

# The Mathematics of Textile and Fashion Design: Global Teacher Fellowship

Katie Hendrickson

2012 Global Teacher Fellowship  
Recipient

Teacher, Athens Middle School  
Albert Einstein Fellow, Triangle  
Coalition/National Science  
Foundation

[KatieAHendrickson@gmail.com](mailto:KatieAHendrickson@gmail.com)

[www.KatieAHendrickson.com](http://www.KatieAHendrickson.com)

Twitter: @HendricksonKA



# Global Teacher Fellowship

- The Rural School and Community Trust
- Awards for teachers (\$5000) or teams of teachers (\$10,000)
- Self-designed summer learning experience
- 2-day follow-up place-based learning institute
- Learning centered in international travel and study
- Develop interdisciplinary, place-based, and standards-aligned lessons and activities

# Goals

- Increase student engagement and interest in math
  - ESPECIALLY for students who are not already interested in math
  - Math is important beyond STEM fields
  - Math is all around us and useful in a variety of careers
- Improve problem-solving skills
  - Work on ill-defined, real-life problems
  - Incorporate modeling (CCSS SMP)
  - Prepare students for PARCC performance assessments

# Why fashion and math?

- Patterns
- Design
- Weaving
- Marketing
- Sales



Ratio and proportion

Transformations

Estimating

Measurement

Area

Unit price

Patterns

Graphing

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- Research shows math is used in careers but workers do not recognize the math
 

*Nicol, C. (2002). Where's the Math? Prospective teachers visit the workplace. Educational Studies in Mathematics, 50, 289-309.*
- While people report not using math in their careers, they are actually using deep and high level math.
  - Advanced mathematical modeling and decision-making often not recognized as math
 

*Kent P., & Noss R. The mathematical components of engineering expertise: the relationship between doing and understanding mathematics. Paper delivered at the conference Engineering Education 2002, Institution of Electrical Engineers, London, January 2002.*
- Researchers and mathematics educators have been able to identify the mathematics
 

*Showalter, D., & Klein, R. (2011). Buried math at a local opera house: Where's the math? Paper presented at the Annual meeting of the Ohio Council of Teachers of Mathematics, Toledo, OH.*



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# Where's the Math?

- Two types of math lessons:
  - Opener questions to motivate a topic
  - Projects



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# Rate of change, % change

- Silk needs to be dried until it contains the correct amount of humidity.
- Is the rate of change proportional?
- What is the percent change in weight from day 6 to day 10?

Day	6	7	8	9	10	11	12	13
Weight	2.2 g	2.19 g	2.17 g	2.16 g	2.15	2.13	2.11	2.09

# Sampling

- When producing silk thread, the silk fibers have to be dried to the correct humidity.
- Break tests are done on 50 cm long pieces of silk.
- How many break tests do you think they do on one silk lot to ensure the strength of the silk?
- 50 per silk lot! Why so many?

# Mixture problem

- You need to dye batches of yarn. You need your dye to contain 15% red dye. However, your supplier only sells red in 10% and 30%. You decide to mix the correct percent yourself.
- You need a total of 10 gallons of dye.
- How much of each dye do you use?

# Handbag/Backpack Project

- Design your own handbag/backpack with a specified volume

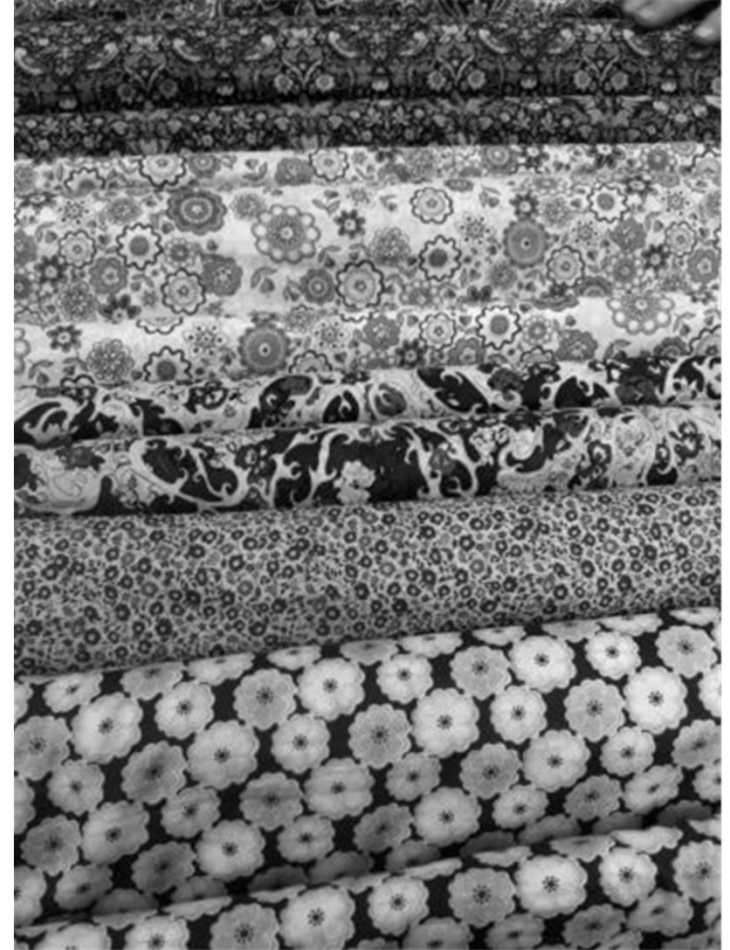


- You want the volume to be as close to 1000 square inches as possible.
- You must use at least two of the following solid shapes in your design:
  - Pyramid, prism, cylinder, cone, sphere
- Your report must include
  - the volume of your bag
  - the amount of fabric it will take
  - Detailed drawings of your bag



# Profit and Revenue

- The fabric that you need costs \$389 for an 80 yard roll and \$589 for a 150 yard roll. You know that you will need 400 yards of fabric. Which is the better deal? How many rolls do you need to purchase?



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- You purchase 450 yards of fabric for \$1767.
- It costs \$25/hour to hand-sew the garment.
- It takes 2.5 yards of fabric and 1.25 hours to make one garment.
- You want to make 30% profit. How should you price the garments?
- How much money will you make?

# Design/Waste Minimizing Project

- Tailors need to minimize fabric waste. Use your measurements (or favorite item of clothing) to design a shirt/dress/pants and determine how the designs should be laid out on the fabric.
- Determine the cost, selling price, revenue, and profit.



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# Requirements

- Must make profit of at least 30% while selling the garment for under \$50
- Must produce 150 of the garment



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# Parameters

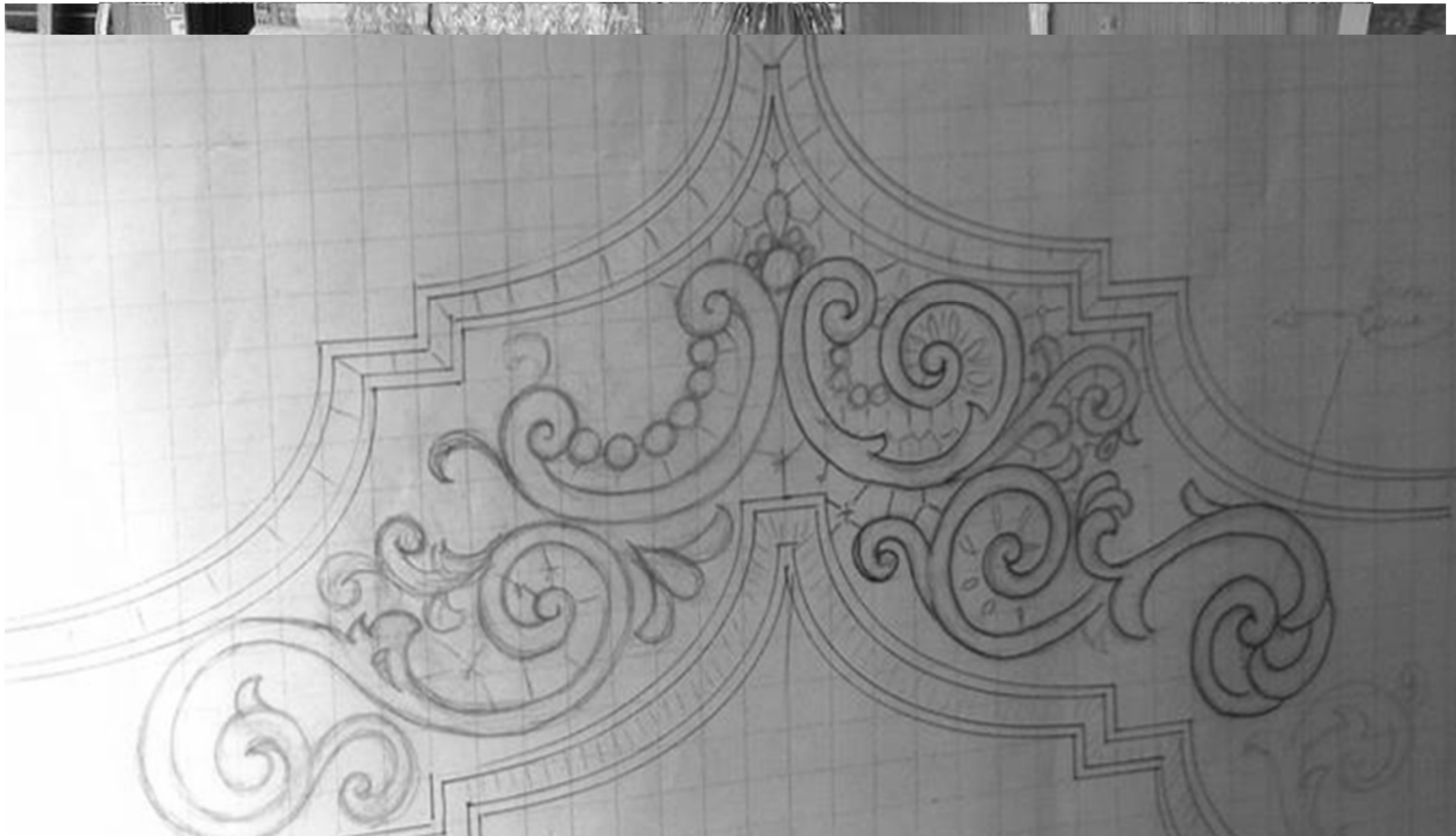
- You can choose one of the fabrics below:
  - 58 or 27 inch wide rolls of fabric (depends on student design)
  - Length: 80 yard or 60 yard (price varies per style of sample)
  - Style: (prints/samples of small swatches with prices for different lengths & widths)
- You also need to choose a sewing method:
  - Hand-sewn
  - Machine-stitched
  - Extra details

# Final report

- Pattern of your garment including actual measurements. Show how it will lay out on the fabric you chose.
  - Explain why you chose the width/length of fabric
  - Determine the approximate amount (square feet) and percent of fabric that is wasted
- How much you will price your garment
  - Explain your costs (including style of fabric and sewing method), revenue, and profit.

# Tapestry Project

- At the Manufacture des Gobelins in Paris, artists weave tapestries by recreating designs. They place the design on the wall behind them and a mirror beside them, and must use the reflection in the mirror to create a mirror image of what they see- a mirror image of a mirror image is the original design!
- You see the below design in the mirror. Create the reflection over the y-axis to create your tapestry.
- Now it's your turn to design a tapestry. Create it on the left, then have a friend create the reflection on the right.



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# Patterns Project

- Identify the symmetry and geometry in patterns and design your own print using graph paper and transformations



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- Create a 1-page pattern, with color, that includes at least 2 different transformations:

- Translation
- reflection
- rotation/  
rotational  
symmetry
- dilation



- 1 paragraph explaining how your design displays transformations (the type of transformation, the angle of rotation, etc.)

# Tessellations Project

- A tessellation is a repeated geometric design that covers a plane without gaps or overlaps.
- With which regular polygons can we make regular tessellations? (using pattern blocks)

Polygon	# of Sides	Interior Angle
Triangle		
Rectangle		
Hexagon		

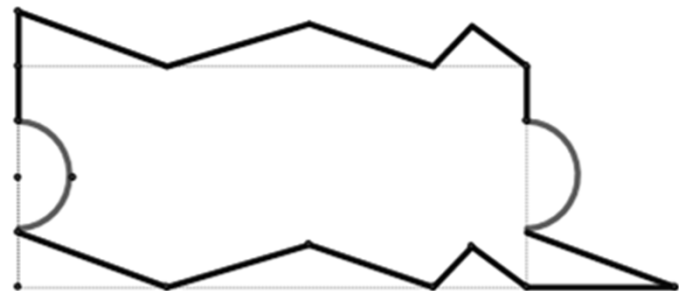
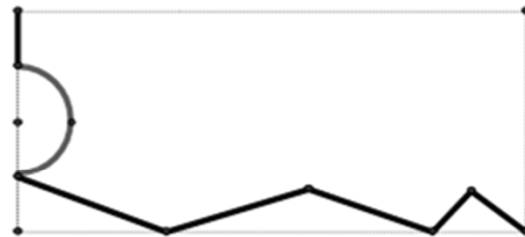
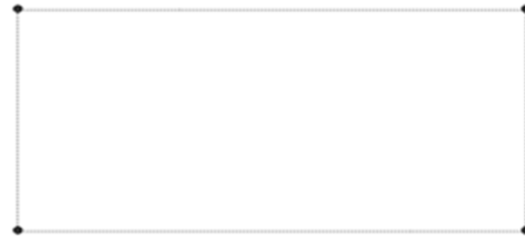
- Use a notecard to create a template
- Repeatedly tile and trace your template (it should interlock)
- Color!



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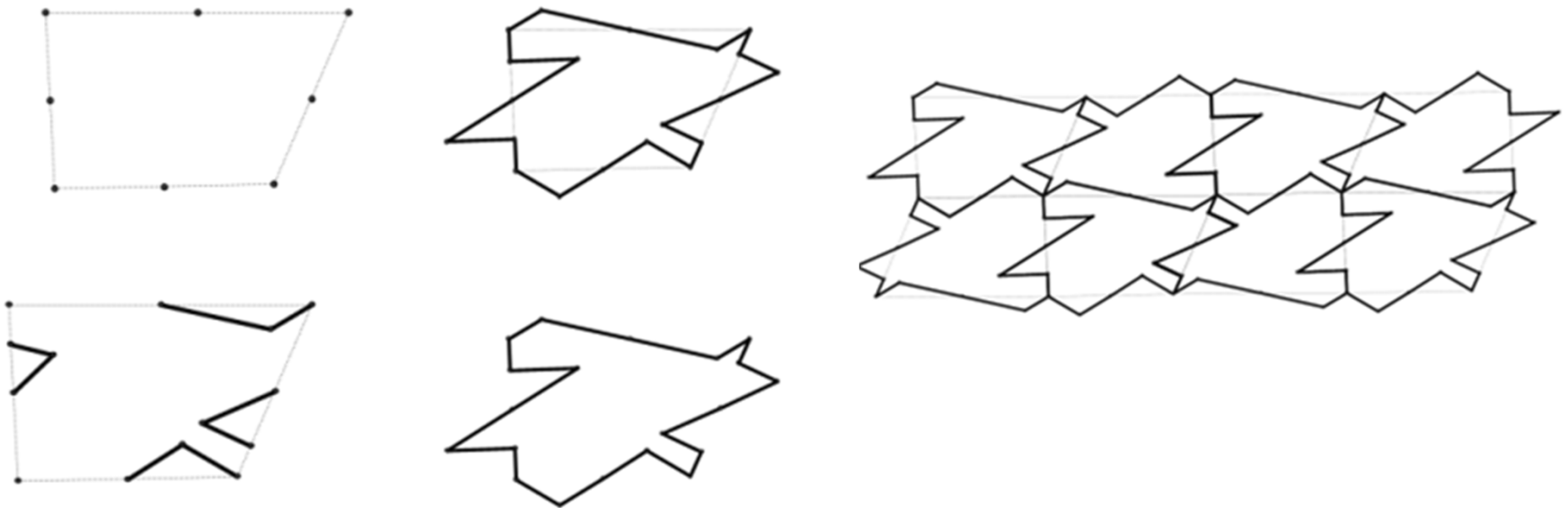
# Method 1: Cut and Slide

- Start with a rectangle. Make cuts on one side and either the top or bottom
- Translate cut pieces to the opposite side and tape.



# Method 2: Cut and Turn

- Find the midpoint of each side and cut a piece out of that side (don't overlap cuts)
- Rotate the cut piece 180° about the midpoint of the side



# How to apply?

- <http://www.globalteacherfellowship.ruraledu.org/apply.html>
- Send them an email of intent to apply.
- Apply by January 30, 2015
- K-12 teacher working full-time and teaching at least 60% of time in a public rural school.
- 4 years of teaching before fellowship starts
- School must be rural/REAP eligible: use NCES to define rural

# Application includes:

- Fellowship Title and Short Overview (500 characters)
- Describe a teaching or learning experience you have had that has been transformative for you or for students (2000 characters)
- Purpose of the Fellowship: What are you hoping to discover and learn? (2500 characters)
- Rationale for the Fellowship: How valuable do you intend this experience to be? Why is this the right experience for you at this point in time? (2500 characters)
- Fellowship Description: What do you plan to do? Where, when, and how long will your fellowship be? (3000 characters)
- How will this experience transform student engagement? (2000 characters)
- How will you use this experience to impact teaching and learning in your school and community? (2000 characters)
- Detailed Budget Narrative (2000 characters) [note: there is a limit for classroom materials and equipment/supplies. Most of the money should be for travel: accommodation, food, transportation, program/entrance fees, visas.]