

Importance of developmentally age-appropriate learning during early stages of Neural Plasticity: Toys as Tools

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Abstract

Neural plasticity refers to the ability of the brain to reorganize and modify its neural connections in response to environmental stimuli, experience, learning, injury, and disease processes. The first thousand days of life represent a critical window of heightened neural plasticity, during which the brain exhibits extraordinary capacity for adaptation and learning. Developmentally age-appropriate learning experiences during this period can profoundly influence neurodevelopment.

During early childhood, when the brain is highly adaptable, toys act as valuable learning tools that promote cognitive, motor, and social growth. Infants benefit from simple toys like rattles and soft blocks, which support sensory-motor development by improving grasping skills, cause-and-effect understanding, and object permanence. As children enter early childhood, engaging in pretend play with dolls, building blocks, and kitchen set toys enhances their symbolic thinking, language abilities, and creativity. In middle childhood, more

advanced toys such as puzzles, construction sets, and board games help strengthen logical reasoning, spatial skills, and executive functions. Each stage of development interacts with neural plasticity, enabling children to continuously adapt, learn, and improve their skills through play. Knowing which toy to provide when is the key here.

Developmentally appropriate learning ensures that activities align with a child's cognitive, emotional, and physical development at each stage. In infancy and early childhood, learning is primarily driven by sensory exploration, play, and hands-on activities that enhance motor skills, language development, and problem-solving. As children mature, their ability to think logically, retain information, and interact socially improves, making rule-involving games, group projects, and creative problem-solving increasingly beneficial. Adapting learning experiences to match a child's developmental stage promotes engagement, skill development, and a lifelong passion for learning.

Toys can serve as important tools to support a child's holistic developmental process. When chosen appropriately for a child's developmental stage, toys provide sensory, motor, and cognitive stimulation that promotes growth and development of the brain, facilitating neural plasticity. Toys such as soft blocks, rattles, or sensory balls help babies explore their environment and develop their senses. The tactile stimulation from touching or manipulating these objects helps form neural connections related to sensory and motor areas of the brain. This study examines the role of toys as tools for facilitating age-appropriate learning, emphasizing their potential to harness neural plasticity.

Keywords – *toys, early development, early childhood, neural plasticity, age-appropriate learning*

Introduction

Neural plasticity is a cornerstone of cognitive and behavioral development throughout the lifespan and it encompasses a range of mechanisms, including changes in synaptic strength and connectivity, the formation of new synapses, alterations in the structure and function of neurons, and the

generation of new neurons. It is extremely essential for early brain development in children. It allows the brain to rapidly adapt and form new neural connections based on previous experiences, enabling learning and skill acquisition, proper development of cognitive functioning.

This process is most prominent during early childhood when the brain is most adaptable and undergoes rapid and extensive growth and development, during which neural plasticity is particularly high, making the early stages of life crucial for cognitive, emotional, and physical development, as it establishes a strong foundation for future learning by forming robust neural connections through enriched experiences and engaging environments. Developmentally age-appropriate learning plays a vital role in enhancing neural plasticity, during early childhood. Young children have significantly higher level of neural plasticity compared to adults which suggests that a child's brain is more adaptable to new experiences and they can learn faster in order to form new neural connections and when they are exposed to age-appropriate learning activities, they contribute to the physical, social, cognitive and psychological development of the child. This developmental period highlights the need for learning activities that align with a child's age and developmental stage, ensuring that the brain's capacity for growth and adaptation is fully utilized.

Toys serve as valuable tools for developmentally age-appropriate learning by fostering cognitive, motor, and social skills at different developmental stages. When chosen appropriately for a child's developmental stage, toys provide sensory, motor, and cognitive stimulation that promotes growth and development of the brain, facilitating neural plasticity. Toys such as soft blocks, rattles, or sensory balls help babies explore their environment and develop their senses. The tactile stimulation from touching or manipulating these objects helps form neural connections related to sensory and motor areas of the brain. Selecting toys suited to a child's developmental stage supports learning, engagement, and overall growth and development.

For infants and toddlers, sensory toys, rattles, and soft blocks stimulate exploration and fine motor skills. In early childhood, building blocks, pretend play sets, and simple puzzles encourage creativity, language development, and problem-solving.

Infants:

For infants (0-12 months), toys should be designed to stimulate sensory exploration and motor development. Soft, sensory toys such as rattles, large rings, squeeze toys, teething toys, soft dolls, textured balls, plush toys and crinkle fabric toys engage a baby's sense of touch, while rattles or teething rings can help soothe gums and promote hand-eye coordination, things to play pretend with—baby dolls, puppets, toy vehicles made out of non-toxic materials, and water toys. Brightly colored toys encourage visual tracking, while unbreakable reflecting surfaces support self-recognition and visual development. These toys focus primarily on sensory development, motor skills, and early cognitive development.

Toddlers:

For toddlers (1-3 years), toys should support the development of motor skills, problem-solving, and early social skills. Simple building blocks encourage creativity and fine motor development by requiring children to grasp and stack pieces. Shape sorters are excellent for improving problem-solving abilities and hand-eye coordination as toddlers match shapes to corresponding holes. Push and pull toys also help toddlers with limb pressure, walking, balance, and coordination. Interactive books with textures or buttons promote early literacy skills while fostering a love for reading. These types of toys support gross and fine motor development, cognitive skills, and early literacy.

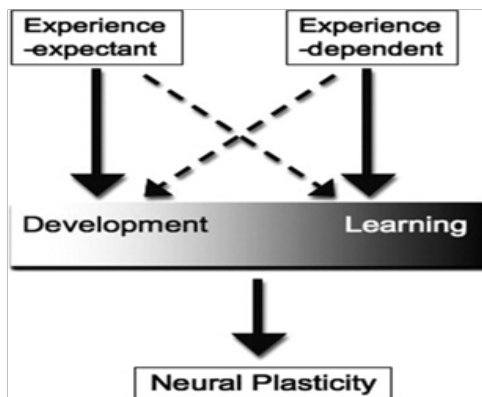
Preschoolers:

For preschoolers (3-5 years), toys should engage creativity, imagination, and further cognitive development. Art supplies such as non-toxic play doughs, washable markers, crayons, and coloring books allow children to explore their creativity while enhancing fine motor skills. Simple puzzles with large

pieces help children improve cognitive and problem-solving abilities, as well as spatial awareness. Pretend play toys, such as play kitchens, tool sets, or dolls, foster social-emotional growth by encouraging role-play and interaction with others. These toys nurture cognitive growth, fine and gross motor skills, social-emotional development, and creativity.

Understanding the significant relationship between Neuroplasticity and Developmentally Age-Appropriate Learning

The early stages of life are considered to be the critical period during which our brain is highly plastic. This postulates that it is particularly receptive to environmental stimuli and forms of neural pathways, which are crucial for developing the key skills such as language, communication, vision and motor functioning. Technological advances in cognitive neuroscientific tools such as MRI (Magnetic Resonance Imaging), fMRI (functional MRI), and electroencephalogram foster to examine connection and alteration in neural and behavioural changes. These aforementioned techniques play a pivotal role in behavioural diagnostics, as they provide elucidated, non-invasive images of the brain, its function, and neural connectivity, allowing us to investigate and identify the abnormalities.



The above picture indicates that development and learning are two interwoven constructs as they both exist on a continuum.

Each influences the neural plasticity simultaneously. From the picture it can be said that development is highly guided by experience- expectant mechanism, while it receives input from experience- dependent mechanisms. On the other hand, learning is mainly guided by experience- dependent mechanism, while it receives input from experience- expectant mechanism.

Research highlights the importance of providing young children with developmentally age-appropriate toys as they align with the developmental milestones children typically reach at various stages and can significantly enhance neural connections. For infants (0-12 months), soft sensory toys such as rattles, squeeze toys, soft dolls, and balls support sensory exploration and motor coordination. For toddlers (1-3 years), toys like simple building blocks encourage creativity and fine motor development. For preschoolers (3-6 years), art supplies such as washable markers, crayons, and colouring books allow children to explore their creativity while enhancing fine motor skills.

Significance of Sensory and Motor Exploration

Studies have highlighted the importance of providing young children with developmentally age-appropriate stimuli to optimize brain development. Developmentally age-inappropriate toys can impact a child's natural, neural development, impacting their cognitive, and motor development along with other areas of functioning. Therefore, providing young children with developmentally age-appropriate toys can optimize brain development and play a vital role in enhancing neural plasticity.

Children from infancy gradually develop cognitive, motor, and sensory skills through exploration and interaction with their environment. During this stage, sensory experiences, such as touching, grasping, and observing vibrant colors, play a crucial role in their development. Soft toys come in various textures, soft fur, and rough fabric. This enables them to comprehend the difference between what is soft and what is hard. Infants gradually develop their ability to grasp, which helps enhance their hand-eye coordination and motor

skills over time. Soft toys are often brightly colored, which attracts infants' attention and helps them gradually recognize color contrast patterns, enhancing their visual perception. Additionally, these toys serve as a safety measure, providing comfort and protection during their early, vulnerable stages of development.

Eventually when they reach toddlerhood, the toys that are provided to them facilitate them to develop autonomy, sense of accomplishment and initiation tendency. When building blocks are placed in front of them at this stage, children instinctively focus on arranging and stacking them while considering size and patterns. This process strengthens their problem-solving abilities, hand-eye coordination, and spatial awareness, contributing to their overall cognitive and motor development. They do not seek help, rather they try to accomplish it on their own, which develops their sense of autonomy and confidence. They become efficient in exploring the potential and creative sides. Fine motor and gross motor development are constantly taking place during this stage.

As children reach the preschool stage, they are introduced to crayons, art supplies, and drawing books, which foster their creative skills and enhance their memory and attention. To further enhance creative skills, they are also provided with dressing-up dolls and cooking sets. At this stage, developmentally age-appropriate toys help to stimulate problem-solving skills and critical thinking, which further supports the child in the developmental stages through lifetime.

Pretend Play:

During childhood, one of the most commonly played games was pretend play. Pretend play or role play of our role model fosters the child to develop interactive and communication skills, social responsibility, taking turn, sharing tendencies, initiative skills. It helps to develop new schemes they are developing cognitively. It improves child's symbolic thinking as they can understand better that objects and actions can symbolize many things, while navigating significant challenges. Finally, it has positive impact on their expressive

and receptive language efficiency.

When we reflect on our childhood, pretend play was one of the most common activities. Engaging in role play, often inspired by role models, helps children develop communication skills, social responsibility, turn-taking, sharing, and initiative. It also supports cognitive growth by allowing them to create and refine new mental frameworks. Additionally, pretend play enhances symbolic thinking, helping children understand that objects and actions can represent various concepts while overcoming challenges. Ultimately, it positively influences their expressive and receptive language skills, fostering overall linguistic development.

Conclusion:

During the early stages of life, when neuroplasticity is at its peak, the brain's capacity to form and refine neural connections plays a pivotal role and it is essential to capitalize on this period of rapid brain development. Therefore, developmentally age-appropriate learning is crucial for development as they are designed to align with a child's current abilities, allowing them to effectively practice and build new skills across physical, cognitive, social and emotional areas, promoting optimal learning. Knowing which toy to provide when ensures the healthy holistic development of the child. The main motive of providing children with toys is to encourage them to think critically and let them learn on their own. It can foster their intellectual capacity by improving their skills to form ideas and concepts through play. Toys develop a child's emotional intelligence, by enabling them to comprehend their emotions as well as others. In a nutshell, developmentally age-appropriate toys improve a child's cognitive, language, motor and interactive skills as he learns how to develop holistically as a fully functioning individual.

Additionally, adequate nutrition, warm and responsive caregiving and/or parenting, free-play opportunities, etc. contribute significantly to the holistic development of children.

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