated with exposure to nature for children with ASD, and the barriers to accessing these benefits. A screening and diagnostic test was administered to learners with autism to determine their sensory integration status. Ten pupils with autism took the diagnostic test and five were diagnosed with sensory integration disorders and then served as participants of the study alongside their parents and guidance as such 5 pupils, 5 teachers, 3 parents, and 2 caregivers of children with ASD gave us a sample population of 15 purposively selected for this study. The researcher made use of the interview guide, an observational checklist, and a diagnostic test for sensory integration ability in Autistic spectrum disorders. With such a sample, the researcher was able to understand the changes recorded as the teachers provided records of pupils' work for one academic year. Parents and caregivers presented monitoring charts for their children over a period of six months. The researchers also provided a monitoring chart on activities meant to check for improvement of the sensory integration abilities of learners with autism after six months of exposure to various natural environments. It is worth noting that the is no statistic on the population of children with ASD in Cameroon thus the researcher made use of the purposive and convenient sampling techniques. This was because the researchers wanted only teachers, parents, and caregivers who had received training on ASD identification and intervention via nature connect therapy offered by the Centre for Child and Family Development and Education (CRCFDE) in Limbe in December of 2022 and who have worked consistently with children with ASD over a period of one year. With such a sample, the researcher was able to understand the changes recorded as the teachers provided records of pupils' work for one academic year. Parents and caregivers presented monitoring charts for their children over a period of one year since they became knowledgeable about the nature of connect therapy and were practicing it with their children.

7. Research questions

The study sought to answer the following questions:

- What kind of natural environment do you expose your child with ASD to and what is the duration of exposure?
- How do children with ASD benefit from this exposure to nature?
- What are the barriers limiting access to and timing in nature for children with ASD?
- How does nature expo therapy impact the sensory integrative ability of children with ASD?

To answer the above research questions data was collected using two main instruments; an observation checklist for parents/caregivers and teachers and a semi-

structured interview guide for parents/caregivers and teachers. The observation was found valid because it describes children's typical behaviour patterns in natural settings, and it is credited for their ecological validity. The observation checklist contained items on sensory integrative abilities for parents, teachers, and other caregivers to observe the frequency of occurrence before and after exposure to nature. In this study the parents and teachers were asked to stroll with ASD children in different natural neighborhood environments, interviewing them about their activities and placement engagement to identify which they preferred.

Lim & Calabrese Barton (2010) hold that child-participatory methods empower young people to express their concerns and contribute to ameliorating suggestions for their communities. The observational method was also chosen because it is rich in providing written photographs of the situation under study.

8. Findings

- **What kind of natural environment do you expose your child with ASD to and what is the duration of exposure?**

The following natural environments were identified by parents/caregivers and teachers as places where they took the children with ASD.

Table 1

Interview findings statements/quotations	**Natural environment**	**Emerging therapy**
"*We went to the following places: in Limbe, we visited the following places: The Botanic Garden the zoo in Limbe, the beach, play site for children at the entrance to Limbe. Since it was a weekend, we took two days to visit the various sites. we intended to spend four hours each but ended up spending less than two hours in areas where the child was not comfortable.*"	Horticultural/Garden zones such as the Limbe Botanic Garden, personally developed garden	**Horticultural therapy:** guided exposure and manipulation with, soil, sand, stones, flowers, trees, vegetables
	Animal/ Bird zone	**Pet therapy:** guided exposure and manipulation of various animals and birds such as cats, dogs, parrots, and more
"I also realise that taking my child to the pool for swimming made him quite excited and from that time she started talking and playing with other children in the compound and in school, I think exposing her to what she likes makes her to be able to play and relate freely with others." *"In school, as I teacher I do most often present pictures of some natural sites we can't go to so they have a feel of them such as mountains."*	Water/ Aquatic zone	**Aquatic therapy:** guided exposure and manipulation with water such as being in the pool, or staying in the bathtub and playing with other sea creatures

From Table 1 above it is seen that children with autism in the Fako division are exposed to the following kinds of natural environment horticultural/garden zones such as in the Limbe Botanic Garden, and personally developed garden most often at the back of the house, where children are guided and exposed to play and manipulate soil, sand, stones, flowers, trees, vegetables. Such interaction leaves the children excited and stimulated. The next natural environment ASD children were exposed to, was the Animal /Bird zone called Pet therapy. Here the children were guided and exposed to play with various animals and birds such as cats, dogs, parrots, and more their choices. Lastly, the children were exposed to Water/Aquatic zone where they received aquatic therapy: guided exposure and manipulation with water such as being in the pool, or staying in the bathtub and playing with other sea creatures. Numerous changes were seen in these children after exposing them to these various natural environments which will be discussed below.

- **How do children with ASD benefit from exposure to nature?**

From the interview conducted with parents and caregivers, the following were discovered to be benefits of nature-expo to children with autism spectrum disorders:

Table 2

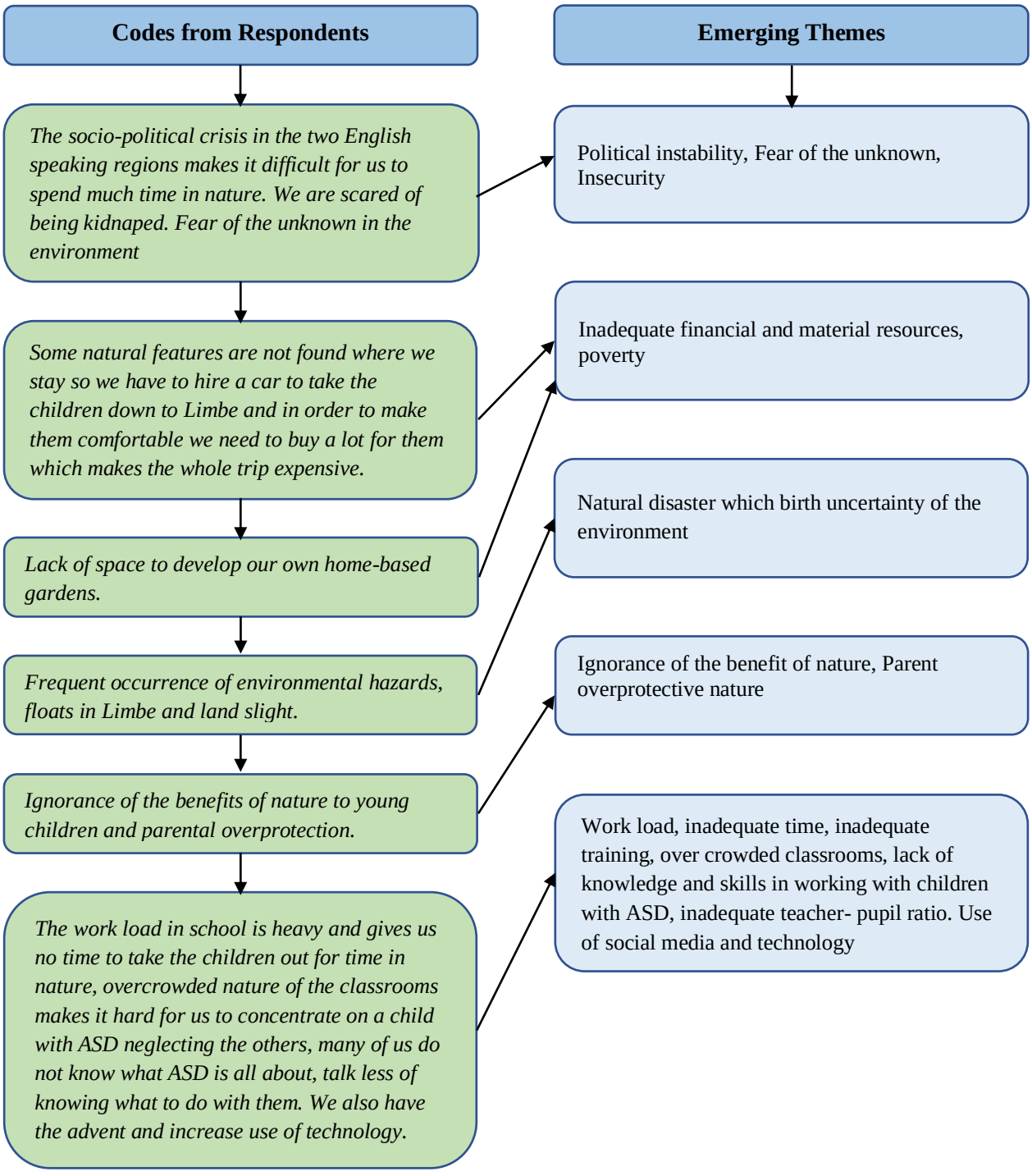
Statements/Quotations	**Emerging themes**
"Since we started the water expo my son has become calmer and more responsive."	Improved concentration and attention
"For my daughter, she would rather become more interactive I can't explain what makes her this outgoing unlike before when she was just going to school, she could not learn now the teachers are giving me reports that she can play with other children freely now."	Happier, Better mood, Stress reduction, Improved energy, Improved cognitive performance.
"At first my daughter could not stand the multiple sources of noise but now she is capable of staying in the house where the Television and computer are on at the same time and she can concentrate on her own thing if it is television, she is watching she stays glued to it and doesn't border about the computer the sister is working with before she would want only her own equipment of interest to be functioning while others go to the room or turn off theirs."	Improved creativity, Improved problem-solving, Better self, Improved family bonding time, Improved empathy Cognitive flexibility, Attention control, Logical thinking ability.
"The frequent mood swings he exhibited have reduced drastically and he seems to remember things and peoples' names more easily now than before."	Improved memory, Lower depression, and anxiety, Development of positive emotion, Reduced risk of the development of psychiatric disorders (including eating disorders, and substance use).
My daughter now sleeps like an angel and there is a lot of improvement in her movement	Improved sleep. Improved motor skills such as coordination, balance, and agility.
"Teacher also observed the following improvement: in drawing, copying from the board, confidence level, recalling facts, especially three- and four-letter words, increased accurate ability in imitating."	Improved cognitive function (language, recall,

Table 2 above indicates the benefits observed by teachers, parents, and other caregivers of children with autism exposed to the various natural environments discussed above. The following were identified as benefits for children with autism: improved concentration and attention, happier, better mood, stress reduction, and improved energy. For a better appraisal of the impact of nature expo therapy according to the systems affected by sensory disintegration as well as the following classification of sensory disintegration.

- **What are the barriers limiting access to and timing in nature for children with ASD?**

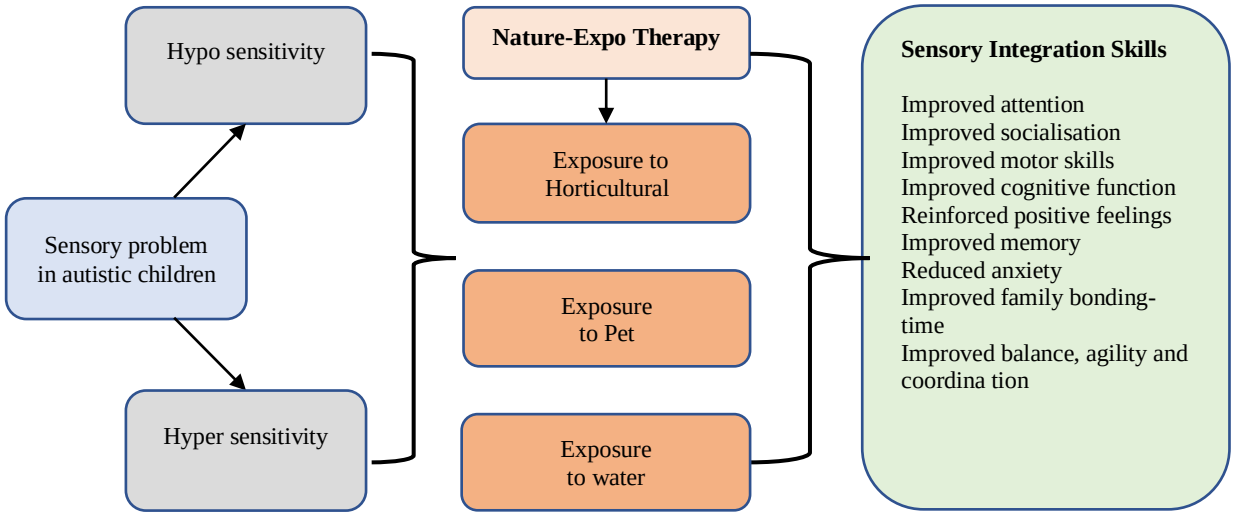
Figure 1 below illustrates the thematic presentation of barriers to access and timing in nature for children with ASD as identified by parents, caregivers, and teachers. From the parental stance barriers to access and timing in nature range from ignorance of the benefits of nature to these children, to inadequate financial and material resources, political instability, fear of the unknown, insecurity, and natural disasters which birth uncertainty of the environment and poverty. On the part of the teachers, they highlighted the following workload, inadequate time, inadequate training, overcrowded classrooms, lack of knowledge and skills in working with children with ASD, and inadequate teacher-pupil ratio as factors that hinder their ability to take the children out of the school environment to have access and spend ample time in the natural environment. Thus, it could be said that if parents, caregivers, and teachers are aware of the benefits of nature expo therapy and are empowered with the skills on how to use this therapy we will see a better result.

Figure 1: Thematic presentation of barriers to access and timing in nature



- **How does nature expo therapy impact the development of sensory integrative ability in children with ASD?**

Figure 2: How nature enhances sensory integration development in children with ASD



At the beginning of the study, the children were observed to have significant problems with attention socialisation, dexterity, and more, and after the exposure to the various natural environments teachers, parents, and caregivers were able to observe a significant improvement using the same observational checklist items used at the beginning of the study. Based on a report from the observational checklist on sensory integration skills they discovered an improvement in the following areas which are fundamental in sensory integration activities: attention, socialisation, motor skills, improved recall, reduced anxiety, improved balance, agility coordination, positive feelings, and more. This implies that exposure to the natural environment significantly improved sensory integration for children with ASD.

9. Discussion

The African child before the twenty-first century could be termed a child in the woods but this appellation is far-fetched for most African children in contemporary times. This is because they are completely separated from the natural world. Urbanisation, civilisation, and modernisation have brought a total disconnection from the natural world for most children in Africa and most especially children with disabilities. In response to the various natural environments, ASD children were exposed to and the duration of exposure findings of this study revealed that most children with ASD spend few hours in gardens, with water and animals. Spending adequate time in the natural environment has tremendous benefits for children with ASD, this is supported by Barakat, Bakr, and El-Sayad (2018) who found that landscape features include microclimate, landform/slope, plant materials, water features, groundcovers, therapeutic animals and site furniture and that the sound of running water, wildflower meadows and the life of the entire neighbourhood have great effects on the social and psychological behaviours of humans. They further state that there is a sense of positive effect on

children where birds and butterflies filled the air with their beautiful sound and colours. Many parents do not understand what nature is all about. Most think of nature as wilderness, but Clayton and Myers (2009) classified nature into four categories: Domestic nature (e.g., indoor plants, companion animals), nearby nature (parks, gardens, urban greenery), managed nature (e.g., forests, zoos, fisheries), and wild nature, including remote areas (e.g., the open ocean).

Louv (2008) further states that for children, nature comes in many forms, a newborn calf; a pet that lives and dies; a worn path through the woods; a fort nested in stinging nettles; a damp whatever shape nature takes, it offers each child an older, larger world separate from parents. Summarily nature could be seen as any domestic-managed-wild continuum, with the presence of some natural process as the common denominator what makes for nature or natural environment is the presence of some natural processes as stated by Carver, Evans, & Fritz, (2002). Fjørtoft (2001), states "*Natural environments represent dynamic and rough playscapes…The topography, like slopes and rocks, afford natural obstacles that children have to cope with. The vegetation provides shelters and trees for climbing. The meadows are for running and tumbling*." (p. 111). Thus parents, teachers, and other caregivers in Fako must not necessarily move from one environment to the other to have their kids exposed to the natural environment, they can also create a nature in their various homes, school campuses, and more.

Gifford and Chen (2016) emphasized the words of Hofferth & Curtin, (2005) that, over the last five decades, children's recreational activities have radically changed, given that they spend considerably less time outdoors than their predecessors. Evidence for this trend has been collected through online surveys, children's time-use diaries, and data on visits to specific nature destinations. This is the case for most institutions today pupils with and without disabilities do not have recreational centers, no fields for sporting activities, and more.

Children with ASD demonstrate hyper or hypo reactivity to sensory input or unusual interest in sensory aspects of the environment. Numerous studies have been conducted on sensory dysfunctions in people with ASD. Reports on studies conducted show that 95% of children with ASD have some degree of sensory dysfunction. It is believed that humans have an innate bond with nature but most children in contemporary societies are deprived of experiences in nature that offer sensory stimulation, physical challenges, exploration, and creative play in support of optimal development (Faber Taylor & Kuo, 2006). Most Eco-psychologist believe that modern living suppresses the conscious recognition of this innate interconnectedness with nature and to simultaneously awaken the ecological unconscious and help restore the ecology, Eco-psychologists utilize techniques such as ecotherapy (the practice of psychotherapy in nature settings), outdoor meditation, wilderness retreats, environmental restoration, and contact with animals (Gifford & Chen, 2016).

Pellegrini (2005) holds that natural environments differ from artificial environments in several ways; the terrain is more varied and uneven and has a wide range of irregular obstacles that offer unique physical challenges for cultivating fitness

and motor skills. Hofferth (2009) buttressed that natural landscapes are also inherently complex, dynamic, and often disordered and are filled with a large supply of diverse objects, and a close encounter with other creatures provides mental and sensory stimulation while offering multiple avenues for diverse activities, exploration, divergent thinking, imagination, and creativity.

Children with ASD need to maintain contact with nature as their cognitive, mental health, physical health, social, and emotional health receive tremendous benefits from every hour spent in nature. Few parents, teachers, and caregivers are aware of the benefits of contacting nature. Cognitively parents, teachers, and other caregivers realized that children with ASD who were exposed to a natural environment recorded an improvement in certain cognitive abilities such as concentration, attention, creativity, problem-solving, thinking ability, memory (recall and recognition), language, and more. These findings corroborate those of Gifford & Chen, (2016) and Barakat, Bakr, and El-Sayad (2018) who revealed that spending time in nature produces the following benefits for children with autism: cognitively after connecting with nature, children develop great powers of creativity and observation. Play in natural environments reinforces collaborative skills and language development. Cottrell, & Raadik-Cottrell (2010) hold that outdoor skills education improves intrapersonal and interpersonal ability to learn and concentrate and develop imagination and a sense of wonder which are very important in life-long learning. Natural landscapes not only offer developmentally significant functional play behaviours (running, climbing) or symbolic (dramatic and role-playing) but also constructive (building huts and objects). Appleton's (1975) Prospect-refuge theory predicted that children tend to seek out naturally occurring shelters or actively shape or construct shelters that afford safety and protection. Thus, exposure to the natural environment has tremendous cognitive benefits for children.

The study also brought out some physical health benefits such as enhanced motor skills such as coordination, balance, and agility. These findings are in line with Fjortoft, (2001) who holds that children who have positive experiences with nature demonstrate more motor fitness, including agility, balance, and coordination and that spending time in outdoor spaces is one potential factor that may affect children's physical activity and reduce accidents. Play in uneven terrain reoriented the mind and builds preventive measures. Clayton (2012) holds that time outside lowers the rate of obesity, deriving from greater levels of physical activities, and engagement in some recreational activities. These physical activities help children, and all people, to be more physically fit, reducing obesity and other health problems that arise from being overweight and generally inactive. Also, a green environment leads to lower rates of asthma and myopia better recovery from hospital stays, and enhanced immunological response. Views of trees, green spaces, and natural vistas have been proposed to support walking, in concurrence with this Louv (2011), describes nature as a place where children can find healing through their imagination, this is because nature creates space for the utilisation of all senses in a way that other areas such as urban and room spaces do not. This space for creative

thought is psychologically healthy because it lets children imagine the world as they perceive it, or think that it should be.

There are further details of the specific privileges of outdoor exploration over sedentary indoor habits because it combines cognitive and emotional behaviours with social development. Parents teachers and caregivers reported positive changes in their kids with ASD in their social experiences as they demonstrated a happier and better mood, stress reduction, lower depression and anxiety, improved empathy and cooperation, improved family bonding time, the development of positive emotion, and a better self. Piaget (1962) corroborates these findings when stated that children's play in nature enhances their social competence and emotional maturity. Through pretend or dramatic forms of play children develop peer relationships as they learn important skills such as cooperation, altruistic behaviour, self-control, social roles, conflict management, language, problem-solving, and emotional regulation (Gifford & Chen, 2016). Sachs & Tara (2011) say outdoor experience leads to fewer bonds of children's behaviours and enables them to find solitude away from adults and other children, engage in solitary activity or be in small, intimate groups. Such private experience is necessary for young children.

Challenges highlighted by teachers, parents, and other caregivers included political instability, fear of the unknown, insecurity, inadequate financial and material resources, poverty, a natural disaster that birth uncertainty of the environment, ignorance of the benefit of nature, workload, inadequate time, inadequate training, overcrowded classrooms, lack of knowledge and skills in working with children with ASD, inadequate teacher-pupil ratio, and advent and increase the use of social media and technology. Literature emphasized the fact that contextual challenges abound but challenges such as parents as gatekeepers, which in the context of this study is seen as parental overprotection where parent's perception and fear acts as a major factor in restricting children's use of outdoor nature. These fears stem from increased media coverage of criminal activities, fear of potential play injuries, strangers and gangs, liability lawsuits, and anxieties about insect-borne illness, ultraviolet rays, and pollution may all contribute to the recent culture of "*paranoid parenting*" (Barakat, Bakr, and El-Sayad (2018), Cottrell, & Raadik-Cottrell (2010)).

It was also realised that the proliferation of digital media and technology is another major obstacle to children spending time in nature. Many children nowadays spend ample time on the screen, which has been associated with reduced social interaction, less time spent doing homework, and less outdoor and creative play. The American Academy of Pediatrics (AAP, 2011) advises no screen time for children under the age of two, and less than two hours a day for older children. More time on screens creates attentional problems, poor academic achievement, loss of self-confidence, loneliness, depression, snacking on unhealthy food, childhood aggression, and diminished prosocial behaviour, as well as more materialistic values and less environmental concern (Gifford & Chen, 2016). Access to nature for children with ASD is considerably limited by such barriers. In current planning and place-making, the needs

and concerns of this particularly vulnerable group have received little attention. Unfortunately, we know very little about how to create inclusive places for children with ASD.

Socio-political constraints on access to nature such as crises in the English-speaking regions, disappearing open space, poor urban planning, household sizes, poverty, Natural disaster birth uncertainty in the environment. Many towns and cities have lost the urge to create green spaces for children and other learners. Li, Larsen, Yang, Wang, Zhai, & Sullivan (2019) reported that children manifest fewer symptoms and functioned better after activities in green spaces. They were more specific in stating that children with ASD showed milder symptoms of attention deficit, and isolation when they play outdoors.

Overall the findings of this study demonstrate that time in nature for children with ASD resulted in significant improvement in their attention, socialisation, memory, motor skills, cognitive function, family bonding time, balance, agility, and coordination, reinforced positive feelings, reduced anxiety, and more. Two established theories also support the proposition that children with ASD benefit from spending time in nature. Attention Restoration Theory (ART) of Kaplan, (1995) states that directed attention which is the ability to focus on cognitively demanding tasks, and behavioural regulation, easily wears out when used but can be restored through exposure to nature. Children with ASD, have inattentiveness and difficulty in regulating emotion as core deficiencies, but exposure to nature can restore attentional capacity and provide opportunities for enhanced cognitive and behavioural performance. Also, Ulrich's Stress Recovery Theory (SRT) (1991) proposes a psycho-evolutionary framework suggesting that exposure to nature yields positive affective and physiological responses. Children with ASD are at high risk for anxiety disorder and experience emotion-related difficulties such as tantrums, or aggression however, exposure to nature may contribute to their ability to regulate emotions. Overall, our findings demonstrate that children with ASD benefit from their exposure to nature, despite the fact that they face more access barriers to green space than neurotypical children. While further research is necessary to replicate these findings and elucidate mechanisms that underpin the observed relationships, our study provides important new evidence linking nature exposure therapy to improved sensory integration development in children with ASD.

10. Implication for education and practice

Children with autism often face unique challenges in learning and schooling. They have issues with cognitive, and sensory development, as well as behavioural problems. From the Attention Restoration Theory and Stress Reduction Theory perspective, the place of nature expo-therapy to the education of children with autistic spectrum disorders needs to be given due attention. Thus teachers, school administrators, parents, and other stakeholders should incorporate outdoor time into the timetable as well as the life of children with autism. Give these children the opportunity to live in nature by providing;

habitats for animals, and places to experience natural resources as the wind, sun, rain, and shade. Provide chances for planting and harvesting. This is because outdoor play can improve their awareness, reasoning, and observational skills and social interaction, language, and cooperative skills.

Schools and homes can also bring nature indoors by designing a sensory garden for children with ASD. This is the creation of a wide range of landscape features and multi-level spaces designed to be manipulative. Use various colors and scents of nature to create a calming environment in your school, classroom, or home. Colours like pale leaf green, soft sky blue, cloud white, and sand beige, and scents like lavender, pine, and eucalyptus mimic the natural world. Find a place in your school, classroom, or home to display pictures of nature use a variety of pictures to represent the changing seasons, include bird feeders, and decorate the house plants. Such spaces can help calm the nervous system if they become overwhelmed.

Learners are expected to be active participants in their learning process valuing their thoughts, ideas, and creativity. As such the classrooms are to be filled with materials, mirrors, and open-ended activities to stimulate curiosity and exploration as such:

- Play-based pedagogy could be adopted for learners with ASD. Nature-oriented play could be adopted as a teaching method or strategy for learners with ASD. Nature-oriented play is characterised by a warm and homelike atmosphere with an emphasis on imaginative play and storytelling. Nature-oriented play discourages screen time in favour of creative play, art, music, and movement.
- The designing of a project approach curriculum: children are given greater time to explore, inquire, and investigate. All activities are geared towards active engagement in real-world projects.

Schools can design sensory gardens. This is a concept appropriate at any place in any environment and weather. It is the creation of a wide variety of landscape features and multi-level spaces for manipulation by learners.

This study sought to understand the place of nature-expo therapy in the development of sensory integrative abilities for learners with autistic spectrum disorders in the Buea Municipality. It was realised that nature-expo therapy positively affects the sensory integrative abilities of children with autistic spectrum disorders, however, there are many restraints for parents, teachers, and other caregivers to expose these children to the natural environment as seen in the study. It can therefore be concluded that from the perspective of parents' teachers and other caregivers, nature-expo therapy significantly improves the development of sensory integration ability in children with Autistic Spectrum Disorder.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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