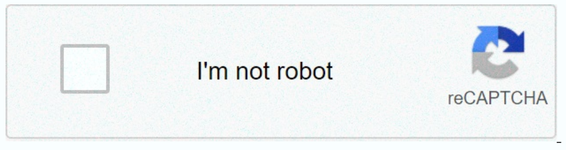
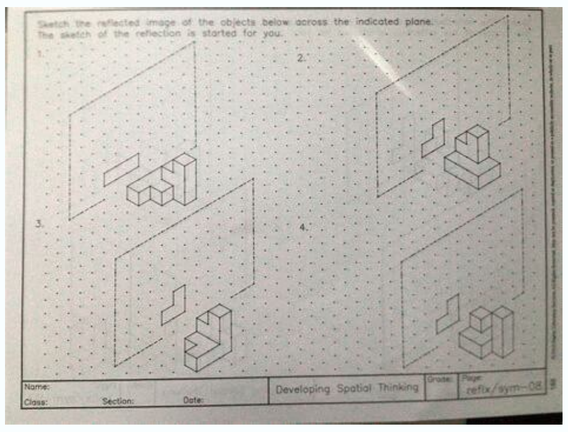


I am not robot!

This article is a continuation from two previous articles titled "The early years" and "Coordinating space in drawings". When it comes to selecting resources for teaching shape and space, many educators often question the effectiveness of tools like shape puzzles, tangrams, and other mosaic-type resources. While children enjoy using these resources, the concern lies in whether they are actually learning anything from them. This article aims to address these concerns by exploring different levels of geometric thinking and the corresponding activities needed to foster this type of thinking. Extensive research on this topic has been influencing educational curriculum development globally since the 1950s, particularly by a couple from the Netherlands, Pierre and Dina van Hiele. Pierre van Hiele has further developed the theory over the years, with numerous researchers worldwide exploring its foundations and practical applications. The core principle of the theory suggests that while children naturally develop some spatial thinking skills, targeted instruction is crucial to guide them through various levels of geometric understanding and reasoning abilities. The theory challenges the traditional approach of teaching children Euclidean geometry using formal axioms, definitions, theorems, and proofs established by Euclid. When teaching spatial thinking, it is important to consider the van Hiele theory, which suggests that students need to progress through different levels of thinking to fully understand geometric concepts. This theory, originally consisting of five levels but now focusing on three for school-aged children, emphasizes the importance of visual recognition and descriptive abilities when it comes to shapes.
At the visual level, children rely on nonverbal thinking to recognize shapes based on appearance, often associating them with familiar objects without providing detailed explanations. As they move to the descriptive level, they begin to identify and describe the components and properties of shapes, such as distinguishing an equilateral triangle by its equal sides and angles. By understanding these levels of thinking, educators can help students develop the necessary language and skills to comprehend geometric concepts more effectively.



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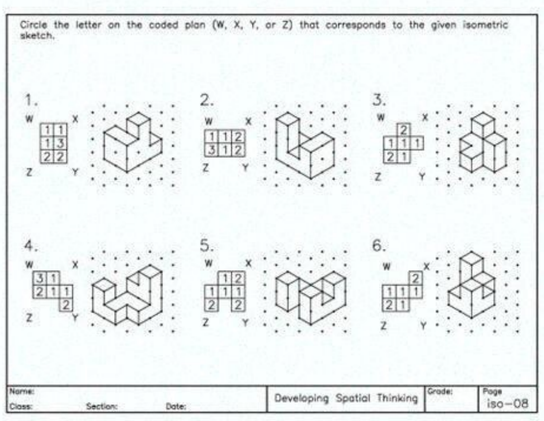
They can deduce one property from another and explain relationships between shapes, like why all squares are rectangles. However, they may not fully grasp concepts like axioms, definitions, and theorems. Van Hiele's theory includes a sequence of five phases to help children progress from one level of thinking to the next. Teachers can plan lessons by focusing on specific shapes, like squares, or exploring multiple shapes together. Activities involving manipulation, construction, and discussion can be used to guide students through these phases using tools such as tangrams. Engaging in mosaic puzzles helps children develop their visual and descriptive thinking skills related to shapes and their characteristics. For example, traditional tangram sets with seven pieces are commonly used to illustrate various activities focused on the properties of 2D shapes.



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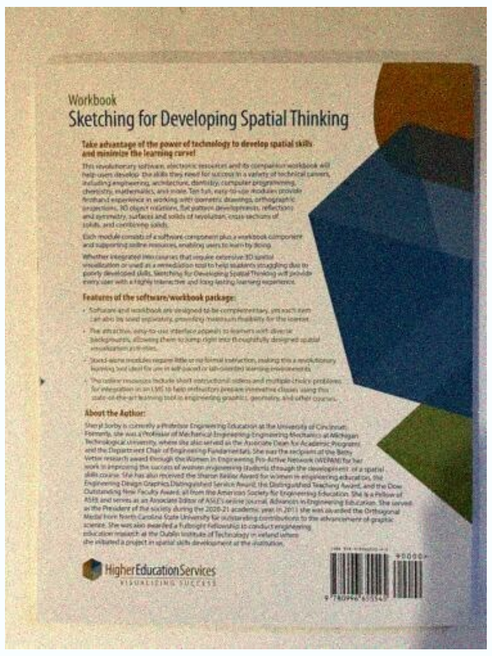

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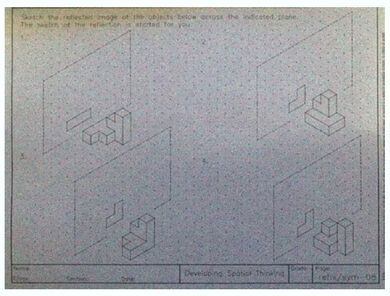

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For example, traditional tangram sets with seven pieces are commonly used to illustrate various activities focused on the properties of 2D shapes. These activities are suitable for children aged 7 to 10 years. It is recommended for each child to have their own tangram set, which can be easily made from card and stored in envelopes. Numbering or color-coding the pieces can help with easy reference during activities. The learning process begins with inquiry and play, allowing children to explore the materials freely and discover different properties and structures. Teachers can observe and informally assess children's thinking and language during this time. For example, giving each child a tangram set and asking them what they can create with the pieces can stimulate discussion and exploration. Providing ample time for children to experiment with the pieces is essential for learning. During play, children become familiar with the shapes and sizes of puzzle pieces, learning how they fit together and discovering their properties and relationships. In Phase 2, activities are designed to focus children's attention on specific characteristics of the shapes. For example, children may be asked to figure out if all puzzle pieces can be made from two smaller pieces or how many ways the largest triangle can be constructed using other pieces. By recording their findings and exploring different combinations of shapes, children develop a deeper understanding of the properties of shapes such as side lengths and symmetry.

In the first phase, students will be introduced to various shapes and begin to understand their properties. They will learn how to manipulate shapes by flipping and turning them to fit different spaces. The second phase involves tasks that further develop vocabulary related to shapes and properties. Teachers will clarify terms already used by students and introduce new terms, encouraging them to use the vocabulary in discussions and written work. For example, students may be asked to identify shapes with specific properties, trace shapes, and discuss symmetry and parallel sides. Activities like 'Mystery Bag' can help reinforce vocabulary and concepts. Children can explore spatial thinking through a series of structured phases. In the first phase, they familiarize themselves with tangram pieces and their properties. The second phase involves manipulating the pieces to create specific shapes, encouraging problem-solving skills. In the third phase, children investigate patterns and relationships between shapes. They can present their findings using visual aids or posters. The fourth phase challenges children to complete tasks in various ways, building on their existing knowledge.

For example, they can solve complex tangram puzzles or enlarge pieces on a grid. In the final phase, children integrate their new knowledge and reflect on their learning as a whole. They can create charts, class books, or games to demonstrate their understanding of tangram shapes. This structured approach helps children develop spatial thinking skills effectively. Engaging in various activities, such as identifying shapes and designing cards, can help children progress from basic shape recognition to discussing geometric properties and making comparisons between shapes. This advancement from Level 1 Visual thinking to Level 2 Descriptive thinking is essential for developing spatial understanding.

While knowledge and vocabulary gained from these activities are useful, additional experiences are needed to foster geometric thinking about different shapes. For instance, exploring puzzle shapes can help children understand types of triangles and quadrilaterals. This hands-on approach is supported by research on geometric thinking among adolescents and the importance of play in developing spatial thinking.