Michael Serra | *A Term Project: Creating a Geometry Cathedral*

Michael Serra's high school classroom became a "geometry Cathedral" when students created panels with a stained-glass effect for the windows in the classroom. Projects like this can convert "math atheists" into "geometry believers".

From my classroom on the third floor of George Washington High School in San Francisco, California, my students and I look out through 24 windows that face the Pacific Ocean. When the sun is out, I have to pull the shades down so that I can use the overhead projector. So for years I thought about designing a "Cathedral of Geometry", using a stained-glass effect for the six columns of four windows that face the afternoon setting sun. This past spring semester, my students and I finally did it!

First I created a scale model of the windows, on which I constructed the basic "lead" line design I wanted for each window. I had three geometry classes in the afternoon, one with six groups and the other two with nine groups each, and I assigned one of the windows to each group. The groups worked on their window designs, adding their personal touches within the parameters I'd set up so that the complete set of 24 windows would have a unified look, theme, and color scheme.

Each window in the top row had a Gothic arch with a circle inscribed within the arch. Within each of these circles were between two and six congruent circles, each internally tangent to the outer circle and tangent to the congruent, adjacent circles. Each window in the second row had two congruent Gothic arches with internally tangent circles. The designs within the circles in these top two rows focused on the types of geometric art featured in Chapter 1 of *Discovering Geometry*: op art; line, daisy, and knot designs; mandalas; and Islamic art.

The windows in the lower two rows had two congruent squares with inscribed circles. The designs within the circles of these lower two rows focused on the content from *Discovering Geometry* Chapters 1-12: inductive reasoning; geometry vocabulary and tools; the properties of angles, triangles, polygons, and circles; tessellations; area; the Pythagorean theorem; volume; and similarity. So just like the great cathedrals of the Middle Ages, the windows told a story.

My students did not have the training, time, or resources to create their designs in actual leading and colored glass, nor did I want to use a plastic-based leading medium and liquid

glass stains because they can be messy and rather expensive. For a quick and easy medium that produced a very colorful effect, we used large sheets of tracing paper and colored marking pens. The students constructed the first drafts of their designs with large chalkboard compasses on sheets of butcher paper; planned the details that personalized their artworks; and carefully transferred everything to the tracing paper. Finally, they used the markers to color the regions, and they finished their work by using wide black markers to trace the lead lines.

We placed their work on the windows with masking tape and stepped back to observe the result: it was beautiful! Not only had 24 groups of students enjoyed combining their efforts to create a work of art, but they had reviewed the year's content. Projects like this can convert "math atheists" into "geometry believers".

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The Author

Since 1990, with the publication of the first edition of *Discovering Geometry: An Inductive Approach* (San Francisco: Key Curriculum Press, 1990), Michael Serra has continued to teach at George Washington High School in San Francisco. When he is not teaching, he is either writing new material or traveling all over the country giving workshops to districts that have already adopted or are thinking of adopting *Discovering Geometry*. He also gives presentations at four or five National Council of Teachers of Mathematics (NCTM) regional conferences, or state mathematics conferences around the country. In 1997 the second edition of *Discovering Geometry* was published. Other publications include the very popular supplementary geometry book, *Patty Paper Geometry*, and the set of five workbooks used as classroom starters called *Mathercise (Mathercise A-E)*. He is currently working on two supplementary books, *What's Wrong With This Picture? - Activities for Discussion in Algebra* and *What's Wrong With This Picture? - Activities for Discussion in Geometry*. Also planned is a *Patty Paper Algebra* book, and a third edition of *Discovering Geometry*.