



Montessori for Children with Neurodiversity

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Received Date: August 26, 2024; **Published Date:** September 06, 2024

Abstract

Montessori principles into children's lives effectively. This principle is a guide that recognizes and adjusts to each child's developmental level and interests to provide personalized instruction, which is crucial for students with neurodiversity. As a result, children can progress through the curriculum at their own pace without the pressure of meeting predetermined grade-level benchmarks while being challenged in all areas of learning at the appropriate level. Multi-sensory activities and hands-on learning facilitate learning in the Montessori classroom, as well as differentiated teaching and individual approach, depending on each student's needs. Students are encouraged to learn by doing and have the freedom to move around, which benefits those who require physical activity or may have difficulty paying attention in traditional classroom settings. In addition, Montessori classrooms provide a structured environment that assists children in developing organizational and time management skills, ultimately leading to greater independence. Access to different devices that facilitate communication and specialized equipment that helps with sitting, writing, reading, or moving is crucial in special needs classrooms or homes. These items are necessary tools for supporting individuals in such settings. The Montessori curriculum is designed based on certain principles derived from our philosophies about how children learn and think, and this approach is particularly beneficial for students with learning difficulties and those with cognitive and developmental disorders.

Keywords: Montessori; Fine Motor Skills; Learning Difficulties; Neurodiversity; Communication; Inclusion

Abbreviations

SEN: Special Education Needs; ADHD: Attention Deficit Hyperactivity Disorder; ASD: Autism Spectrum Disorder; ZPD: Zone Of Proximal Development; MKO: More Knowledgeable Others; LD: Learning Disabilities; LAPMS: Learn and Play Montessori School; EF: Effective Functioning.

Introduction

Montessori schools place a high value on respecting others, embracing diversity, and promoting inclusivity [1]. Children

who have disabilities or neurodivergent conditions tend to thrive socially in Montessori environments, where they are warmly welcomed into a multi-age peer group that emphasizes compassion and acceptance. In a classroom that includes both older and younger students, your child can learn from their peers and encounter new challenges through watching their friends. Moreover, they can also enhance their learning by mastering concepts they have already learned and interacted with other children while simultaneously building leadership skills and serving as a role model [2].

What's more, in a multi-age classroom, children can build self-esteem through personalized, positive learning experiences. Each child in a Montessori classroom works on their own individualized tasks at their own pace [3]. This reduces the tendency of children to compare their progress with that of their peers or to notice if another student is more or less advanced. As a result, the impression of being "behind" that children with disabilities or neurodivergence may experience in traditional classrooms is eliminated. Montessori education acknowledges each child's unique learning style and pace. The curriculum matches their developmental level, interests, and learning path. Children receive individualized instruction and progress at their own pace, free from the pressure of meeting predetermined standards. Every child possesses innate skills and abilities that enable them to reach their highest potential [4]. From a very young age, children can become independent and develop their physical, intellectual, and emotional faculties to their fullest expression. Expressive and speech disorders are distinguished among speech development disorders at an early age. Speech development disorders observed at an early age manifest themselves as specific disorders of school skills. The Montessori Method has made a significant difference in the lives of many children because it was designed to embrace a child's unique individuality and utilize their personal abilities [5]. Classic Montessori material is supposed to develop oral and written speech in this category of children. It is based on observing the child's development and creating an original approach to teaching children. Teaching is based on scientific observation of children, which makes it possible to create a comprehensive curriculum. Moreover, Maria Montessori claimed that children should learn while they play, and teachers observe them and help only when needed [6].

What is the Montessori Method?

The research participants are Israeli children with special education needs (SEN) from elementary to high school. They have LDs that are often accompanied by attention deficit hyperactivity disorder (ADHD), Asperger syndrome, or autism spectrum disorder (ASD). This article researches the Montessori Method and its role in SEN. Nevertheless, most of them do well and graduate from school successfully. Furthermore, they do military service and integrate into society successfully. The Montessori Method is a highly effective approach to early education that has been successfully incorporated into various private and public school curricula. This method prioritizes a child's holistic development, including social, emotional, physical, and academic aspects [7]. It is based on the belief that children should lead their own learning and discovery process in accordance with Vygotsky's theory of learning, which includes the concepts of culture-specific tools, private

speech, and the zone of proximal development (ZPD) [8]. Furthermore, Vygotsky believed that children could get knowledge in different ways, including "more knowledgeable others" (MKO). MKO refers to a person with a higher level of ability or greater understanding than the learner regarding a particular task, process, or concept [9]. MKO can be a parent, a relative, a teacher, or a peer.

The Montessori curriculum for SEN school

Montessori Secondary Programs provide an integrated curriculum that combines academic rigor with purposeful work for junior high and high school students between the ages of 12 and 18. The programs aim to equip teenagers with the necessary skills to become self-confident, contributing citizens who can thrive in society. Adolescence marks a new stage of development with unique educational requirements, different from those of the Elementary stage. Montessori Secondary Programs respond to the unique developmental changes of this stage, which include:

Physical: Adolescents undergo significant physical and neurological growth.

Emotional: Adolescents experience increased self-awareness and self-criticism, emotional highs and lows, and egocentrism. They also develop a stronger desire for independence while being susceptible to peer pressure. A tendency towards courage and creativity marks this stage.

Social: During adolescence, young people desire to connect with their peers and assert their independence from adults as they strive to develop their own sense of self. They are passionate about the well-being and respect of all individuals and may exhibit adventurous and daring behavior as a way to demonstrate their bravery and inventiveness [9,10].

Cognitive: Adolescents exhibit advanced cognitive abilities such as critical thinking, creative problem-solving, and reasoning skills. They are characterized by their persistent questioning and tendency to engage in debates. They possess a well-developed ability to analyse complex situations and evaluate multiple perspectives [9].

The chain of Beit Ekshtein SEN schools in Israel, where I teach, implements the Montessori program, which has the unique feature of a multi-age grouping of children. The classrooms are designed to accommodate students of different ages and stages, creating an environment that supports collaborative learning. This approach is mainly practiced in elementary and junior high schools of the forenamed chain. At Beit Ekshtein, students receive individual treatment from psychologists, as well as music, art, and sports therapists. This helps to enhance their sensory abilities and communication skills. Teachers also practice differential teaching to ensure that each student receives enough help and individual attention. At the same time, students work in pairs and groups, and other jigsaw activities are practiced

during the lessons. This approach has two main benefits. Firstly, younger students learn from their older peers, while older students retain more information when they teach it to younger ones. Secondly, having children of different ages and interests together in the same classroom prepares them for the real world, where they must interact with people of various backgrounds and personalities [2]. Overall, the Montessori method is a scientifically founded approach to educating children. It prioritizes their holistic development and encourages a collaborative and supportive learning environment, especially for kids with neurodevelopmental dysfunction [11].

A modern Montessori studio includes the following areas:

- Development of general movements (gross motor skills), or a “noisy” room
- Understanding cause-and-effect relationships (transition to activity),
- Sensory development (familiar games with cereals, various Montessori materials in the form of wall aids, etc.)
- Exercises with water (favorite area, especially for older children),
- Development of fine motor skills,
- Speech development,
- Art.

One of the most important principles of the Montessori system is that children should not be forced to do any activity [12]. They should be given the freedom to choose what they want to do. If they are not interested in a particular task, they can observe. The child should only engage in an activity if they want to do it themselves, not because their parents or teachers want them to. As a remedial teacher, I implement this approach while teaching English language and literature to neurodivergent children. When faced with a new task, the child is encouraged to independently find a way to complete it, making their own discoveries along the way. The role of the teacher in this process is to be patient, offer gentle guidance, and correct any errors in a constructive manner [13]. The child is encouraged to learn from their mistakes and find ways to improve independently.

Montessori for children with reading and writing challenges

Learning disabilities (LD) are “characterized by impairments in understanding, remembering, and processing new information” [5]. Thus, dyslexia is defined as a disorder in which a child’s spelling skills are significantly impaired in relation to his or her intellectual development. It is also recognized as a significant impairment in the development of reading skills, reading comprehension, and related tasks [14]. Reading productivity is significantly lower than a child’s

intellectual development. In the early stages of learning, difficulties in learning and reproducing the alphabet are detected. In later stages, there are:

- Omissions.
- Substitutions.
- Rearrangements of syllables and letters.
- Distortions and additions of words.
- Slow reading pace.
- Attempts to start rereading the text.
- Loss of reading passages in a text, prolonged hesitation.
- Inability to understand the text read, draw a conclusion about the essence of what was read, or remember individual facts.

The biology of dyslexia has been investigated in a range of studies that have confirmed a difference in brain anatomy, organization, and functioning [15]. Since all the parts of the brain are connected, the dysfunction of one or more causes reading disorders. The latter are often accompanied by grammatical disorders in oral and written speech, graphomotor disorders, vocabulary and semantics disorders that cause limited vocabulary, difficulties in determining the meanings of individual words, and communication disorders [16].

Galuschka K, et al. [17] claim that disturbances in the development of written speech and reading in schoolchildren are often preceded by delayed speech development at an early age. That is, the development of the symbolic expression of speech - written speech - is naturally preceded by a violation of the development of oral speech. Speech is one of the most important means of human communication. In a child’s education, starting from the age of three, verbal interaction with adults takes an increasingly important place, which, at the same time, remains the leading means of emotional communication. Speech development disorders lead to cognitive, emotional, and social development disorders [18].

In the realm of speech development, the initial exercises focus on broadening vocabulary and introducing the concept of object classification. To aid in developing writing skills, Maria Montessori introduced a unique method - learning to read through writing [7]. This method involves learning letters at a sensory level. Montessori developed a system to help children gradually master the movements required for writing by working with objects in a prepared environment. Through practical life exercises, children learn to orient themselves in the working space, organize it, maintain order, and perform actions from left to right. Activities that develop hand-eye coordination also indirectly prepare children for writing [19].

The Montessori system is a great way to teach children how to read while nurturing their love for reading. The training

is designed to be playful and engaging, which helps children develop their skills in a fun and exciting way. The system allows children to explore letters and words independently and to start reading and writing well [2]. The key principles of the Montessori system include independent learning, using special materials, and considering each child's individual needs and abilities. The main goal of this system is "to help children develop reading and writing skills in a natural and fun way" [20]. The Montessori language materials are divided into five categories: pre-literacy, writing, reading, grammar, and word study [12].

According to the research, Montessori's educational philosophy emphasizes the importance of "sensory reading" [2,21]. According to Montessori, children should use all their senses to learn and understand letters and words. Children benefit from seeing, hearing, feeling, and even tasting words. Using materials such as soft playdough or wooden letters helps children visualize letters and make connections between visual and tactile perception [21]. The Montessori system also prioritizes the development of speech and auditory perception. Children must learn to distinguish sounds and associate them with the corresponding letters. To achieve this goal, special games and materials are employed to help develop auditory skills and promote the correct pronunciation of sounds [7]. The educators of Learn and Play Montessori School (LAPMS) [22] claim that much attention is paid to developing the hand's fine motor skills in the Montessori system. The child must learn to hold a pencil correctly and write letters. Various exercises and games use special materials such as sand or plasticine. These exercises help develop hand motor skills and prepare the hand for writing. Learning to read according to the Montessori system also includes reading aloud and reading from pictures [21]. Reading aloud helps develop reading comprehension and speaking skills. Reading from pictures allows children to connect written words with their pictures and develops imagination and creativity.

Montessori Teaching in Neurodivergent Heterogeneous Classes

The ability to learn, communicate and social integration are affected by neurological conditions such as autism, Asperger syndrome, ADHD, and other disorders, according to the concept of neurodiversity. [1]. Advocates of neurodiversity seek to celebrate human differences that have traditionally been considered problematic, highlighting the strengths associated with each unique neurological composition. They aim to demonstrate how incorporating neurodiverse individuals in partnerships and teams can improve complex problem-solving capabilities [23].

Neurodiversity in the Montessori classroom means that different ways in which children's brains function are

embraced and celebrated. In this approach, children are encouraged to explore their interests and learn through practical, hands-on experiences. Normalization refers to children becoming comfortable with the presentation of materials and the learning style in the classroom [24]. However, normalization should also include neurodiversity. In a Montessori classroom, freedom of movement is a fundamental feature. Students are not confined to small desks in rows, but instead have the freedom to move around and work in different areas. This is especially important for children with sensory or movement needs, as it reduces stress and enhances focus. Montessori schools place great value on inclusion and acceptance. Children with disabilities and neurodivergence are welcomed into a multi-aged peer group that emphasizes kindness and acceptance [25].

The Montessori classroom is designed to provide a multi-sensory and hands-on learning experience. This allows students to learn by doing and gives them the freedom to move about. Students who require a lot of physical activity or might find it challenging to concentrate in a conventional classroom setting can particularly benefit from it [24]. Additionally, the structured and organized environment of a Montessori classroom helps students develop time management and organizational skills, which promotes independence. This is especially important for students who struggle with executive functioning deficits and communication skills [2]. Montessori teachers are highly trained observers who take a personalized approach to instruction for all students, not just those with learning differences. By carefully observing each student, teachers can adjust their lesson plans to include accommodations and support for those who need it. This means that students with learning differences can participate in lessons with their peers, which promotes social inclusion [26]. They can also receive individualized follow-up work to address their unique needs. As a result, every student in a Montessori classroom can achieve success.

Constructivism in Neurodivergent Classes

It is essential to discuss Vygotsky's constructivism theory while researching the development of neurodivergent children's skills. Vygotsky's contribution to cognitive psychology and social development theory is significant [9]. Constructivism is a fundamental principle that postulates that learning is an active and constructive process. According to this theory, learners create subjective representations of objective reality by constructing information [27]. As they gain new knowledge, it is integrated with prior knowledge, resulting in the formation of subjective mental representations. Constructivism is an educational philosophy that emphasizes the importance of letting learners actively participate in constructing their own understanding of the world. This means that learners should be encouraged to take

an active role in the learning process instead of just passively receiving information. The philosophy stresses that learners should be active participants in their own learning, and the ultimate goal is to help them construct their own knowledge based on their previous experiences and interactions with the world around them [28]. "Applying this cognitive development theory to the classroom setting, constructivists advocate that teachers should foster a deep and meaningful learning environment in which the students develop their critical thinking skills" [13]. This approach is especially relevant and advantageous in neurodiverse classrooms. In constructivist classrooms, the focus shifts from a teacher-centered approach to a student-centered one. The students are inspired to explore their interests, ask questions, and engage actively in the learning process.

Flexible learning is another key component of constructivism, which allows for flexible learning methods. Rather than imposing rigid expectations, the constructivist approach accommodates unique learning styles, particularly in neurodiverse students. For instance, students can demonstrate their understanding in various ways, such as through projects, discussions, or creative assignments. "Vygotsky claims that ZPD refers to a zone where children learn with more experience from adults or peers through interaction." [29]. ZPD is a concept that aligns with constructivism, referring to the range of tasks a learner can perform with guidance [30]. In neurodiverse classrooms, teachers act as facilitators, providing support and scaffolding to help students reach their potential. Scaffolding is widely acknowledged as one of Vygotsky's most prominent theories, although MKO is not as well effective as ZPD [29,31]. When it comes to educators, they possess the ability to recognize the unique qualities of children. MKO can be applied to young peers or adults in a child's environment, where it can be used to facilitate imitation, which is crucial for children during the learning process [9]. Additionally, it helps teachers to analyse the interactions between children with speech delays and their peers who possess better language skills. This analysis can help teachers identify language barriers and determine appropriate next steps, ultimately reducing language barriers in a positive way [29].

Creative Activities for Neurodivergent Kids

Every student in our classrooms has their own distinctive learning style that they bring to their coursework. This is particularly true of students who have been diagnosed with learning differences and have their own set of strengths and challenges. For instance, students with ADHD may be highly focused, energetic learners who may struggle with executive functioning skills that are crucial for completing daily tasks and understanding intricate problems. Meanwhile, autistic students may be detail-oriented and have excellent memory,

but they may be more prone to anxiety and have difficulty connecting with their peers and comprehending the course's overarching concepts [25].

Incorporating effective strategies into the structure of your courses can help you tap into your neurodivergent students' strengths, aid them in making crucial connections to the course material and their classmates, and develop the executive functioning skills they require. Additionally, you will be conveying a clear message to your class that divergent thinking is a valued asset, and you will help ensure that your neurodivergent students feel confident in their individual strengths and abilities to complete the work successfully [26]. Knight A [25] claims that neurodivergent students possess exceptional problem-solving abilities and innovative thinking skills. By encouraging them to utilize these strengths while reviewing the syllabus and upcoming course assignments, you can help enhance their effective functioning (EF) skills. To begin with, assist them in establishing connections between their existing knowledge and the course content to facilitate planning and organizing their approach to the work. As a result, they will gain better insight into what they will learn and what the course will demand from them.

To achieve success, neurodivergent students need to develop a deeper connection to their teachers and classmates, and these skills do not always come naturally to them. A great way to do this is by developing teams. Vygotsky believed that cognitive development is affected by cultural and social factors and that the development of EF depends on such abilities as speech and reasoning in children, which are significantly influenced by social interaction. This implies that social interaction is a crucial factor in this process. [10]. He also claimed that the importance of community in the process of "making meaning." Children go through cognitive development, which involves acquiring cultural values, beliefs, and problem-solving strategies through conversations with more knowledgeable members of society. This process is collaborative and involves dialogues [26]. Thus, when a teacher divides the class into teams of three to four students, they will work together throughout the course to complete group assignments, grapple with complex problems, and conduct research to teach-not just present-to the class or to other teams if your class size is large, and each of them will be MKO for other classmates.

Technology use is being pushed not only in traditional public schools but also in Montessori classrooms [32]. Assistive Technology is another tool that educators can use to support neurodiverse students. With advancements in technology, a wider range of assistive tools can be used to enhance learning experiences and cater to individual needs. Thus, the Interactive Technological Institute (2023)

[33] has initiated a research project called DiversiBots. The project aims to create robotic games that are suitable for neurodiverse children and promote the co-creation of games that include both neurodivergent and neurotypical children. DiversiBots has produced two main products so far: the game “The Shark’s Escape” and the co-creation kit “PartiPlay”. It works on the Montessori system since “...co-designing with neurodivergent children within neurodiverse groups brings about unique challenges, such as different communication styles, sensory needs, and preferences” [34]. Furthermore, PartiPlay is a design kit that includes a range of manual activities and worksheets that researchers working with neurodiverse children’s groups can use [34]. The project aims to encourage neurodivergent children to actively participate in creating their own playful moments, promoting self-determination and mutual understanding between neurodivergent and neurotypical children [24]. Furthermore, such a way of teaching acknowledges that every child learns differently and at their own pace.

The “Shark’s Escape” is another board game developed for kids with ADHD that features a small robot and augmented reality. Together, they provide an inclusive experience for groups of neurodiverse children. The game also encourages collaboration among neurodivergent students, which in turn promotes social interaction among themselves and with their teachers. DiversiBots uses a small robot and augmented reality to create an engaging experience for groups of children, including both neurodivergent and neurotypical ones [4]. Sue S [24] claims that his approach can help to create more inclusive educational environments and provide valuable resources for other researchers in this field. The project aims to promote the self-determination of neurodivergent children by encouraging their active participation in creating playful moments. This approach fosters mutual understanding between neurodivergent and neurotypical children, leading to more inclusive educational environments [33]. To sum up, the Montessori system values each neurodivergent and neurotypical child’s unique learning path and tailors their educational plan to match their individual developmental level, learning style, and interests. So, each child can receive customized instruction and advance through the curriculum at their own speed [2]. They will be free from the stress of meeting formal learning standards, such as grade-level benchmarks, at a predetermined rate. Instead, they will be challenged at the appropriate level in all areas of learning.

Conclusion

Classic Montessori materials are highly effective for developing oral and written speech in children. Maria Montessori’s teaching method for reading allows school children of all ages to learn at their own pace and level. The child works on assignments independently, and the teacher

intervenes only when necessary [25,35]. This approach helps in developing independence, confidence, and motivation in the child. It is also used in some Israeli SEN schools, and I apply it in my teaching as well. For instance, my students study at their own pace: some are slower, while some are faster. To facilitate their learning, I offer lead-in activities that encourage communication among them before they work on their tasks. Therefore, differential learning is especially relevant when learning English literature.

Constructivism is an approach that encourages inclusivity and creates a dynamic learning environment. It recognizes the uniqueness and value of each student, regardless of their learning differences. By adopting this approach, educators can create effective strategies that empower all learners in the classroom [27]. The constructivist method is a pedagogical approach that emphasizes the importance of active learning, collaboration, and critical thinking [9]. This method encourages students to work in groups, critique each other’s ideas, and solve problems through experiments and projects. Students can progress at their own speed and gain a greater comprehension of the topic due to the adaptable nature of the curriculum. Research has shown that constructivism promotes creativity and engagement in students. However, it is essential to consider individual personality traits, learning abilities, and contextual factors when implementing this approach. Overall, the constructivist method is an effective way to foster student-centered learning and promote academic success [29].

The results of the research show that the Montessori system is an innovative and effective approach to teaching reading since it enhances their skills of reading, writing, and language acquisition, which is vital for kids with dyslexia and other LDs [14]. It not only helps children develop reading and writing skills but also fosters independence, confidence, and motivation. Using this system, children are better prepared for successful school life, creating a favorable learning environment for their full development. Montessori classrooms embrace neurodiversity as they acknowledge that each child’s brain functions in a unique way [18]. The environment is then adapted accordingly to cater to their individual needs and learning styles, which is the main goal.

As we design our curriculum, it is crucial to recognize and cater to the unique strengths and attributes of our neurodivergent students. To support their needs and enable them to succeed in our courses, we must adopt strategic activities that foster their creativity, innovative thinking, and problem-solving skills while also developing their cognitive functions [9]. This can be achieved through clear guidance on procedures, frequent and timely feedback, and close connection with our students. Montessori programs for adolescents offer thoughtful environments and experienced

teachers attuned to these needs, safeguarding the learners' well-being while preparing them for adulthood. To ensure that all students can excel, it is important to establish a challenging learning environment that offers various options and adaptable paths to accommodate the unique needs of our neurodivergent students [13]. By embedding universal support and creating multiple access routes to learning, we can ensure that all students have the opportunity to work diligently and achieve success in our classrooms and beyond. This requires trust and openness on our part to co-create an inclusive learning environment that enables all students to thrive.

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