SCIENCE AND TECHNOLOGY

GRADE 5

Forms of Energy

40 minutes

Virtual

SCIENCE AND TECHNOLOGY IN PRIMARY/JUNIOR LEVEL

EDPJ 2000 with Tigist Amdemichael

ASSIGNMENT 3

Planning, Instructing, and Assessing

An Inquiry Lesson using the Science and Technology Curriculum

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May 2024

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PART A
PLANNING

DIFFERENTIATED INSTRUCTION

Teaching/Learning Examples

- Setting objectives for learning necessary for self-assessment
- Generating and testing hypothesis thru experimental inquiry
- Utilizing questions that elicit inferences on relationships and connections.
- Providing homework and practice in the reinforcement and application of learnings
- Reinforcing effort and providing recognition thru timely praise

Knowledge of Students

Differentiation based on student

☒ Readiness

☐ Interests

☒ Preferences:

- ☒ Styles
- ☒ Intelligences
- ☐ Other (e.g., environment, gender, and culture

Need to Know:

Student readiness in understanding characteristics and relationships of energy, and preferences in in intelligences in communicating conclusion of the scientific experiment

How to Find Out

- Observations prior to this lesson and during the Minds-On activity**:** discussion during the lesson for preferences of styles and intelligences

Differentiated Instruction Response

☒ Topic, Entry Point (Content)

☒ Ways of Learning (Process)

☒ Ways of Demonstrating Learning (Product)

☒ Learning Environment

CURRICULUM CONNECTIONS

Big Idea: Potential energy is stored energy. Kinetic energy is the energy in motion. Energy is directly proportional to mass and velocity/speed. Initial point of an object can impact its related energy levels.

Fundamental Concepts: Forms of Energy.

Strand and Expectations:

A. STEM Skills and Connections

A1. STEM Investigation and Communication Skills. Use a scientific research process, a scientific experimentation process, and an engineering design process to conduct investigations, following appropriate health and safety procedures:

A1.2 use a scientific experimentation process and associated skills to conduct investigations.

E. Earth and Space Systems

CONSERVATION OF ENERGY AND RESOURCES

E2. Exploring and Understanding Concepts. Demonstrate an understanding of energy, and the forms, sources, and uses of energy and resources.

E2.1 identify a variety of forms of energy, and describe how each form is used in everyday life.

Learning Goals:

- I can describe the relationship of kinetic and potential energy.
- I can describe the relationship of mass and total energy of an object.
- I can describe the relationship of initial point of an object and its total energy.

ASSESSMENT AND EVALUATION

Success Criteria

Knowledge and Understanding

- Knowledge of content
  - *I have defined the following term*
    - *Energy*

- *Kinetic energy*
- *Potential energy*

- *Understanding of content*
  - *I have provided examples of kinetic and potential energy.*

Thinking and Investigation

- Use of initiating and planning skills and strategies
  - *In WH-form of questioning, I have provided 3 questions*
    - *about the topic of energy, or*
    - *about the Energy Skate Park – Intro Simulation*
- Use of processing skills
  - *I drew a bar graph from the Energy Skate Park – Intro Simulation that displays*
    - *Comparison of kinetic vs potential energy*
    - *Changes in total energy for each change in mass*
    - *Changes in total energy in each change in height of initial point*
- Use of critical/creative thinking process, skills, and strategies
  - I have communicated my inference based on the bar graph

Communication

- Expression and organization of ideas and information in oral, visual, and/or written forms
  - *I have applied my inference to other examples of energy in oral, visual, and/or written forms*

Application

- Application of knowledge and skills in familiar contexts
  - *I have applied my inference to from a previous example*

PRIOR LEARNING

Prior Knowledge

- Energy and its Definition
- Kinetic Energy: Definition and Examples
- Potential Energy: Definition and Examples
- Definition of Mass

Prior Skills

- Use of computer
- Making bar graphs

- WH Questioning
- Describing correlations

MATERIALS AND RESOURCES

Materials

This is an online/remote lesson plan. Access to a computer with up to date Internet browser and access to the Internet is mandatory. Main activities uses platforms of Google Jamboard and PHET Interactive Simulations.

Activities for Students

- PHET Simulation PHET Energy Skate Park
- Jamboard *My Prior Knowledge*
- Jamboard *My Further Wonderings*
- Jamboard *My New Learnings*

Alternative for Jamboard: students may use pen and paper with the Jamboard screenshared by the facilitator.

Readings for Students

- TVO Kinetic and Potential Energy
- Activities for Kinetic and Potential Energy

Resources

Marzano, Robert J., Pickering, Debra, and Pollock, Jane E. (2001). *Classroom Instruction that Works: Research-Based Strategies for Increasing Student Achievement*. Alexandria, VA: ASCD.

Ministry of Education. (2010). *Growing Success, Assessment, Evaluation, and Reporting in Ontario Schools, Grades 1 to 12.*

Ministry of Education. (2022). *The Ontario Curriculum, Grades 1–8: Science and Technology, 2022.*

PART B
INSTRUCTING

MINDS ON 10 mins	**Notes**
Individual/Whole Class → Engage with My Prior Knowledge 1. REVIEW: Potential and kinetic energy using Visual Aid. - *What do we remember about Energy?* - *… Kinetic Energy?* - *… Potential Energy?* - *… examples of them?* 2. ACTIVITY: Using Jamboard, students are to provide at least 5 examples EACH of Kinetic and Potential energy. How? - Google search or non-fiction texts - Exploring your surroundings (safely) - Or using your imagination 3. Share examples within the class: write, draw, screenshot, or voice chat 4. TRANSITION to next activity: Energy Skate Park Simulation	**Cross-Curricular Connection** • Literacy**:** Use of non-fiction texts and media **Students:** • Readiness of Prior Learning **Strategies** • Setting objectives for learning necessary for self-assessment **Success Criteria** • I have defined the following terms (KU: *Knowledge of Content)* - Energy - Kinetic energy - Potential energy • I have provided examples of kinetic and potential energy (KU: *Understanding of Content)*

ACTION 25 mins	**Notes**
Individual/Whole Class → Explore My Wonderings 5. ACTIVITY: Energy Skate Park – Explore the *Intro to Basics:* - Various starting points	**Strategies:** • Generating and testing hypothesis thru experimental inquiry • Utilizing questions that elicit inferences on relationships and connections. **Cross-Curricular Connection** • Mathematics: Generating bar graphs.

- Various data visualization
- Changing mass
- Changing ramps

6. While exploring, jot down your questions/wonderings using WH-Questions on Jamboard
7. TRANSITION: Introduce topic of discussion:
   - *Exploring Characteristics of Kinetic and Potential*
8. LEARNING GOALS: *We are learning to:*

- *Describe the relationship of kinetic and potential energy.*
- *Describe how energy levels increase or decrease with*
  - Mass
  - Starting points

Individual/Whole Class → Explain My New Learnings

9. Using the activity on Jamboard, the class will complete the experiment about the three topics on learning goals using the PHET Energy Skate Park Simulator:

- Energy and Starting Point *(Page 1)*
- Energy and Mass *(Page 2)*
- Kinetic and Potential Energy *(Page 3)*

10. After completing each experiment on the

- Literacy: KWL

Success Criteria

In WH-form,

- I have provided 3 questions *(TI: Use of initiating and planning skills and strategies)*
  - about the topic of energy, or
  - about the Energy Skate Park – Intro Simulation

In my learnings, on each topic from learning goals

- I have filled the bar graph with the correct details *(TI: Use of processing skills)*
- I have communicated my inference based from the bar graph *(TI: Use of critical/creative thinking process, skills, and strategies)*

Expected Responses

Questions:

- *What is the relationship of Kinetic and Potential Energy?*
- *How is total energy and mass related?*
- *What is the importance of starting points in the total energy of the object?*
- Any other WH questions related to the topic is acceptable

Learnings

- *As Kinetic energy goes up, Potential energy goes down (Inverse Relationship).*
- *The higher the mass, the higher the total energy (Direct Relationship).*
- *The higher the starting point/height, the higher the energy (Direct Relationship)*

Jamboard, must fill out, on each page: - The bar graph. - An inference	

CONSOLIDATION AND CONNECTION 5 mins	**Connections**
Whole Class → Elaborate My New Learnings into My Prior Knowledge *Elaborate: Application and expounding of new learnings to prior knowledge.* *11.* Consolidate learnings by creating a classroom discussion of inferences from each topic on learning goals: - Energy and Starting Point *(Page 1)* - Energy and Mass *(Page 2)* - Kinetic and Potential Energy *(Page 3)* *12.* Create a discussion about the application of new learnings from examples on prior knowledge. - *How does weight or mass of a battery affect its total energy? …of a falling rock … etc* - *How does starting/initial points affect the total energy on falling rocks? … on stretched elastics? … on bow and arrow? …etc.* - *How can you relate the kinetic and potential energy of a resting to falling rock? … unlit to lit candle? … etc.* **Individual/Whole Class → Evaluate My New Learnings with Further Wonderings** *13.* Collect more questions that were unanswered or incurred after the consolidation. *14.* Instruct further inquiry by providing home assignments and experiments: - Wonderings on forms of energy, e.g., chemical, electric, nuclear, etc.	**Strategies:** • Utilizing questions that elicit inferences on relationships and connections. • Providing homework and practice in the reinforcement and application of learnings • Reinforcing effort and providing recognition thru timely praise • Setting objectives and providing feedback by asking students to articulate learnings about the content **Cross-Curricular Connection** • Literacy: KWL **Success Criteria** • I have applied my inference to from previous examples *(A: Application of knowledge and skills in familiar contexts)*

	- Wonderings on Conservation and Transformation of Energy - Inquiry on other experiments	

PART C
ASSESSING

REFLECTION

- Great reflection on Land Acknowledgement: *How do we benefit on the land we are on?*
- Great use of open-ended questions in eliciting appropriate responses from students
- Choices in the processing of examples: barrier-free choices
- Simulation, great use in remote/virtual learning
- Content needs more cultural and identity connection and application: e.g., energy in your house, culture, or country of experience; use of energy in the rural areas of Canada, including in Indigenous communities
- Groups or pairs in activities as other strategies
- Scientific Experimentation: be more explicit on the steps
- Great use of 5E's and KWL and its integration
- Modelling: I do, We, You do, ensure consistency!
- Great learning goals, ensure communication in various forms, including visual
- Bar graph in Math CC, use and practice more with students, use pairing or show and tell.
- Jamboard, ensure each one has a page to use
- Consolidation, ensure solid foundation of activity, what exactly they need to do or show
- Great connections and application of KWL and the 5E Model of Instruction
- Success criteria: be more explicit, verbal, written, and/or visual communication to students

Learners

- Connect more with the identity of the students, including cultural and gender identity in creating an inclusive and engaging lesson
    - Addition of CRRP materials and contents, examples, and connections
- It helped that the participants (schoolmates in the program) have prior understanding of the concept, but what if they do not?
- Success criteria: ensure communication to students in various forms: written, oral, and visual, e.g., post on the chat, include in the Jamboard activity sheet
- Great use of praise and encouragement in eliciting responses for evaluation
- Conversations, Products, and Obersvation: need actual products in improved evaluation and assessment.

- Allow opportunities for students for self-evaluation
- Great use of KWL in Assessment for, as, and of!

SELF-ASSESSMENT	Grade
Knowledge Lesson Plan using the DI Lesson Planner Demonstrated a thorough understanding of an inquiry lesson plan as described in seminar 6, 7, 8 and 9 as well as all previous seminars including an integration of science and technology with at least one other curriculum area using the scientific experimentation process or the engineering design process	8.5 out of 10 Great modification of lesson for virtual delivery. Needs more solid CC integration of the activity with Math, e.g., try other types of graphs. Great use and integration of 5E Model of Instruction with KWL, but improve more on its delivery/instruction. Great learning and success criteria, but implementation needs improvement, e.g., conversations, products, and observations needs more consistency
Communication Assessment Tools The assessment tool(s) are well-designed, aligning with the lesson learning goals and providing clear success criteria for assessing understanding and performance for learners	7.25 out of 10 Assessment tools were clear, specific, attainable, realistic, and time-bound. However, communication with students needs more in all forms, especially written/visual. Provide more opportunities for self-assessment with products if possible. Good summarization and "what have we learned today? " question as closing.
Application Instruction Conducting the lesson: The lesson is well-executed, with students engaging in the scientific processes with an exploration of the five pursuits (identity, skills, intellectualism, criticality and joy) as outlined in Dr. Muhammad's framework	7.5 out of 10 Opportunities for learning with intellect and criticality were highly evident with use of KWL, 5E Model, and Scientific Experimentation. Opportunities with skills, identity, and Joy needs more consistency and stronger foundation, e.g.,

		CRRP, and skills in mathematics as CCC.
	Thinking Reflection The reflection of the lesson delivery is thoughtful and demonstrates a thorough understanding of the successes and challenges of the lesson, as well as ways to improve in the future and includes data collected and analyzed from learners (Assessment for Learning)	8.25 out of 10 Reflection were honest, clear, and reflective of connection with course contents, including the success and challenges. Further investigation and reflection needed for assessment of learners thru assessment for learning.
	OVERALL GRADE	7.88 out of 10

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