

**E-B.1 – Picario**  
**A Traditional Indigenous Game to Develop**  
**Spatial Reasoning, and Analytical and Critical Thinking Skills**

**Grade 10 Mathematics Workplace and Apprenticeship**

**Kevin Duchscherer**

This two- or three-period lesson exemplifies Indigenous mathematizing in the form of a game that becomes an activity for students to explore analytically in a way featured in the mathematics curriculum. In the first lesson (optional), students follow authentic Plains Cree protocol to acquire three stones that serve as their markers in the game of Picario. In the second and third lessons, students play a simple form of the game and sequentially make the rules more challenging. They find *patterns* in the resulting strategies for winning. Finding hidden patterns in players' strategies promotes two-dimensional spatial reasoning. Students develop analytical and critical thinking strategies by posing their own problems to solve.

**Curricular Knowledge**

*Outcome WA10.2:* Analyze puzzles and games that involve spatial reasoning using problem-solving strategies.

**Indigenous Mathematizing and Perspectives**

Aspects of Cree First Nation Worldview (Sources: Sharon Meyer, North East School Division, FNMI: "Grandfather Rock," 2014; "Medicine Wheel Teachings," 2014; and "Tobacco Teachings.")

*See more content in Appendix A.*

*Grandfather Rock* (synopsis of the PowerPoint)

1. Creator created four things above Mother Earth: sun, sky, moon, and stars.
2. Then Creator made the four elements of Mother Earth: wind, fire, rock, and water.
3. Traditional First Nations people call rock "Grandfather Rock" because of the relationship of rock with all things created by Creator. Its relationship is made with respect, and the highest respect given or received is through family relationships, as in relation to a grandfather.

*Medicine Wheel Teachings* (synopsis of the PowerPoint)

1. The circle is very sacred for traditional First Nations people. All ceremonies, celebrations, gatherings, and ways of thinking about the world are done within a circle format. The assumed direction sequence around a circle is based on the way the sun moves across the sky (clockwise).
2. Although the medicine wheel has four parts (in recognition of the sacred number four), everything within it is interconnected holistically.

*Tobacco Teachings* (synopsis of the PowerPoint)

Tobacco teaches us to be thankful. It is offered to give thanks; for example, before harvesting plants or roots, before removing natural items from Mother Earth, or before hunting or fishing. In some ceremonies, it's giving thanks for the wind, fire, rock, and water being a part of our lives.

**Time:** 2-3 hours

### Teacher Materials

- PowerPoints: Grandfather Rock, Medicine Wheel Teachings, and Tobacco Teachings from the North East School Division.
- Optional: Pouch of tobacco for ceremonial use, only if students interact with Mother Earth when each student gathers three game tokens (stones) from the out of doors.
- Optional: If a teacher does not understand the protocol of offering tobacco, then an Elder or knowledge keeper should aid the process to honour the Grandfather Rocks that are about to be used for educational purposes (how a student should place a pinch of tobacco on the ground when gathering their three stones).

### Student Materials

1. For each of two students, a surface to play the game on. The game board represents an animal hide such as tan- or brown-coloured cloth. The size should be a loose leaf size.  
With a permanent marker, draw the structure shown below in Appendix B.
2. Each student will have three small stones or facsimiles of stones. Their colour should ensure that game partners can easily identify their own game pieces.
3. Pen/pencil for recording findings/perceptions/critical conclusions on the student handout, Appendix C.

### Vocabulary

Spatial reasoning, relationship, pattern, analyze, variation, Grandfather Rock, medicine wheel, tobacco, Mother Earth, and animal hides.

### Assessment

Formative – Group work, group discussion, think-pair-share, and 3-2-1 exit cards.

The basic exit card format is as follows:

- Students write 3 things they learned in today's lesson.
- Students write 2 things they liked or two interesting facts about the lesson.
- Students write 1 question they still have about the lesson.

Summative – Presentation of strategies used, variation in game rules made, how the variation affects strategy for winning, and rubric of curriculum focus supplied to students.

### Conceptual Framework<sup>1</sup>

Indigenous perspectives are represented with respect to the following aspects of learning mathematics:

- Oral communication based on experiential learning: Students are provided with opportunities to learn by listening, doing, and speaking. Solving problems and engaging in hands-on activities will enable students to gather information and knowledge, express their learning, and communicate with others. Group discussion encourages students to share their experiences and thereby develop mathematical understanding.
- Problem solving: Students are encouraged to develop strategies for approaching problems either individually, in pairs, or in small groups.
- Reasoning: Hands-on activities where there is no one-set method and no one-set solution, challenge students to use analytical skills to find a solution. Group discussion over mathematics problems develops students' ability to make predictions and conjectures, and encourages student participation. It also helps students develop abstract thought from their experiences in concrete problem solving.

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<sup>1</sup> These aspects of learning mathematics are taken from, or inspired by, *MathWorks 10*, Teacher Resource, a common resource used by teachers in teaching the Math Workplace and Apprenticeship 10 curriculum.

- Visualizations: The development of visualization skills and spatial sense are fostered through the use of manipulatives (e.g., the game board, game rules, and the organization of the game board).
- Critical thinking: Students develop analytical and critical thinking skills by strategizing solutions to problems and evaluating the options presented with respect to the advantage of a player winning the game.

### Optional Lesson

1. An excellent first activity, weather permitting, engages each of your students in an authentic Indigenous way of gathering three small stones out-of-doors to serve as their tokens for the game Picario.
2. Learn from someone who knows an authentic way of giving thanks with tobacco, in this case, for borrowing stones from Mother Earth. Tobacco is offered before harvesting the Grandfather Rocks. The students should be made aware that before anything is taken from Mother Earth, we offer gratitude by laying tobacco on the ground. In that way we acknowledge the rock as becoming a part of our purpose – in this case a First Nations math game. A pinch of tobacco is sufficient for each trio of rocks. Another reason for offering tobacco is to establish or strengthen a reciprocal relationship between a student and Mother Earth.
3. Ahead of time, pick out a place where students will select (borrow from Mother Earth) three small rocks (stones) each. It is preferred that the area has not been infused with other chemicals such as oil, gas, or other chemicals, thus, avoid parking lots. The rocks should be closely connected to the pure medicine of Mother Earth. A nearby park, forest, or creek would work well.
4. Take a pouch of tobacco with you for this out-of-school activity. When you and your students reach the stone gathering place, each student takes a pinch of tobacco from your pouch.
5. They sprinkle it on the ground just where they select their small stones. This act acknowledges a *reciprocal relationship* between a student and Mother Earth: As students pick up the three stones, they offer this sacred substance (tobacco) in return. A student should say something like, “Thank you Mother Earth for letting me use these stones,” or “Thank you Mother Earth for the Grandfather Rocks that we are about to use for our math education.” This is an appropriate way for a student to show respect to Mother Earth either said out loud or under their breath. It’s the thought that counts. Students can say anything they think of in a positive way or with positive energy.
6. Students should pay attention to choosing rocks by colour or shape in order to distinguish their rocks from another student’s rocks.
7. The rocks are to be returned to the same place at the end of the activity. Have a place in your classroom for students to store their Grandfather Rocks until they return them to Mother Earth.



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### Lesson

1. Back in the classroom, have students sit in a circle on the floor with the teacher. (Some First Nations people leave a small opening in the circle to facilitate Creator's movement in and out of the circle.)
2. Open the lesson with a 10-minute discussion about how different cultures see the world differently. For instance, the importance of the circle to First Nations cultures. Based on the lesson's background material synthesized in this lesson plan's section Indigenous Mathematizing and Perspectives, introduce students to some of your understandings of how most First Nations cultures view the world by teaching them about Grandfather Rock, medicine wheel teachings, and optionally, tobacco teachings. Choose information that will most likely capture your students' interests.
3. Tell the students that First Nations people played a game that they will be playing. Let them know that they will be expected to give a thoughtful analysis of playing the game, and then later, to suggest variations on the game rules to see what difference it makes.
4. Introduce the rules of Picario (see Appendix B). It is a more sophisticated version of x's and o's.
5. Have students pair off facing each other in the circle and give them a marked-up piece of cloth (game board) that represents an animal hide (see the section Student Materials).
6. Have them play a basic version of the game to begin with. Hold a discussion to decide if a player had an automatic advantage to win depending on who was first to place a rock on the "hide." This establishes the agenda to critically analyze the game
7. Once students are familiar with the game, introduce a more complex version (see Appendix B). Ask them to turn around in their place and play with the person next to them in the circle. Allow them to experience as many aspects of the game as time permits.
8. Gather the materials back before moving to a deeper analytical portion of the lesson.
9. Give students a handout (Appendix C) to help guide them in their reflection and analysis of the game. Once everyone has completed the handout, hold a full class discussion regarding the students' findings.
10. Collect the handout for assessment.

## Appendix A

### More Background Information on Indigenous Mathematizing and Perspectives

#### *Grandfather Rock*

1. Grandfather Rocks are used to anchor tipis, control a fire pit, to heat a sweat lodge, etc.
2. The bowl of the sacred pipe is made from red Grandfather Rock.
3. Grandfather Rocks are found in jewelry, birthstones, fertilizers, and weapons (e.g., slingshots).
4. Grandfather Rock is mineral rock.
5. Grandfather Rock can be destructive, for example: earthquakes, volcanos, and rockslides.

#### *Medicine Wheel Teachings*

The **four** parts can indicate:

1. *directions* (east, south, west, and north).
2. *seasons* (spring, summer, fall, and winter).
3. *plant life* (flowers, berries, trees, and grasses).
4. *sacred plants* (tobacco, sweetgrass, cedar, and sage).
5. *animals* (crawlers, winged ones, swimmers, and legged ones).
6. *dimensions of humanness* (spiritual, emotional, physical, and mental), etc.

#### *Tobacco Teachings*

1. Tobacco, along with sweetgrass, sage, and cedar, are the four sacred plants to traditional First Nations people.
2. When the sacred plants are used in a smudge, its smoke cleanses our hearts, minds, body, and spirit.
3. The wild tobacco plant was originally native to Turtle Island. Its commercialization added addictive poisons to it. The original plant almost became extinct. In some sacred First Nations ceremonies, the pure tobacco is used and not the chemically infused tobacco that is purchased in stores.

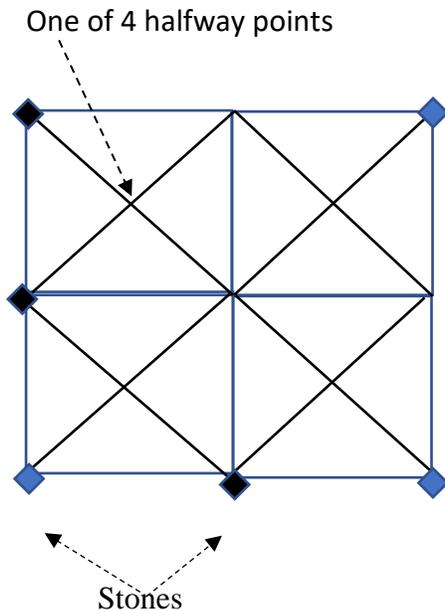
## Appendix B

### Picario

#### Rules for Playing

##### Simple Way

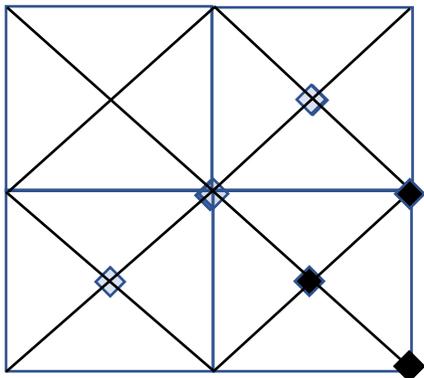
1. Taking turns, each player places one stone on one of the eight exterior corners of the five squares that comprise the diagram.
2. The centre point now comes into play. This makes nine points. The first player moves one of their stones along the *full* length of one diagonal line within a box. No stopping at a halfway point. The second player follows.
3. Continue until one player has three of their stones in a straight line. They win.



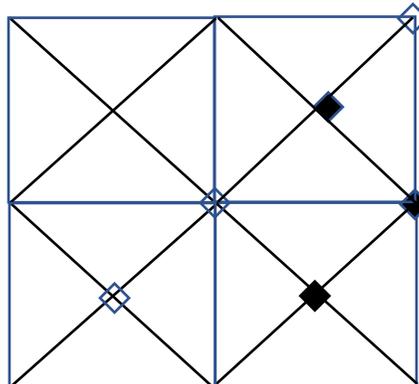
##### A More Complex Way

1. Once the stones are placed on the hide as before, players move a stone only one *segment* of a line at a time from one intersection to the next.
2. The centre intersection now becomes in play as before.
3. The winner is the first player to have their three stones placed in a straight line consecutively along three of the 13 intersections. These three stones cannot be interrupted by an intervening opposite players stone.

For example: Player with the  rocks wins in this result:



But not this result:



## Appendix C

### Math 10 WA Indigenous Game Assignment

1. Describe your experience playing the different variations of the game:
  - a. With just the eight outer points to start.
  - b. With any of the points to start.
  - c. When you were the first player to play.
  - d. When you were the second player to play.
2. What would you change about the game to make it more competitive or more challenging? Explain how the change would affect the play of the game.
3. From the perspective of an Indigenous person living before contact with Europeans, what benefits do you see in playing the game?
4.
  - a. What does reciprocity mean?
  - b. How does the value of reciprocity influence a traditional minded Indigenous person's behaviour?

## APPENDIX D

### A Selection of Students' Answers

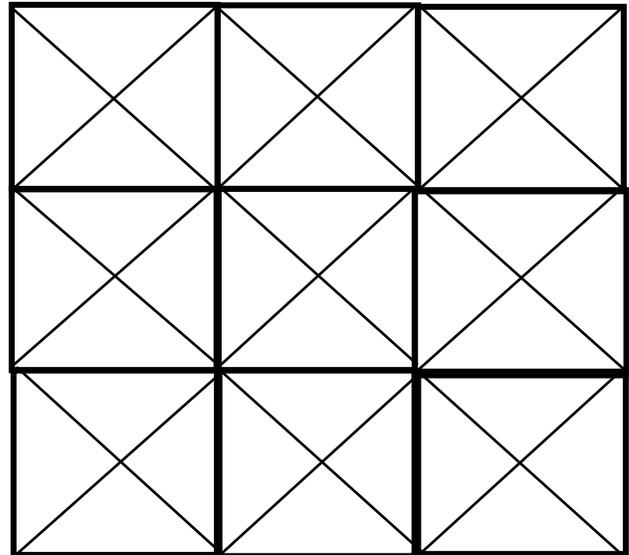
(spelling, grammar, and punctuation corrected for easier reading)

- 1.a. When you could only use the outer parts, the first-move person had a very big advantage. With the eight outer points, it was really easy to play.
- 1.b. When you could use all points, if you started on the halfway point, it was a guaranteed win. It was fairer and more challenging. It was more fun.
- 1.c. You had a very big advantage as the first to play. It was an automatic win.
- 1.d. You had a disadvantage to overcome but could still win as second to play. I mostly lost. I still usually won against whom I was playing with, but I still lost a couple of rounds. Very unfair for the second player.
2. I would make a rule stating you could not start at the halfway points. Make it so the first player can only place their rock on the inside, and the second player can only place their rock on the outside points. It would be a little more challenging. I would only allow one object in a square, but no middle point until after all three rocks are placed. First time placing rocks on the board, you must have each rock in a different square.

Eliminate the middle spot, so you can't land on it.

Add more lines: → → → → →

Add more rocks



3. Back in an earlier time, this game would teach strategy for multiple things: war, hunting, dealing with issues within the tribe. It also teaches patience, which can be handy for multiple things such as creating treaties, dealing with enemies, and being a decent human being.

Thinking back to when Indigenous people invented this game, it was probably a main source of entertainment.

It builds up flexibility, thinking skills, strategy. Flexibility is an important quality in a person, especially in a leader.

It was probably a main source of entertainment for them.

Helps to stimulate your brain because you need to think the moves through.

A good way to keep the culture and traditions going is through games. It also helps kids with learning strategies of everyday life such as problem-solving skills or reading another person.

This game could build intergenerational relationships because anyone of any age can play.

Non-Indigenous people can also learn about First Nations culture by playing this game.

Being patient and learning to analyze the situation before making a move.

You learn how to plan ahead more.

- 4.a. If someone does something for you, you do something for them.

It means always sharing with others.

If you help yourself to something, you give back in some way.

It's an ethical way to live.

Moving it forward.

- 4.b. They live by being aware of what they get from Mother Earth and think of ways to give back like not harming her, like not taking too much.

Way back when, one nation would make deals with another nation. Both benefited in some way.

Treaties were made when it got serious.