

# Developing Exciting Outreach Material

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## Four Color Theorem Activity

This lesson plan was developed for 2nd and 3rd grade students. We modified activities from Melinda Lanius' Four Color Fest Activity Book for students to explore map structures that need at most four colors to be colored in.

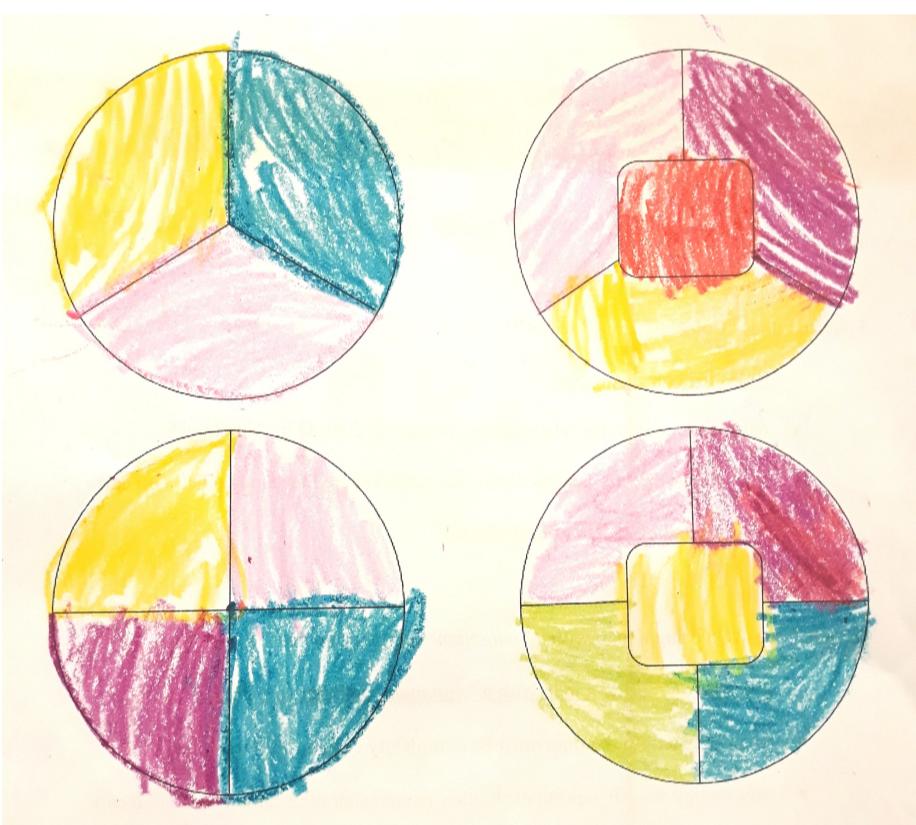
### Content Objectives:

- Students will explore definitions related to the Four Color Theorem such as maps, regions, coloring, even and odd
- Students will extend their knowledge of the Four Color Theorem to draw maps that need more than four different colors to be shaded in.
- Students will build connections between the structures of maps that need three vs. four colors to be shaded in.

### Coloring Handout and Master Mapper Activities

- Students will:

- Practice properly coloring 4 different maps using a least number of colors.
- Complete the handout in groups of 4-6 and share their findings with the class afterwards.
- Discover the relationship between minimum number of colors needed to shade a center surrounded by an even or odd number of regions.
- Try and create a set of maps that uses 5+ minimum colors to be properly colored in and in pairs, color a partner's set of maps to conclude any map can be colored in at least 4 colors.



### Four Color Theorem

- After the Master Mapper Activity, students will learn the Four Color Theorem: Any map can be colored using at most 4 different colors, and further conclusions that can draw from it.
- Looking at connections between the activities and the Four Color Theorem, we briefly cover how computers helped prove of the Four Color Theorem.

### Classroom Results

- This activity was run with DREAAM House students at University High School.
- Students struggled to color maps on the Coloring Handout with a least number of colors.
- To clarify instructions, we modified the handout where students write the least number of colors needed to color each map.
- To speed up coloring, we will consider using Xerox sheets and expo markers to color maps.



## About This Project

Our team created lesson plans such as Platonic Solids, the Four Color Theorem, and the Algorithms Activity. We hope to spark a greater interest in mathematics within students grades K-12 by researching brainstormed activities, discussing relevant concepts for different educational standards, and constructing activities that fit our allotted time spans.

### Completed Goals this Year

- Finalized the Platonic Solids Activity
- Formalized and tested lesson plans for the Four Color Theorem and Algorithms Activity in both the classroom and IGL Undergrad Outreach RSO
- Participated in the 2019 Undergraduate Research Symposium poster presentation

### Future Goals

- Continue testing and revising Four Color Theorem and Algorithms Activity lesson plan based off classroom results
- Participate in the MAA MathFest 2019 poster presentation

## IGL Undergraduate Outreach RSO

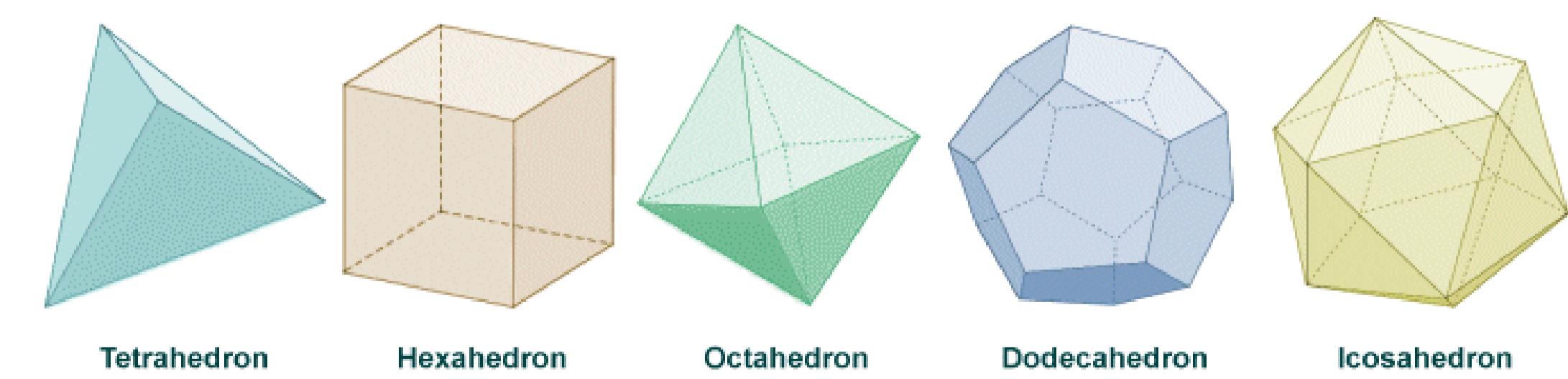


Throughout the semester, we visited the IGL Outreach RSO sharing our lesson plans and shared instructional tips on implementing our lessons in the classroom. Together, we discussed how the lesson plan was created and received feedback on how we could improve. Moving forward, we are confident that the IGL Outreach RSO is ready to take on any lesson plan that we create.

## Past Projects

### Platonic Solids:

The first lesson plan we created pertained to Platonic Solids (regular three-dimensional polygons) for 4th and 5th grade students. We designed an activity that allowed them to discover Euler's Characteristic, topological equivalence, and dual solids.

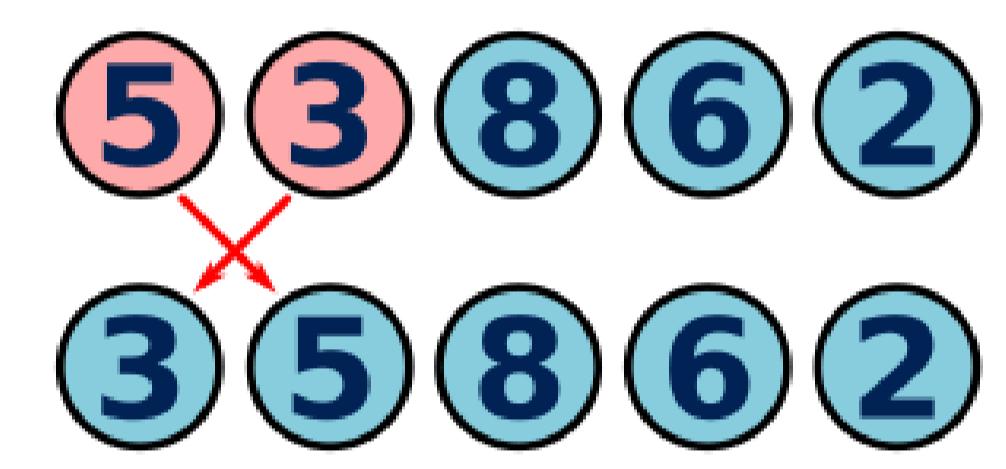


## Algorithms Activity

This activity is designed for 6th through 8th grade students to explore different sorting algorithms and their real world applications by creating algorithms, sorting themselves, and sorting various objects with an assigned algorithm.

### Content Objectives:

- Students will sort themselves by birthdate and describe the process with algorithms.
- Students will test 4 algorithms: bubble sort, merge sort, insertion sort, selection sort.
- Students will compare and analyze 4 sorting algorithms by sorting groups of objects.
- Students will explore how algorithms are used in computers and real life.



### Lesson Plan

The lesson will begin with a warm-up activity where students will sort themselves into birthday order and determine if these methods are a sorting algorithm. Moving into group work, we will have students in 4 separate groups be assigned an algorithm, watch an instructional sorting video, and sort objects in a given scenario. After following guiding questions during group work, each group will present their algorithm and findings to the rest of the class, and discuss how algorithms can be used in real life.

### Classroom Results

- This activity was run with 5 students at Countryside School. Students explored two sorting algorithms (bubble sort and merge sort) instead of four.
- The bubble sort group sorted ten cups of different weights in 3:45 and the merge sort group sorted a deck of cards in 1:35.
- Students successfully made connections to how computers use algorithms.
- In the future, we will provide a take home sheet that includes a list of steps for each sorting algorithm.



### References

- [\[1\] https://en.wikipedia.org/wiki/Platonic\\_solid](https://en.wikipedia.org/wiki/Platonic_solid)
- [\[2\] https://en.wikipedia.org/wiki/Four\\_color\\_theorem](https://en.wikipedia.org/wiki/Four_color_theorem)
- [\[3\] http://www.technologyuk.net/mathematics/geometry/platonic-solids.shtml](http://www.technologyuk.net/mathematics/geometry/platonic-solids.shtml)
- [4] Four Color Fest Activity Book by Melinda Lanius

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