Teacher: Panagiotis PAPADOPOULOS
Subject: Mathematics

Title: Visualizing the Algebraic Identity $(a + b)^2$ using Squares	**Time: 45 minutes**
Subject: ***Mathematics***	
Aims: Understanding the Algebraic Identity $(a + b)^2$ using squares	
Key CS elements: Decomposition; Pattern recognition; Abstraction; Algorithm design.	
Age group: 12-14 years old	
Learning situations: Classroom, IT lab	**Activity type:** analysis

Resources:

1. Graph paper
2. Rulers
3. Markers/colored pencils
4. Whiteboard and markers

Learning development:

Lesson Objective:

- Students will visualize and understand the algebraic identity $(a + b)^2 = a^2 + 2ab + b^2$ by breaking it down and drawing it geometrically using squares and rectangles.
- Introduce the 4 principles of computational thinking to facilitate critical thinking and problem-solving in mathematics.

Principles of Computational Thinking:

1. **Decomposition**
   Goal: Break down the formula $(a + b)^2$ into manageable parts.
   - Activity: Explain that $(a + b)^2$ represents the area of a large square with side length $(a + b)$.
   - Break down the large square into smaller areas:
     - One square of area a^2
     - Another square of area b^2
     - Two rectangles with area ab.

2. **Pattern Recognition**
   The **pattern recognition** focuses on recognizing the consistent geometrical relationship between the areas of **squares** and **rectangles** formed by the expansion. Here's how the pattern works:

   a) **The Large Square**:
      - Students recognize that the entire large square has an area of $(a+b)^2$.

   b) **The Smaller Squares**:
      - The area of the first small square is a^2 (side length a), and the area of the second small square is b^2 (side length b). These two squares are always present and account for the squared terms.

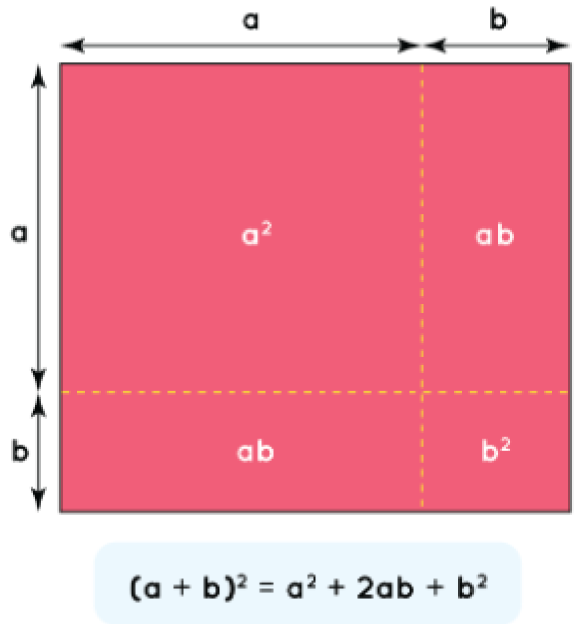
   c) **Identical Areas Representing the Product ab**:
      - There are **two identical squares/rectangular areas** representing the product of a and b, contributing to 2ab. These squares/rectangles are positioned consistently in every instance of the expansion.

   d) **The Sum of All Parts**:
      - Students will recognize that the total area of the large square is the sum of the areas of the smaller squares and rectangles, which leads to the identity $a^2+2ab+b^2$.

3. **Abstraction**
The **abstraction** in this lesson plan involves simplifying the algebraic identity $(a+b)^2=a^2+2ab+b^2$ by representing it visually with squares and rectangles. Instead of focusing on the complex algebraic expression, students understand the concept by visualizing the equation as a large square made up of smaller areas: two squares for a^2 and b^2, and two identical rectangles for 2ab. This helps them grasp the general relationship without needing to focus on specific numbers or detailed algebraic manipulation.

4. **Algorithm Design**
Goal: Create a step-by-step process for constructing and understanding the algebraic identity visually.

Step 1: Draw a large square representing (a + b) as the side.
Step 2: Divide the large square into a smaller square of area a^2, a square of area b^2, and two rectangles of area ab.
Step 3: Label each area with its algebraic equivalent (a^2, b^2, ab).
Step 4: Add the areas together to show the total area is $a^2 + 2ab + b^2$.
Step 5: Conclude that this visual proves the identity $(a + b)^2 = a^2 + 2ab + b^2$.



Assessment:
- Students will complete their own visual representation of the algebraic identity on graph paper and label each part.
- Discuss the visualization and ask students to explain how the geometric representation proves the algebraic formula.

Assessment Test: Algebraic Identity $(a+b)^2=a^2+2ab+b^2$

Part 1: Multiple Choice Questions (MCQ)

1. What does the expression $(a+b)^2$ represent in geometrical terms?
   a) The perimeter of a square
   b) The area of a square with side length a+b

c) The area of a triangle
d) The perimeter of a rectangle

2. In the identity $(a+b)^2=a^2+2ab+b^2$, what does the term 2ab represent?
   a) The area of two squares with side a
   b) The area of two rectangles, each with sides a and b
   c) The length of the side of a square
   d) The diagonal of a square

Part 2: Fill in the Blanks

3. In the square diagram, the area a^2 represents the square with side _______.
4. The term b^2 in the identity represents the area of a square with side _______.

Part 3: Short Answer

5. If a=3 and b=2, calculate $(a+b)^2$ using the algebraic identity $(a+b)^2=a^2+2ab+b^2$
6. Explain in your own words how the visual representation of the square helps you understand the algebraic identity $(a+b)^2=a^2+2ab+b^2$.

Expected results: By the end of this lesson, students will not only understand the algebraic identity $(a + b)^2$, but also how to break it down into its components using visual and computational thinking strategies, allowing them to approach similar algebraic problems with greater clarity.

Note: