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Relating Visuo-Perceptual Task Training To Maths Learning In Primary School Children

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Abstract

The term visuo perceptual ability is a component of visual perception. It enables recognition of objects by their form, pattern, and colour. Moreover the term implies, as the ability to see & organize, (understand) interpret to make sense. This sense is a complex combination & needs to be coordinated with functional abilities like movement & processing information. Visual perceptual skills rely on the brain's cognitive abilities. In school going children, it's essential for reading, writing, spatial awareness in daily life task, playground activities, size awareness and to all MATHEMATICAL knowledge. This ensures that visual perception and mathematical learning deficits are addressed holistically, leading to better outcomes in both academic and functional domains. The study is done with primary school children of age less than ten years. Totally hundred students were assessed using visual perceptual aspect test (VPAT). Then study sample of 25 students, were selected, made as single group based on the inclusion criteria. They received brainteasers activities as therapy. This skill is correlated with maths learning ability by the evidence from, Visuo-Spatial Working Memory and Mathematical Skills in Children by Mammarella & Angelelli 2023.

Key words: visual perception, VPAT, School going children, maths knowledge, Brain teaser activity

Introduction

Does Visual perceptual skills impact maths learning in order to understand this, the study is done with primary school children of age less than ten years. Visual perception in these children is analysed, using standardized test (VPTA). This skill is correlated with maths learning ability by the evidence from, Visuo-Spatial Working Memory and Mathematical Skills in Children by Mammarella & Angelelli 2023.

Mathematics is not merely a subject confined to classrooms; it is a fundamental aspect of our daily lives that fosters an organized, efficient, and intelligent approach to various tasks. . By addressing visual perception and mathematical skills simultaneously, occupational therapists and educators can ensure comprehensive cognitive and functional development. Occupational therapy is centered on enabling students to participate in meaningful activities to enhance better education. Visual perception and mathematical skills are crucial components in OT, as they underpin both academic success and daily functioning.

Aim of the study

To assess the relationship between visuo perceptual task and maths concept learning in normal school going children of age upto 10 years.

Objective of the study

1) To analyse visuo perceptual task as relevant to maths concept learning.
2) To identify easy visuo perceptual task for normal school going children upto age 10 years.
3) To train (therapy) selected task for a period of 3 months.
4) To relate academic maths scores before and after administering training.

Method of study

The study is done with primary school children of age less than ten years. For selecting appropriate students, totally hundred students were assessed using visual perceptual aspect test (VPAT). Then study sample of 25 students, were selected, made as single group based on the inclusion criteria (VPAT). They received brainteasers activities as therapy. Visual perception in these children is analysed, using standardized test (VPTA). Therapy session was conducted 2 times a week, as afternoon sessions, over the period of 8 weeks. Post therapy was done using visual perceptual aspect test after intervention. Scores were noted, statistical analysis done.

Result

The participants pre score & post score were analysed with t test.

Using bar diagram scores were plotted. It is clearly seen that academic maths learning after therapy (95.32) score is having higher mean value than academic maths learning before therapy (73.44). The calculated t value (12.651) is also greater & a significant difference noted. So, visuo perceptual task training has an impact to maths learning is evident.

CONCLUSION

Occupational therapy is centered on enabling students to participate in meaningful activities to enhance better education. Visual perception and mathematical skills are crucial components in OT, as they underpin both academic success and daily functioning. By enhancing visual-spatial skills, therapists help clients perform better in mathematics and daily tasks requiring spatial awareness. OT activities enhance numerical fluency, which is crucial for managing finances, and other practical tasks like driving.

Through this study, we can conclude that, by Visual perceptual task training we can help students learn better maths. As early training is applied, we can prevent DYSCALCULIA learning problem also.

Types of visual perception

1. Visual Attention: The ability to focus on important visual information and filter out unimportant background information. If affected, for example, inability to follow directions in walking or driving would be seen.
2. Visual Discrimination: The ability to determine differences or similarities in objects based on size, colour, and shape. For example, it allows perceiving the difference between “p” and “d”. OT’s can help through Tangrams. It’s an activity to incorporate visual motor integration through play.
3. Visual Memory: The ability to recall visual traits of a form or object. For good maths skill, remembering how the problem is supposed to be worked out , visual memory is important.
4. Visual Spatial Relationships: Understanding the relationships of objects within the environment and for completing physical action spatial relationship is necessary. (Appropriate words are laterality & directionality) for example, understanding how far to move, next to others in traffic & positioning right, behind, over etc. In academics, when writing words and sentences with the correct letter size this is essential
5. Visual Sequential-Memory: The ability to recall a sequence of objects in the correct order
6. Visual Figure Ground: The ability to locate something in a busy background
7. Visual Form Constancy: The ability to know that a form or shape is the same, even if it has been made smaller/larger or has been turned around
8. Visual Closure: The ability to recognize a form or object when part of the picture is missing

VISUAL MOTOR INTEGRATION

Eye-hand coordination is often, referred to as visual motor integration. It is the visual ability to capture information with brain's ability to perceive and process that information to produce movement. The process of visual perceptual development begins at birth and is learned over a period of time. All individuals do not have opportunities to develop visual perception due to a possible injury or illness , lack of appropriate stimulation, emotional trauma.

Several authors agree that early identification and appropriate intervention are crucial (Engelbrecht, 2004, Hard et al., 2004, Irlen, 2005).

In primary education, the fundamental objectives focus on a learner acquiring skills to read, write, spell, and do mathematics. Research, indicates that emotional problems manifest in intra or interpersonal relationships of the learner's life. Approximately twenty percent of learners do not achieve academic competency in basic literacy and numeracy skills. Furthermore, they argue that it is not sensible to expect that the learner will automatically outgrow basic perceptual challenges. If visual perceptual challenges are not detected, an unnecessary amount of stress is placed on the learner's central nervous system. This stress can trigger various fight-or-flight responses within learners (Cheatum & Hammond, Gunning, 2006), which are then expressed through their behavior (Finestone, 2004 Rief & Heimburge, 2006).

According to Korkman et al. (2007), factors that underlie challenges in mathematics are usually not well researched or understood. The organization of written or printed mathematical symbols presents challenges to the learner who experiences visual-perceptual challenges, such as left-right confusion or sequential problems (Dednam, Frederickson & cline 2006)

Visual Perceptual Aspects: Skills and Functions

Visual perception is also a learned process. Processing visual information is a cognitive activity involving both aptitude (skill) and purpose (function). Perception initiates all cognition (Bjorklund, 2000) & there is a complex connection between visual, spatial, and cognitive aspects, which involve a vast collection of automatic processes and procedures.

The eyes attend to relevant details of visual stimuli, facilitate discrimination, and interpret cues in experience-related ways (Williams, 1988). The process of teaching can have a direct impact on the perceptual competence of the individual learner (Lerner, 1993).

Visual Discrimination

Visual discrimination is the ability to differentiate one object from another. Kavale (1982) describes it as perceiving dominant features in different stimuli. Schneck (2005) identifies three abilities such as **recognition, matching, and categorization** as important for visual discrimination.

- **Recognition**: Awareness of key features and relating them to memory.
- **Matching**: Observing similarities among stimuli.
- **Categorization**: Differentiating quality based on noted differences .

Visual discrimination is vital for reading, writing, and mathematics, enabling learners to differentiate between letters, figures, numbers, and words (Dednam, 2005 Kurtz, 1997). It allows learners to distinguish subtle differences in similar letters and numbers, such as between 12 and 21, similar looking words such as where and were. Inability to visually discriminate can hinder literacy and numeracy skills.

Visual Form Constancy

Visual form constancy is the ability to recognize the dominant features of forms regarding size, color, shading, texture, or position (Hamill et al., 1993). It involves recognizing objects regardless of orientation or detail differences (Schneck, 2005). Challenges with form constancy can manifest in difficulties recognizing letters presented in different ways or words with similar appearances (Dednam, 2005). In mathematics both visual discrimination and visual form constancy challenges learners to confuse the numbers (Dednam 2005).

Visual Spatial Orientation

Visual spatial orientation refers to awareness of space around the learner in terms of form, position, distance, and direction (Retief & Heimburge, 2006). It allows for the development of spatial concepts essential for organizing the environment and interaction with it (Scheiman & Gallaway, 2006). This aspect includes bilateral integration, laterality, and directionality, crucial for letter formation, reading direction, and mathematical tasks. The determination of direction and the relationship between objects is also important for mathematical tasks (Dednam 2005b:198). The learners face challenges with place values e.g. a learner has difficulty understanding the value of 3 on the left of the number 33.

Position-in-Space

Position-in-space refers to the discrimination of reversals and rotations of figures, forms, or objects (Hamill et al., 1993:2). It is measured by the ability to match figures based on common features, assessing visual discrimination and spatial orientation.

Visual Spatial Relationships

Visual spatial relationships involve recognizing the position or orientation of objects in two- and three-dimensional spaces (Williams, 1983:104). It is essential for spatial awareness and organization within the classroom, aiding in tasks such as letter formation and mathematical problem-solving (Schneck, 2005:420). An important aspect in the development of an awareness of dualism and spatial opposites (i.e. in/out, top/bottom, front/back) is spatial directional mastery (Williams 1983:104).

Visual Memory

Visual memory is the ability to remember what the eyes have seen. It involves retaining visual information for immediate recall and is crucial for reading, spelling, writing, and numeracy (Borsting, 2006:55; Sattler, 2002:330). Memory is developmental and with growth individuals increase their capacity to encoding, storage and retrieve information (gunning 2006:28). The aspect of attention ("the act or state of directing one's consciousness to stimuli", gunning 2006) is also crucial for this visual perceptual aspect.

Visual memory encompasses short-term and long-term memory, where information is processed, stored, and retrieved. Short-term memory holds information briefly, while working memory processes and temporarily holds information for cognitive tasks (Sousa, 2001).

Visual Sequential Memory

Visual sequential memory is the ability to perceive forms or characters in the exact order (Groffman, 2006**). Difficulties with visual sequential memory can lead to omissions, additions, or transpositions of letters and numbers, affecting reading, writing, and mathematics** (Ram-Tur, Faust, & Zivotofsky, 2008). Addressing challenges in these areas is crucial for supporting learners' overall academic development.

Analytical visual perceptual aspects

Analytical visual perceptual aspects play a crucial role in developing cognitive abilities, such as logical reasoning, memory, and problem-solving skills. These aspects involve the manipulation and interpretation of visual information, which is essential for various learning activities, including reading, writing, and mathematics (Barry & Sargent, 2006).

Visual Analysis and Synthesis

- Visual anlysis is the ability to deconstruct visual stimuli into their component parts. In literacy, this means analyzing words into individual sounds (phonemes) or syllables (Dednam, 2005).
- Developing strong visual analysis skills helps learners understand the structure of words and improves their decoding abilities, which are essential for reading and spelling (Scheiman & Gallaway, 2006).
- Visual synthesis, involves assembling parts to form a whole (Dednam, 2005c). Challenges in visual analysis and synthesis can lead to difficulties in reading, spelling, writing, and math.
- Effective visual synthesis allows learners to read fluently by blending sounds or syllables quickly and accurately (Scheiman & Gallaway, 2006).

Visual Closure

- This skill allows individuals to recognize a complete object even when only partial information is available (Lerner, 2000). For example, recognizing the word "hippopotamus" when presented with "hippo-"
- It involves using contextual clues to fill in missing parts of a visual stimulus (Kavale, 1982).

Learners with strong visual closure skills can predict outcomes and comprehend text quickly. However, those with poor visual closure skills might struggle with reading, writing, spelling, and comprehension. They may confuse similar-looking words and have difficulty completing thoughts or recognizing patterns (Dednam, 2005c).

Visual Figure-Ground Discrimination

- This is the ability to distinguish an object from its background (Lerner, 2000). It is crucial for tasks like finding a specific word on a page
- It enables a learner to perceive and locate a form or object within a busy field without being confused by the background (Dednam, 2005).

Mathematics has no generally accepted definition. Different schools of thought, particularly in philosophy, have put forth radically different definitions. All proposed definitions are controversial in their own ways.

- Mura

Need and importance of mathematics in daily life:

Mathematics help us carry out a variety of important daily tasks. The importance and need for mathematics are evident in numerous aspects of personal development. Mathematics is used to count the repetitions, calculate time, measure weights. It forms part of our daily lives, from counting to more complex calculations. Accessing maths, in the basis of everyday life from money management, through activities like

measurements, rates, calculations, and negotiations, is known. Math plays a significant role in sports also. By being good in trigonometry, a player can identify the direction and angle that the ball will strike to score. Simple numbers are used to improve coordination while dancing.

Understanding fractions and ratios facilitate comprehension of musical note rhythm. To manage money, bank account, credit card .People who take out loans need to understand interest. Knowing how to calculate perimeters can help child with deciding how much lumber to buy for floor or ceiling trim.

Benefits of Mathematics for Students

Problem solving abilities is enhanced in academic challenges and real-world issues. For eg maths students use right formulas, they adapt to analytical thinking & concepts.

Problems with inadequate basic maths

Inadequate basic maths skills can lead to a wide range of problems in various aspects of life. Dropout rates are high in school due to struggles with math courses. Struggles in advanced subjects- difficulty processing in subjects like, technology, engineering, could be seen.

Financial management: challenges in managing personal finances, budgeting issues, struggles with understanding interest rates, struggles in interpreting data related to loan terms, and repayment effectively.

Social interactions: difficulty in understanding and discussing topics that involve numbers or data, leading to miscommunication. Challenges occur in group projects or teamwork that require mathematical input. Challenges in managing natural resources efficiently, which often requires mathematical calculations

Scientific research and innovation limited ability to engage in innovative activities that require mathematical modelling and problem-solving.

Cognitive development:

limited development of mental flexibility and adaptive thinking skills. Poor spatial reasoning skills, which are critical for task ranging from navigation to understanding physical relationship.

Lifelong learning:

Reduced ability to adapt to new technologies involving mathematical principles .

Role of Occupational Therapy for Students

Occupational therapy is centered on enabling students to participate in meaningful activities to enhance better education. Visual perception and mathematical skills are crucial components in OT, as they underpin both academic success and daily functioning. Occupational therapists use targeted interventions to improve spatial reasoning. Anne G. Fisher and Shelly J. Lane (1995) highlight the importance of these interventions in supporting cognitive and functional development. By enhancing visual-spatial skills, therapists help clients perform better in mathematics and daily tasks requiring spatial awareness. OT activities enhance numerical fluency, which is crucial for managing finances, cooking, and other practical tasks. Stanislas Dehaene (2011) underscores the importance of numerical representation in early arithmetic and everyday functioning. Boaler and Cathy Williams (2015) emphasize the importance of pattern recognition in both academic and functional contexts. This skill is vital not only in mathematics but also in understanding routines and sequences in daily activities.

Occupational therapists often work with educators to integrate visual perception training into the curriculum. Jerome Bruner (1966) and advocate for using concrete materials and visual representations in teaching, a practice mirrored in OT to facilitate learning and skill acquisition. S. Kelly (2017) highlight the long-term benefits of early interventions in these areas

Long-Term Benefits and Outcomes

The long-term benefits of integrating visual perception and mathematics learning in occupational therapy are significant **Claire E. Cameron and Anthony S. Kelly (2017) highlight the importance of early interventions, noting that children who receive support in these areas are more likely to succeed academically and develop essential life skills**.

Furthermore, enhancing visual perception and mathematical skills contributes to overall cognitive development and participation in meaningful activities. David H. Uttal and Nora S. Newcombe (2013) provide evidence in "enhancing spatial reasoning in child with learning disabilities" by using spatial reasoning activities such as puzzles, block building, & interactive geometry software can significantly enhance spatial reasoning and mathematical abilities.

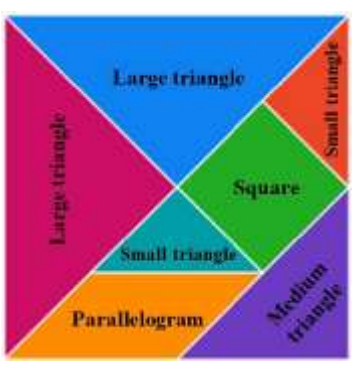
Stanislas Dehaene's (2011) research in "improving numerical fluency in an adult with brain injury" by using visual aids with exercises like grocery shopping.

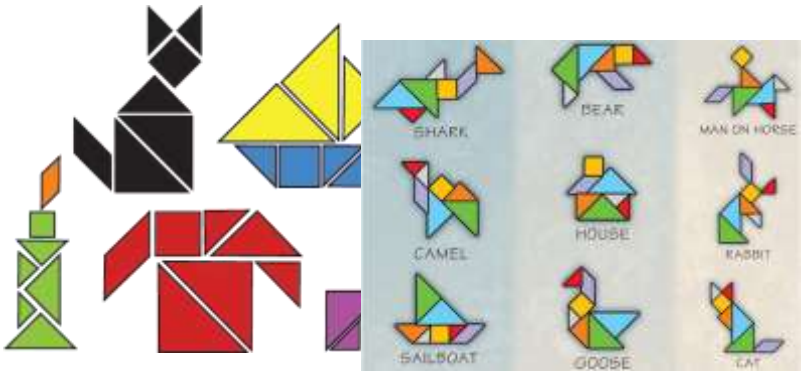
Visual Perception and Brain Teasers Games:

Visual perception involves several skills crucial for young learners, including visual discrimination, visual form constancy, visual closure, visual memory, visual sequential memory, visual spatial relationships, visual figure-ground, position in space, and visual analysis and synthesis. Here's a game called brain teaser, to enhance these skills and improve math learning for primary school children. The game consists of seven sub play parts.

1. Tangrams:

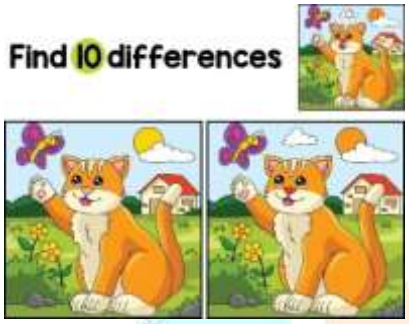
- Description: Tangrams are ancient Chinese puzzles consisting of seven geometric pieces that can be arranged to form various shapes.
- Children are instructed to construct images
  - Visual Discrimination: Differentiating shapes.
  - Visual Spatial Relationships: Understanding how shapes fit together.
  - Visual Analysis and Synthesis: Breaking down images into parts and reconstructing them.
- Improving Math Learning: **children understand geometric concepts and spatial reasoning, which are essential for geometry and problem-solving in math.**
- Picture:

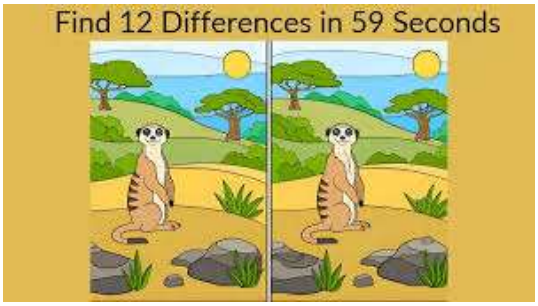




2. Spot the Difference

- Description: Children compare two similar images to identify differences.
- Visual Perception Skills:
  Visual Discrimination: Noticing subtle differences between images.
  Visual Figure-Ground: Distinguishing objects from the background.
  Attention to Detail: Enhancing focus and concentration.
- Improving Math Learning: **Develops attention to detail, with careful observation, for solving math problems accurately.**
- Picture:





3.Memory Matching Cards

- Description: Children flip over cards to find matching pairs, requiring them to remember the location of different images.
- Visual Perception Skills:
  Visual Memory: Remembering the position of cards.
  Visual Sequential Memory: Recalling sequences of visual information.
  Concentration: Maintaining focus to match pairs.
- Improving Math Learning: **Enhances memory and the ability to recall sequences, which are important for learning math procedures and formulas.**

Picture:

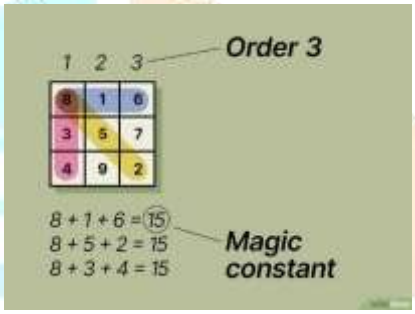
4. Jigsaw Puzzles

- Description - Small pieces of puzzle is fit together to form a whole picture.
- Visual Perception Skills:
  Visual Spatial Relationships: Understanding how pieces fit together.
  Visual Form Constancy: Recognizing shapes regardless of change in size or orientation.
  Visual-Motor Integration: Picking up and placing pieces correctly.
- Math Learning: Helps with **understanding part-whole relationships and spatial reasoning, important for geometry and problem-solving.**

- Picture:

5. Magic Squares

- Description: A grid where numbers must be arranged so that the sum of each row, column, and diagonal is the same.
- Math Skills:
  Pattern Recognition: Identifying numerical patterns.
  Logical Thinking: Using reasoning to place numbers correctly.
- Visual Perception Skills:
  Visual Analysis and Synthesis: Breaking down a problem and synthesizing information.
  Improving Math Learning: **Develops logical thinking and pattern recognition, which are crucial for problem-solving and algebra.**
- Picture:



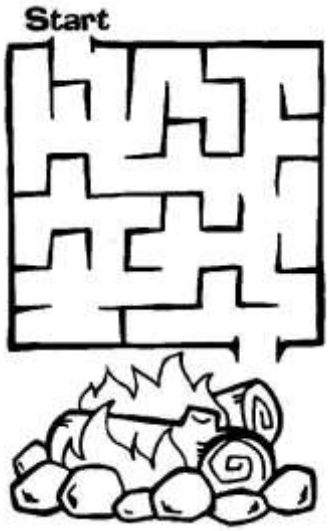
6. Word Search

- Description: A grid of letters where children find hidden words.
- Visual Perception Skills:
  Visual Discrimination: Recognizing patterns in the grid.
  Visual Figure-Ground: Distinguishing words from a complex background.
  Visual Sequential Memory: Remembering sequences of letters.
- Math Learning: **Enhances pattern recognition and sequential memory, which can be transferred to maths learning.**
- Picture:

7. Mazes

- Description: Paths where children navigate from a start point to an end point.
- Visual Perception Skills:
  Visual Spatial Relationships: Understanding the layout of the maze.
  Position in Space: Understanding the location of objects in relation to oneself.
  Problem-Solving: Finding the correct path through the maze.
- Math Learning: **Develops problem-solving skills and spatial reasoning, which are essential for geometry and mathematical reasoning.**

- Picture:



By integrating these games into the learning process, children improve their mathematical abilities through engaging themselves in fun activities.

Review of literature

Mammarella, I. C., Caviola, S., Giofrè, D., & Borella, E. (2018) explored the role of visual and spatial working memory abilities in early arithmetic achievement. The study included preschool children with typical development, excluding those with identified cognitive impairments. Over a school year, children were assessed using VPAT to measure visual perceptual skills. The results show that strong visual-spatial working memory abilities are predictive of higher arithmetic achievement, emphasizing the importance of early assessment and intervention to support math learning.

Fletcher et al. (2018) provide a comprehensive overview of learning disabilities, including those related to visual perception, in their book "Learning Disabilities: From Identification to Intervention." The **book emphasizes the use of Visual Perceptual Assessment Tools (VPAT) to identify visual perceptual deficits and outlines effective interventions**. The authors included studies on students with diagnosed learning disabilities, excluding those without such diagnoses. Spanning multiple studies over several years, the literature underscores the importance of early identification and targeted interventions. The results demonstrate that **addressing visual perceptual challenges can significantly improve mathematical abilities in students with learning disabilities.**

Peng, P., & Fuchs, D. (2016). Peng and Fuchs (2016) conducted a meta-analysis to examine working memory deficits in verbal and numerical domains among children with learning difficulties. The analysis included studies that specifically assessed visual-spatial working memory using VPAT, excluding studies that did not focus on these cognitive areas. Covering research from the past two decades, the findings indicate that visual-spatial working memory deficits significantly affect math performance. The conclusion supports the need for targeted interventions to address these deficits and improve mathematical outcomes.

Wong, T. K., Ho, C. S., & Tang, J. (2014) investigated the relationship between visual perception and academic performance in reading and mathematics among Hong Kong Chinese children in their study "The Role of Visual Perception in Chinese Reading and Mathematics Performance in Hong Kong Chinese Children." The study included school children without learning disabilities, excluding those with significant sensory or cognitive impairments. Conducted over one academic year, the researchers used VPAT assessments to measure various visual perceptual skills. The results indicate a strong correlation between visual perceptual skills and math achievement, suggesting that enhancing these skills can lead to improved outcomes in both reading and mathematics.

Alloway, T. P., Bibile, V., & Lau, G. (2013). This article, "Computerized Working Memory Training: Can It Lead to Gains in Cognitive Skills in Students?" was published in Computers in Human Behavior, examines the effectiveness of computerized working memory training on cognitive skills, including visual-spatial memory. The study included school children with varying levels of working memory capacity, excluding those with diagnosed learning disabilities. Conducted over three months, the results discuss how such training can enhance mathematical performance in students.

Friso-van den Bos,& Van Luit, J. E. (2013). This meta-analysis, "Working Memory and Mathematics in Primary School Children: A Meta-Analysis," published in Educational Research Review, examines the relationship between working memory, including visual-spatial working memory, and mathematics achievement in primary school children. The study included primary school children, excluding those with severe cognitive impairments, covering research from the past decade. The findings underscore the importance of visual perceptual skills in math learning.

Case-Smith, J. **"Occupational Therapy for Children**" provides a comprehensive guide on the role of occupational therapy in supporting children with learning disabilities, including those with visual perceptual deficits. The book includes studies and case examples where occupational therapy interventions **are used to improve visual perceptual skills and their impact on academic performance, particularly in mathematics.** The inclusion criteria were children with diagnosed learning disabilities, while those without such diagnoses were excluded. The results highlight the effectiveness of occupational therapy in enhancing visual perceptual skills and subsequent academic performance.

Pieters, S., Desoete, A., Roeyers, H., Vanderswalmen, R., & Van Waelvelde, H. (2012). investigated the role of visual perception and motor skills in mathematical learning disabilities in their article "Behind Mathematical Learning Disabilities: What About Visual Perception and Motor Skills?". The study included children diagnosed with mathematical learning disabilities, excluding those with other types of learning disabilities. Conducted over one academic year, the researchers used VPAT assessments to identify specific visual perceptual deficits impacting math performance. The results suggest that visual perceptual and motor skills are crucial for mathematical learning, and targeted interventions can enhance math achievement in students with these disabilities.

Brown, T., & Hockey, S. (2012). investigated the use of occupational therapy interventions to improve visual perceptual skills in children with learning difficulties in their study "The Effectiveness of Occupational Therapy Interventions in Improving the Visual Perceptual Skills of Children with Learning Difficulties." The study included children with diagnosed learning difficulties, Conducted over six months,

the researchers used VPAT assessments to measure improvements in visual perceptual skills. The results show significant improvements in visual perceptual skills, leading to enhanced academic performance in subjects like mathematics.

Mix, K. S., & Cheng, Y. L. (2012). This article, "The Relation Between Space and Math: Developmental and Educational Implications," published in Current Directions in Psychological Science, reviews research on the relationship between spatial skills and mathematics. The authors included studies on children from preschool to middle school, excluding those with severe cognitive impairments, conducted over several years. The findings discuss how spatial reasoning underpins many mathematical concepts and suggest educational practices to enhance spatial and mathematical skills.

Alloway, T. P., & Passolunghi, M. C. (2011). This study, "The Relationship Between Working Memory, IQ, and Mathematical Skills in Children," published in Learning and Individual Differences, examines how different components of working memory, including visual-spatial working memory, relate to mathematical skills. The study included children in elementary school, excluding those with diagnosed learning disabilities, conducted over two academic years. The findings underscore the importance of visual-spatial memory in math achievement.

Fisher, A. V., & Borchert, K. (2011). examined the role of visual perception in early mathematics achievement among preschool children in their article "Visual Perception and Early Mathematics Achievement in Preschool Children." The study included typically developing preschoolers, excluding those with diagnosed developmental disorders. Conducted over a single school year, VPAT assessments were used to measure visual perceptual skills. The findings indicate that preschool children with strong visual perceptual skills tend to achieve higher in mathematics, underscoring the importance of early assessment and intervention to support math learning.

Lervag, A., & Hulme, C. (2010). This longitudinal study, "The Role of Speech Perception and Phonological Skills in the Development of Reading and Spelling," published in the Journal of Experimental Child Psychology, explores the development of reading and spelling skills in relation to visual perception and phonological skills. The study included children from kindergarten to third grade, excluding those with severe cognitive impairments, conducted over three academic years. The findings discuss implications for mathematics learning, particularly in identifying visual perceptual deficits using VPAT.

Bender, W. N. (2009). Bender (2009) provides a guide to differentiating math instruction based on students' visual perceptual abilities, assessed through VPAT tools like the DTVP-3 and Beery VMI, in his book "Differentiating Math Instruction: Strategies That Work for K-8 Classrooms." The book includes case studies of K-8 students, excluding those without visual perceptual issues. Over several school years, the strategies described show that tailored instruction focusing on visual-spatial skills leads to improved math performance and engagement in students with visual perceptual deficits.

Marrongelle, K. A., & Rasmussen, C. (2008). This article, "Meeting New Standards with Elementary and Middle School Mathematics Programs," published in Teaching Children Mathematics, discusses how incorporating visual perceptual skills in mathematics instruction can help meet educational standards. The study included elementary and middle school students, excluding those with diagnosed learning disabilities, conducted over one academic year. The article provides strategies for integrating visual aids and spatial reasoning tasks into the curriculum to support math learning.

***Ayres, A. J. (2005)* discusses sensory integration, including visual perception, and its impact on children's learning in her book "Sensory Integration and the Child."** The book includes case studies and research involving children with sensory processing challenges, excluding those without such issues.

Various **VPAT tools** are highlighted as part of sensory integration therapies. Results from the case studies show that sensory integration therapies, including visual perceptual training, can significantly enhance children's learning abilities, including mathematics.

Ginsburg, H. P., & Opper, S. (1988). This book, "Piaget's Theory of Intellectual Development," provides an overview of Piaget's theory, emphasizing the stages of cognitive development and their implications for mathematical learning. The book summaries of various studies on children's cognitive development, excluding those not relevant to Piagetian stages, covering research over several decades. It discusses the role of visual-spatial skills in the development of mathematical understanding.

METHODOLOGY

INTRODUCTION:

The term visual perception can be understood by looking into the meaning as the ability to see & organize, (understand) interpret to make sense . This sense is a complex combination & needs to be coordinated with functional abilities like movement & processing information. Visual perceptual skills rely on the brain's cognitive abilities. In school going children, it's essential for reading, writing, spatial awareness in daily life task, playground activities, size awareness and to all MATHEMATICAL knowledge.

AIM:

To assess the relationship between visuo perceptual task and maths concept learning in normal school going children of age upto 10 years.

OBJECTIVES:

1) To analyse visuo perceptual task as relevant to maths concepts.

2) To identify easy visuo perceptual task for normal school going children upto age 10 years.

3) To train these identified task for a period of two months.

4) To relate academic maths scores before and after administering training.

METHODS:

The total school students need to be screened & appropriate number of students needs to be assigned into a single group. All of them will be assessed for visuo perception using visual perceptual aspect test (VPAT) based on the inclusion criteria.

The intervention session was conducted 2 times a week, each afternoon sessions, over the period of 8 weeks.They received brainteasers activities All the samples were assessed using visual perceptual aspect test (VPAT) before and after intervention.

OUTCOME MEASURE:

Visual perceptual aspects test (VPAT), Teacher framed MATHS TEST as suitable to their academics. For therapy, Brain teaser activity is used.

Brain teasers are essentially a type of puzzle or activity that requires to think out of the box to find the solution. It is introduced in early childhood, and children usually love solving them. They enhance cognitive skills by improving problem-solving, memory, and learning. Fredricks et al. (2004) found that non-academic brain boosters increase student engagement and satisfaction. They also improve memory by reinforcing brain cell connections and enhancing short-term memory. Regular engagement in brain teasers

challenges the intellect, develops different levels of thought processes. Studies by Alloway, 2010 show that cognitive activities like puzzles substantially enhance working memory, crucial for problem-solving and learning. They train the mind to process information quickly, like physical exercises building muscles. They require sustained attention to solve problems, which releases dopamine, enhancing focus and concentration. Moreover, brain teasers boost creativity by encouraging lateral thinking and creative problem-solving. Because of all these advantages, maths learning is encouraged for the user.

STUDY DESIGN

Single group experimental study.

STUDY PARTICIPANTS

25 School going students, studying 3rd & 4th grade at panchayat union middle school, vazhaikollai , Cuddalore district of Tamilnadu

Inclusion criteria

Both gender students, who scored low in VPAT with more errors

Exclusion criteria

Students score adequate with VPAT without errors, Student suffering other neurological disorder is excluded

DATA ANALYSIS

Table 1
't' test for relating visuo perceptual task training to maths learning on pre and post test score among the primary school children

Groups	Number	Mean	Standard Deviation	t-value	P Value
Pre therapy	25	96.88	19.96	18.184	0.001
Post therapy	25	47.48	14.13		

In pre and post therapy analysis, Pre therapy (96.88) score has higher mean value than Post therapy (47.48). As the calculated t' value (18.184) is greater than table't' value, there is a significant difference between the pre and post therapy groups. So, high level correlation between visuo perceptual task training to maths learning is noted.

Bar diagram for mean value, relating visuo perceptual task training & maths learning on pre and post test score among the primary school children

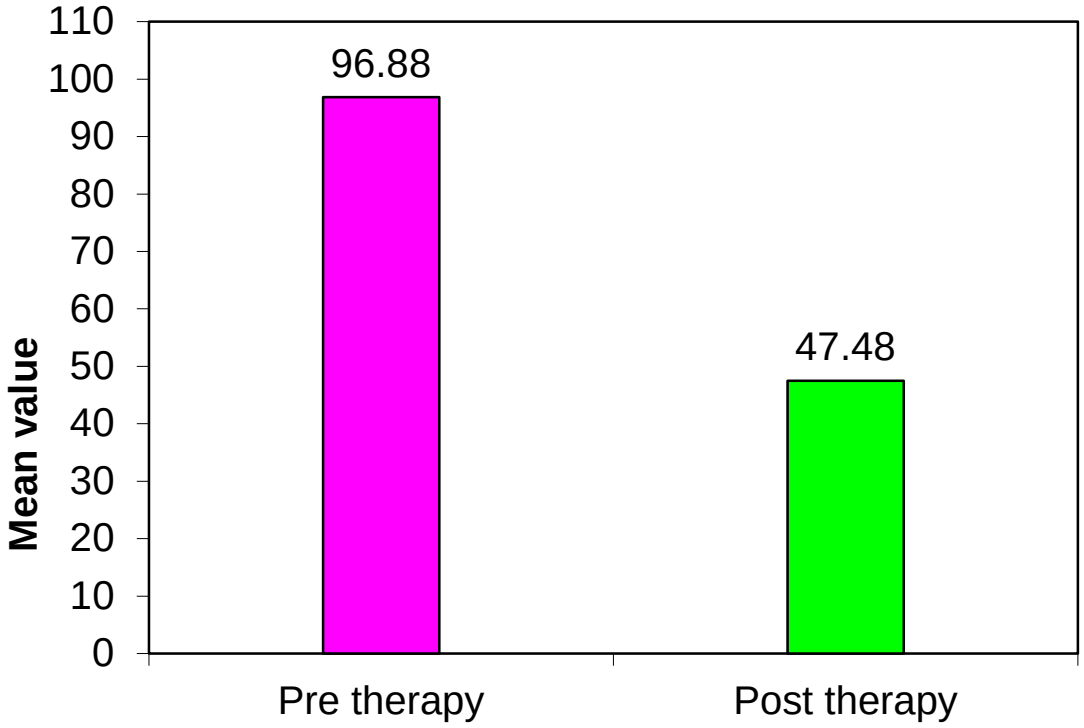


Table 2

't' test for relating visuo perceptual task training to maths learning on academic maths learning before therapy and after therapy

Groups	Number	Mean	Standard Deviation	t-value	P Value
Before therapy	25	73.44	12.14	12.651	0.001
After therapy	25	95.32	5.18		

It is clearly seen that academic maths learning after therapy (95.32) score is having higher mean value than academic maths learning before therapy (73.44). The calculated 't' value (12.651) is also greater than the table 't' value, there is a significant difference noted. So, **visuo perceptual task training has an impact to maths learning is evident.**

Bar diagram for mean value, relating visuo perceptual task training to maths learning before therapy and after therapy

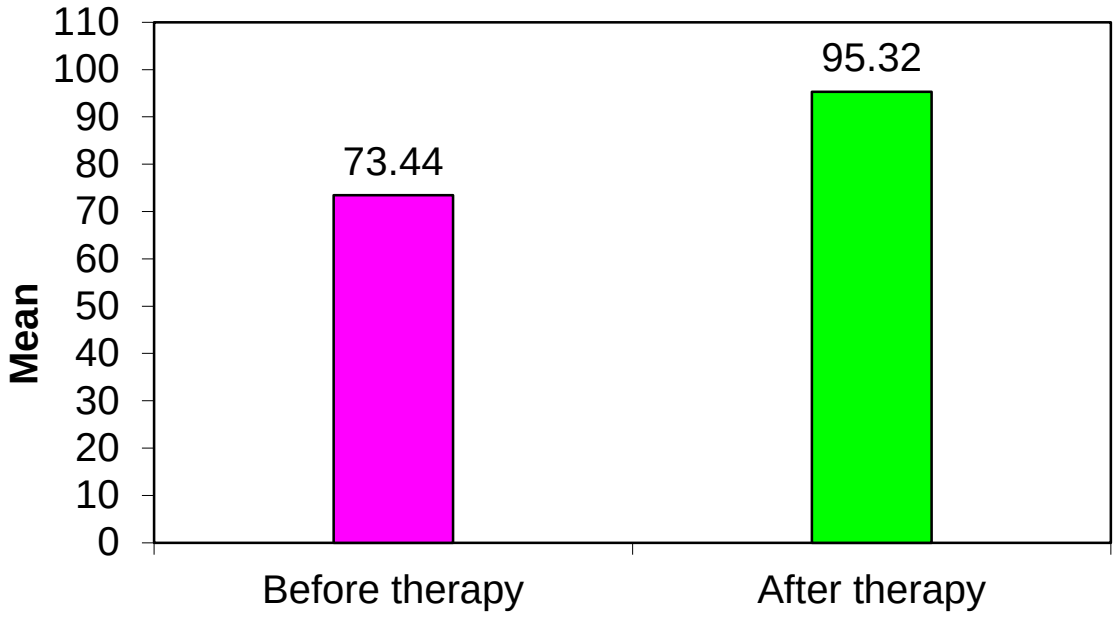


Table 3

't' test for visual discriminatory aspects on pre and post therapy score among the primary school children

Groups	Number	Mean	Standard Deviation	t-value	P Value
Pre therapy	25	20.20	5.70	15.556	0.001
Post therapy	25	9.36	3.76		

Comparing pre and post therapy, Pre therapy (20.20) scored higher mean value than Post therapy (9.36). The calculated 't' value (15.556) which is greater than the table 't' value & there is a significanct difference between the pre and post therapy scores. **It is clear that, Post therapy scores have high level visual discriminatory differences than pre therapy among the primary school children.**

Mean value for visual discriminatory aspects on pre and post therapy score among the primary school children

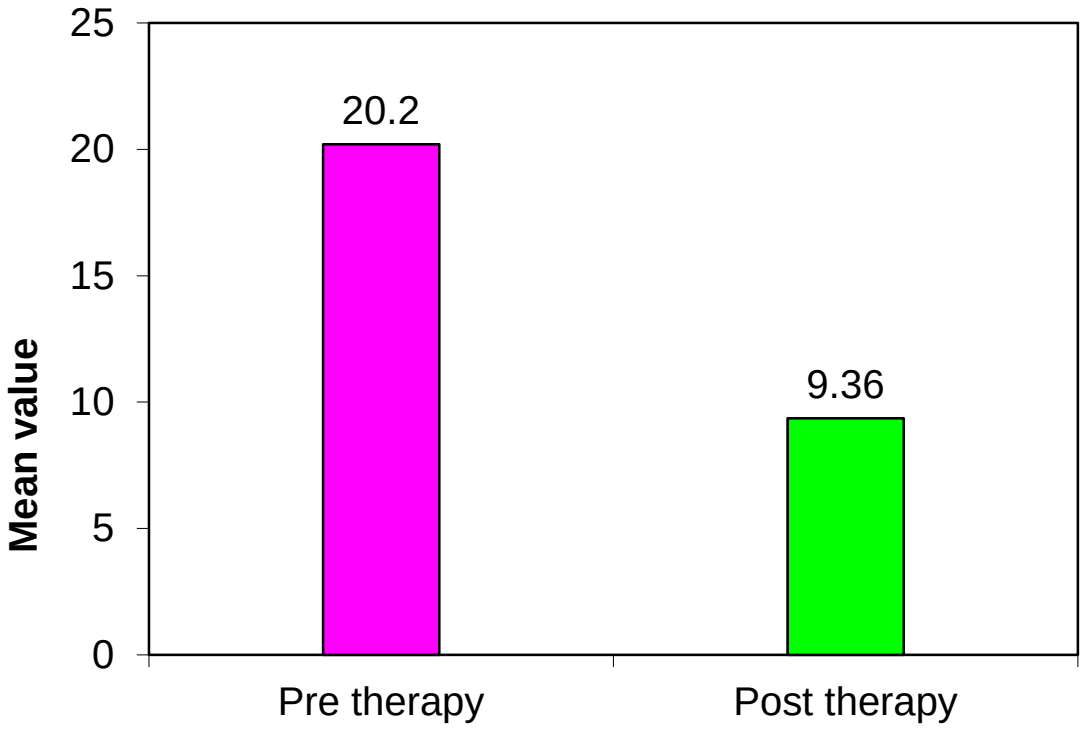


Table 4
't' test for visual memory aspects on pre and post therapy score among the primary school children

Groups	Number	Mean	Standard Deviation	t-value	P Value
Pre therapy	25	24.80	6.38	13.848	0.001
Post therapy	25	12.36	4.47		

Comparing pre and post therapy, Pre therapy (24.12) scored higher mean value than Post therapy (12.36). The calculated 't' value (13.848) is greater than the table 't' value & there is significanct difference seen between the pre and post therapy groups. So**, Post therapy scores have high level visual memory aspects than pre therapy** among the primary school children.

Mean value for visual memory aspects on pre and post therapy score among the primary school children

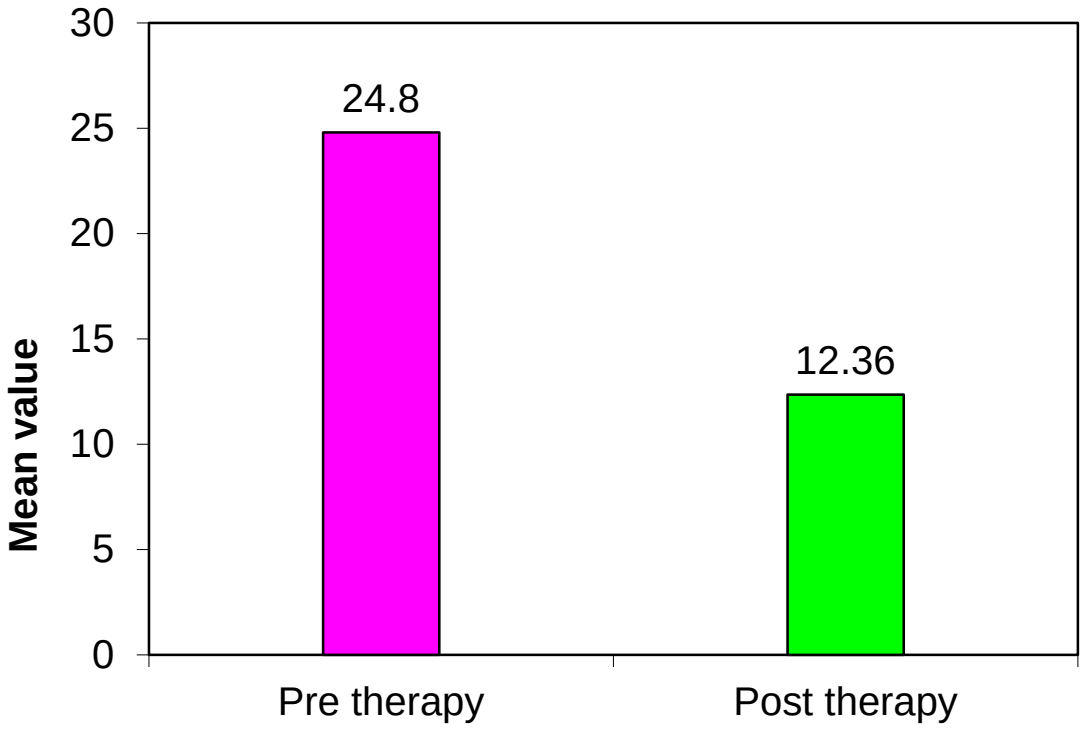


Table 5
't' test for visual spatial processing aspects on pre and post therapy score among the primary school children

Groups	Number	Mean	Standard Deviation	t-value	P Value
Pre therapy	25	16.80	7.91	7.040	0.001
Post therapy	25	8.84	4.01		

Comparing pre and post therapy, Pre therapy (16.80) score is having higher mean value than Post therapy (8.84). The calculated 't' value (7.040) which is greater than the table 't' value, shows that there is a significant difference between the pre and post therapy groups. So, Post therapy scores have high level visual spatial processing aspects than pre therapy among the primary school children.

Mean value for visual spatial processing aspects on pre and post therapy score among the primary school children

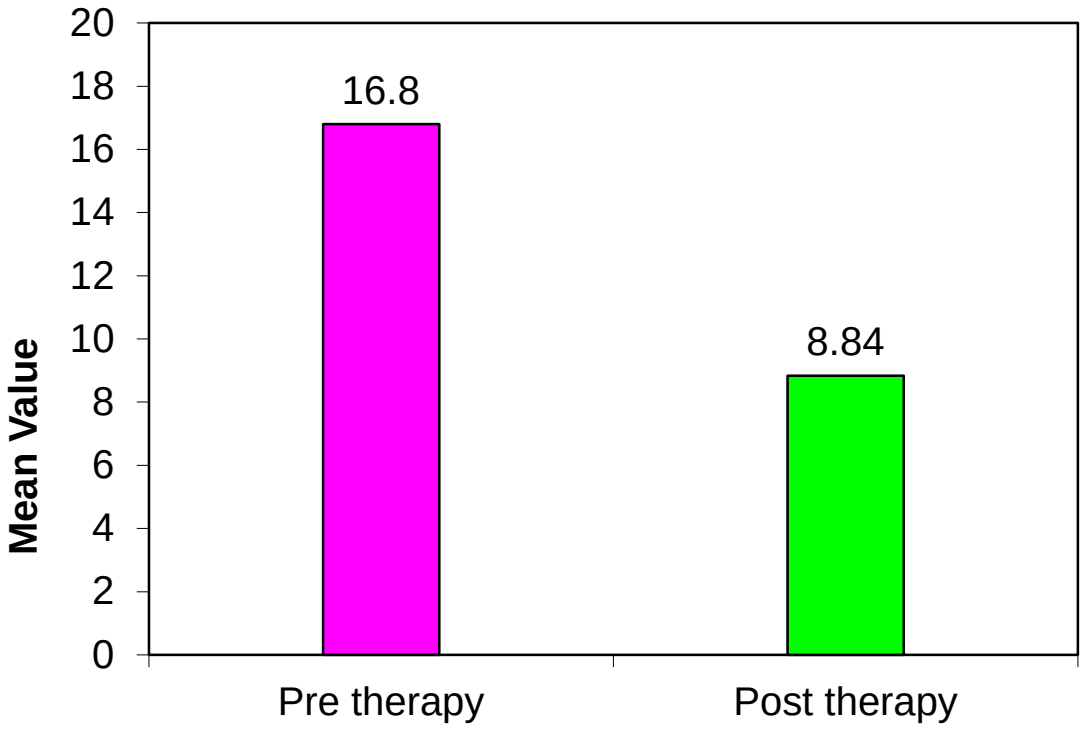
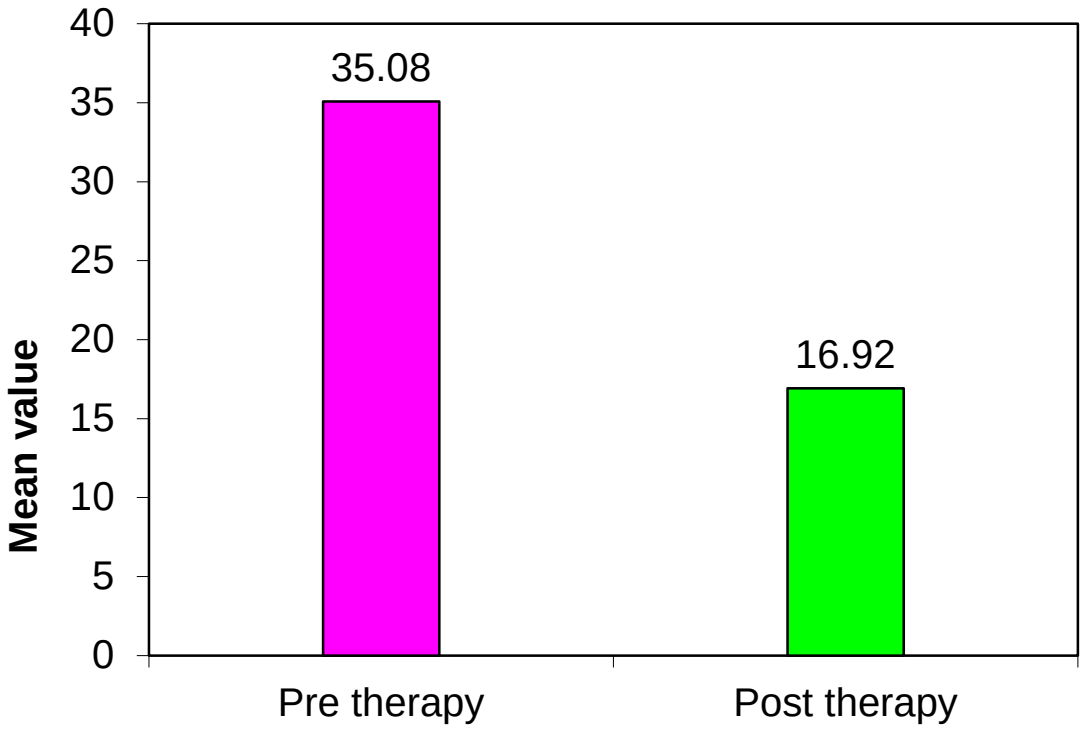


Table 6
't' test for visual analysis aspects on pre and post therapy score among the primary school children

Groups	Number	Mean	Standard Deviation	t-value	P Value
Pre therapy	25	35.08	8.44	12.718	0.001
Post therapy	25	16.92	5.35		

In the case of pre and post therapy, Pre therapy (35.08) scored higher mean value than Post therapy (16.92). The calculated 't' value (12.718) which is greater than the table 't' value, there is a significance difference exists between the pre and post therapy groups. So, Post therapy scores have high level visual analysis aspects than pre therapy among the primary school children.

Mean value for visual analysis aspects on pre and post therapy score among the primary school children



RESULT

Comparing pre and post therapy scores, from the statistical analysis, there is a significant difference between the pre and post therapy groups. So, Post therapy scores shows, level visual spatial processing aspects has an impact to maths learning among the primary school children

DISCUSSION

The purpose of the study is to relate visuo perceptual task training to maths learning in primary school children. After obtaining consent for the study, from parents of students, school headmaster for using the school premises, hundred students from panchayat union middle school, vazhaikollai were screened by assessment form. The students were assessed with visual perceptual aspect test (VPAT), and a test was conducted from their maths subject.

Among the hundred students, 25 students from 3rd and 4th grade were selected as appropriate for training. While assessing, it was found that they were too playful, when everyone is put together; they were unable to listen to the instructions. Hence decision for using fun activity as therapy was made by discussion with research guide. The intervention program session (brain teasers) was conducted twice in a week each session for 1 hour for a period of 2 months. At end of second month intervention, the children were again assessed with VPAT and same MATHS test is again conducted. The wrong answers in the VPAT & MATHS TEST are significantly lower in the post-therapy assessment and the test scores shows, Students better maths learning. The intervention program of brain teasers games and visual perceptual activities were effective in improving maths learning.

CONCLUSION

The experimental programme in panchayat union middle school, vazhaikollai was done by screening hundred students of the school. Assessment with VPAT & academic maths test was used as pre & post-test. Occupational therapy is centered on enabling students to participate in meaningful activities to enhance better education. Visual perception and mathematical skills are crucial components in OT, as they underpin both academic success and daily functioning. By enhancing visual-spatial skills, therapists help clients perform better in mathematics and daily tasks requiring spatial awareness. OT activities enhance numerical fluency, which is crucial for managing finances, and other practical tasks like driving.**Through this study, we can conclude that**, by Visual perceptual task training we can help students learn better maths. As early training is applied, we can prevent DYSCALCULIA problem also.

Hence suggestions regarding, including brain teaser activities and games as part of curriculum is given to authorities.

LIMITATION

1. This experimental study was done in a single school (panchayat union middle school, vazhaikollai) due to limited time availability for the research project

2. The study was conducted for 3rd and 4th grade students for appropriate small sample size, with 25 students only.

3. As because of end of academic year, permission for only 2 session in a week was granted by authorities of school

RECOMMENDATION

- Study can be carried out on larger samples, with older children
- We can teach in other schools, visual spatial tasks as summer vacation activity
- The duration can be extended so that children can better learn maths.
- Assessment on mentally challenged children can be done by VPAT.

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