

To what grade level did you teach this lesson? Grade 10

How many students are in your class? 26

What is the ratio of male to female students in the class? About 50:50

Does the class include special education students? Yes

Does the class include gifted/talented students? Yes

Does the class include students of color or diverse ethnicities? If so, please describe.

African American, Latinx, ELL

Describe the students' prior knowledge or the focus of any previous related lesson:

This project was from the first unit of our year, so there was no prior instruction in this class. Students had most likely been exposed to an entry level understanding of transformations in middle school. Class conversations and opening formative activities proved this to be this case. (Note: this project was completed in my four Geometry classes this year. The data above represents a typical class).

Describe the purpose of the lesson as it relates to diversity:

Project Overview: Students were tasked with creating an original work of art around the theme of change. They had a choice of focus: a change they wanted to see in the world OR a change that has happened in them. They also had choice in the product they created.

Diversity connections: This project was intended to challenge students' conception of what 'counts' as mathematics and who gets credit for mathematical thinking. They explored art forms from multiple cultures and analyzed the transformational geometry in each. Ultimately, the project sought to connect their work to their own identity both as individual creators of mathematics and as part of a rich and diverse mathematical tradition. The creation of art also allowed us to address issues of cultural appropriation.

Describe any modifications, if necessary:

This was my first attempt at implementing this project, and it was fully over NTI. NTI (and related pandemic stress/trauma) slowed the pace of the project much more than I expected and made many aspects more difficult than I expected.

State what the students will demonstrate as a result of this lesson. Please keep the description student centered, i.e., “Students will . . . “ “I can . . . “

The project's learning goals are described through the 4 layers of the Historically Responsive Literacy framework (Muhammad, 2020).

- Identity - Students will, through their culture and interests, see themselves as part of a rich history of mathematics.
- Intellect - Students will learn about the contributions and expressions multiple cultures have made to geometry.
- Criticality - Students will question what ‘counts’ as math and who gets credit for mathematics.
- Skills - Students will experiment with, perform, and describe geometric transformations.

Please describe your instructional strategies:

This was designed to be a project-based learning experience where students learned by doing. Some specific strategies employed:

- Student Choice - students choose what product to make to demonstrate their learning.
- Planning and Revision - students made intentional plans before beginning their work and were required to make multiple drafts before arriving at a final product.
- Individualized Feedback - Individual feedback was given at each stage of revision. Feedback was given both on the mathematics and overall product.
- Individual/Small Group Conferencing - used to answer targeted questions and provided additional feedback.
- Interactive Mini-Lesson - throughout the project mini-lessons were provided on the more technical and mathematical aspects. These lessons were designed around current challenges faced by students and using examples from their work. Lessons were also interactive, requiring students to do, think, and experiment.

Rough outline of the process for this project:

1. We found examples of art forms from many different cultures.
2. We identified and analyzed the use of geometric transformations and symmetry in those art forms.

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3. We brainstormed ideas for the personal theme and the art form.
4. We discussed issues of cultural appropriation.
5. We went through multiple rounds of drafts and feedback.
6. We annotated our artwork.

List the Kentucky Core Academic Standard(s) being addressed in the lesson; please include the written language of the targeted standards:

- KY.HS.G.4 Understand the effects of transformations of geometric figures
- KY.HS.G.2 Representing transformations in the plane.

What impact did your lesson plan have on your students to enhance their awareness of diversity?

Through this project students saw expressions of transformational geometry in multiple cultures. This allowed them to see mathematics not just as dull, pencil-and-paper problems, and not just as a product of white, European thinkers (as it is often portrayed in textbooks). Students were able to experience mathematics as a vibrant and diverse practice that can include everything from designing tiles to braiding hair to writing music and many more. They also saw how their culture or passion contributed to the field of geometry. By creating a product, they were also able to see themselves not just as receivers of mathematics, but as creators of it.

Why did you select this lesson?

Mostly, I was proud of the students' work particularly in this difficult time of NTI. I also have found 'choice of product' to be very difficult to integrate in classroom, but I think this project did it nicely. It gave students personalized choices that engaged them more, and the diversity provided a much richer study for the class as a whole. I also think part of diversity work is helping students see diversity beyond tokenism and for them to start to think about how our contents have been complicit in exclusion and oppression. Who decides what math is and that the transformations that happen on a graph count as more mathematical than geometry behind our songs, artwork, dance, hairstyles, etc...? I think project helps students start to ask some of those questions. Moreover, the diversity in this project wasn't an add-on, but a core element. Lastly, culturally relevant examples in math education tend to be based on data that highlights racial trauma and pain. Alternatively, this project felt more like a celebration of culture.

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Why is it important to your school community?

If we had been in person, we could have showcased these student products throughout the school. Within our class, I think this project provided an engaging way for students to bring their full selves to math class. It also, hopefully, helped them connect and learn a bit more about each other.

Please list the resources needed to teach this lesson:

Teacher: Primarily google slides and Desmos

Student: resources varied greatly depending on choice of product. Some examples, pencil, paper, paint, rubber bands, computer, markers...

Generally, what type of assessment did you use to evaluate the effectiveness of this lesson?

Both

Briefly describe the assessment you found most useful and include your data results.

Individual and small group conferences provided the most useful formative assessments. They gave students a chance to share their progress and discuss their thinking. The conference setting also made it easier for me, as a teacher, to ask clarifying questions and really understand student thinking. The conference setting also allowed for direct feedback that the student could immediately act on. The nature of NTI and the level of choice in this project meant students were usually working at vastly different paces. Thus, conferences were the best place to understand their present need. Attached is a written checkpoint that was completed before students began work on their drafts.

Please share some evidence or data that shows students met the goals and objectives of this lesson:

A wide diversity of products was created. Students analyzed the mathematics behind and designed their own Hair Braids, Dia de Los Muertos skulls, African Kente Cloth, Greek Architectural Patterns, Italian Ceramic Tiles, Hip Hop Music Production, Indian Paisleys, Luchador Masks, graffiti, and more. Only 8 of the students who submitted a final draft received below a 3 (out of 4). All student final drafts had evidence of growth from previous drafts.
-Students found creative ways to integrate transformational geometry into their products.

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In what areas did students exceed goals and objectives?

Several students created products that showed great attention to detail and quality and that revealed great depth of thought and reflection behind their work.

What might you do differently next time?

My biggest struggle was completing this project over NTI which didn't allow for the amount of daily conversation and circulation that would happen in an in-person classroom. I think that would have helped provide even more timely feedback to student and prevent some mistakes. In NTI, all students didn't have access to classroom resources (like a compass) that would have helped with mathematical accuracy. I would allocate more time for students to analyze the geometry and features of the exemplars students found. I would have students make rubrics for each before beginning their drafts. I would create a more concise project packet and guide, as well as simplify the theme selection process.