THOMPSON RIVERS UNIVERSITY | Education & Social Work

Bachelor of Education (Secondary) STEM Mini-Unit

Teacher: Julia Sonnleitner	Grade: 8
Core Competencies: Thinking: Critical, Reflective Thinking, Creative Thinking Communication: Communicating, Collaboration Personal and Social: Social Awareness and Responsibility (Session 2 – anti/pro-electromagnetic radiation)	

Science/Math Discipline	Big Idea
Physics	Energy can be transferred as both a particle and a wave
Physics	The electromagnetic force produces both electricity and magnetism
Math	The principles and processes underlying operations with numbers apply equally to algebraic situations and can be described and analyzed.

Science Learning Standards		Math Learning Standards	
Curriculum Competencies	Content	Curricular Competencies	Content
Make observations aimed at identifying their own questions about the natural world; Use scientific understandings to identify relationships and draw conclusions; Identify a question to answer or a problem to solve through scientific inquiry; Transfer and apply learning to new situations	types and effects of electromagnetic radiation; the properties, behaviours and ways of sensing light	Use tools or technology to explore and create patterns and relationships, and test conjectures; Represent mathematical ideas in concrete, pictorial, and symbolic forms	two-variable linear relations, using graphing, interpolation, and extrapolation

Community link
https://www.tru.ca/science/programs/physics/observatory.html
Career link
https://www.aip.org/jobs/profiles/optics-and-lasers-careers

Literacy Links
https://www.chemteam.info/Electrons/LightEquations2.html

First Peoples
I was unable to make a meaningful connection to first peoples knowledge.

Assessment Plans:
How will I look for evidence of learning? Observations – I will use an observation check list to observe student's growth while they are working both independently and collaboratively. Conversations – I will have students reflect in journals in addition to having them participate in group discussion with the class and their peers Product – Students will have some assignments to hand in and will be tasked with preparing a poster presentation

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Education (Information) Technology (IT)

I will use a technology such as videos, lasers, cameras and the internet to engage students. Sam will be provided with a talking calculator and a tablet/computer.

Universal Design for Learning (UDL)

As shown by my Multiple intelligence instructional planner I have provided at least two was to support every MI for this unit. In my lessons I have included individual, class and group work and I include a variety of assessment methods based on observations of the students, conversations and products of their learning.

Differentiated Instruction (DI)

Sam has Dyscalculia and has trouble understanding numbers and math facts. Lesson 1 and 3 have equation and calculation components. Sam will be able to use a talking calculator for those classes. In lesson 1 Sam will be checked on frequently for support, given extra time to complete the assignment and will be provided with a computer or tablet to access equatio. For lesson 3 Sam will be paired with a partner who demonstrates logical mathematical characteristics.

Teacher Preparation Required:

Lesson #	Teacher Preparation Required (See Unit Plan Sample)
Session 1	Introduction to types of waves, sin, cos waves. Amplitude, period, wavelength and frequency. Use speaker video to visualize waves.
Session 2	Types of electromagnetic radiation. Example: Radio, Microwave and infrared. How it can be positive (cancer treatment) or negative sunburns
Session 3	Light – the properties of light as both a wave and a particle. Show the ways light behaves reflection, refraction, absorption, transmission and scattering.
Session 4	Behaviour of light –How humans sense light using vision optical lenses and cameras.

Overview of Sessions:

Session 1

Name &Time (Minutes Allotted):	Properties of waves (75 min)
Learning Standards: Curricular Competencies	Make observations aimed at identifying their own questions about the natural world; Use scientific understandings to identify relationships and draw conclusions
Learning Standards: Content	Introduction to wavelength, period, amplitude and frequency; types of waves (ei. Cos and sin)
Instructional Objectives	Students will be given an opportunity to discuss their observations in relation to the real world. New concepts such as wavelength, period, amplitude and frequency; types of waves (ei. Cos and sin) will be introduced. Students will solidify their understanding through independent research into the topic.
Assessment:	Conversation - At the end of the class students will reflect in their journals about the types of waves in nature, the definitions of amplitude, wavelength, period and frequency with equations. Product - If the hand drawn graph isn't finished in class they can hand it in for the next session. Product - KW chart
Teaching Strategies:	Discussion, video presentation, lecture, graphing activity, KW chart
Materials:	Corn starch, Speaker, Graphing paper, Sam will be provided with a talking calculator and a tablet/computer
Activities: Group discussion, Whole class discussion, video, lecture, independent research	
Introduction/Hook:	Students will be asked to start a KW chart on light. Students will be split into groups and asked to reflect on the types of waves they experience in the real world. The results are discussed with the class.

Body:	Experiment with a speaker and cornstarch. Show video: https://www.youtube.com/watch?v=MwsGULCvMBk The Terms wavelength, amplitude and frequency are defined in a lecture format. They are related to a mathematical equation.
Closure:	Students are asked to graph the sin function and research how to change the amplitude, period/frequency and wavelength. They will then draw the altered wave in a different colour on the same sheet. Students will reflect in their journals about the types of waves in nature, the definitions of amplitude, wavelength, period and frequency with equations. Sam will be checked on frequently for support, given extra time to complete the assignment and will be provided with a computer or tablet to access equatio. Sam will also be given a talking calculator.

Session 2

Name &Time (Minutes Allotted):	Electromagnetic waves (75 min)
Learning Standards: Curricular Competencies	Communicate ideas, findings, and solutions to problems, using scientific language, representations, and digital technologies as appropriate; Collaboratively plan a range of investigation types, including field work and experiments, to answer their questions or solve problems they have identified
Learning Standards: Content	Types of electromagnetic radiation: the electromagnetic spectrum consists of radio, microwave, infrared, light, UV, X-ray, and gamma rays electromagnetic radiation; effects of electromagnetic radiation: positive effects include cancer treatments; negative effects include sunburns
Instructional Objectives	Students will become familiar with the types of electromagnetic radiation: the electromagnetic spectrum consists of radio, microwave, infrared, light, UV, X-ray, and gamma rays electromagnetic radiation. Student will be able to discuss the effects of electromagnetic radiation: positive effects include cancer treatments; negative effects include sunburns. The argument will take place in the form of a debate. Students will be able to work cooperatively in a group and develop/present an well supported argument to their peers and ultimately discuss their feeling on electromagnetic radiation.
Assessment:	Conversational – Students research will be evaluated based on debate. Observational – As students are working in their groups they will be evaluated by an observational checklist.
Teaching Strategies:	Crowd sourcing, group work, class debate, music video
Materials:	None
Activities: Crowd source definition, Group research, Class debate	
Introduction/Hook:	Use crowd source to define electromagnetic radiation and other related terms. As a class listen to the electromagnetic spectrum song. https://www.youtube.com/watch?v=U-9Lkq-3XAo
Body:	Divide class into groups of 3. Assign each group either pro-electromagnetic radiation or anti-electromagnetic radiation. Give the groups a chance to research topic and develop an argument on whether they feel electromagnetic radiation is positive for the world or negative.
Closure:	Have groups debate each other.

Session 3

Name &Time (Minutes Allotted):	Properties of Light (75 min)
Learning Standards: Curricular Competencies	Demonstrate an understanding and appreciation of evidence (qualitative and quantitative); Seek patterns and connections in data from their own investigations and secondary sources; Observe, measure, and record data (qualitative and quantitative), using equipment, including digital technologies, with accuracy and precision

Learning Standards: Content	Light acts like both a wave and a particle. Review wavelength, amplitude, frequency in relation to light. How light behaves reflection, refraction, absorption, transmission and scattering
Instructional Objectives	Students will be challenge to reflect on their own interpretation of the world (light) and expand it further using experimentation and observations. Students will use their observations to draw conclusions regarding the properties and behaviours of light.
Assessment:	Product – Evaluate their notebook. Conversational – Students reflection in their notebook
Teaching Strategies:	Lecture, observation through experimentation, discussion
Materials:	Prisms, mirrors with different curvature, paper of different colours, light source, uv lamp, lenses, periscope
Activities: Drawing and reflection of their own understanding, lecture, stations with many experiments, discussion about experimental observations	
Introduction/Hook:	Challenge students to draw their interpretation of light. I would then draw my interpretation of light as a photon. Explain how light is both a wave and a particle and why it is important. Go over mathematical equations explaining light: $\lambda\nu = c$ and $E = h\nu$.
Body:	Have several stations exhibiting different properties and behaviors of light. Go over any safety precautions. Instruct students to go around the room and record their observations in their data book. These observations can be in the form of notes, a drawing or both. Some of the stations will demonstrate mathematical equations: $\lambda\nu = c$ and $E = h\nu$. Once students have visited each station they can either work collaboratively or independently to figure out what property or behavior of light each station was testing. Sam will be paired with a partner who demonstrates logical mathematical characteristics for support. Frequent checks to insure understanding will occur. I will go around and demonstrate my observation and finding for each experiment. I will also ask students to suggest anything I may have missed or questions of their own.
Closure:	We will conclude the class with a game of Kahoot! Reviewing new terms from the previous three sessions. They will reflect on their learning by writing in their journal.

Session 4

Name &Time (Minutes Allotted):	Behaviour of Light (75 min)
Learning Standards: Curricular Competencies	Identify a question to answer or a problem to solve through scientific inquiry; Transfer and apply learning to new situations
Learning Standards: Content	Humans sense light using vision optical lenses. Cameras and other optical instruments can sense light in similar ways.
Instructional Objectives	Students will be tasked with physically taking photos and reflecting on how those photos were taken by their camera. They will learn how cameras and other light sensors operate in a similar capacity to human vision. They will also be tasked with developing a question electromagnetic spectrum. They will use their question to start a small research project which Once they have completed their experiment in a future session they will present it as a poster.
Assessment:	Observational – Observational checklist Product – Poster presentation Product - KW chart
Teaching Strategies:	Experiential learning, Video, Poster presentation, Lecture
Materials:	Old cameras that can be deconstructed
Activities: Scavenger hunt, camera deconstruction, lecture on human vision, Laser eye surgery video, review of big idea in the form of a research project.	
Introduction/Hook:	Students will be given a camera and sent on a scavenger hunt to take 3 photos. They will be asked to take photos at three different settings. Students will be able to visualise how manipulating light alters an image. When they come back they are given a camera to deconstruct.

Body:	In groups they are tasked with trying to determine the function of labelled each camera pieces. Students are introduced to the main components of camera and asked to draw comparisons to the human vision. Once they have made some connections, an overview will be given on how humans sense light using vision optical lenses. Laser eye vide will demonstrate our eyes sensitivity to lens shape: https://www.youtube.com/watch?v=Bb8bnjnEM00
Closure:	Students will be asked to complete the last column of their KW chart. Students are then asked to partner up and develop a scientific question relating to electromagnetic waves, its properties or how it behaves. Their question will be dependent on what interested then in the unit.

Resources:

Speaker, cornstarch, graphing paper, Prisms, mirrors with different curvature, paper of different colours, light source, uv lamp, lenses, periscope, Old cameras that can be deconstructed
https://www.sciencealert.com/this-is-world-s-first-image-of-light-as-both-a-particle-and-a-wave

Extensions to Unit:

I only thought of it after I made my lesson plan, but it would be interesting to take students to an observatory. They would get a review of their grade 6 big idea “The solar system is part of the Milky Way, which is one of billions of galaxies” and be able to see the power of lenses and light.

Reflections and Revisions

A reflection would be most useful if I was in a class room setting and able to test out the ideas.