Classroom Implementation Strategy – **FINAL DRAFT**

Jamie Esler - Drumlin Formation in Iceland

2013

**9th Grade Physical Science**

**Teaching/Learning Goals and Classroom Activity Overview**

1. One of the primary concepts taught throughout this course is that science is a system and body of knowledge, as well as the processes used to acquire that knowledge. My experiences with PolarTREC in Iceland will provide me ample opportunities to enhance existing labs and activities about the Scientific Method, Observations and Inferences, and the value of models in science. This includes the Surface Temperature/Soda Can Lab, the Observation/Inference Lab, and Scientific Models lab. Idaho State Science Standards:
* 8-9.PS.1.2.1 Use observations and data as evidence on which to base scientific explanations. (648.02a)
* 8-9.PS.1.2.2 Develop models to explain concepts or systems. (648.02b)
* 8-9.PS.1.2.3 Develop scientific explanations based on knowledge, logic, and analysis. (648.02c)
* 8-9.PS.1.6.7 Explain the differences among observations, hypotheses, and theories. (649.01g)

2. Physical properties of matter are important concepts taught in this class, with emphasis placed on density. I would like to use my experiences in Iceland/North Atlantic this summer to teach density in the context of the impacts of climate change on oceanic currents and circulations in the North Atlantic. This will be a new lab activity where students will investigate how dissolved salt concentration affects the density of water, and how varying densities of water in the oceans plays a role in oceanic circulation around the earth. I also plan to teach density through a lab that models the till density sampling our team will conduct on the drumlins of Mulajokull. This is called the excavation method for measure density of sediment or till in situ. Idaho State Science Standards:

* 8-9.PS.1.3.3 Measure and calculate using the metric system. (648.03c)
* 8-9.PS.1.6.3 Use appropriate technology and mathematics to make investigations. (649.01c)

3. Magnetism is another physical property of matter that is emphasized in this course. My work with the research team in Iceland, and in the laboratory in Ames and Milwaukee (post-fieldwork), testing the magnetic fabric of till samples from the Mulajokull drumlins will provide students a great context for learning about magnetism as an important physical property of matter. This will be a lab where students will use a compass to investigate the magnetic field lines of various magnets. This will serve as a model for how the research team investigates the magnetic fabric of till samples to determine the formation of drumlins at Mulajokull. Idaho State Science Standards:

* 8-9.PS.2.4.5Describe the relationships between magnetism and electricity.

4. Changes in matter (both physical and chemical) are taught in this course. I plan to use the formation of glacial ice from snow as the context for teaching the unit on physical and chemical changes of matter. Idaho State Science Standards:

* 8-9.PS.1.3.1 Measure changes that can occur in and among systems. (648.03b)
* 8-9.PS.1.3.2 Analyze changes that can occur in and among systems. (648.03b)

5. Electromagnetic waves are a major unit in my Physical Science class. I will implement a lesson plan on how Ground-Penetrating Radar works to collect data of subsurface geologic structures through the utilization of EM waves. Students will use real GPR data from the field at Mulajokull to apply and analyze how different frequency GPR’s are capable of producing higher resolution data at varying depths.

* 8-9.PS.2.3.2 Classify energy as potential and/or kinetic and as energy contained in a field. (650.05b)

**11/12th Grade IB Environmental Systems and Societies**

**Teaching/Learning Goals and Classroom Activity Overview**

1. This course is taught entirely through the lens of system science and the inputs/outputs/storages/feedback mechanisms of energy and matter throughout the planet. I plan to us the Mulajokull glacier as an example of a system for students to practice drawing systems diagrams, and identifying inputs/outputs/feedbacks of energy and matter. This is covered in *Topic 1: Systems and Models* of the IB Curriculum.

2. Ecological relationships and food webs are a vital component of this course, with emphasis on the role of biotic and abiotic factors of ecosystems in dictating the health of food webs. The impacts of climate change on these factors, and their associated impacts on food webs will be taught through the lens of Arctic food webs. I will teach this through a lesson on the impacts of climate change on the fishing industry of Iceland. This is covered in*Topic 2: The Ecosystem* of the IB Curriculum.

3. Earth's various biomes, and the climatic conditions/parameters associated with these biomes, are covered in this course. I plan to include a lesson on the climate/biome of Iceland, and why, although it is in the upper latitudes of the northern hemisphere, it is a relatively mild climate when compared to regions nearby at similar latitude. This will highlight the importance of oceanic-atmospheric circulations in distributing energy across the planet, with emphasis on the North Atlantic and Gulf Stream, and will allows students to explore, graph, and analyze real historical climate data for this region. This is covered in*Topic 2: The Ecosystem* of the IB Curriculum.

4. Nutrient cycling through ecosystems (carbon, nitrogen, phosphorus, etc.) are a valuable component of this course. I plan to use PolarTREC Expeditions from Bruce Taterka and Tom Lane to provide meaningful context to the carbon cycle and its role in Earth's climate. This is covered in *Topic 2: The Ecosystem* of the IB Curriculum.

5. This course also includes a unit on climate change and global warming. I choose to teach this unit throughout all other units, using climate change as an environmental disturbance that can be observed in all of Earth's systems. I plan to use a collection of aerial and satellite images of Mulajokull, along with photographs from my trip there, to teach about the changes to glacial mass balance around the globe as a result of climate change. This is covered in *Topic 6: The Issue of Global Warming* of the IB Curriculum.

**11/12th Grade ATMS 211: Climate Science and Climate Change**

**Teaching/Learning Goals and Classroom Activity Overview**

1. This course is also taught entirely through the lens of system science and the inputs/outputs/storages/feedback mechanisms of energy and matter throughout the planet. I plan to us the Mulajokull glacier as an example of a system for students to practice drawing systems diagrams, and identifying inputs/outputs/feedbacks of energy and matter. This is covered in *Unit 2: Global Energy Budget and Transport* of the ATMS 211 curriculum.

2. Earth's various biomes, and the climatic conditions/parameters associated with these biomes, are also covered in this course. I plan to include a lesson on the climate/biome of Iceland, and why, although it is in the upper latitudes of the northern hemisphere, it is a relatively mild climate when compared to regions nearby at similar latitude. This will highlight the importance of oceanic-atmospheric circulations in distributing energy across the planet, with emphasis on the North Atlantic and Gulf Stream, and will allows students to explore, graph, and analyze real historical climate data for this region. *Unit 2: Global Energy Budget and Transport* of the ATMS 211 curriculum.

3. I plan to use a collection of aerial and satellite images of Mulajokull, along with photographs from my trip there, to teach about the changes to glacial mass balance around the globe as a result of climate change. I also plan to add a student exploration of the PolarTREC Expedition of Ken Williams during our lab investigation and modeling of ice cores and paleoclimates. This is covered in *Unit 3: Natural Variability* or *Unit 4: Anthropogenic Influences on Climate* of the ATMS 211 Curriculum.

4. Proxy records of Earth's paleoclimates play a significant role in this course, and I would like to use tephrochronology studies and C-14 dating studies from Mulajokull and other Icelandic glaciers to teach about Pleistocene and Holocene climate changes in Central Iceland. This is covered in *Unit 3: Natural Variability* of the ATMS 211 Curriculum.