THOMPSON RIVERS UNIVERSITY | Education & Social Work

Bachelor of Education (Elementary) & Bachelor of Education (Secondary) STEM

Lesson Plan

Lesson Title: Navigation and the addition of vector and scalar quantities Lesson # 1 Date: Monday, December 14th 2020

Name: Julia Sonnleitner Subject: Physics Grade(s): 11

Rationale:

This lesson will introduce the big ideas that an object's motion can be predicted, analyzed, and described. Learning how to describe and objects motion is valuable to students as it will give them the foundation to precisely communicate details about the world around them. This lesson will be done using FPPL that learning recognizes the role of Indigenous knowledge by exploring indigenous navigational practices. It will help support all learners by providing them with an integrated perspective of physics and providing them with applicable navigational wisdom.

Core Competencies:

Communication	Thinking	Personal & Social
Students will be able to accurately communicate by receiving and presenting information. This will aid them in using appropriate scientific language, conventions, and representations to when discussing or referring to scientific ideas or principals.	Students will be asked to evaluate and develop their own ideas through creative thinking. Students will be able to engage in ongoing reflection as they develop their creative ideas. Using their personal and social awareness, students will benefit from the experiences, perspectives, and worldviews of indigenous communities.	Students will develop a well-rounded understanding of relationships and cultural contexts. By implementing this cross-cultural wisdom, they will be able to recognize the value in their own strengths, choices and abilities.

Big Ideas (Understand)

Physics - An object's motion can be predicted, analyzed, and described.

Learning Standards

(DO)	(KNOW)
Learning Standards - Curricular Competencies	Learning Standards - Content
● Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information ● Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest ● Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data	<u>vector and scalar quantities</u> • addition and subtraction • right-angle triangle trigonometry

• Experience and interpret the local environment • Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled • Communicate scientific ideas and information • Express and reflect on a variety of experiences, perspectives, and worldviews through place	

Instructional Objectives & Assessment

Instructional Objectives (students will be able to…)	Assessment
• Differentiate between Scalar and Vector Quantifies • Understand that they are able to Subtract and add vectors • Formulate cross-cultural navigational models to communicate scientific ideas and information • Compare and contrast different navigational methods • Investigate their own ideas through creative thinking and self-evaluation	• Reflective Journal • Informal Oral Presentation • Frequent Checks for understanding

Prerequisite Concepts and Skills:

- Students will have already been introduced to vector and scalar quantities in a previous course, but may have not applied their knowledge.
-Students should be familiar with trigonometry identities and right angle trigonometry, but have not been introduced the idea using vectors.

Indigenous Connections/ First Peoples Principles of Learning:

Learning recognizes the role of Indigenous knowledge – The knowledge of first people has not always been acknowledged and is still often put aside to focus on post-industrial Euro-centric cultures. Through story telling indigenous people have passed on wisdom relating to many scientific ideas and principles in STEM. In this lesson plan will not focus on a community story, but rather on Wilfed Buck's story of how he applied indigenous wisdom to navigate himself out of the woods after getting lost hunting. Ultimately this FPPL provides students with an integrated view of science. Promoting social awareness, experiential learning, exploration of diverse perspectives including the views of indigenous communities.

Wilfred Buck's video: https://www.youtube.com/watch?v=sHLb-fDY0lk
Wilfred Buck is from the Opaskwayak Cree Nation, in northern Manitoba. I chose to base my lesson off of his video because he is an Indigenous star-story expert and supports local school by developing science and astronomy curriculum for them. Buck is also a compelling story teller and provides a multifaceted approach to understanding science. More information about him can be found in this article: https://thewalrus.ca/space-teaching-indigenous-star-stories/

Universal Design for Learning (UDL):

This lesson plan supports learners with multiple intelligences:
Interpersonal – This lesson heavily supports interpersonal students by asking them to reflect on their own experiences to navigate in a survival situation and also to a place that is meaningful to them. Students will also be asked to complete a KWL chat at the beginning of this unit to be completed at the end of the unit.
Existential – Students will be given opportunities to relate big ideas in physics their own experiences in the world.
Visual Spatial – A video demonstrating that the north star is fixed will help students visualize the concept.
Interpersonal – Students will be provided with indigenous cultural views and believes and be asked to relate them to fundamental physics content.
Verbal-Linguistic – Students will be given a several short lecture on some key terms and concepts. They will also be asked to present their learning to the class orally.
Logical Mathematical – Students will be presented with the idea of adding and subtracting vectors. Helping them explain the world through a mathematical lens.
Naturalistic – Students will be supported by asking them to reflect on how to navigate in nature.

This lesson will support indigenous learners by including an indigenous connections/ first people's principles of learning, being aware of indigenous learning styles and connecting physics with community.

Differentiate Instruction (DI):

A.L. has mild dyslexia and struggles with time management. They have an IEP to help him keep things organized and to also have him use a Chromebook with Read-to-Me installed. It has been found that having them use a day planner works the best for them to insure his assignments are handed in. They also work best when specific days are given for class worksheets and journals to be due but sometimes needs an extra day to complete. They work well with others and understands their learning disorder well.

In this lesson plan, AL might struggle with direction and orientation. They will be given an option to present their learning in another format and/or a separate time. I will not make them or any student present if they are not confrontable with it. I will also perform more frequent checks for understanding with them.

Materials and Resources

Projector, prepared power point

Lesson Activities:

Teacher Activities	Student Activities	Time
Introduction (anticipatory set – "HOOK"): This class will begin using journal entries. Students will be prompted with a survival scenario. I will tell them to imagine that they have spontaneously appeared in the middle of a forest and it is starting to get dark out. In this scenario they do not have access to any modern technology and they are on their own. They do have one portion of their favorite meal, the sky is clear and they do know that there is a highway East of them and a river North. Students are then asked to describe how they would find their way home in their Journal. As a class we will watch Wilfred Buck's Orientating with the sky video (12	Students will be given a KWL chart. They will be instructed to describe how they would navigate themselves in a survival scenario. Students will describe what they hope to learn about wilderness navigation. Students will. Students will watch a 12-minute video about how indigenous people orient using the sky and be shown a visual representation of how the stars rotate around the north star.	25 min

min) - https://www.youtube.com/watch?v=sHLb-fDY0lk I will show students how and why the north star stays fixed as the earth rotates (30 sec) - https://www.youtube.com/watch?v=5UGvs6yUTkA&feature=youtu.be		
Body: Use the white board to differentiate scalar vs vector quantities with examples relating to Buck's orientating video. Explain the coordination system used in physics. Emphasize how velocity is equal to change in position (has direction) over change in time. Use equation and units to describe velocity Example: As Buck is walking through the forest he changes direction but his speed stays the same. Given this information, is speed a scalar or a vector quantity? (scalar) Students will be told that they will be doing a short informal presentation to the class. I will ask: 1) students to choose meaningful place to them (near or far) 2) to describe using vector quantities (with units) how they would move from school to chosen destination 3) to describe the distance using scalar quantities (and units) to demonstrate how they would move from school to chosen destination 4) Students are asked to use the Opaskwayak Cree Nation method of navigating. (using stars as a means of direction) After giving the instructions I will give my own example of how I get from my school to my favorite restaurant. Students will be given time to present. Review tri identities and introduce students to the idea of using right angle trigonometry to add and subtract vector quantities.	Students will hear a short lecture definition scalar and vector quantities. Students will to construct a small Venn diagram to compare and contrast the coordination system we use in physics to Wilfred Buck's method. After more active listening to velocity vs speed students will be given time to answer example questions. Students will choose a place, answer the provided questions and present their learning orally to the class. Students will then be introducing to the idea of add and subtracting vector quantities.	50 min
Closure: Students will be asked to write a reflective journal entry of their leaning. They will be given the following prompts: What did you learn from Wilfred Buck's video on wilderness navigation? What was the moral of Buck's story?	Students will complete a reflective journal before leaving. They have to answer a minimum of two prompts before leaving the class.	15 min

What would you change about your own approach to navigating the world around you? How did Buck's video contribute to your understanding of how to describe the physical world around us? How are the navigational methods we use in Physics similar or different than the ones used by Buck?		

Organizational Strategies:

On the side of the whiteboard I will have the unit plan schedule with due dates posted. Students will be given breaks in between lectures to work and apply their knowledge. I will aim to not lecture for more than 10 minutes. Also I will let some students work through challenges. This depends on how the student learns best some students may need an answer presented in front of them immediately to proceed (this is a strategy that supports indigenous learners). I will be sure to give frequent information checks to A.L. and let them know before class starts or before I assign the presentation that they have a choice on how they want to present their learning.

Proactive, Positive Classroom Learning Environment Strategies:

I plan on encouraging a positive learning environment by setting clear and consistent expectations, modeling positive and enthusiastic behaviour and by using lot of positive affirmations while speaking to and evaluating students.

Reflections (if necessary, continue on separate sheet):

Teacher will place reflections based on observations, things that went good/change for next time after the lab has occurred.

References

Boutsalis, K. (2020, November 06). Teaching Indigenous Star Stories. Retrieved December 19, 2020, from https://thewalrus.ca/space-teaching-indigenous-star-stories

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