WAMC Lab Template

Math Concept(s): Dilation about centers

Developed by: Michelle McCallum
E-Mail: michelle.mccallum@vansd.org

Date: Summer Conference 2022

Attach the following documents:

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

Short Description (Be sure to include where in your instruction this lab takes place):

Students will first choose a "simple" picture (semi-complex doodle) with the expectation of creating a larger (or smaller) copy of their drawing, given the placement of a center. Students will generate the dilated figure and discuss findings. The lab can then be extended by generating another dilation with a differently oriented center. After such, the students will generate comparisons and discuss the impacts of center placement. This lesson takes place within one day of class time during dilation unit after/during introduction lesson

Lab Plan

Lab Title: Picture Perfect Dilations (updated)

Prerequisite skills:

- Use of rulers and/or compasses
- Understanding of dilation
- Understanding of center

Lab objective: Students will perform a dilation of a self-selected figure about a center

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*

Mathematics K–12 Learning Standards:

- HSG-SRT.A.1- Verify experimentally the properties of dilations given by a center and a scale factor
- N-Q.3- Choose a level of accuracy appropriate to limitations on measurement when reporting quantities (or in this case, choosing the number of points to directly dilate)

Standards for Mathematical Practice:

- Attend to precision
- Modeling with mathematics (creating a larger or smaller version of a figure/picture)
- Look for and make use of structure

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- In response to the essential questions:
    - W.9-10.4- Produce clear and coherent writing in when the development, organization and style are appropriate to task, purpose, and audience.

Washington Applied Math Council https://wa-appliedmath.org/

- SL.9-10.4- Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

K-12 Science Standards

- WHST.9-10.4- Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose, and audience.

Technology

- 2.4.1 Formulate and synthesize new knowledge

Engineering

- N/A

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness ☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION

Creativity and Innovation
☐ Think Creatively
☐ Work Creatively with Others
☐ Implement Innovations

Critical Thinking and Problem Solving
☐ Reason Effectively
☐ Use Systems Thinking
☒ Make Judgments and Decisions
☐ Solve Problems

Communication and Collaboration
☒ Communicate Clearly
☒ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy
☐ Access and Evaluate Information
☐ Use and manage Information

Media Literacy
☐ Analyze Media
☐ Create Media Products

Information, Communications and Technology (ICT Literacy)
☐ Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability
☒ Adapt to Change
☐ Be Flexible

Initiative and Self-Direction
☐ Manage Goals and Time
☒ Work Independently
☐ Be Self-Directed Learners

Social and Cross-Cultural
☐ Interact Effectively with Others
☐ Work Effectively in Diverse Teams

Productivity and Accountability
☐ Manage Projects
☒ Produce Results

Leadership and Responsibility
☐ Guide and Lead Others
☐ Be Responsible to Others

Washington Applied Math Council
https://wa-appliedmath.org/

Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Pre-image icon
- Patty Paper for dilation process (lines of dilation and center)
    - If no access to patty paper, original doodle can be done on small pieces of plain paper
- Plain paper (construction or printer) for image
- Ruler (for measuring distance from center to vertices and generated image vertice placement)
- Permanent and semi-permanent writing utensils (pencil, pens, etc.)
- Coloring options if students are done early
- Work paper for recording discoveries, dilation scale, errors, etc.
- Calculators for dilated lengths
- Reflection worksheet

Set-Up Required:

- For each student:
    - A ruler
    - (at a min.) One plain paper for dilated image
    - A couple pieces of patty paper for dilation marks and center
    - One pencil/pen
    - Scratch/work paper
    - Reflection sheet at the end
- Coloring options available to those who finish early

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Make judgments and decisions
- Communicate clearly
- Collaborate with others
- Adapt to change
- Work Independently
- Produce Results

Cooperative Learning:

- Students will be given the opportunity to share materials
- Students can work together to dilate more complex images
- Students will be sharing space for work
- Students will be sharing thinking in end-of-work reflection

Expectations:

- Students will choose icon to dilate (complexity depends on time and desire)
- Students will identify their *center*
- Students will choose desired scale factor (positive integer)
- Students will identify points of dilation (given complexity of doodle)

Washington Applied Math Council
https://wa-appliedmath.org/

Timeline:

- The basic lab can be completed within a single 50-minute class period; time requirements can be extended by adding discussion questions, observation questions, group extensions, additional dilations (negative, fractional, larger positive integers, or more complex figures)
- A previous lesson needs to occur where students learn what dilations are, how to calculate the dilations, the components of dilations, and how to apply dilation/transformation skills.
- Introduction:
    - Teacher shows example of chosen icon
    - Teacher models dilation process:
        - Choosing the center placement
        - Choosing the scale factor
        - Choosing points of dilation to stay true to image shape
        - Beginning the dilation calculations

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- How does the center position affect the perspective of the image?
- How does the number of dilated points effect the accuracy of your image?
- How does the scale factor change your image?
- How do scale and center position interact?

Career Applications

- Photographer- angle of lens affects “center” and scale throughout photo and how it would distort/dilate photo
- Digital artist- dilation of pieces in your digital work; how changing scale and center could distort/dilate photo appropriately
- Those who work outside- judging, by the angle of the sun and the shadows around, what time of day it is.

Optional or Extension Activities

- Provide alternate dilations
    - Positioning of center
    - Different scale factors
    - What would happen if your scale changed through your image? Ex: if your dilated point reaches past “this line” your scale jumps to 3 instead of 2

Washington Applied Math Council
https://wa-appliedmath.org/

WAMC Lesson Plan

Name(s): Michelle McCallum
Email Address: michelle.mccallum@vansd.org
Lesson Title: Picture Perfect Dilations
Date: Summer Conference 2022

Washington Applied Math Council https://wa-appliedmath.org/

Big Idea (Cluster): Geometry; Transformations—Dilations

Mathematics K–12 Learning Standards:

- HSG-SRT.A.1- Verify experimentally the properties of dilations given by a center and a scale factor
- N-Q.3- Choose a level of accuracy appropriate to limitations on measurement when reporting quantities (or in this case, choosing the number of points to directly dilate)

Mathematical Practice(s):

- Attend to precision
- Modeling with mathematics (creating a larger or smaller version of a figure/picture)
- Look for and make use of structure

Content Objectives: Students will be able to produce and positive, negative, and fractional dilations about different placed centers	Language Objectives (ELL): Students will be able to make predictions and observations, of how changes in scale factor and center placement changes image results.
Vocabulary: • Scale Factor • Center • Line of Dilation • Pre-image • Image	Connections to Prior Learning: • Students will observe differences between dilations and the rigid transformations from before
Questions to Develop Mathematical Thinking: • What occurs when your scale factor is fractional? • What occurs when you scale factor is negative? • What do you think would happen as the center shifts around? • Where do you think the center on *this* image?	Common Misconceptions: • Negative scale factor produces a smaller image • Plain avoidance of fractional scale factors

Assessment (Formative and Summative):

- Formative: Various practice sheets and examples
- Summative: Picture Perfect Dilation Lab

Materials:

- Pre-image icon (From Icon Sheet)
- Patty Paper for dilation process (lines of dilation and center)
  - If no access to patty paper, original doodle can be done on small pieces of plain paper
- Plain paper (construction or printer) for image
- Ruler (for measuring distance from center to vertices and generated image vertice placement)
- Permanent and semi-permanent writing utensils (pencil, pens, etc.)
- Coloring options if students are done early
- Work paper for recording discoveries, dilation scale, errors, etc.
- Calculators for dilated lengths
- Reflection worksheet

Instruction Plan:

Introduction: Introduce the mathematical aspect to dilations (image, pre-image, center, scale factor, and how to apply)
Explore: Students explore where they've experiences dilations before (taking pictures, engaging in digital work) and then explore the production of different dilations.
When I observe students… I will be checking for correct use of vocabular and mathematical concepts
Questions to Develop Mathematical Thinking as you observe: Recall→ "What is *that*?" Understanding → What occurs when your scale factor is fractional? → What occurs when you scale factor is negative? Analysis →What do you think would happen as the center shifts around? →Where do you think the center on *this* image?
Answers: → students will be able to use the vocab accurately → "the image gets smaller" → "The image is flipped in the opposite direction; then flipped again" →Specific responses depending on the example
Summarize: Teacher informs students of dilation components, demonstrating the dilation process. Over the course of three days, students learn what all dilations are and how to produce them.

Washington Applied Math Council
https://wa-appliedmath.org/

Career Application(s):

- Photographer- angle of lens affects “center” and scale throughout photo and how it would distort/dilate photo
- Digital artist- dilation of pieces in your digital work; how changing scale and center could distort/dilate photo appropriately
- Those who work outside- judging, by the angle of the sun and the shadows around, what time of day it is.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness ☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION
Creativity and Innovation
☐ Think Creatively
☐ Work Creatively with Others
☐ Implement Innovations
Critical Thinking and Problem Solving
☐ Reason Effectively
☐ Use Systems Thinking
☒ Make Judgments and Decisions
☐ Solve Problems
Communication and Collaboration
☒ Communicate Clearly
☒ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS
Information Literacy
☐ Access and Evaluate Information
☐ Use and manage Information
Media Literacy
☐ Analyze Media
☐ Create Media Products
Information, Communications and Technology (ICT Literacy)
☐ Apply Technology Effectively

LIFE & CAREER SKILLS
Flexibility and Adaptability
☒ Adapt to Change
☐ Be Flexible
Initiative and Self-Direction
☐ Manage Goals and Time
☒ Work Independently
☐ Be Self-Directed Learners
Social and Cross-Cultural
☐ Interact Effectively with Others
☐ Work Effectively in Diverse Teams

Productivity and Accountability
☐ Manage Projects
☒ Produce Results
Leadership and Responsibility
☐ Guide and Lead Others
☐ Be Responsible to Others

Washington Applied Math Council
https://wa-appliedmath.org/