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BENEFITS OF VESTIBULAR EXERCISES AFFECTING PERFORMANCE IN EARLY CHILDHOOD

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Abstract

Specifically will explore the effects of vestibular exercises on sensory and motor systems, as well as emotional and social regulation, which impact the performance of early childhood learners. This qualitative study is grounded in the constructivist paradigm, involving the participation of eight Grade 1 learners, eight Grade 2 learners, and eight Grade 3 learners in South Africa. Additionally, three parents completed weekly observation sheets to monitor the learners' performance. Data collection techniques in this study used questionnaires and observations. The result shows that vestibular exercises serve as a relay, transferring signals to other sensory systems, which then convey them to the motor system. This interconnected process is likely to impact scholastic performance positively. By framing this within the social model theory, we recognize the importance of creating an inclusive environment where all learners can engage in these exercises. This model emphasizes the role of societal structures in enabling or restricting participation, highlighting that providing access to vestibular exercises can reduce barriers and promote equal developmental opportunities. Hence, it can be concluded that vestibular exercises benefit developmental areas in early childhood, thereby influencing academic performance. Through the social model theory lens, this underscores the importance of inclusive practices that support all learners in reaching their full potential.

Keywords

Early Childhood; Emotional Regulation; Motor System; Sensory System; Social Regulation; Vestibular Exercises.

INTRODUCTION

Without a properly functioning vestibular system, achieving exceptional performance in sports or academics may not be possible. The vestibular system, regarded as the primary sensory system, significantly influences other sensory systems (Akay & Murray, 2021) and is crucial in numerous everyday life skills. Acting as the sensory center in the brain, it integrates information from various sensory systems, including visual, proprioceptive, auditory, and tactile, to unify, modify, and coordinate responses (Cheatum & Hammond, 2000; Jones, 2014).

As an early learning experience, movement is necessary for optimal neural development. Various studies have been conducted on movement and brain development. Research by (Davin, 2020) has demonstrated the significance of movement as part of early education for brain development. It influences the organization and stimulation of specific neurological systems essential for optimal brain functioning and development (Krog, 2010). (Lubbe, 2010) argued that motor movement aids the brain's development toward complexity and forms the foundation of learning. (Krog, 2010) stated that brain structure is intimately connected and that growth occurs through bodily movement. Motor movement lays the groundwork for all brain development, and cognitive development is grounded in motor activities (Cameron et al., 2016). However, movement is the foundation of cognitive development and physical, emotional, social, and spiritual development (De Jager & Victor, 2013), all crucial aspects of learners' potential development. Motor development is now intertwined with cognitive skills and motor skills (gross and fine motor skills) (Jones, 2014). Motor skills are associated with a range of academic and behavioral abilities, including letter and word decoding, solving quantitative problems, writing skills, and interaction with other learners and adults (Cameron et al., 2016).

A study conducted by (Van Wyk, 2011) indicated that good ocular motor control of the visual system is a direct result of the effective development of gross and fine motor skills, which directly impacts academic skills. Midline crossing is another crucial milestone for learners, stemming from the physical growth of both brain hemispheres. This milestone contributes to the holistic improvement of learners' potential, positively influencing their speech, reading, and writing development (Davin, 2013). Studies by (Blythe, 2017) and (Jones, 2014) recognize that each developmental stage builds upon the preceding ones. It can be inferred that reading and language skills are reliant on the development of foundational areas of brain development, namely the vestibular and proprioceptive systems.

According to (Koester et al., 2014) Ayres dedicated much of her research to investigating the interconnectedness of various sensory systems and their collective influence on overall sensory processing, facilitating efficient motor actions. Studies by (Krog, 2010) and (Jones, 2014) suggest that sensory integration dysfunction is often at the core of many learning challenges. Learners experiencing difficulties with their sensory systems frequently exhibit developmental delays that impede academic achievement. The sensory system operates as an interconnected system vital for bodily function. Another study by indicated that the malfunctioning of the vestibular system has been identified as a primary factor leading to the misinterpretation of information by other sensory systems. For instance, reading necessitates intricate coordination among the senses of the eyes, neck muscles, and the balance organ (vestibular system) located in the ear. Hence, efficient reading relies heavily on the proper functioning of the vestibular system (Ayres & Robbins, 2005). (Cheatum & Hammond, 2000) and (Van Wyk, 2011) affirm the critical role of the vestibular system in regulating eye movements and fixation. Each eye is governed by six pairs of muscles that respond to signals from the vestibular system. Head movements in space are perceived through a combination of visual, proprioceptive, and vestibular senses (Berthoz, 2002; Van Wyk, 2011).

Reading, writing, and mathematics are complex processes that can only develop when there is a strong foundation of sensory integration. Learners experiencing poor sensory integration exhibit various symptoms, such as difficulties in reading comprehension and understanding mathematical concepts (Brazelton, 2013). Emotional and social experiences are regulated by the neural structure known as the limbic system. Consequently, it can be argued that learners' physical, cognitive, and emotional readiness are interdependent (Aslan & Çıkar, 2019). An emotionally stable child tends to learn more easily (Davin, 2020) and according to (Ayres & Robbins, 2005), "tactile, vestibular, and proprioceptive functions serve as the foundation for emotional security." The vestibular system is intricately linked to emotional regulation at a neurological level. Research by (Dee Veer, 2018) stated that it is crucial to stimulate the vestibular system, as it holds significance for all learners in the classroom, not just those experiencing learning difficulties. The vestibular organization is intricately linked with visual, auditory, and proprioceptive accuracy. Consequently, a learner's capacity to focus, read, write, and engage in mathematics is directly impacted. The development of the vestibular system can significantly influence the quality of a learner's education.

While the above studies have contributed to the study of the vestibular system and its importance in brain development, none have focused on vestibular exercises' effects on Early

Childhood performance. In light of this, the study aims to investigate the benefits of vestibular exercises affecting performance in Early Childhood. The paper is grounded in social model theory, emphasizing how individuals interact with their physical, political, and social surroundings (McCarthy & Hurst, 2001). This theory is relevant to the study as it frames disability as a culturally and historically specific phenomenon. The theory aims to challenge preconceived notions so that people with disabilities can participate more spontaneously in mainstream society (Devlin & Pothier, 2006; Zwiegers, 2017).

Some previous studies related to this theme are: (1) (Han, 2021) about Vestibular Rehabilitation Therapy: Review of Indications, Mechanisms, and Key Exercises. Result: VRT is indicated for any stable but poorly compensated vestibular lesions regardless of age, cause, symptom duration, and symptom intensity. Vestibular suppressants, visual and somatosensory deprivation, immobilization, old age, concurrent central lesion, and long symptom duration delay recovery but there is no difference in the final outcome. As far as the exercises are performed several times every day, even brief periods of exercise are enough to facilitate vestibular recovery. Here the authors review the mechanisms and the key exercises for each goal of VRT. (2) (Mashaal et al., 2018) about Effect of vestibular stimulation on balance in obese children. Results: Comparing pre and post-treatment mean values of stability indexes showed a statistically significant improvement of all measured variables in both groups. While, post treatment significant difference between the two groups was recorded in all variables in favor of the study group. (3) (Shears et al., 2022) about Vestibular and balance dysfunction in children with congenital CMV: a systematic review. Result: 1371 studies were identified, and subsequently 16 observational studies were eligible for analysis, leading to an overall cohort of 600 children with cCMV. All studies were of low/moderate quality. In 12/16 studies, vestibular function tests were performed. 10/12 reported vestibular dysfunction in ≥40% of children with cCMV. Three studies compared outcomes for children with symptomatic or asymptomatic cCMV at birth; vestibular dysfunction was more frequently reported in children with symptomatic (22%–60%), than asymptomatic cCMV (0%–12.5%). Two studies found that vestibular function deteriorated over time: one in children (mean age 7.2 months) over 10 months and the other (mean age 34.7 months) over 26 months.

(4) (Atwa et al., 2023) about Effect of a vestibular-stimulating training program on motor skills in conjunction with cognitive aptitude of young school-aged children. Result: The analysed data indicated that engaging in Minds-in-Motion Maze activities positively influenced the motor

and cognitive abilities among the children. The between-group analysis exhibited strong significant improvement in the experimental group compared to the control group ($p < 0.05$), which did not show significant development. Boys outperformed girls on most tests, notably as age increased. The within-groups analysis (experimental group) demonstrated significant differences in the post-intervention gains of all motor and cognitive parameters ($p < 0.05$). (5) (Wiener-Vacher et al., 2013) about Vestibular activity and cognitive development in children: perspectives. Vestibular signals play an essential role in oculomotor and static and dynamic posturomotor functions. Increasing attention is now focusing on their impact on spatial and non-spatial cognitive functions. Movements of the head in space evoke vestibular signals that make important contributions during the development of brain representations of body parts relative to one another as well as representations of body orientation and position within the environment. A central nervous system pathway relays signals from the vestibular nuclei to the hippocampal system where this input is indispensable for neuronal responses selective for the position and orientation of the head in space.

Learners must be accommodated in the education system despite their barriers to learning and be given the same opportunities as those without obstacles or disabilities, or adjustments must be made so that all students have an equal chance to succeed. Teaching manuals describe the accommodation of learners as the full provision for the needs of individuals with disabilities or barriers to learning (Landsberg, 1979). The social model has proven to be a valuable tool in advancing the freedom of disabled individuals by illustrating that the challenges faced by disabled people stem from societal oppression and exclusion, rather than personal shortcomings. This empirical research will discuss the benefits of vestibular exercises affecting performance in early childhood. Specifically will explore the effects of vestibular exercises on sensory and motor systems, as well as emotional and social regulation, which impact the performance of early childhood learners. These factors influence concentration, listening skills, attention span, eye contact, and social interaction.

METHOD

The research for this paper is qualitative and aligns well with the research paradigm of constructivism. A qualitative approach is integral to this research type, where the researcher will use observation sheets to observe the learners' performance in early childhood. With this qualitative study, the researcher aims to thoroughly understand the phenomenon's characteristics within the

context of the interventions and through investigations where parents will conduct observations (Creswell & Creswell, 2017; Du Toit & Mouton, 2013; Levitt et al., 2021). Qualitative research provides an extensive, in-depth understanding of participants' experiences, perceptions, and behaviors, focusing on individuals and their experiences, behaviors, and opinions while engaging in vestibular exercises (Gill & Baillie, 2018). An advantage of qualitative research lies in its flexibility. Researchers begin with predetermined procedures but can modify them as the research progresses, including clarifying developmental terms as required (Qureshi, 2013).

The study is situated within the constructivist paradigm. This research paradigm denotes the scientific perspective through which a particular study is perceived, emphasizing the participation of the learners and their parents (Booyse et al., 2013). The constructivist approach is employed to comprehend human experiences, with this study specifically concentrating on the learners' experiences as perceived and reported by their parents (Geduld, 2011). It hinges on participants' interpretations of the researched study, wherein learners participate in the intervention program, emphasizing their active engagement in creating, interpreting, and reshaping knowledge through relevant learning tasks within a meaningful context (Golightly et al., 2017). Parents formulate subjective viewpoints based on their personal experiences and observations of the learners, which researchers seek to explore to understand the benefits of vestibular exercises on development. Researchers discern and interpret the significance of these viewpoints to construct theories or patterns.

The constructivist paradigm underscores the perspectives and understanding of participants within the research domain (Levitt et al., 2021), specifically focusing on Grade 1-3 learners and their parents in this context. Within constructivism, participants are actively involved throughout the entire research project. Grade 1-3 learners and their parents are engaged from the outset, with their interest sparked through initial discussions about the problem and exploration of potential solutions. Consequently, they consistently contribute to discovering answers. Throughout this process, participants influence the research, holding a voice and stake in the research process and its ultimate outcomes (De Vos, 2002).

The researcher utilized two test groups from different schools to improve the research outcomes. The target population consists of students in grades 1 to 3 who may be affected by vestibular dysfunction nationwide. Recognizing the difficulty of accessing or monitoring all these students, the researcher elected to conveniently select test groups from two classes within nearby

accessible schools. In this study, I used eight participants from Grade 1, drawn from a private school in the Northern Free State, and 16 participants from a farm school in the Northern Free State—eight participants from Grade 2 and eight participants from Grade 3. I employed a non-probability sampling technique known as convenience sampling. These learners were chosen based on their physical availability and the willingness and availability of their parents and teachers to participate in the study. Convenience sampling, or accidental or availability sampling, entails selecting readily available subjects or objects for the study (Brink & Van der Walt, 2006). This sampling technique is significant in enhancing the sample's representativeness and the research findings' generalizability. Among the non-probability sampling methods is convenience sampling, where participants are selected from the target population based on ease of access. This sampling method offers notable practical advantages, such as cost reduction and expedited data collection (Golzar et al., 2022).

The participants responded, "What are the benefits of vestibular exercises affecting performance in early childhood?" Data were collected through observation sheets and interviews with parents. A set of physical exercises, including using a trampoline, was conducted to assess motor integration and improvements in the vestibular system. These exercises were structured in a circuit format, comprising 10 different activities performed for one minute each before rotating to the next. Learners completed the circuit twice per session. The exercise sessions occurred thrice a week, lasting 30 minutes each, within a classroom setting over eight weeks. Parents filled out an observation sheet every week, reflecting on the exercises conducted during the week. The study observed all ethical considerations, including seeking permission to conduct the study. UNISA ethically cleared the study (2018/08/15/41979095/33/MC). Participants in the study were contacted and provided with clear information regarding the study and its potential risks. Consent forms were signed by teachers and parents for learners' participation in the study. The identities of learners and parents were kept anonymous, with symbols used to represent them (Creswell, 2015).

Visual displays offer a multidimensional framework for organizing data and illustrating the relationships between relevant elements. The visual representation will provide immediate access to information while effectively conveying a message, discovery, or specific perspective on a particular dataset or topic. To address the research questions, an interpretation of the literature review and transcribed interviews with parents were conducted. Visual representations of the observational data collected by parents throughout the eight-week vestibular exercise program were created using graphs. A detailed analysis identified the specific area of development that showed

the most significant progress and was most influenced by the vestibular training program over the eight-week period. Through graphic representation, the researcher gained insights, develop a deeper understanding, and appreciate new knowledge. This was essential for organizing, simplifying, and transforming data. Data was analyzed using visual displays of graphs to organize the data from the observation sheets to allow the researcher to acquire insights and develop a deeper understanding of the benefits of the vestibular exercises affecting performance in Early Childhood (Verdinelli & Scagnoli, 2013).

Furthermore, to ensure the successful execution of the research process, it is essential to transcribe the interviews (Gous-Kemp, 2009). The transcribed interviews and the data from the graphs were essential steps in discovering the benefits of vestibular exercises affecting performance in the Foundation phase. This approach enabled the researcher to concentrate on specific aspects of meaning pertinent to the central research question, specifically, the benefits of vestibular exercises on early childhood development. It is observed across several categories: social interaction, concentration, listening skills, attention span, and eye contact. This data analysis aims to illuminate the significance and necessity of the study, with conclusions drawn based on the analyzed data (Pandey & Pandey, 2015). To ensure that the data is credible, the researcher did member checking where I took the data to the participants to confirm if the deliberations presented as categories reflect the observations.

FINDINGS AND DISCUSSION

Findings

The study found that vestibular exercises benefit performance in early childhood, resulting in noticeable improvements in developmental areas, as supported by the following:

Improvement of Concentration

Table 1. Results of Parent Reports on the Improvement of Concentration

No	Respondents	Reports
1	Parent A	Homework completion is more satisfactory when my child does homework. He demonstrates improved focus and attentiveness to his work, showing concentration. He can provide answers to the questions that I pose.
2	Parent B	There has been a definite improvement in concentration. Previously, my son would often get up halfway through his task and wander around, but now he remains seated and completes his homework without interruption.
3	Parent C	There has been improvement in concentration; my son can now sit and work for 20-25 minutes at a stretch and maintain focus for longer periods of homework. He now can initiate a project and see it through to completion,

	making a notable improvement in his task completion.

Based on the table 1 above, it can be concluded that the participants' concentration has significantly improved through regular vestibular exercises, which have proven effective in stimulating the central nervous system and enhancing focus and attention. These vestibular exercises, which involve various physical activities that stimulate balance and coordination, have had a positive impact on improving cognitive abilities, particularly in terms of increasing concentration levels, which in turn can affect academic performance and daily tasks.

Improvement of Attention Span

Table 2. Results of Parent Reports on the Improvement of Attention Span

No	Respondents	Reports
1	Parent A	Attention is better when doing homework.
2	Parent B	He now works accurately, completes tasks, and finishes his homework more quickly. This is a clear indication that his attention span has improved.
3	Parent C	has been improvement in attention span; my son can now sit for longer periods when doing homework and give attention when doing tasks at home.

Based on the table 2 above, it can be concluded that the children's attention span has significantly improved. Parent A reported that their child now shows increased focus while doing homework. Parent B also confirmed that their child is more accurate, completes tasks more quickly, and shows an improved attention span. Furthermore, Parent C observed that their child can now sit longer while doing homework and pays better attention to the tasks given. This provides clear evidence that their attention span has improved.

Improvement of Listening Skills

Table 3. Results of Parent Reports on the Improvement of Listening Skills

No	Respondents	Reports
1	Parent A	There has been a slight improvement in listening skills, but there is still room for improvement.
2	Parent B	Prior to the exercises, my son would listen but often failed to execute tasks as required. However, following the eight weeks, he listened attentively and performed the chores exactly as instructed, demonstrating remarkable performance. There has been a noticeable improvement in task completion.
3	Parent C	My child now listens more attentively and comprehends what I ask of him. He is capable of both listening and effectively executing tasks given to him. There is a clearer understanding of instructions compared to before.

Based on the table above, it can be concluded that there has been a notable improvement in the children's listening skills and task execution. Parent A mentioned that while there has been a slight improvement in listening skills, there is still room for further growth. However, Parent B's report highlighted a significant transformation, as their child, who previously struggled to execute tasks despite listening, now not only listens attentively but also performs tasks exactly as instructed, showing remarkable progress in task completion. Parent C further reinforced this improvement, noting that their child now listens attentively and comprehends instructions better than before, effectively executing tasks as requested. These observations suggest that the exercises have positively impacted the children's ability to listen and follow instructions, with noticeable progress in task performance.

Improvement of Eye Contact

Table 4. Results of Parent Reports on the Improvement of Eye Contact

No	Respondents	Reports
1	Parent A	Eye contact improved, and while playing, he makes eye contact with his friends and adults.
2	Parent B	when interacting with others, he consistently makes eye contact.
3	Parent C	during the school concert, my son exhibited increased confidence and danced with ease while maintaining eye contact with the audience, a behavior he typically avoids.

Based on the table 4, it can be concluded that there has been a significant improvement in the child's ability to maintain eye contact during interactions. Parent A noted that the child now makes eye contact with friends and adults during play, indicating progress in social engagement. Parent B also confirmed this improvement, reporting that the child consistently makes eye contact when interacting with others, a sign of enhanced social comfort and communication skills. Most notably, Parent C described a remarkable increase in the child's confidence during a school concert, where he danced easily while maintaining eye contact with the audience—something he typically avoids. These collective observations suggest that the child has made notable strides in social interactions and personal confidence, particularly in situations that previously challenged him.

Improvement of Social Interaction

Table 5. Results of Parent Reports on the Improvement of Social Interaction

No	Respondents	Reports
1	Parent A	Social interaction has shown improvement—he enjoys playing with others and now participates more actively in group activities.
2	Parent B	His temperament has notably improved—he appears calmer and more

		composed and is better able to manage his emotions; as a result, his social interaction has shown improvement.
3	Parent C	The child, usually very withdrawn and reluctant to talk to strangers, surprised us by greeting and chatting with people at the coffee shop. His social interaction is better after the intervention sessions.

Based on the table 5 above, it can be concluded that the child has made significant progress in social interactions and emotional regulation. Parent A noted that the child now enjoys playing with others and participates more actively in group activities, indicating a positive shift in social engagement. Parent B reported a noticeable improvement in the child's temperament, observing that he appears calmer, more composed, and better able to manage his emotions, which has further contributed to better social interactions. Parent C highlighted a particularly striking change: the typically withdrawn child, who is usually reluctant to engage with strangers, surprised them by greeting and chatting with people at a coffee shop. This improvement in social interaction after the intervention sessions indicates a substantial positive shift in the child's social behavior and emotional well-being, suggesting that the interventions have had a meaningful and lasting impact.

Discussion

Improvement of Concentration

Concentration refers to the learner's ability to focus their attention, which is crucial for learning. There are three types of concentration: focused attention, sustained attention, and divided attention (Lai & Chang, 2020). The study found that learners' concentration improved through vestibular exercises. This observation is supported by (Atwa et al., 2023), who argue that concentration improved by the end of an intervention period that involved vestibular stimulation exercises. Parents of the learners reported enhancements in concentration and noticed improved task completion.

From the statements of the participants, it is clear that concentration has improved through vestibular exercises. (Archana et al., 2020) argued that controlled vestibular system stimulation has demonstrated numerous benefits, including improved concentration and attentiveness. In addition, (Grzywniak, 2017) reports that an exercise program enhances learners' balance, motor skills, and visual-motor coordination. Additionally, the study suggests an improvement in concentration.

Integrating these findings with the social model theory, it becomes evident that the improvements in concentration due to vestibular exercises can have broader implications for social interactions and learning environments. The social model theory emphasizes the role of

environmental factors and social interactions in shaping behavior and cognitive development (Lawson & Beckett, 2021). Therefore, incorporating vestibular exercises into educational and social settings can create more inclusive and supportive environments that enhance learners' overall development and social integration. This approach addresses individual needs and fosters a collective improvement in concentration, benefiting the community as a whole.

Improvement of Attention Span

Attention typically involves focusing on external stimuli, but it's also possible to direct attention inward toward internal thoughts. Consequently, attention span can be defined as an individual's capacity to selectively concentrate on multiple things while maintaining focus (Chastain, 2018). The study found that learners' attention spans improved through vestibular exercises. In an article by (Atwa et al., 2023), they stated that attention span was one of the areas that improved by the end of the intervention period involving vestibular stimulation exercises. Parents observed improvements in attention span.

The interviews indicate that attention span has improved. A study by (Archana et al., 2020) showed that controlled vestibular system stimulation has numerous benefits, including improved attentiveness. A study conducted by (Chungade et al., 2022) confirmed that sensory integration, including vestibular exercises, effectively improves learners' attention span. The social model theory, which emphasizes the role of society and the environment in turning individuals on or off, provides a framework for understanding these findings. In this context, the studies by (Archana et al., 2020; Chungade et al., 2022) demonstrate how targeted interventions, such as vestibular system stimulation, can enhance attentiveness.

These interventions can be seen as tools that reduce the disabling impact of societal structures that do not accommodate diverse sensory needs. By improving attention span through these methods, we are not merely addressing a neurological deficit but actively dismantling a barrier that prevents individuals from fully participating in social, educational, and professional environments. This aligns with the social model's emphasis on altering the environment to be more inclusive rather than focusing solely on changing the individual (Lawson & Beckett, 2021).

Improvement of Listening Skills

Listening involves active communication, including hearing, interpreting, and understanding constructively (Van den Heever, 2013). Effective listening skills foster learning, enabling learners to comprehend instructions and execute tasks accordingly. As stated in the

Department of Education's policy statement on curriculum assessment (2011), listening skills are essential for the optimal development of speaking, reading, observing, and writing skills. Parents observed advancements not only in listening skills but also in listening comprehension, with learners now capable of listening attentively and understanding what is required of them.

In the observation results, improving listening skills aligns with social model theory, emphasizing the interconnectedness of physiological and social factors in shaping human experiences. This finding is substantiated by research conducted by (Madaule, 1997), which asserts the critical significance of the connection between the auditory and vestibular systems in listening. (Kuzu, 2023) further reinforces this perspective by indicating that the vestibular system can significantly impact hearing. This suggests that targeted stimulation of the vestibular system may enhance listening abilities, thereby underscoring the potential for environmental and sensory interventions to improve auditory processing within the framework of social model theory.

Improvement of Eye Contact

Eye contact is a non-verbal form of communication among individuals, transcending cultural boundaries and relating to social behavior. In Western culture, maintaining eye contact signifies politeness and conveys confidence and honesty (Ruth, 2018). Parents observed that there had been notable progress in eye contact, enabling learners to express themselves more confidently and engage comfortably with others.

Despite the absence of other resources reporting enhancements in eye contact, this study demonstrates such improvements. This highlights a gap in the current research regarding the impact of the vestibular system on eye contact. Recent studies indicate that the vestibular system is pivotal in maintaining ocular stability during head movements. The precise coordination of eye movement is essential for maintaining a stable gaze during everyday activities (Cullen, 2023). The complex integration with the visual system enables the precise execution of the vestibulo-ocular reflex (VOR). A properly functioning VOR is essential for sustaining consistent eye contact. Conversely, vestibular dysfunction, which compromises ocular stability, can impair the ability to focus on another individual's face, potentially leading to disruptions in social interactions and retinal image displacement, which can result in blurred vision and a disorienting sensory experience (Cheng & Gu, 2018; Cullen, 2023).

Improvement of Social Interaction

Social interaction can be defined as the dynamic interchange of social exchanges, where individuals attribute meaning, respond, and interpret (Press, 2018). In essence, it involves meaningful interactions between individuals, where both parties feel involved in the situation, and the exchange of information holds significance within the relationship.

It was clear from the participants that they, as parents, observed improvements across all developmental areas, noting that no additional stimulation was provided aside from the vestibular exercises during this period. Consequently, the observed changes can be attributed to the vestibular training program. This experience has provided teachers and parents with a comprehensive understanding of vestibular exercises' benefits affecting early childhood performance. The improvement in all developmental areas suggests that vestibular exercise impacts early childhood performance. Given the improvements observed in concentration, attention span, listening skills, and eye contact, it is reasonable to expect a corresponding enhancement in academic performance.

The condensed vestibular exercises were designed for teachers to incorporate during a school sports period or a life orientation lesson. Consisting of 10 circuit activities, the learners enjoyed them and could proficiently complete them twice within a 30-minute timeframe. Feedback from parents revealed that students exhibited increased focus after participating in the sessions, resulting in enhanced productivity. Based on these findings, it became evident that teachers can effectively incorporate vestibular exercises into circuit activities to support performance in early childhood.

According to a study by (Chungade et al., 2022), incorporating physical activity, breathing techniques, and sensory integration—including vestibular exercises—led to notable improvements in attention span. These findings highlight the positive impact of sensory integration interventions on cognitive functions, with vestibular exercises playing a key role in enhancing focus and attentional performance. (Akbar, 2020) highlighted that learners with sensory processing disorders, which include vestibular problems, often exhibit challenges related to their cognitive and developmental learning processes. (Perrotti et al., 2004) reported that exercise positively impacts cognitive and motor functions in learners, contributing to improvements in cognitive, social, and motor skills. Additionally, the study found that learners with vestibular immaturity experienced delays in motor coordination, balance, language development, and reading and writing abilities. Notably, the accessibility, affordability, and adaptability of the tools further underscored their advantages.

In light of the discussion, the theory of this study, grounded in social model theory, promotes participation in all activities that help learners experience the benefits of vestibular exercises affecting developmental areas and performance in early childhood.

CONCLUSION

In conclusion, vestibular exercises serve as a relay, transferring signals to other sensory systems, which then convey them to the motor system. This interconnected process is likely to impact scholastic performance positively. By framing this within the social model theory, we recognize the importance of creating an inclusive environment where all learners can engage in these exercises. This model emphasizes the role of societal structures in enabling or restricting participation, highlighting that providing access to vestibular exercises can reduce barriers and promote equal developmental opportunities. Hence, it can be concluded that vestibular exercises benefit developmental areas in early childhood, thereby influencing academic performance. Through the lens of the social model theory, this underscores the importance of inclusive practices that support all learners in reaching their full potential.

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