



Inclusive Instructional Design for Neurodiverse Learners

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Abstract

The variations in the cognitive processes through which neurodiverse learners perceive, acquire knowledge, and engage with their surroundings are construed as inherent cognitive diversity, analogous to the biodiversity observed in the natural ecosystem. Research objectives for interventions aimed at establishing inclusive learning environments through instructional design that will help neurodivergent learners excel in learning environments. Lev Vygotsky envisioned an inclusive model of special education that places a premium on recognizing and leveraging the strengths of special (neurodiverse) learners rather than focusing solely on their weaknesses. Vygotsky opined that the way society perceives and treats special learners plays a crucial role in their development and inclusion in education and society. Inclusion and equity in education may remain mere statements if it fail to focus on infusing teaching with support and resources to a broad spectrum of learners which includes neurodivergent learners. This spectrum encompasses a wide range of conditions, each with its own unique set of strengths and needs. This paper explores how instructional design can be inclusive and aligned to create a supportive learning environment for neurodiverse learners to foster equity in education. This literature-based approach adopts Vygotsky's Social Constructionist Theory, which envisions an inclusive model for special learners. The study concludes that by recognizing and accommodating the unique differences of these learners, adopting inclusive instructional design can help unlock the potential of neurodiverse learners and create a more inclusive learning environment.

Keywords: Education, Equity, Inclusion, Instructional Design, Neurodiversity

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Introduction

There is an ongoing global concern for educators and educational institutions about the growing number of learners experiencing learning disabilities linked to neurodiversity and learning styles (Clouder et al., 2020). This concern includes the need to address the diverse learning needs of students, including those with conditions such as autism spectrum disorder (ASD), ADHD, dyslexia, and other neurological or developmental differences. This is recognized as essential for the achievement of inclusive education. Over the past century, human society has witnessed changes and ongoing development in the provision of education and supportive services for people with cognitive challenges and needs (Darling-Hammond et al., 2020). These changes include a gradual progression from the provision of separate segregated care and health services, sometimes in residential settings, to more inclusive, community-based services. The provision of education to children with cognitive variation and educational needs has in many respects reflected societal progression towards inclusion. However, despite the progress that has taken place, many aspects such as neurodiverse learners have not been adequately captured in the inclusion and equity safety net.

The Education (Goldberg, 2023), defines neurodiversity as a term used to describe neurological differences in the human brain. It represents the diverse spectrum of neurological differences and is viewed as a range of natural variations in the human brain rather than as a deficit in individuals. The term describes the natural variation in human brain function and cognition. It recognizes that every individual has unique patterns of thinking, learning, and processing information. This diversity is not limited to differences in gender, race, or cultural background, but also encompasses neurological differences that impact an individual's learning abilities and social interactions. These neurological variations can be seen in individuals who are diagnosed with conditions such as autism, dyslexia, ADHD, and other learning disabilities. While these conditions may present challenges for individuals in traditional learning settings, they also bring unique strengths and abilities. Therefore, it is crucial to unlock these diverse minds by embracing inclusive instructional design for neurodiversity (Chrysochoou et al., 2022).

Neurodiversity is the recognition and acceptance of neurological differences in individuals. It is a concept that celebrates the idea that there is no one 'normal' or one 'right' way of thinking, learning, and processing information (Garrett, 2022). The term was first coined in the late 1990s by sociologist Judy Singer, and it has since gained popularity in the education and workplace sectors. Neurodiversity encompasses a wide range of neurological variations, including developmental, intellectual, and learning disabilities. For example, individuals with autism may have difficulties with social interactions and communication, while those with dyslexia may struggle with reading and writing (Kurzeja et al., 2024). On the other hand, individuals with ADHD may have trouble with concentration and focus, and those with dyscalculia may experience difficulties with math. However, these conditions also bring unique cognitive strengths, such as creativity, problem-solving skills, and attention to detail.

The emergence of the neurodiversity perspective has influenced pedagogical practice in educational settings (Salisbury et al., 2024). In recent years, there has been a growing awareness of the importance of inclusive instructional design for neurodiverse learners. Traditional education systems are often designed for neurotypical students, making it challenging for neurodiverse individuals to feel included and thrive academically (Higbee et al., 2010). By embracing inclusive instructional design, we can create learning environments that cater to the diverse needs of all learners, including those with neurodiversity. Inclusive instructional design recognizes and supports the different learning styles and needs of neurodiverse learners. It involves adapting teaching methods, materials, and assessments to accommodate these variations and provide equal learning opportunities for all students (Lindner & Schwab, 2020). This approach not only benefits neurodiverse

individuals but also fosters an inclusive and supportive learning environment for all learners. Moreover, inclusive instructional design allows neurodiverse learners to tap into their unique strengths and abilities, promoting their self-confidence and overall well-being (Asbell-Clarke et al., 2024). By acknowledging and valuing their neurodiversity, these learners can feel a sense of belonging and realize their full potential. Research objectives for interventions aimed at establishing inclusive learning environments through instructional design that will help neurodivergent learners excel in learning environments.

Methodology

Lev Vygotsky's Social Constructionist Theory

Lev Vygotsky envisioned an inclusive model of special education that places a premium on recognizing and leveraging the strengths of special (neurodiverse) learners rather than focusing solely on their weaknesses. Vygotsky opined that the way society perceives and treats special learners plays a crucial role in their development and inclusion in education and society. According to Vygotsky, there is a connection between sociocultural processes and an individual's mental processes. This theory develops a teaching approach that connects social and mental processes and focuses on the socialization and development of human beings and how they affect learning. From Vygotsky's view, learning is a shared process in a responsive social context. While Vygotsky's theory has been influential in inclusive educational research, adapting his ideas to classroom practice remains a challenge. It fails to provide guidelines to effectively help neurodiverse learners in the classroom. Instructional design for neurodiverse learners requires careful attention because it tends to their unique learning needs. To effectively cater to their learning needs, theories and practices must prioritize instructional designs that have the critical elements of flexibility, multi-sensory input, and individualized learning pathways. Flexibility in instructional design allows for varied pacing, alternative assessment methods, and customized learning materials. This ensures that neurodiverse learners can process information at their own pace and in a way that suits their specific needs. Multi-sensory input, such as incorporating visual, auditory, and tactile elements, helps engage neurodiverse learners by providing different avenues for information processing. Additionally, individualized learning pathways acknowledge that each neurodiverse learner may require a personalized approach to achieve academic success. That is why there is need for concerted efforts from stakeholders to prioritize and advocate for inclusive instructional designs that will contribute to the development of inclusive practices in learning environments and beyond.

Results

Understanding Neurodiversity and Neurodiverse Learners

Needs are emerging in curriculum transformation to overcome different learning barriers to make education responsive and inclusive for the ever-evolving diverse learner populations (Nzuza, 2023). According to (Cherewick & Matergia, 2024), around 15-20 % of the world's population are neurodiverse, and many people see it as a deficit and not a variation in brain function. When this percentage is disaggregated down to the classroom, we then understand the need to recognize the specific needs of these learners and truly include them to enrich their learning experience. (Doyle & McDowall, 2022), states that the term "neurodiversity" was coined by a sociologist, Judy Singer in 1990 to describe conditions such as autism spectrum disorder, attention deficit hyperactivity disorder (ADHD), dyslexia, dyspraxia, and other neurological conditions characterized as less-typical cognitive variation. Neurodiversity refers to the natural variation in human brain function and the resulting differences in how individuals learn, process information, and interact with the world. Neurodiversity is the variability that occurs naturally between people, in how our brains process information, and

therefore how we experience the world. This term refers to the fact that all our brains process information in different ways. This means there are differences in how we take in information from the world around us, and in how we put that information together in our brains. Neurodiversity encompasses a wide range of conditions, each with its own unique set of strengths and needs. Some common neurodiverse conditions in the classroom are Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), and Dyslexia, these conditions differently affect learners' social and communication abilities, which can make social interaction and learning challenging, impacting their ability to focus and participate in classroom activities. This simply presents a different learning style for these learners and processing information in unique ways can make it difficult for neurodiverse learners to thrive in traditional educational settings with a general approach.

Before discussing inclusive instructional design for neurodiverse learners it is important to correct the misconception that neurodiversity is a disability. Sociologist, Judy Singer rejected the notion that people with autism are "disabled." It is a natural variation in brain function, not a deficit. While it may present challenges, it also comes with unique strengths. Neurodiverse learners do not lack intelligence, on the contrary, they are uniquely intelligent and the condition is not a reflection of intellectual incapacity as many would believe. With appropriate support and understanding in the classroom, neurodiverse learners can thrive in educational settings. Inclusive instructional design that caters to their unique strengths and needs is crucial for their success, creating more inclusive learning environments that empower all learners whether neurodiverse or neurotypical.

Inclusive Instructional Design

Is there a *right* way of learning? It is an important question to ponder before we discuss how to design inclusive teaching approaches to cater to neurodiverse learners. Why do many people believe that individuals who are neurodiverse have deficits or cannot learn? Approaches to inclusive instructional design not only reflect differing world views, but consist of values, ideologies, and images that involve inclusions and exclusions that act in the interests of particular cultural, class, and gendered groups. (Liu, 2021) Inclusive instructional design can be sustainably implemented with the considerations of inclusive learning space, in-person or virtual. (Berman, 2020); (Yeh et al., 2020). We can liken the classroom with different learners to an orchestra, and as one may observe, not all instruments produce the same sound when played. Neurodiverse learners, with their uniqueness, possess melodies that resonate with a different rhythm that is distinct. Inclusive instructional design becomes the maestro of some sort, steered by the teacher who recognizes the uniqueness of each instrument, where every note, that is, every learner, can flourish and contribute to the richness of the composition.

Scholars like (Sharma et al., 2022), suggest the creation of special cultural learning centers as a specific pedagogical strategy that would cater to neurodiverse individuals and promote their lived experiences. Although this approach forms part of the drive for inclusion, it is different from what this paper recommends, inclusive instructional design. Inclusive instructional design refers to all efforts aimed at achieving inclusion in the classroom by tailoring instruction to meet learners' needs. Not only is the design about instructional material but also creating an accessible, engaging, and supportive learning environment that helps neurodiverse learners to learn and improve their academic outcomes. Inclusive instructional design is grounded in values of social justice and inclusion, which is also a central premise of UDL. It is a design that instructional material should be consciously developed with flexible and engaging options that are available to all learners, which can address learners' variability and reduce barriers to learning through intentional effort. Educators are used to teaching styles that cater to neurotypical learners, which leave neurodiverse learners in a disadvantaged position and excluded. This is why understanding and valuing diversity are at the heart of the teaching profession.

Developing one's understanding of the full range of diversity, and what that means for

individual learners, that the educational system can achieve meaningful inclusive practice. Neurodiverse students face common challenges in the classroom, but support services need to be improved upon to ensure their success. Inclusive instructional design is a practical approach to creating learning environments that cater to the diverse needs and learning styles of all students, including neurodiverse learners. This approach goes beyond merely accommodating neurodiverse learners in the classroom, it is an effort by educators to build a flexible and responsive learning environment where every learner feels supported and empowered to succeed. Considering various challenges and learning needs of Neurodiverse learners, such as struggle with lengthy reading or traditional note-taking methods in the case of Dyslexic learners or difficulty focusing in the classroom or managing their time effectively in the case of learners with ADHD, improved support Services from educators with specially trained in supporting neurodiverse learners could offer personalized ways for helping them learn like their neurotypical peers. The aim of this is to provide wider access to learning that can empower them to overcome specific learning barriers. Educators are encouraged to tailor their instructional strategies to acknowledge cognitive diversity and nurture a learning environment present in the classroom. This involves incorporating diverse learning frameworks that cater to different information processing preferences of learners.

Universal Design for Learning (UDL) Framework

What comes to mind first is the Universal Design for Learning framework. This framework developed by the Center for Applied Special Technology, CAST, it provides a set of guiding principles for creating flexible learning experiences for all learners. Universal Design for Learning is a framework developed in the 1990s to make classrooms more accessible and inclusive. (Rao, 2021) Incorporating elements of Universal Design for Learning into instructional material and its effective implementation can help address the learning barriers faced by neurodiverse learners and create a more inclusive, accessible classroom for all learners. The UDL is grounded in the belief that every learner is different, and therefore planning for this diversity is needed from the beginning of any design process. The focus of this framework is the fact of human diversity. It values the diverse learners' population and their learning needs, making necessary adjustments to enable wide participation. These principles aim to remove barriers to learning through the following ways:

Representation: Presenting learning information in various formats (visual, auditory, kinesthetic) to cater to different learning styles of learners including neurodivergent individuals.

Action and Expression: Providing diverse ways for learners to engage with the instructional material and demonstrate their learning (e.g., projects, presentations, written assignments).

Engagement: Motivating and engaging students through diverse learning activities, technology integration, and fostering collaboration and choice. If applied in the instructional design process, the UDL framework forms a structure for lessons or teaching material to proactively design and integrate inclusive strategies and options that can support all learners in the classroom.

Differentiated Instruction Techniques:

Differentiation refers to the practice of tailoring instruction to meet the individual needs, strengths, and learning preferences of each student. Here are some strategies for differentiation:

Content: Varying the level of complexity, depth, or format of content based on student needs.

Process: Providing different pathways for students to learn the material, offering choices in learning activities or assignments.

Grouping: Utilizing flexible grouping strategies, such as small group work, peer tutoring, or independent learning activities.

Creating a supportive learning space. For inclusive instructional design to be implemented, a supportive learning space must be created to foster a sense of belonging, acceptance, and collaboration for learners. This may include: creating a positive classroom culture that establishes clear expectations

for respectful communication, collaboration, and tolerance for differences. Teachers are encouraged to develop positive relationships with all learners, taking time to understand their unique needs and learning styles and providing the support and scaffolding needed to enable them to utilize their abilities. The training and retraining of teachers is a necessity to equip them with the requisite knowledge and skills to open up to the flexible use of different and inclusive instructional designs for diverse learners, to create and sustain inclusive learning spaces that respect learners' differences, and empowers learners to embrace their neuro-identities. Keeping an open communication channel is important. Opening a positive line of communication with learners will allow all learners to express their thoughts and ideas in their unique ways without being stigmatized. The benefit of inclusive instructional design is not just academic success, but a blossoming of self-belief. Learners, no longer feel confined but discover their unique abilities, their potential unleashed. It is in this state, that learning for them transcends the mere transmission of knowledge, and it becomes a celebration of the beautiful diversity that enriches the classroom experience. By embracing these principles of inclusive instructional design, educators can create classrooms where all learners can flourish and reach their full potential. This approach celebrates neurodiversity and ensures that every student has the opportunity to experience the joy of learning.

Assistive Technologies

To implement inclusive instructional designs for neurodiverse learners (Burgstahler, 2018) proposed the designs accessible, this includes navigation, friendliness, and alternatives of different media formats (text, images, audio, and video). Accessibility compliance in learning environments will yield practical results for learners. That educators' understanding of how students learn is vital when it comes to creating an inclusive and equitable education system. However, if educators do not understand or believe in inclusion, then inclusion and equity imperatives efforts will fail to achieve the objective. This is the 21st century and a digital age, to achieve inclusion in education for neurodiverse learners, technology plays a critical role in aiding learning. This will take the form of teachers providing assistive technologies within the classroom, such as text-to-speech software or mind mapping applications, which can help with specific learning needs to overcome barriers and engage with the instructional material effectively. Furthermore, introducing flexible learning models like recorded classes, online modules, and diverse assessment methods that allow learners to learn based on their unique needs and pace. For example, a learner with dyslexia might benefit from receiving course materials in digital format with text-to-speech functionality, while a student with ADHD might thrive in a learning environment that incorporates frequent movement breaks and shorter, focused tasks. This personalized approach allows neurodiverse students to access the curriculum in ways that are meaningful to them, fostering deeper engagement and ultimately leading to improved academic performance. By providing the necessary technological support tools, neurodiverse learners can participate in the learning process more effectively. However, implementing an inclusive instructional design requires training and retraining of school management, and teachers regarding best practices to cater to neurodiverse learners. Curriculum change to effectively drive the process of inclusion for neurodiverse learners.

Benefits for Neurodiverse Learners

At every level of education, neurodivergent students can benefit from inclusive teaching that promotes cognitive diversity and a diverse learning environment, as well as improved experiences and outcomes. Educational institutions from the basic to tertiary level must create inclusive learning environments that cater to the diverse needs of their learners. Among these learners, neurodivergent learners whose brains function in ways that deviate from the neurotypical norm present unique opportunities for educators to redesign their teaching style and materials to promote the development of neurodivergent learners. This effort should emphasize a deep understanding of the needs of

neurodivergent learners, acknowledging the boundless abilities they possess. Neurodivergent learners benefit from inclusive educational experiences, and the way to broaden this benefit is by questioning normative assumptions about neurodiversity, which can ultimately improve their well-being. In an inclusive educational setting, all learners can participate and learn together, regardless of their abilities and differences. As one observes, and from different studies, neurodiverse learners are often excluded from inclusive educational experiences due to the assumption that they are not capable of meeting the rigor of the study. This exclusion results in lower self-esteem and increased anxiety among these learners, which ultimately hinder their academic development progress. Questioning and challenging the numerous wrong assumptions about neurodiversity can lead to improved outcomes for neurodivergent learners. This can be achieved through promoting neurodiversity awareness which involves but is not limited to understanding and accepting neurodiversity to create a positive and inclusive environment for all learners, Critical awareness is key to achieving a paradigm shift in thinking; this shift in thinking will then create a shift in practice, which will lead to more inclusive teaching practices and inclusive learning space, and also providing general support that cater to the specific needs of neurodivergent students that will lead to improved outcomes for neurodivergent students. Inclusive education has been proven to have numerous benefits for neurodiverse learners, including:

Improved academic outcome

An inclusive instructional design can have a significant impact on academic outcomes for neurodiverse learners because it considers the learners' needs and involves the use of multiple teaching strategies and resources to engage students. Beyond the instructional design, educators are expected to promote a supportive learning space that fosters a sense of belonging and inclusivity. This can have a positive impact on academic outcomes for neurodiverse learners, who may struggle with social and emotional difficulties. When these learners feel accepted and valued, they are more likely to be motivated and engaged in their learning, leading to improved academic performance (Azhar, 2022); (Siregar, 2023). The different ways inclusive instructional design utilizes such as presenting information visually (charts, diagrams), auditorily (recordings, podcasts), and kinesthetically (activities, simulation) to present information to learners, allow those with different learning abilities to grasp concepts more effectively, leading to improved academic performance. This means providing diverse pathways to understanding or learning, therefore, neurodiverse learners can seamlessly access and engage with the instructional material in ways that they can relate, retain, and make use of the information.

Social and emotional outcomes

The social and emotional outcomes are linked to the academic outcome. When neurodiverse perform well in their study, because of the accommodative environment and inclusive teaching style, their confidence and self-esteem will flourish. An inclusive learning space provides opportunities for them to showcase their abilities, fostering a sense of accomplishment and self-efficacy. This positive self-image empowers them to participate more actively in the classroom and even further advocate for their needs. This sense of belonging and acceptance is crucial for their social and emotional well-being. Also, the traditional learning environment can be overwhelming and anxiety-provoking for neurodiverse learners who struggle to keep up with the pace or fit into the rigid expectations of the system. An inclusive design well implemented, alleviates this anxiety. An accommodative learning space makes learners feel less stressed and frustrated, allowing them to focus on learning and engaging with the material. Inclusion in education should not just be a mere mantra but a philosophy that will continually celebrate the diversity in the classroom, creating a learning environment where all learners, regardless of their neurocognitive profile, can thrive academically, socially, and emotionally (Molina Roldán et al., 2021).

Conclusion

Neurodiversity is a natural and valuable aspect of learners' diversity. By recognizing and accommodating the unique differences of these learners, adopting inclusive instructional design can help unlock the potential of neurodiverse learners and create a more inclusive learning environment. Educators, instructional designers, and policymakers need to collaborate and prioritize the needs of neurodiverse learners to promote a more inclusive and diverse educational space. Focusing on inclusive instructional design for neurodiverse learners represents a paradigm shift in education, moving toward recognition of the unique learning styles of different learners. This is also a call to action for educators to embrace inclusive instructional design to create inclusive learning environments that empower every learner to reach their full potential. Continued research on effective inclusive instructional design practices that are tailored to diverse learners is crucial to guide the ongoing drive for inclusion. Also exploring innovative models of support that will further enhance inclusive practices. By continually seeking to expand the understanding and refine approaches, educators can ensure that all learners have the opportunity to express themselves and contribute their unique abilities.

Conflicts of Interest

The authors declare no conflict of interest.

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