Euclid's Plate

Extension to the work with Pythagoras plates. The two theorems of Euclid are related to the Pythagorean Theorem; our work is purely sensorial at this stage. Euclid took Pythagoras' theorem and dropped a line from the angle opposite the hypotenuse to the hypotenuse, cutting the hypotenuse into p and q; p is the projection of b and q is the projection of a; the line then divides the square into two rectangles. Euclid proved that a^2 is equal to c times q – b^2 is equal to c times p. Our Euclid plates display the sensorial representation of this theorem.

Introduction - Equivalency between squares and parallelograms

Materials: green plate

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- Place the plate in the middle of the table.
- What do we have here? scalene right triangle; two squares; two rectangles together form a square.
- **Review previous knowledge:** What do we know about the relationship between the two small squares and the large square? Those two added together equal the large square.
- Over here on the right, I also have a couple of other shapes – what are they? Parallelograms.
- Let's compare the two squares with the parallelograms – like this:
    - Remove the red square and place below the frame.
    - Slide the white triangle to the bottom of the frame inset.
    - Place the yellow and blue parallelograms in the space formed.
    - So what can we say about the two parallelograms? They are equivalent with the red square.
    - Replace everything.
- Now let's look at the relationship between the yellow square and the yellow parallelogram.
    - Remove the yellow square. Slide the white triangle up, place the yellow parallelogram into the space created.
    - Place the yellow parallelogram next to the yellow square.
    - So what can we say about the parallelogram and the yellow square? They are equivalent.
- Now let's look at the blue square and the blue parallelogram.
    - Repeat as above.
    - What can we say about these two figures? They are equivalent.
- **Summarize:** So we have found that the yellow square and the yellow parallelogram are equivalent; the blue square and the blue parallelogram are equivalent; and the sum of the two parallelograms is equivalent to the red square.

Equivalency of Red Rectangles and Parallelograms - On another day:

- Today we'll show equivalence between the larger red rectangle and the yellow square by proving they are both equivalent to the yellow parallelogram. Then we'll show that the blue square is equivalent to the smaller red rectangle by showing that each of these figures is equivalent to the blue parallelogram.
- Yellow square, larger red rectangle and yellow parallelogram:
    - Place the yellow square and parallelogram below the frame.
    - We know that for these two figures to be equivalent, they have to have what in common? Base and height.
        - First let's compare the bases: what can we say about their bases? Hold the bases side by side. They are the same.
        - Now we need to compare the heights. We'll do that like this: Turn the frame 45 degrees, place both yellow pieces in the rectangle for the parallelogram. What can we say about the heights? They are the same.
    - So we can say that this square and this parallelogram are equivalent.
    - Now we'll show the equivalence between the red rectangle and the yellow parallelogram. Place both figures below the frame. This is the base of the red rectangle so I need to do this: turn the parallelogram so they base is horizontal.
        - First thing we need to do is compare the two bases. Hold them so they touch.
            - What can we say about the bases? They are the same – equal bases.
        - What else do we need to compare? The heights.
        - Compare heights in the rectangle as above.
        - What can we say about their two heights? They are the same.
    - We know that this rectangle is equivalent to the parallelogram and this parallelogram is equivalent to the square. So I don't need this parallelogram anymore – I know that this rectangle and this square are equivalent.
- Repeat with the blue square, smaller red rectangle and blue parallelogram.
- Invite the children to manipulate the materials.

Follow-up work:

- Work with the material
- Trace, color, cutout, mount pieces
- Word problems

Age: 9-12 (upper elementary)

Pre-requisites: concept of equivalence; good understanding of the relationships in equivalence work with iron material; Pythagoras work; some of the yellow material (at least the first two); history of geometry