Application of the Gestalt Laws in Children's Perceptual Development through Didactic Material

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Abstract: In order to strengthen visual, tactile and spatial perception in children from 5 to 6 years old, this study implements the Gestalt Laws through audiovisual and physical didactic material. With 22 children and 8 teachers from a public institution in Medellín, an action-research methodology was applied in five phases: diagnosis, planning, action, observation and reflection. Audiovisual materials were used, such as interactive videos, and physical materials, such as jigsaw puzzles and interlocking toys, which are linked to the laws of proximity, similarity, continuity, figure and background, symmetry, closure, pregnancy and segregation, facilitating pattern recognition, spatial organization and visual discrimination. The results show significant advances in infant perception, demonstrating that the Gestalt-based approach is effective in enriching sensory and cognitive learning in early childhood..

Keywords: *visual perception; spatial perception; tactile perception; cognitive development; Gestalt Laws, early childhood*

Introduction

Early childhood is a key period for the holistic development of human beings. During the first seven years of life, children go through fundamental stages in their physical, emotional, social, and cognitive growth, which lay the foundation for skills such as problem-solving, creativity, and the ability to interact socially (Chua Díaz & Pucho, 2020). According to the Colombian Ministry of National Education (MEN) (2016), early childhood is a crucial stage of the life cycle where the foundations for the cognitive, emotional, and social development of human beings are established, encompassing children from zero (0) to six (6) years of age.

Within these stages, sensory perceptions—visual, tactile, and spatial—play a crucial role in how children interact with and understand their environment. According to Olalde (2020), visual perception allows children to interpret the world through stimuli received by sight, while tactile perception, according to Chamorro et al. (2021), begins at birth and develops as children explore objects through touch. Similarly, Ortega (2023) highlights the importance of spatiotemporal perception, which helps children orient themselves and understand spatial and temporal relationships. It is essential to emphasize that, in learning, children gradually grasp concepts of proximity, separation, inside-outside, and positional relationships, using their bodies as a reference for notions such as far-near, up-down, and front-back (Sánchez & Benítez, 2016).

Perceptual skills developed through Gestalt principles, such as proximity, similarity, continuity, figure-ground, symmetry, closure, Prägnanz, and segregation, have a significant impact on children's mathematical education. These skills facilitate pattern recognition, spatial organization, problem-solving, and the understanding of abstract mathematical concepts. For example, the law of proximity helps children group elements and understand classification, while the law of symmetry enhances their understanding of geometry (Vivas, 2018; Quispe et al., 2022). These skills not only strengthen cognitive development but also optimize children's ability to process and apply mathematical knowledge effectively.

During the preschool stage, children experience a crucial period in their perceptual development. Using their skills, they interact effectively with their environment, facilitating their social relationships and adaptation to the world around them (MEN, 2009). One proposed strategy to stimulate these perceptions is through the implementation of Gestalt principles, understanding that the mind is structured according to certain laws, where elements reach it through sensory channels (perception) or memory (thought, intelligence, and problem-solving) (De Armas et al., 2018).

In the educational context, Gestalt Laws are understood as the psychological principles of how the mind organizes visual information (Moran, 2020). These principles have been applied in various disciplines to capture attention and facilitate perception (Núñez & Pacheco, 2022). The Laws aid in pattern recognition, coordination, balance, and the organization of basic or complex forms. The laws used in this project are: proximity, similarity, continuity, figure-ground, symmetry, closure, Prägnanz, and segregation.

To apply Gestalt principles in activities designed to strengthen perception in early childhood, specific examples can be used to facilitate understanding. For example, the law of proximity can be applied by grouping cards of nearby apples, helping children recognize patterns and spatially organize objects. The law of similarity can be illustrated by grouping flowers of different sizes and colors according to their similarities, improving visual processing. The law of continuity can be taught by organizing sequences of images, strengthening the ability to follow sequences and hand-eye coordination. The law of figure and ground can be applied in guessing games where children must

identify objects in blurred images, facilitating the distinction between figure and ground. The law of symmetry can be taught with symmetrical building blocks to complete figures, encouraging pattern recognition and the understanding of symmetrical shapes. The law of closure can be applied with number puzzles, promoting critical thinking and problem-solving. The law of Prägnanz can be taught using wooden shape sorters to complete numbers, simplifying and organizing visual elements. Finally, the law of segregation can be applied in domino games with animal figures, helping children group and differentiate elements, improving visual discrimination and perceptual organization.

In the school setting, their use can be relevant, as these laws allow for the design of activities and teaching resources that foster meaningful learning, helping students recognize patterns and shapes and understand spatial relationships (Solano, 2020). For their implementation in cognitive development, Gestalt laws should focus on areas where they can be applied, such as logical-mathematical reasoning.

According to Vivas (2018), problem-solving is a mathematical skill that is acquired sooner or later. Mathematical thinking allows students to develop analytical skills to solve any type of problem. It is important to highlight that involving children in diverse activities stimulates brain functions that strengthen the development of skills related to logical-mathematical thinking. This is achieved through the child's experiences and interactions with their environment (Quispe et al., 2022).

To apply the aforementioned principles in this study, children's movement is considered relevant, as they can learn while exploring. According to Sáez and López (2022), play in education is used to enhance learning. It strengthens students' reasoning skills, leadership, collaboration, and motivation to learn. It is essential to incorporate didactic activities and resources that capture children's attention.

Given the impact of perception on cognitive development and learning, especially in logical-mathematical areas, the importance of creating educational materials based on Gestalt principles to enhance these abilities in young children is evident. Therefore, this research explores how and in what ways Gestalt principles can be implemented in audiovisual and physical educational materials to develop the visual, tactile, and spatial perceptions of children aged 5 to 6.

Methodology

Participants

A non-probability convenience sample was used, selecting participants who were available and willing to participate in the study. This allowed for easier and faster access to the sample needed for the research. The sample included 22 children and 8 teachers. The study focused on 5- to 6-year-old children in the transition grade at the Francisco Antonio Zea Educational Institution and its second location, Pedro de Castro. These children presented variations in their cognitive and perceptual development. All were enrolled in the transition grade and willing to actively participate in the study. Exclusion criteria applied to children who did not meet the inclusion requirements or whose parents did not consent to their participation. The teachers were full-time transition level teachers with experience in preschool education and were willing to actively participate in the study.

Ethical aspects

Informed consent was obtained from all participants, ensuring the confidentiality and anonymity of the data. Measures were taken to protect the physical and emotional well-being of the children and teachers, and the study was approved by an ethics committee. Participation was voluntary, allowing participants to withdraw at any time without negative consequences.

Studio design

The research design is based on a mixed-methods approach with action research, whose objective, according to Córdoba (2017), is to solve real-world problems through a collaborative process that includes the following phases: diagnosis, planning, action, observation, and reflection. This approach allows not only for the improvement of a specific situation but also for the generation of new knowledge. The quantitative approach is evidenced by the application of Likert-scale assessment tests. The study's timeframe spanned from February 6, 2024, to October 25, 2024. The action research stages are described below:

Diagnosis: Identification of the current state of children's perceptual and cognitive development. Application of semi-structured interviews to teachers. The feasibility of using Gestalt principles was identified as an alternative approach to perceptual development. ***Planning:*** Design of educational materials based on Gestalt Laws. Identification of Gestalt Laws, their functions, and characteristics. ***Action:*** a) Implementation of the educational materials in the classroom, both physical and audiovisual. The audiovisual materials included interactive videos exemplifying the laws of proximity, similarity, continuity, and figure-ground, supported by physical cards of apples, flowers, and image sequences. The physical materials consisted of symmetrical building blocks to complete figures of castles and robots, number puzzles from 1 to 5, boards with numerical symbols for weaving threads, wooden puzzles with numbers and geometric figures, and dominoes with aquatic animal figures. These materials were designed to apply Gestalt Laws and strengthen children's visual, tactile, and spatial perception. b) Application of a performance test, which, according to Medina et al. (2023), is a data collection method that involves recording and analyzing the behavior of individuals or groups in their natural environment. The participants' performance in applying the physical materials was evaluated in four different sections. Students were individually asked to complete the material within a set time, and their performance was assessed using a test that included criteria related to perception (Table 2). ***Observation:*** Evaluation of the use and effectiveness of the materials through detailed observations. ***Reflection:*** Analysis of results to adjust strategies and improve future applications. For the quantitative data, a descriptive statistical analysis was used, including the calculation of means and standard deviations to evaluate the participants' performance in the different activities based on Gestalt principles. This analysis allowed for the identification of patterns and variations in the children's perceptual abilities. For the qualitative evidence, a content analysis of the semi-structured interviews was used, categorizing the teachers' responses and observing recurring themes and perceptions regarding the application of Gestalt principles in the development of children's perception.

Information gathering

Interview

According to Baptista et al. (2014), a semi-structured interview is one that includes a guide of basic topics or questions but allows flexibility to delve deeper and explore new ideas that arise during the interaction with the interviewee. A semi-structured interview was conducted with kindergarten teachers, organized into two sections: one related to knowledge of Gestalt principles (10 items) and the other focused on the development of perception (8 items). These interviews were reviewed and validated by experts before being administered to a group of eight teachers.

Structured observation with performance evaluation

were gathered in a classroom where they were shown video clips exemplifying Gestalt Laws. The use of video clips in the study is justified by their effectiveness in concept acquisition, especially in an educational context. Audiovisual materials, such as video clips, have been shown to significantly

improve students' understanding and retention of information. According to studies, the impact of audiovisual material on learning is remarkable, as it facilitates the understanding of complex concepts by combining visual and auditory elements, enriching the learning experience and increasing student motivation and engagement (Briceño & Pernia, 2024). Furthermore, video clips allow information to be presented in a dynamic and engaging way, which is particularly beneficial for young children, helping them to capture and maintain their attention more effectively. Afterward, the children replicated what they had seen through hands-on activities.

The researchers observed and assessed the children's performance using a scale of 1 to 5, noting how each group applied the learned concepts using the instrument shown in Table 1. The assessment scale was developed based on perceptual skills aligned with Gestalt principles and was reviewed by experts in early childhood education and psychology to ensure its relevance and clarity. A pilot test was conducted with a small group of children, allowing for further adjustments.

Table 1.

Assessment tool in audiovisual teaching material based on Gestalt laws.

Teaching Material - Audiovisual						
Law of Proximity						
Criterion	**Description**					
1. Perception of grouping.	It assesses the ability to perceive and group apples that are closer together, recognizing them as part of the same set.					
2. Perception of spatial organization.	It measures the ability to perceive and organize apples into rows or columns based on their spatial proximity.					
3. Pattern perception.	It measures the ability to perceive and identify simple patterns (such as pairs or trios) based on the proximity of apples, in less than 5 minutes.					
4. Perception of association.	It assesses the ability to perceive and associate grouped apples as part of the same set or category, such as "red apples", in less than 5 minutes.					
5. Perception of unity	It measures the ability to perceive several nearby apples as a complete unit rather than individual items, in less than 1 minute.					
Law of Similarity						
Criterion	**Description**					
1. Grouping by color and shape.	Evaluate the child's ability to perceive and group flowers on the card that share similar colors and shapes, recognizing the subtlety in the variations of tone.					

2. Classification by size.	Evaluate the child's accuracy in grouping the flowers according to their size, organizing them coherently.					
3. Pattern recognition	It measures the child's ability to create and recognize patterns using flowers with similar characteristics.					
4. Perception of unity in diversity	It measures the child's ability to group flowers that, although they have variations, share a general resemblance.					
5. Hand-eye perception.	Evaluate the child's ability to coordinate sight and hands by grouping flowers of similar colors, ensuring accuracy in movement.					
Continuity Law						
Criterion	**Description**					
1. Perception of follow-up.	They arrange the pieces in such a way that they reconstruct the scene in the same order in which they saw it in the video.					
2. Laterality perception.	Identify a continuous route or path, mentioning whether the woman goes straight ahead, turns back, goes down or up, etc.					
3. Ability to complete forms	Mention how the line or shape should continue, if there is a part of the sequence that is not complete.					
4. Eye-hand coordination.	He has eye-hand coordination when following continuous lines with the character.					
5. Logical and critical thinking.	Identify the most logical path of continuity among several options, stimulating critical thinking and perception.					
Figure and Ground Law						
Criterion	**Description**					
1. Quick identification of figure and ground.	Look at an image and quickly identify the main object (figure) and the background in 30 seconds.					
2. Focus on the figures.	Distinguish the figure even though the patterns in the background are similar.					
3. Figure-ground perception.	Clearly differentiate elements that are part of the figure and those that belong to the background, even if they are close together, in 30 seconds.					
4. Signaling and verbalization of figure	He is able to point out and verbalize what the central figure of an image is and what its context or					

and ground.	background is, in 30 seconds.					

Note. This table shows how children's perceptual skills were assessed by applying Gestalt laws to physical teaching materials.

Performance test

These instruments (Table 2) facilitated the capture of information to analyze and understand the impact of Gestalt Laws on the development of perception in children aged 5 to 6 years.

Table 2.

Instrument for evaluating visual perception in physical teaching materials.

Physical teaching materials						
Law of Symmetry - Castle - Robot						
Criterion	**Description**					
1. Comparative analysis of characteristics.	Compare the formal characteristics of each side (size, shape, color) before fitting.					
2. Fine motor coordination.	The child's movements are fluid and controlled as he fits the pieces together.					
3. Perception of symmetry.	Recognize when a piece is not symmetrical and find a suitable alternative in less than a minute.					
4. Visual discrimination	Select the symmetrical pieces easily or do you need several attempts before finding the right one?					
5. Spatial location.	Use the center line as a reference for positioning the pieces.					
6. Perception of correspondence.	Compare the symmetrical pieces with the shape of the interlocking puzzle before placing them.					
7. Identification of the symmetrical pattern.	Recognize the symmetrical pattern that is formed when all the pieces are in place.					
Closure Law - Puzzles						
Criterion	**Description**					
1. Ability to complete forms	Evaluate the child's ability to mentally complete incomplete geometric shapes and assemble them to form complete numbers.					
2. Incomplete pattern recognition	It measures the child's ability to identify and recognize geometric patterns that are not fully defined and how they complete them in their mind.					
3. Visual-motor coordination	It measures the child's accuracy in assembling the geometric pieces, evaluating					

	dexterity and coordination between vision and manual movement.					
4. Visual discrimination	Evaluate the child's ability to differentiate between various geometric shapes and select the appropriate pieces to complete the numbers.					
5. Spatial orientation	It measures the child's ability to correctly orient the pieces within the puzzle and adjust their spatial perception to complete the figures.					
Law of Closure - Magic Threads						
Criterion	**Description**					
1. Recognition of mathematical symbols	Evaluate the child's ability to correctly identify and associate mathematical symbols (addition, subtraction, division, multiplication).					
2. Visual-motor coordination	Measure the child's accuracy in inserting the cord into the holes following the outline of the mathematical symbol.					
3. Spatial orientation	Evaluate the child's ability to correctly follow the path of the cord, maintaining the correct spatial orientation of the symbol.					
4. Perceptual closure capacity	Measure whether the child is able to complete the mathematical symbol figure using the law of closure, mentally closing incomplete patterns.					
5. Autonomy in the task	Evaluate the child's independence in performing the task, observing whether they can complete it without help or if they need constant assistance.					
Law of Prägnanz - Numerical adventure						
Criterion	**Description**					
1. Perceptual clarity	Evaluate whether the child can perceive and form numbers clearly and quickly, easily recognizing the geometric shapes involved.					
2. Perceptual organization	It measures how the child visually organizes the puzzle pieces, looking for simple, stable, and symmetrical shapes to form the numbers correctly.					
3. Visual balance	It assesses the child's ability to perceive shapes in a balanced and structured way, adjusting the pieces to create visually stable figures.					
4. Visual-motor coordination	Measure the child's accuracy in assembling the puzzle pieces, ensuring that the visual organization follows an appropriate path.					

5. Recognition of numerical patterns	Evaluate the child's ability to identify, assemble, and form complete numbers using the principles of pregnance (perceptually simple forms).					
Segregation Law - Dominoes						
Criterion	**Description**					
1. Visual discrimination	Evaluate whether the child can correctly identify the animal figures based on the differences in color and shape between the domino pieces.					
2. Perceptual grouping	It measures the child's ability to group domino pieces by color and shape, following the principles of the law of segregation.					
3. Visual-motor coordination	Evaluate the child's accuracy in manipulating and placing the domino pieces in the correct positions, following the color and shape correspondence.					
4. Perceptual segregation	It measures the child's ability to distinguish and mentally separate the different categories of figures (animals) according to their color and shape in the context of play.					
5. Perceptual and problem-solving strategies	Evaluate whether the child uses effective strategies to solve perceptual problems, such as logically finding matches between domino pieces.					
	Pregnancy Law - World of Colors and Numbers					
Criterion	**Description**					
1. Quantitative perception.	Place the correct number of blocks according to the number in 1 minute.					
2. Selective perception of color and sequence.	Easily group the blocks by color, following the sequence shown on the card in 1 minute.					
3. Memory.	You can keep a numerical sequence by using the blocks.					
4. Numerical correspondence.	Establish a correct correspondence between the number and the quantity of blocks.					
5. Identification of categories.	Recognize segregation with tokens, numbers, and blocks in less than 1 minute.					
6. Spatial language.	Use terms like up, down, inside, outside, in front, behind when describing the positions of the blocks.					

Note. This table shows how children's perceptual skills were assessed by applying Gestalt laws to the audiovisual teaching material.

Implementation of Gestalt laws in the creation of teaching materials

The characteristics of the selected Gestalt Laws were implemented in the creation of educational materials to develop perception and logical-mathematical learning in children aged 5 to 6. Methods for applying the Gestalt Laws in audiovisual materials were established through the use of technological tools and physical materials, as described in Table 3.

Table 3.

Description of the use of Gestalt laws in teaching materials.

Gestalt Laws	Material	Applicability
Law of the proximity	Audiovisual	Display a series of points scattered across the screen and then group them with lines or shapes to demonstrate how proximity unites them.
Law of the likeness		Display a series of geometric shapes of different colors and then group those that share the same color using shading or labels
Law of the Continuity		Present a series of dots or intersecting lines and highlight how the direction of movement of the elements helps to perceive continuity.
The Figure and Ground Law		Create guessing games where children have to guess what object or shape is being shown in a blurry or fuzzy image.
Law of the symmetry	Physical	Use symmetrical shapes in toys or learning materials, such as building blocks or puzzles, to encourage pattern recognition.
Law of closing		Design toys that require completing figures or patterns, such as puzzles or jigsaw puzzles, to promote critical thinking and problem-solving.
Law of pregnance		Create materials with clear and recognizable shapes that are easy for children to manipulate and understand, such as cardboard books with simple and attractive illustrations.
Segregation Law		Use contrasting colors and distinct physical elements to differentiate specific parts of a toy or educational material, facilitating understanding and interaction.

Note: This table presents examples of how to apply Gestalt principles in various educational

materials, fostering perceptual and visual organization skills in children.

Results

The study explored the implementation of Gestalt laws in education, specifically in the development of perception in early childhood. The functionality of each law and its characteristics were analyzed to construct teaching materials that strengthen perception, as shown in the following table (4).

Table 4.

Functionalities of Gestalt laws that help in the development of perception

Gestalt Law	**Functionality**	**Development of perception**
Proximity	Elements that are close to each other tend to be perceived as a unit or group.	- Facilitates the recognition of patterns and shapes - Promotes spatial organization - Improves attention and focus
Likeness	Elements that share similar characteristics tend to be perceived as part of the same group.	- Category recognition. - Improved Visual Processing - It encourages generalization
Continuity	Elements that follow a continuous direction tend to be perceived as a unit or pattern.	- Improves the ability to process sequences -Strengthens pattern recognition -Optimizes visual and motor coordination
Figure and ground	It is a principle of visual perception that establishes that the brain organizes what it perceives into a main figure (object or shape) and a background (the area surrounding the figure).	-Speeds up object recognition -Enhances focus and attention -Strengthens spatial understanding
Symmetry	Visual elements are perceived as more stable and harmonious, creating a visual balance that facilitates the perception and understanding	- Enriches the understanding of shapes and objects - Improves balance and coordination

	of information.	-Facilitates the understanding of patterns and sequences
Closing	Complete incomplete figures or shapes to perceive objects as a whole, even when parts of an image are missing.	_ Strengthens the recognition and organization of basic forms _ Improves the interpretation of partial image inference - Strengthens pattern recognition in letters and numbers
Pregnancy	The visual elements form simple and recognizable patterns instead of chaotic or complex shapes, simplifying and organizing elements into coherent forms.	_ Identify familiar objects _ Facilitates the understanding of complex visual scenes - Simplifies learning letters and numbers
Segregation	Similar elements are perceived as belonging to the same group, while different elements are perceived as separate.	_ Group objects by color _ Reinforces the difference between figures and backgrounds _ Recognizes patterns in the environment

The perception of 8 teachers from the Francisco Antonio Zea institution and its second headquarters Pedro de Castro was investigated regarding the application of laws in early childhood development through semi-structured interviews that addressed topics such as understanding, strategies and impact, on Gestalt laws and perception, the results of which are shown in Table 5.

Table 5.

Knowledge, application and development of Gestalt Laws from teaching perspectives.

Categories	**Subcategories**	**Summary of responses**
Knowledge and Application of Gestalt Laws	Familiarity and Knowledge of Gestalt Laws	Most teachers lack knowledge of Gestalt laws. Only two out of eight demonstrate a basic understanding, indicating that these laws relate to visual perception and the senses.

	Application in Teaching and Everyday Situations	Widespread lack of awareness: the vast majority indicate they are unfamiliar with Gestalt principles, using phrases like "I don't know," "I'm not familiar with them," and "None." Consequently, responses such as "I don't apply them because I don't know them" and "They don't apply" highlight the lack of application. Most are unfamiliar with the topic and have not had the opportunity to apply it in their own context.
Development of Perception in Early Childhood	Strategies and Teaching Materials Based on Gestalt	Some teachers indicate that, although they are not familiar with Gestalt principles, they use multisensory strategies in their daily routines to help children understand concepts. The activities mentioned include puzzles, free play, short videos, logic blocks, construction sets , lotteries, and shape sorters. The teachers expressed a lack of familiarity with Gestalt principles and how to apply them. Recurring phrases included "I don't know," "I'm not familiar with them," and "I don't know how they could help." Although multisensory strategies were used, the participants did not understand how these related to the principles.
	Impact of Gestalt Laws on Children's Perception	The teachers mentioned that there is considerable uncertainty regarding the practical application of Gestalt laws for children's perceptual development. They lack a clear understanding of Gestalt laws and their specific applications.
	Importance of Teaching Materials for the Development of Perception	The synthesis of the responses reveals the importance of creating educational materials based on Gestalt principles to strengthen children's perception. The teachers emphasize the need for the materials to be creative, interactive, and child-appropriate, utilizing colors, textures, and physical elements.

Note: This table summarizes teachers' perceptions and practices regarding the knowledge and applicability of Gestalt laws, highlighting the importance of teaching materials that strengthen children's perception.

Of the eight teachers interviewed, only two had a superficial understanding of Gestalt principles and did not apply them in their teaching. This highlights the disconnect between these principles and teachers' perceptions, as well as their lack of training in classroom application.

Based on a literature review of visual, tactile, and spatial perception, as well as Gestalt Laws, the most appropriate laws for the material were identified, according to their applicability. Educational materials were then developed in two formats: audiovisual and physical. Table 6 below presents the created materials, taking into account the characteristics of each law.

Table 6.

Audiovisual and Physical Materials.

Materials	**Name of laws**	**Descriptions**
Audiovisual Material	1. Proximity	**1. Apple to Apple:** It is based on audiovisual material exemplifying the law, supported by physical material with apple cards.
	2. Similarity	**2. Flowers March** It consists of audiovisual material exemplifying the law, supported by physical material of large, medium and small flowers.
	3. Continuity	**3. Secu -line** It is represented with audiovisual material exemplifying the law, supported by physical material of image sequences and a woman who walks through the sequences.
	4. Figure and Ground	**4. Background Magic** It consists of audiovisual material exemplifying the law, supported by physical material of cards with numbers 40, 90, 60, 80.
Physical Material	5. Symmetry	**5. Castle** **6. Robot** They are wooden interlocking pieces, with one half stable and the other movable; their function is to complete the figures.
	6. Closure	**7. Magic Puzzles** It is a number puzzle from 1 to 5, designed for children to complete the incomplete numbers, fostering their ability to perceive the whole from missing parts. **8. Magic Threads** It is a board with numerical symbols where children braid threads through the holes around each figure to complete it.
	7. Pregnance	**9. Numerical Adventure** Wooden puzzle with numbers from 0 to 9, where children must insert geometric shapes into the corresponding spaces to complete and correctly visualize the numbers.

	8. Segregation	**10. OceanDo** It is a domino set featuring figures of aquatic animals. **11. World Of Colors and Numbers** Wooden board with fabric numbers from 0 to 9, includes wooden cubes according to the color of the numbers and laminated number tiles.

Note: This table presents audiovisual and physical materials that illustrate the Gestalt laws. Each material is designed to promote the understanding and application of these laws in an educational context.

Results of the application of the audiovisual material

Table 7 presents the participants' evaluation of the audiovisual materials, using a scale of 1 to 5, where 1 is "low" and 5 is "high." In the law of proximity, a medium-high level was achieved, demonstrating the ability to perceive, associate, and identify patterns; however, difficulties were observed with right and left laterality. In the law of similarity, performance was high, with the ability to perceive, group, and recognize by color and shape, although difficulties were noted with classifying by size (large, small). Subsequently, in the law of continuity, medium-high performance was evident in the organization of sequences, with good eye-hand coordination and perception of laterality such as right, up, and down, etc. Likewise, in the law of figure and ground, a high-superior level was obtained, quickly identifying figures and backgrounds, although difficulties were noted with the numbers 60 and 90.

Table 7.

Focus Group Performance.

Law - Material	**Performance**	**Average**
Proximity Law (Apple to Apple)	Medium - High	4.2
Law of Similarity (Flowers March)	High	4.4
Continuity Law (Secu - Line)	Medium - High	4.2
Figure and Ground Law (Background Magic)	High - Superior	5

Note : The table shows the average performance of participants in a focus group on audiovisual materials, with " Background Magic" standing out with an average of 5, indicating superior performance.

Results of applying the physical material

The results of the physical materials obtained from the analysis of the evaluated skills are presented in Table 8, highlighting the participants' overall performance and the consistency observed in each area. The findings are presented in accordance with each law through tables and descriptions.

Table 8.

Descriptive statistics of the symmetry law applied to the material: castle .

Criteria	Average	Standard Deviation
1. Comparative analysis of characteristics	4.048	0.590
2. Fine motor coordination	4,000	0.632
3. Perception of symmetry	3,952	0.669
4. Visual discrimination	4,000	0.632
5. Spatial location	4,000	0.632
6. Perception of correspondence.	4.048	0.590
7. Identification of the symmetrical pattern.	4,000	0.632

Note. The table shows statistics of skills related to the law of symmetry, highlighting a positive performance in fine motor coordination and perception, with averages close to 4.0.

Participants perform well in key areas: comparative analysis of features and perception of correspondence (M = 4.048), and perception of symmetry (SD = 0.669) are the highest, while in perception of symmetry (M = 3.952) and comparative analysis of features (SD = 0.590) they are the lowest, indicating a need for specific attention in certain students with difficulties in the latter.

Table 9.

Descriptive statistics of the symmetry law applied to the material: robot.

Criteria	Average	Standard Deviation
1. Comparative analysis of characteristics	4.048	0.590
2. Fine motor coordination	4,000	0.632
3. Perception of symmetry	4,000	0.632
4. Visual discrimination	4,000	0.632
5. Spatial location	4,000	0.632
6. Perception of correspondence.	4.048	0.590
7. Identification of the symmetrical pattern.	4,000	0.632

Note : The results indicate positive performance on the assessed criteria, with averages around 4.0 and standard deviations that reflect consistency in the participants' skills.

The participants are perceived to demonstrate high performance. Areas with high scores, such

as comparative feature analysis and correspondence perception (M = 4.048, SD = 0.590), reflect strong skills in comparing elements and visual correspondence. While fine motor coordination, symmetry perception, visual discrimination, spatial location, and symmetrical pattern identification (M = 4.000, SD = 0.632) are low, suggesting overall consistency but with room for improvement.

Table 10.

Descriptive statistics of the law of closure applied to the material: puzzles magic .

Criteria	Average	Standard Deviation
1. Ability to complete forms	3.333	0.966
2. Incomplete pattern recognition	3.238	0.944
3. Visual-motor coordination	3.333	0.966
4. Visual discrimination	3.238	0.944
5. Spatial orientation	3.238	0.944

Note : The results indicate moderate performance on the assessed criteria, with means around 3.2 to 3.3 and standard deviations that suggest variability in the participants' skills.

Participants performed moderately in the 5 descriptions, with the ability to complete shapes being the highest (M = 3.333, SD = 0.966), while incomplete pattern recognition, visual discrimination and spatial orientation (M = 3.238, SD = 0.944) were the lowest, indicating a need for specific attention in the latter.

Table 11.

Descriptive statistics of the closure law applied to the material: threads magic .

Criteria	Average	Standard Deviation
1. Recognition of mathematical symbols	3,714	1.146
2. Visual-motor coordination	3,619	1.161
3. Spatial orientation	3.667	1.155
4. Perceptual closure capacity	3.667	1.155
5. Autonomy in the task	3.667	1.155

Note : The results reflect moderate performance on the assessed criteria, with means ranging from 3.6 to 3.7 and standard deviations indicating significant variability in the participants' skills.

Consistent performance was observed across the skills, with means ranging from 3.619 to 3.714, indicating slightly above-average performance in all areas. The standard deviation, ranging from 1.146 to 1.161, reflects moderate dispersion in the results, suggesting that while some participants performed lower or higher, visual-motor coordination showed the greatest variability overall, which could suggest that some students require additional support.

Table 12.

Descriptive statistics of the law of Prägnanz applied to the material: adventure numerical .

Criteria	Average	Standard Deviation
1. Perceptual clarity	4.211	1.134
2. Perceptual organization	4.211	1.134
3. Visual balance	4.158	1.119
4. Visual-motor coordination	4.211	1.134
5. Recognition of numerical patterns	4.211	1.134

Note : The results show positive performance, with averages of around 4.2 in clarity and perceptual organization, although the standard deviations indicate variability in the responses.

The table shows consistently high scores in perceptual clarity, organization, visual balance, visual-motor coordination, and numerical pattern recognition, with averages ranging from 4.211 (highest) to 4.158 (lowest). Furthermore, the standard deviations were narrow (1.119 to 1.134). These results reflect generally positive and consistent performance across the assessed skills.

Table 13.

Descriptive statistics of the segregation law applied to the material: oceanDo .

Criteria	Average	Standard Deviation
1. Visual discrimination	4.429	0.646
2. Perceptual grouping	4.214	1.122
3. Visual-motor coordination	4.214	1.122
4. Perceptual segregation	4.429	0.646
5. Perceptual and problem-solving strategies	4.214	1.122

Note : The results reflect outstanding performance, with averages between 4.2 and 4.4, suggesting strong skills in visual discrimination and grouping, although with moderate variability in responses.

Good performance was achieved, with mean scores between 4.214 and 4.429, indicating a high level of skill in visual discrimination, perceptual grouping, visual-motor coordination, perceptual segregation, and problem-solving strategies. Discrimination and perceptual segregation skills were the most consistent, with low standard deviations (0.646), suggesting that participants performed uniformly in these areas. However, the greatest variability was found in perceptual grouping, visual-motor coordination, and problem-solving strategies, with higher standard deviations (1.122), indicating significant differences in performance.

Table 14.

Descriptive statistics of the segregation law applied to the material: world of colors and numbers .

Criteria	Average	Standard Deviation
1. Quantitative perception.	4,500	0.855
2. Selective perception of color and sequence.	4,357	0.929
3. Memory.	4.429	0.938
4. Numerical correspondence.	4,500	0.855
5. Identification of categories.	4,357	0.929

Note : The results show high performance, with averages between 4.3 and 4.5, indicating a solid capacity in quantitative perception and memory, with moderate variability in the responses.

Overall performance was good across all skills, with averages between 4.357 and 4.500. Quantitative perception and numerical correspondence showed greater consistency with standard deviations of 0.855, while selective perception, memory, category identification, and spatial language exhibited slightly greater variability (0.929–0.938). Overall, performance was high, with small differences among participants.

Discussion

Gestalt Laws have traditionally been applied in fields such as graphic design, advertising, and visual psychology, where they are used to organize and optimize visual perception (Kim & Lee, 2020). However, they are also viable for use in early childhood education for cognitive development, as they facilitate pattern recognition, promote spatial organization (Posso et al., 2021), improve attention and focus, optimize visual-motor coordination, and simplify the learning of letters and numbers. Gestalt Laws directly impact children's logical-mathematical abilities and attention development. For example, the law of proximity facilitates the understanding of grouping and classification in mathematics, while the law of similarity improves the recognition of patterns and sequences. The law of continuity strengthens the ability to follow logical sequences, and the law of figure and ground improves attention by allowing children to focus on relevant elements of a problem. The law of symmetry encourages the recognition of symmetrical patterns, the law of closure promotes critical thinking and problem-solving, the law of Prägnanz helps to simplify complex problems, and the law of segregation improves the ability to classify and organize data.

Semi-structured interviews with teachers revealed that, while initially unfamiliar with Gestalt Laws, they quickly recognized their pedagogical relevance once they understood their classroom applications. The teachers noted that these principles not only improved the visual focus of activities (Holmes et al., 2024) but also facilitated children's comprehension and retention of information. Teacher feedback was crucial in adjusting materials to ensure they aligned with students' pedagogical and perceptual needs. Understanding and adopting these principles led to changes in their teaching practices, incorporating strategies based on Gestalt Laws, such as using more organized and structured visual materials, creating activities that encourage pattern recognition, and applying techniques that enhance students' attention and focus. This resulted in a more dynamic and effective learning environment where children could engage more meaningfully with the educational content. Teacher feedback was essential in adjusting the materials and ensuring they aligned with the students'

pedagogical and perceptual needs.

Based on the principles of Gestalt Laws, a set of educational materials adapted to children's needs was developed, integrating both audiovisual and tactile elements. The use of these media represents a positive experience in the process of developing pattern recognition skills in the school setting (Marín et al., 2021). The materials include interactive games and practical activities that utilize different Gestalt Laws. These materials proved effective in improving children's visual perception, helping them to better organize and process the information they received. At the beginning of this project, one of the main challenges was finding relevant information, since Gestalt Laws are principles widely used in graphic design, advertising, and visual psychology. Because of this, it was difficult to find foundations that would allow these principles to be adapted to the educational context. The study prioritized the laws of proximity, similarity, continuity, and figure-ground due to their relevance to perceptual and cognitive development in early childhood. These laws helped overcome barriers such as difficulties with object persistence by providing structured and visually organized activities. For example, the law of proximity facilitated the grouping of nearby items, improving attention and persistence in pattern identification, while the law of similarity enhanced the recognition and classification of similar items. Continuity and figure-ground distinction allowed children to follow logical sequences and focus on relevant elements, improving their problem-solving abilities.

The application of the materials in the classroom allowed for the observation of significant improvements in children's visual, tactile, and spatial perceptions. Activities based on Gestalt principles facilitated the development of skills such as shape distinction, pattern recognition, and spatial organization (Orrala, 2023). The children interacted positively with the materials, showing progress in their ability to understand and process visual stimuli (Overvliet et al., 2024). The activities revealed initial difficulties in object persistence, but also showed improvement as the children received more environmental stimuli (Hupp & Jewell, 2020). A bottom-up approach to visual perception proposes that children build knowledge from basic sensory inputs, thus developing more complex perceptual skills over time (Brooking, 2015; Lewkowicz & Bremner, 2020).

Conclusions

The study has shown that implementing Gestalt principles through audiovisual and physical learning materials is effective in improving visual, tactile, and spatial perception in children aged 5 to 6. The children demonstrated a greater ability to identify shapes and patterns, which contributed to improved category recognition and spatial organization. Furthermore, these activities based on Gestalt principles also had a positive impact on the development of logical-mathematical skills, improving problem-solving, critical thinking, and visual-motor coordination.

Interviews with teachers revealed a lack of prior knowledge about Gestalt Laws, but once their pedagogical applications were understood, the teachers recognized their relevance and usefulness in the classroom. This underscores the need for teacher training in the use of these laws to maximize their educational impact. The teaching materials designed based on these laws facilitated the development of critical perceptual skills, indicating an improvement in children's ability to process and organize visual information.

In summary, the research confirms that Gestalt Laws are an effective tool for strengthening perception and learning in early childhood. Integrating these principles into the design of teaching materials and educational activities can significantly contribute to children's cognitive and perceptual development, laying a solid foundation for their academic and personal future. It is recommended that

teachers be provided with training and resources to effectively apply these principles in their daily practice, thereby enriching the learning environment. Further research is suggested to explore other areas of cognitive development, such as complex problem-solving and creativity, evaluating the longitudinal impact of Gestalt Laws in diverse educational contexts.

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Conflict of Interest

The authors of the study declare that they have no conflict of interest in relation to the research presented.

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