E-D.2 Quadrilateral Patterning through Indigenous Beading

Grade 5

Serena Palmer

This lesson follows a lesson that introduced polygons and their attributes. Students create a pattern that incorporates a quadrilateral in order to make a beading artifact. They draw their pattern on graph paper using coloured pencils. From there, the design is transferred to an 11-strand loom by way of coloured beads. After the students have made their beading artifact, they describe the attributes of their quadrilateral as well as of other students' quadrilaterals.

Curricular Knowledge

Outcome SS5.6	Identify and sort quadrilaterals (rectangles, squares, trapezoids, parallelograms, rhombuses) according to their attributes.
Indicator d	Describe, orally or in writing, the attributes of different quadrilaterals.
Outcome SS5.7	Identify, create, and analyze single transformations of 2-D shapes (with and without the use of technology).

Indigenous Mathematizing and Perspectives

The students will be able to (see Appendices A and C for more information):

a) Understand that First Nations tradition of beading is a spatial mathematical process passed down from generation to generation.
b) Understand that beading patterns often represent the family or the local area.
c) List materials used by First Nations people to loom, before and after European contact.
d) Explain the uses of beads in First Nations jewelry, art, and ceremonies.
e) Describe the functions of beads and beading: as a form of money, to record agreements/treaties, to represent stories, and to decorate clothing.
f) Create a beading artifact with an 11-strand cardboard loom. A specific example of Indigenous mathematizing and of the math curriculum's Outcome SS5.7.

General Knowledge

Understand that patterns represent meanings. The same pattern may have different meanings depending upon the context in which it is found (see Appendix B).

Time 1-2 classes

Materials

*Supply of different coloured pony beads
*Coloured pencils
*Graph paper
*Needle and thread
*String
*Cardboard loom each (Appendix D)
*Tape
*Student Assessment Handout

Teacher Resources

1. YouTube introductions to the process of loom beading.
   a. https://www.youtube.com/watch?v=YeBBBiqD8nA. This is excellent in all ways.

      The next two videos (b. and c.) divide the process into two parts: (1) making the artifact on the loom board, and (2) removing it from the board. The technique shown is informative for you.
      WARNING: Because the two videos *appropriate* "wampum belt" from First Nations by identifying their artifact that way, it becomes a negative teachable moment about appropriation if students were to see the videos. We strongly suggest they do not.

   b. https://www.youtube.com/watch?v=r6psg_WD-Bw
   c. https://www.youtube.com/watch?v=mwwx41aFVUQ
2. Indigenous cultural information about beading (Appendices A and C).

Lesson Procedure

1. Review the attributes of a quadrilateral. Get students to pick out objects in the classroom that have a quadrilateral shape. Identify each example's attributes.
2. Convey information on First Nations beading in a way that students interact with the PowerPoint. Go through it quickly, without mentioning all the points; but as the lesson unfolds, continue to add PowerPoint information as part of the normal discussion. The Indigenous mathematizing and perspectives can be *woven into* the curricular math content for best results, as opposed to keeping the two separate.
3. View photos of local Indigenous regalia and decorated jackets. Students find patterns that mathematicians call "quadrilaterals".
4. Distinguish between, on the one hand, an Indigenous pattern whose name and meaning we may not know, and on the other hand, an analogous Western math pattern that the curriculum calls a quadrilateral. Students usually discover other decorative math patterns called polygons.
5. Show students the beading artifact you made when preparing for this lesson. If Indigenous loom-beading artifacts are available to you, have students identify patterns that translate into Western math such as a polygon or quadrilateral. For engaging students, concrete objects are superior to photos.
6. Organize students in groups of three or four, so students who catch on quickly to the process of beading can help the others. This lets the teacher focus on a group that needs help.
7. With coloured pencils and graph paper, each student creates a coloured pattern that has at least one type of quadrilateral. Students need to use 11 lines width on their graph paper. (The loom will have 11 strings to hold 11 rows of beads.) The student's artifact will display this coloured pattern. The length of the artifact is the student's choice within reason.
8. Ahead of time, construct a cardboard loom for each student, already snipped to hold 11 lines of string (see Appendix D). Cut the students' string to the proper length.

9. Demonstrate the process of beading (see the first website in Teacher Resources above). Show students how to add 10 beads at a time to their loom (rather than one at a time) by threading each row's 10 beads with a needle and thread and placing them under the string on the loom making sure that each bead is between a string. The string is threaded back through the beads ready to start the next line.
10. Repeat this process for the next 10 rows, so students transfer their design from the graph paper onto their loom.
11. When the students have finished beading, make sure each knot is tied very tightly. For Grade 5 students, you might consider tying their knots yourself to avoid the tragedy of a knot becoming undone, some beads flowing off the thread, and a student depressed.
12. Taking the completed beading artifact off the loom can be tricky as students typically do not tie knots tightly enough, and they trim the leftover string too short. The trim should be at least two inches (5.1 cm) long or longer (see the first YouTube video [at 12 minutes] in the Teacher Resources section. The third YouTube video is dedicated to the removal of the artifact from the board.)
13. End the lesson with a discussion on the *personal* meaning each artifact has for the student who made it (e.g., a word expressing a value, or a student's identity expressed by their initials, hockey jersey number, or family initial). Then compare these personal meanings with the mathematical meaning the artifacts hold (i.e., quadrilaterals). This discussion can easily be related to Item #4 above. This comparison can make the point that math is just *one way* of understanding something. Other Indigenous understandings or personal understandings can exist as well.
14. Have students complete the two-page assessment (next page).
15. Take up the answers to the Student Assessment Handout taking time to discuss Questions 9 and 10. Ask what their answers tell us about comparing a First Nations meaning of a pattern to the mathematical meaning of that pattern.

Assessment

Students will hand in an assignment (the next two pages that follow) that includes: their beading design, a description of their quadrilateral, descriptions of two other classmates' quadrilaterals, and ideas about First Nations perspectives on loom beading.

Student Assessment Handout

Name: _____

Math 5 Quadrilaterals and Loom Beading

Date: _____

Outcome SS5.6: Identify and sort quadrilaterals according to their attributes.

Outcome for the meaning of patterns: First Nations, mathematical, and personal.

1. What is the name of the quadrilateral you made?

   _____

2. Describe your quadrilateral's attributes.

   Number of sides: _____

   Number of vertices:_____

   Length of sides:_____

   Parallel sides: _____

   Lines of symmetry: _____

3. Describe your colour pattern.

   _____

   _____

4. Attach the graph-paper design of your beading here.

5. Find two students who did not create the same quadrilateral as you did. Complete the chart below using their beading.

Student	Quadrilateral Shape	Attributes

6. What materials did First Nations people use for beading before contact with the Europeans?

   _____

   _____

7. What materials did they use after contact with the Europeans?

   _____

   _____

8. Before contact with the Europeans, beads had many uses and purposes in First Nations cultures. List three different ways First Nations people used beads.

   _____

   _____

   _____

9. What does your beaded object mean to you in a personal way?

   _____

   _____

10. What does your beaded object mean to a mathematician?

    _____

    _____

Appendix A

Teacher Background Information on First Nations Beading

Beads are one of the earliest forms of First Nations art. Beading has been a part of First Nations culture for about 8,000 years.

Beading is passed down from generation to generation using the patterns that are of the family or of the area.

Before contact with Europeans, beads were made of shell, bone, pearl, teeth, stone, and fossil stems. When Europeans came to Canada, they saw the importance of beads to the First Nations people, so they used beads in trade.

When smaller beads were made, these beads were used in loom weaving. They were used in ceremonies and to decorate clothing, baskets, and dolls that were used to trade at the trading posts.

A loom is used to weave cloth. Much beadwork by First Nations people was done on looms. Woven beadwork included beads and twisted sinew from animals. Twisted cords from plants, bark, or roots was also used before string was introduced. When European threads became available, First Nations people considered their own natural “string” superior and continued to use it.

The earliest weavings were most likely hand-held finger-woven techniques. European contact led to metal tools that allowed First Nations people to produce smaller shell beads and also made available glass beads and iron needles. First Nations people were able to create larger beadwork pieces using the smaller tools and supplies.

Beads were used in many different ways in First Nations cultures. Jewelry was used to show connections with a particular group. Jewelry was also used in rites of passage and in ceremonies of dance that celebrated the change in seasons, harvest, births, and marriages. Ceremonies of healing often used specific types of jewelry or beads. Beads were used to validate treaties, remember oral tradition, and for currency (money).
https://www.google.com/search?q=Plains+Cree+regalia&tbm=isch&source=univ&client=firefox-b-d&sa=X&ved=2ahUKEwiah6mm8vDgAhXE5YMKHXhvD6MQ7Al6BAgEEBE&biw=1198&bih=626#imgrc=MicHeAZV6JDamM

Appendix B

The Nature of Mathematics Knowledge

Like similes in any language, patterns represent meanings. The same pattern may have different meanings depending upon the context in which it is found.

A pattern's mathematical meaning relates to just one context (i.e., Western math) out of several legitimate contexts (e.g., art, law, and culture). A mathematical meaning is not superior to other accepted meanings of a pattern. Therefore, its meaning is neither true or false. As with any pattern, however, it may be more effective in one context (e.g., engineering) than in another (e.g., judging a beading artifact's creativity). For example:

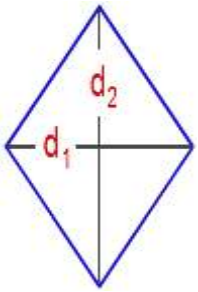
Context A

An Indigenous quilter tells a story for the person who receives the quilt.

Star Blanket[2]

Context B

Mathematicians tell a story about how to find the area of a rhombus.



$$Area = \frac{1}{2}d_1 d_2$$

The pattern of interest in Context B has a precise universal meaning, whereas the pattern's meaning in Context A comes from the local knowledge of the quilter. The process of gaining that knowledge is to locate the quilter, forge a relationship, and then, following proper protocol, ask what the pattern means to them. The same pattern has two different meanings depending upon the context.

In Context A, the pattern has emotional, spiritual, physical, and intellectual meaning. Whereas in Context B, the pattern only has intellectual meaning.

In Context A, the pattern's meaning is associated with a wide host of values; whereas, Context B is associated with only intellectual values.

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[1] https://socratic.org/questions/a-rhombus-has-sides-8-cm-in-length-and-its-shortest-diagonal-is-10-cm-in-length-

[2] https://www.google.com/search?q=photos+of+Canadian+Indigenous+star+blanket&client=firefox-b-d&tbm=isch&source=iu&ictx=1&fir=68inB3i0Uf1khM%253A%252CLL-y4RdtfSL1EM%252C_&vet=1&usg=AI4_-kQa9BPsgi49DiA4hyjsKXyvszT-5A&sa=X&ved=2ahUKEwi0qMjl86zhAhVBMawKHcouCUwQ9QEwBHoECAkQDA#imgrc=F3pPpzNfaAwCjM:&vet=1

Appendix C

From the First Nations Loom Beading PowerPoint

What patterns do you see?

https://www.google.com/search?q=Plains+Cree+regalia&tbm=isch&source=univ&client=firefox-b-d&sa=X&ved=2ahUKEwiah6mm8vDgAhXE5YMKHXhvD6MQ7Al6BAgEEBE&biw=1198&bih=626#imgrc=ZzhNW3nuNl1k0M:

History

- Beads are one of the earliest forms of First Nations art. Beading has been a part of the First Nations culture for about 8,000 years.
- Beading was, and still is, passed down from generation to generation using the patterns that are of the family or of a region.
- Beads were made of shell, bone, pearl, teeth, stone, and fossil stems originally.
- The earliest weavings were most likely hand-held finger-woven techniques.
- Twisted sinew from animals or twisted cord from plants, bark, or roots was used for string.
- Early beading was done to make art and jewelry, to decorate regalia, to record history, and to tell stories.

www.flickr.com

European Influence

- When the Europeans came, they brought new materials for looming and beads.
- The Europeans brought glass and plastic beads with them. They also brought different sizes of beads.
- The Europeans also brought string, but First Nations people considered their own string superior, and they continued to use it.
- New metal tools were also brought by the Europeans which allowed First Nations people to make smaller beads and larger bead works.
- The Europeans also saw how important beads were to First Nations peoples, so they used beads to trade.

www.deviantart.com/cre8art4life/art/gLass-BeAds-stock-cU-Ok-383298943

https://www.flickr.com/photos/evelynishere/3716702829

Uses of Beads

- Beads were used in many different ways in First Nations culture.
- Beading designs and patterns were used to show connections with a particular group.
- Jewelry was also used in rites of passage and in ceremonies of dance that celebrated the change in seasons, harvest, births, and marriages.
- Beads were used to validate treaties, remember oral traditions, and for currency or money.

https://www.flickr.com/photos/21728045@N08/14041207697

http://education.davidspencer.ca/wiki/Aboriginal_Clothing

Can you find a quadrilateral or a polygon in the beading patterns?

Nehiwayak: Traditions of the Cree People
https://www.google.com/search?q=Plains+Cree+regalia&tbm=isch&source=univ&client=firefox-b-d&sa=X&ved=2ahUKEwiah6mm8vDgAhXE5YMKHXhvD6MQ7Al6BAgEEBE&biw=1198&bih=626#imgdii=y3uKXVympja6tM:&imgrc=MicHeAZV6JDamM

https://www.google.com/search?q=Plains+Cree+regalia&tbm=isch&source=univ&client=firefox-b-d&sa=X&ved=2ahUKEwiah6mm8vDgAhXE5YMKHXhvD6MQ7Al6BAgEEBE&biw=1198&bih=626#imgrc=MicHeAZV6JDamM

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https://www.google.com/search?q=Plains+Cree+regalia&client=firefox-b-d&tbm=isch&tbs=rimg:CSMw7q6Ee1rlIjgpPY-XgXLflGwxjxk1hEpgS3UJBaigzOacIRelqIg71_1nYo_1Z1ycxEMUrAzxAeZG57ne1eZk47nCoSCSk9j5eBct-UERVIK1osxEjDKhIJbDGPGTWESmAR8pIlieFWSqwqEglLdQkFqKDM5hEDv59RM_1eaLCoSCZwhF6WoiDvXEToX1nrybkaLKhIJ

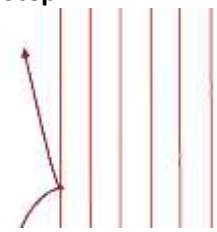
Samson Cree Nation Pow Wow

Appendix D

Basic Beading on a Loom

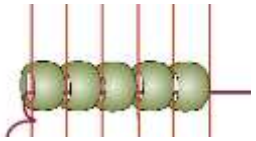
https://www.fusionbeads.com/basic-beading-on-a-loom

Step 1

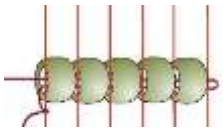


Cut a three-foot length of thread. Thread a needle. Knot the end of the beading thread (red) around an outside warp thread (shown orange).

Step 2



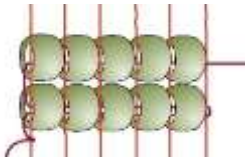
String one less bead than the number of warp threads, in this case, five beads. Keep the thread under the warp threads. Lift the beads up, and position one bead between each warp thread. Keep the tension pulled tight.



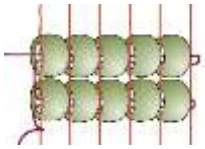
Step 3

Bring the needle back over the warp threads and pass back through the row of beads making sure that the weft thread sits on top of the warp threads.

Step 4



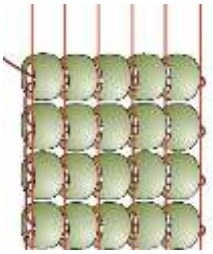
String another row of beads, pull the thread behind, and push the beads up between the warp threads.



Step 5

Bring the needle back over the warp threads and pass back through the row of beads making sure that the weft thread sits on top of the warp threads.

Step 6

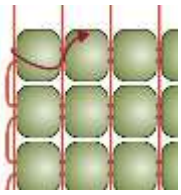


Continue to repeat Steps 4 and 5 until you've woven the desired length or until you run out of thread.

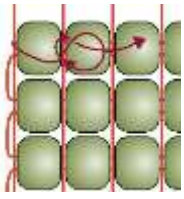
Step 7

To finish one thread and add a new one, go back through the last bead.

Step 8

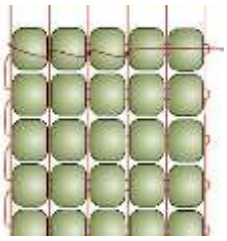


Go underneath the warp thread.



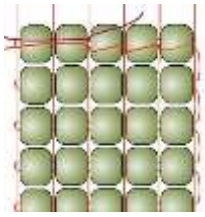
Step 9

Tie a half-hitch knot around the warp thread and trim the thread close to the knot.



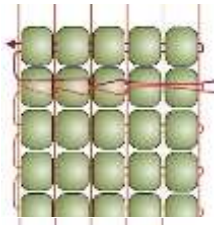
Step 10
Repeat Steps 7-9 tying a knot between every bead until there are two beads left in the row. Pass through the last two beads, pull taut, and leave the tail coming out of the row.

Step 11
Thread a new weft thread, and bring the needle through the last two beads passed through by the old weft thread going in the opposite direction. Pull the thread through the beads until a three-inch tail remains.

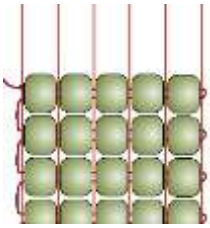


Step 12
Go underneath the weft thread, and tie a half hitch. Grasp the old and new weft threads and pull them in opposite directions to even out the tension.

Step 13
Repeat Steps 7-9 tying a knot between every bead until there are two beads left in the row. Pass through the last two beads.

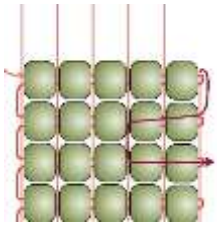


Step 14
Return to weaving as before. Leave the thread tails until later, then pull them taut and trim the ends off.

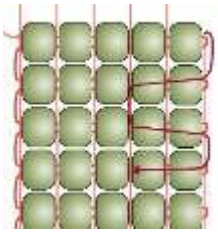


Step 15
When you're finished weaving, remove the piece from the loom. To finish the piece, the warp threads will need to be woven back in. Trim down any threads that are more than eight inches long.

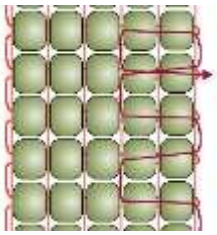
Step 16
Thread a needle on an outside warp thread and pass through the two outside beads in the second row.



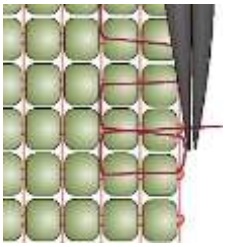
Step 17
Pass through two beads in the next row down, back toward the edge of the weaving.



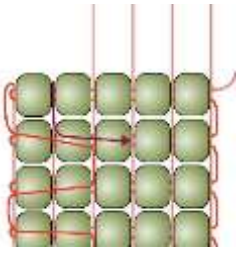
Step 18
Pass through two beads in the next row down, back toward the center of the weaving.



Step 19
Repeat Steps 17 and 18 through another three or four rows. On the last row, turn and go back through the two beads in the previous row to complete a full loop of the thread.

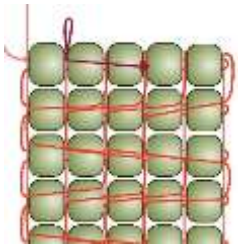


Step 20
Use sharp scissors to trim off any remaining thread.



Step 21
Thread the needle on the next warp thread over and pass through the two beads in the adjacent row, back toward the center of the bracelet.

Step 22
Continue through more rows, just as you did with the previous thread. It is not necessary to make a full loop on the last rows. Exit the two beads and trim the thread close to the beads.



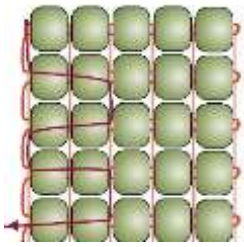
Step 23
On the second to last row, you'll need to start by weaving through two adjacent beads.

Step 24
Weave the warp thread back in as you did for the previous threads.

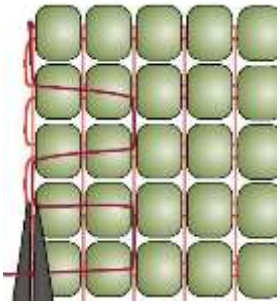
Step 25
Weave the last row in the same way as all the previous rows, but make sure that the thread emerges from a bead going toward the center instead of coming out the side.

Step 26
Trim the thread close to the beads.

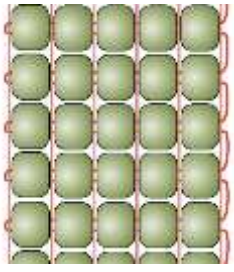
Step 27
Repeat on the opposite end to secure the other ends of the warp threads.



Step 28
The last step is to weave in any weft thread tails. Thread the needle on the weft thread tail. Weave the thread back through three to four rows.



Step 29
Trim the thread close to the beads.



Step 30
Congratulations, you have learned how to weave using a beading loom!

Appendix E

Examples of Students' Loom Beading