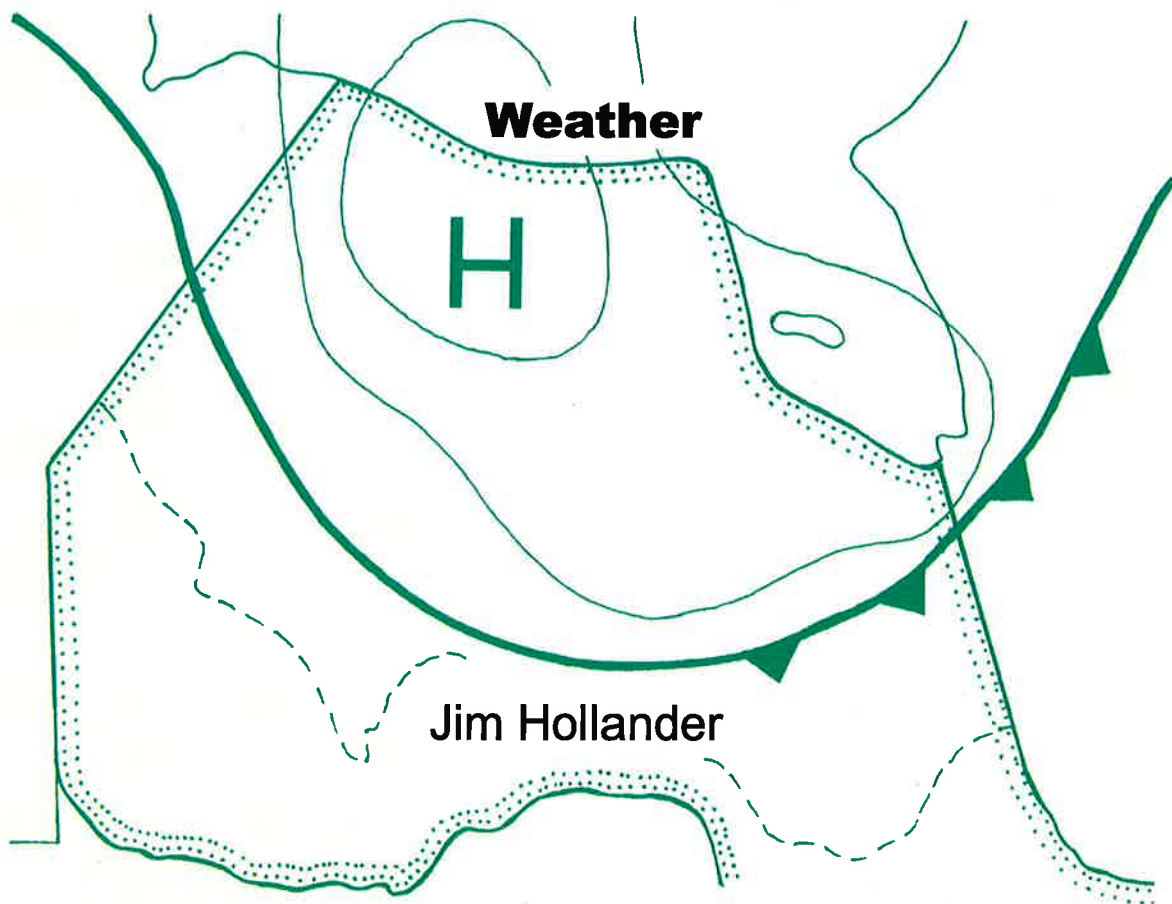


Weather, It's Right or Not

**A Resource and Curriculum Document for the
Ontario Curriculum: Science and Technology,
Grade 5—Earth and Space Systems Strand**



Weather, It's Right or Not

Jim Hollander



Timmins, Ontario

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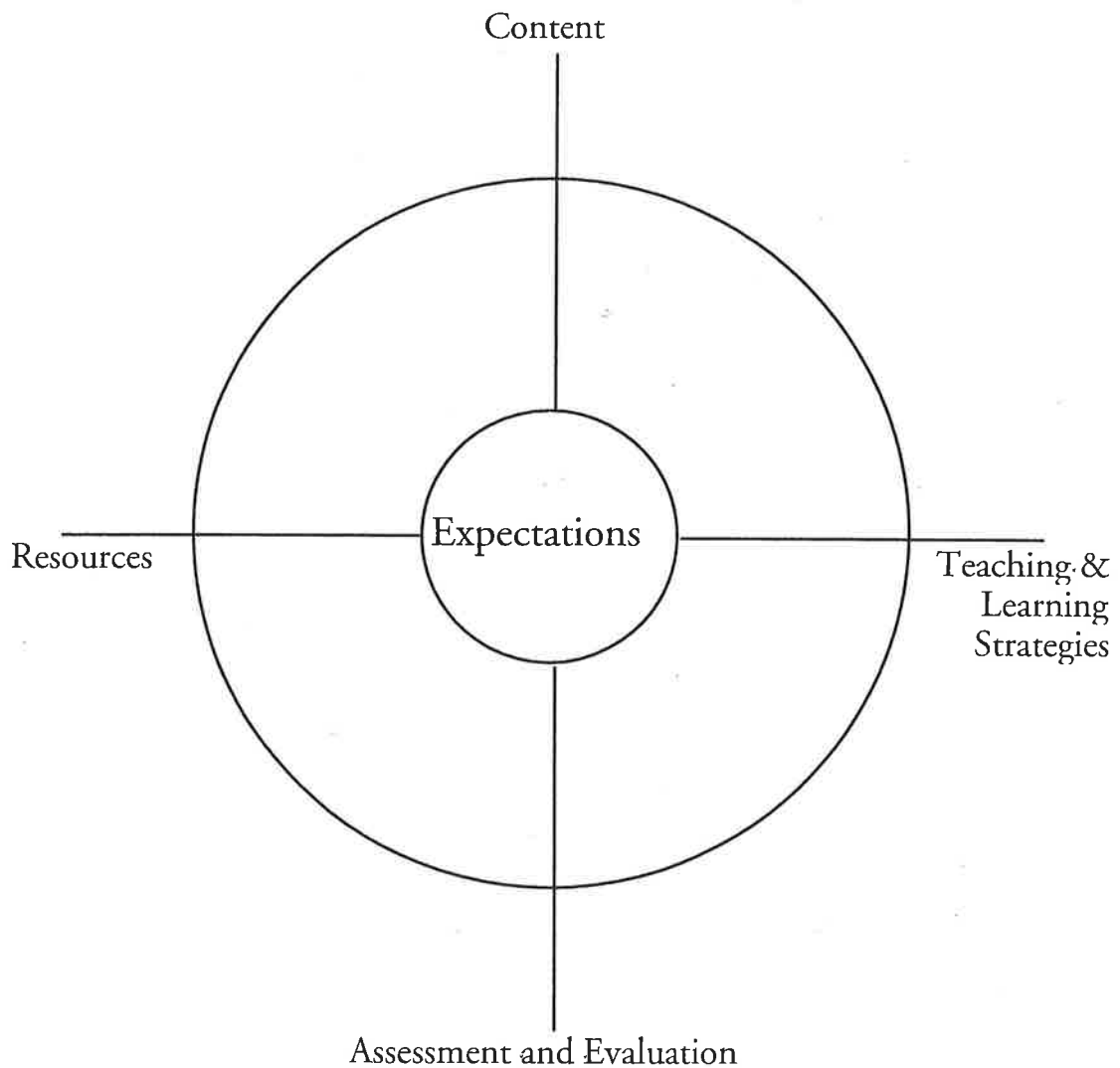
Introduction

How To Use This Resource and Curriculum Document

The *Weather, It's Right or Not* resource and curriculum document was developed to provide you with teaching and learning activities for the **expectations** identified in *The Ontario Curriculum, Grades 1–8: Science and Technology*. **Values and attitudes** (pp. 9–11) are included with the Ministry of Education and Training expectations because teaching values was and remains important to the Aboriginal peoples of the past and the present. Because this document reflects Aboriginal and non-Aboriginal worldviews, **content** is offered for your consideration. The **teaching and learning strategies** presented here were collected from many sources and are offered as suggestions for achieving the expectations outlined. Furthermore, a variety of activities are provided to accommodate the differing needs of teachers and students. The **assessment and evaluation** tools listed in this document reflect current practices and are aligned with achievement levels described in the *Ontario Curriculum, Grades 1–8: Science and Technology* (pp. 12–13). All **resources** used in the development of the *Weather, It's Right or Not* resource and curriculum document are noted in the resources section of each lesson and in the Reference and Resource List. Teachers are encouraged to seek out these resources from the school library or obtain them for your school as required. You are also invited to amend, revise, and otherwise adapt this material as required for educational purposes.

Curriculum Planning Overview

Careful curriculum planning requires an awareness of the relationships between the expectations and the content, teaching and learning activities, assessment and evaluation, and resources. A circular or holistic approach allows us to see these relationships by showing how various aspects of curriculum planning are connected. This approach also reflects Aboriginal worldviews where everything is related and everything is connected.



The Purpose of *The Ontario Curriculum, Grades 1-8: Science and Technology, 1998*

Students graduating from Ontario schools require the scientific and technological knowledge and skill that will enable them to be productive members of society. They also need to develop attitudes that will motivate them to use their knowledge and skill in a responsible manner. *The Ontario Curriculum, Grades 1-8: Science and Technology, 1998* outlines the knowledge and skill that students must develop in Grades 1 to 8, as well as the levels of achievement at which they are expected to master them. It is these levels that teachers will use to assess students' achievement.
—from *The Ontario Curriculum, Grades 1-8: Science and Technology*, p. 3

What Are Science and Technology?

Science is a form of knowledge that seeks to describe and explain the natural and physical world and its place in the universe. ...

Technology includes much more than the knowledge and skills related to computers and their applications. Technology is both a form of knowledge that uses concepts and skills from other disciplines (including science) and the application of this knowledge to meet an identified need or solve a specific problem using materials, energy, and tools (including computers). ...

—from *The Ontario Curriculum, Grades 1-8: Science and Technology*, p. 3

Curriculum Expectations and Achievement Levels

The Ontario Curriculum, Grades 1-8: Science and Technology, 1998 has two main elements: expectations and achievement levels. The expectations identified for each grade describe the knowledge and skills that the students are expected to develop and to demonstrate in their class work and investigations, on test, and in various other activities on which their achievement is assessed.

Two sets of expectations are listed for each grade in each strand or broad area of the curriculum. The three *Overall Expectations* correspond to the three goals of the science and technology program and describe in general terms the knowledge and skills that students are expected to achieve by the end of each grade. The *Specific Expectations* describe the expected knowledge and skills in greater detail.

The specific expectations are organized under three subheadings: Understanding Basic Concepts; Developing Skills of Inquiry, Design, and Communication; and Relating Science and Technology to the World Outside the School. This organization is not meant to imply that the expectations in any one group are achieved independently of the expectation in the other two groups. The subheadings are used merely to help teachers focus on particular aspects of knowledge and skills as they plan learning activities for their students.

The achievement levels are brief descriptions of four different degrees of achievement of the provincial curriculum expectations for any given grade. These descriptions are among a number of tools that teachers will use to assess students' learning. The achievement levels for science and technology focus on the three goals of science and technology education: understanding the basic concepts of science and technology; developing the skills and strategies required for scientific inquiry and technological design, including the techniques involved in the safe use of appropriate tools and equipment; and developing the ability to relate science and technology to each other and to the outside world.

—from *The Ontario Curriculum, Grades 1–8: Science and Technology*, p.p. 6–7

Strands in the Science and Technology Curriculum

The science and technology expectations are organized into five strands, which are the major areas of knowledge and skills in the science and technology curriculum. The five strands, which combine topics from science and technology, are:

- Life Systems
- Matter and Materials
- Energy and Control
- Structures and Mechanisms
- Earth and Space Systems

—from *The Ontario Curriculum, Grades 1–8: Science and Technology*, p. 7

Earth and Space Systems

The Earth and Space Systems strand deals with the science and technology of our planet and of space. As with other strands in the curriculum, students begin with aspects of the topic that are most familiar to them—the cycles of the days and seasons, the local soil and rocks, the particular features of their region of the province, the observable constellations in the night sky—and progress towards those with which they are less familiar or that are more complex.

... The materials covered in this strand naturally leads students to observation and exploration. Investigations will be numerous and varied, and should be of particular interest to students since many of the topics deal with things and events that

students have often observed and wondered about. Links with the world beyond the classroom also arise naturally since most of the topics studied in the strand relate to the world outside. Students will have many opportunities to explore the environment, the use and abuse of resources, and the impact of space technology on our knowledge of the earth.

It is important that students follow established safety practices in all investigations. These practices include:

- washing one's hands after handling soil samples and other earth materials;
- covering rock samples and wearing safety goggles when chipping;
- waiting for instructions in field work before proceeding;
- following specific instructions during investigations that involve observation of the sun (for example, never looking directly at the sun or through a lens or coloured glass).

—from *The Ontario Curriculum, Grades 1–8: Science and Technology*, p. 88

Grade 5: Weather, It's Right or Not

Overview

Weather, the study of which is called meteorology, is an important aspect of daily life. Students will learn that daily weather conditions are not the result of random occurrences, but are, rather, part of larger climatic systems and patterns that can be predicted both on a short-term and on a seasonal basis. Students will study various aspects of weather (temperature, wind speed, cloud formation, precipitation, atmospheric pressure), and examine the role they play in determining weather conditions.

—from *The Ontario Curriculum, Grades 1–8: Science and Technology*, p. 97

Overall and Specific Expectations Organizer

All of the overall and specific expectations identified for the Grade 5: Weather topic, found in *The Ontario Curriculum, Grades 1–8: Science and Technology* (pp. 97–98), are organized in the *Weather, It's Right or Not* resource and curriculum document into three sections. In addition, Northern Ojibway and Cree values and attitudes in Science and Technology are listed following these sections.

ONE: Weather and Weather Patterns

Overall Expectation

By the end of this section, students will:

- demonstrate an understanding of the major climatic factors and patterns associated with weather.

Specific Expectations

By the end of this section, students will:

- explain the difference between weather and climate and the factors that influence both of these systems (e.g., temperature, moisture, wind, air pressure, the sun);
- recognize large-scale and local weather systems (e.g., fronts, air masses, storms);
- recognize how the movement of large-scale air masses affects regional weather in Ontario (e.g., high pressure systems from the Arctic are associated with clear and cool weather; Atlantic systems are associated with cloudy skies; Pacific systems are associated with a variety of different weather conditions);
- identify patterns of air movement (e.g., low pressure and high pressure);
- compare outdoor air movement with indoor air movement (e.g., as hot air rises, cold air takes its place; the warmest rooms in a house are usually the upstairs bedrooms);
- identify the effects of air pressure (e.g., low pressure air masses associated with mild temperature and create conditions that cause storms or clouds; high pressure air

- masses are cooler and are often associated with clear weather conditions);
 - explain the formation of clouds and the effects of different cloud formations on weather and climate (e.g., create a model of a cloud in a jar and relate it to the water cycle; describe the relationship between the formation of cumulonimbus clouds and thunderstorms);
 - describe the water cycle in terms of evaporation, condensation, and precipitation;
 - describe the ways in which energy from the sun affects weather conditions (e.g., evaporation of water results in condensation, which in turn results in precipitation);
 - communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labelled diagram of the water cycle).
- from *The Ontario Curriculum, Grades 1–8: Science and Technology*, pp. 97–98

TWO: Weather Investigations and Forecasting

Overall Expectation

By the end of this section, students will:

- investigate the major climatic factors associated with weather, and design, construct, and test a variety of instruments for recording various features of the weather.

Specific Expectations

By the end of this section, students will:

- design, construct, and test a variety of weather instruments (e.g., weather vane, anemometer, rain gauge, wind sock, hygrometer);
 - formulate questions about and identify needs and problems related to objects and events in the environment, and explore possible answers and solutions (e.g., test a variety of fabrics for their waterproofing or insulating properties);
 - plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;
 - use appropriate vocabulary, including correct science and technology, in describing their investigations and observations (e.g., use terms such as *temperature*, *precipitation*, *humidity*, *wind chill factor*, *barometric pressure*, and *cloud cover*);
 - compile data gathered through investigation in order to record and present results, using tally charts, tables, and labelled graphs produced by hand or with a computer (e.g., record both qualitative and quantitative data from observations of weather over a period of time; accurately use a thermometer to read and record the results);
 - communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labelled diagram of the water cycle).
- from *The Ontario Curriculum, Grades 1–8: Science and Technology*, pp. 97–98

THREE: Weather Conditions and Adaptations

Overall Expectation

By the end of this section, students will:

- examine how weather forecasts influence decisions concerning human activity and how humans have adapted to a variety of weather conditions.

Specific Expectations

By the end of this section, students will:

- formulate questions about and identify needs and problems related to objects and events in the environment, and explore possible answers and solutions (e.g., test a variety of fabrics for their waterproofing or insulating properties);
 - describe ways in which weather conditions affect the activities of humans and animals (e.g., people refrain from strenuous physical activity in extreme heat; farmers plant crops when the soil is moist; animals hibernate in extreme cold);
 - understand and explain the importance of weather forecasts for people in certain occupations (e.g., farmers, pilots);
 - explain how climatic and weather conditions influence the choice of materials used for building shelters (e.g., bricks are often used in cold climates, stone and marble in warmer climates);
 - explain how advances in technology and science have enabled humans to make predictions about the weather (e.g., microwave beams are used to reflect cloud cover; satellite images of the earth allow us to track weather patterns on a larger scale than was previously possible);
 - explain how weather conditions influence activities and events related to science and technology (e.g., launching the space shuttle);
 - predict local weather patterns using data from their own observations of weather and from weather reports;
 - communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labelled diagram of the water cycle).
- from *The Ontario Curriculum, Grades 1–8: Science and Technology*, pp. 97–98

Northern Ojibway and Cree Values

Overall Expectation

By the end of this unit, students will:

•develop the values or general more stable beliefs generated from personal experiences (learned by directed encounters with an object or situation) and cultural transmission (learned from others) that are considered essential for meaningful life in the world around them.

Specific Expectations

By the end of this unit, students will:

- listen to, be considerate of, and honour themselves (respect for themselves);
- listen to, be considerate of, and honour everything in the world (respect for the Creator);
- listen to, be considerate of, and honour parents around them (respect for parents);
- listen to, be considerate of, and honour elders around them (respect for elders);
- listen to, be considerate of, and honour others around them (respect for others);
- listen to, be considerate of, and honour plants and animals around them (respect for plants and animals);
- listen to, be considerate of, and honour the land around them (respect for the environment);
- use resources together (sharing);
- recognize and accept accountability to themselves for decisions made and action taken (responsibility to themselves);
- recognize and accept accountability to others for decisions made and action taken (responsibility to others);
- recognize and accept accountability to themselves and others for decisions made and action taken (responsibility to themselves and others);
- recognize and accept accountability to the environment for decisions made and action taken (environmental responsibility);
- recognize, value and enjoy their own language, traditions, and culture (appreciation for their culture);
- recognize, value and enjoy another's language, traditions, and culture (appreciation for another's culture);
- control their actions or feelings which may be demonstrated by listening attentively, observing quietly, asking questions properly, and participating effectively (self-control);
- show a desire to work hard with steady, careful effort (diligence);

- feel or express thanks for the good things that the Creator has given them and others (thankfulness);
 - show honesty (truthfulness);
 - show feelings of interest or concern which may be demonstrated by the kind treatment of others (caring);
 - develop a willingness to put up with anything that annoys, troubles or hurts without losing self-control (patience);
 - pursue a problem or task to its completion (perseverance);*
 - show initiative in beginning tasks, working independently and solving problems (self-reliance).*
- from Cree School Board. (1997). *Cree School Board Cree Language and Culture Guide—Secondary Sector*. Chisasibi, QC: Cree School Board; Northern Nishnawbe Education Council. (1996). *Sioux Lookout District First Nations' Response to Secondary School Reform*. Sioux Lookout, ON: Northern Nishnawbe Education Council; Ohmagari, K. (1996). *Social Change and Transmission of Knowledge and Bush Skills Among Omushkegowuk Cree Women*. Unpublished doctoral dissertation, University of Manitoba, Winnipeg, Canada; Hishkoonikun Education Authority. (1995). *The Traditional Values Project 1994–1995*. Kashechewan, ON: Hishkoonikun Education Authority; Hishkoonikun Education Authority. (1994). *The Traditional Values Project 1993–1994*. Kashechewan, ON: Hishkoonikun Education Authority; *also from Ministry of Education.

Attitudes in Science and Technology

Overall Expectation

By the end of this unit, students will:

•develop the “habits of mind” [attitudes or specific beliefs which are more prone to change] that are considered essential for meaningful work in science and technology.

Specific Expectations

- develop a concern for the welfare of others and working towards a common good (societal responsibility);
- recognize, value and enjoy the world in which we live (appreciation for the world around them);
- develop feelings of self-worth which may be demonstrated by cheerfulness, participation, risk-taking, volunteering or accepting challenges (self-esteem);
- show a desire for knowledge and understanding by listening attentively, observing, asking questions and investigating independently (curiosity);
- use imagination in solving problems by becoming resourceful innovative and intuitive (creativity);
- work together effectively (cooperation);
- be receptive to new and different situations and show a willingness to accept evaluation and constructive criticism (openness);
- examine facts honestly and impartially to form conclusions (objectivity);
- learn that science and technology is open-ended, constantly changing, empirical and humanistic (reality orientation);
- evaluate the outcomes of a scientific investigation (critical mindedness);
- show concern for safety (safety-mindedness).

—from Ministry of Education and Training. (1999). *The Ontario Curriculum Grades 1–8, Science and Technology*. Toronto: Queen’s Printer; Ministry of Education. (1988). *Science Is Happening Here*. Toronto: Ministry of Education; Ministry of Education. (1983). *Personal and Societal Values: A Resource Guide for the Primary and Junior Divisions*. Toronto: Ministry of Education.

ONE: Weather and Weather Patterns

Overall Expectation

By the end of this section, students will:

- demonstrate an understanding of the major climatic factors and patterns associated with weather.

Overview

The weather and weather patterns section begins with a brief discussion of the terms weather, climate, and factors determining the state of the weather—air temperature, moisture, and pressure. Next, planetary-scale weather systems that affect large areas of the earth including winds, air masses and the weather associated with them are presented. Following this, large-scale weather systems that influence areas of the northern Ontario including lows, highs, fronts and the weather found in them are introduced. This section ends with descriptions of the water cycle, clouds, precipitation, thunderstorms, and relationships between them.

Lesson Titles and Sequence

Lesson 1: Weather and Climate

Lesson 2: Air Temperature and the Sun

Lesson 3: Air Moisture and Air Pressure

Lesson 4: Winds and Air Masses

Lesson 5: Lows and Highs

Lesson 6: Cold, Warm, and Occluded Fronts

Lesson 7: The Water Cycle

Lesson 8: Clouds and Precipitation

Lesson 9: Thunderstorms

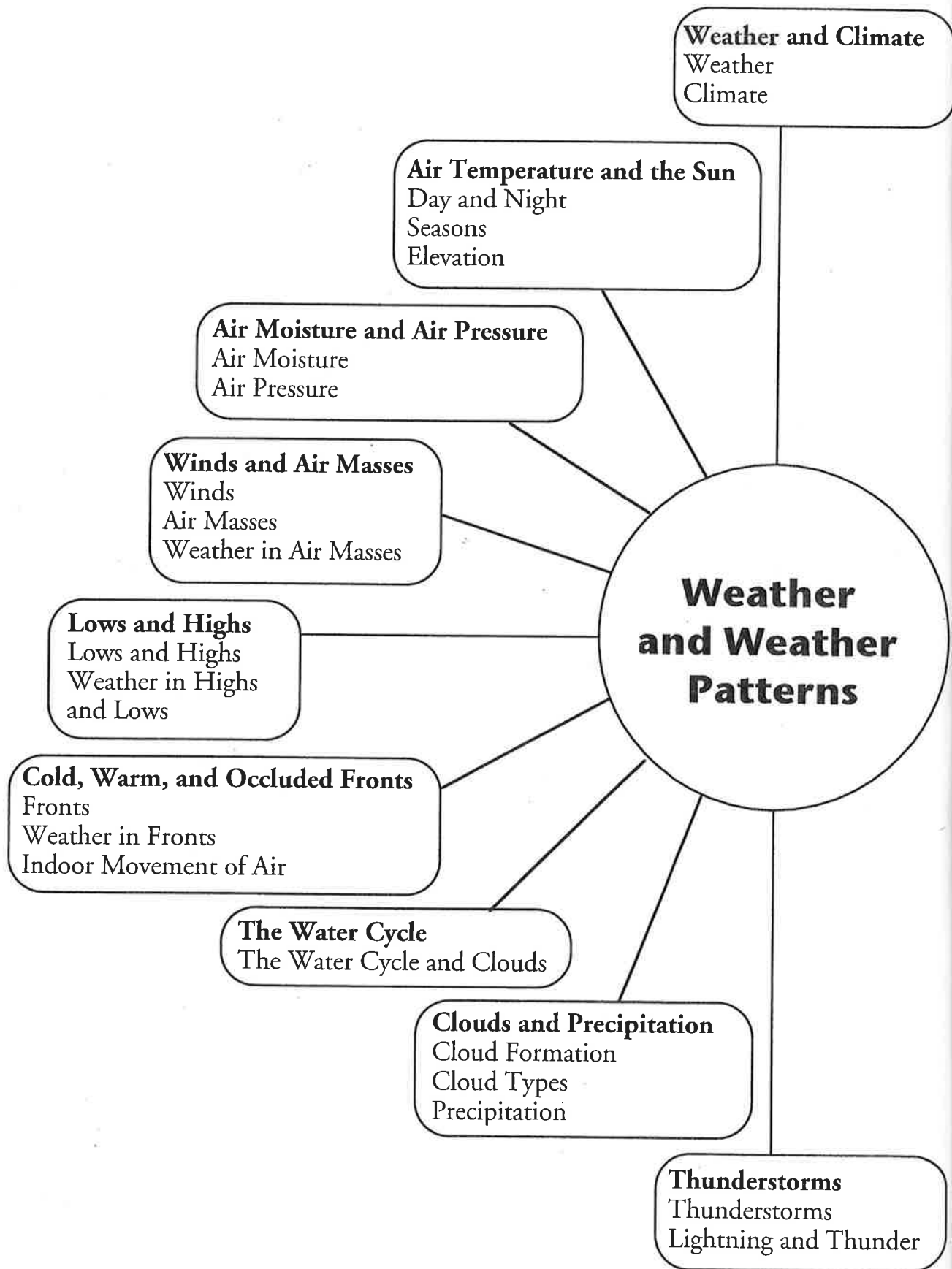
Planning Notes

- review entire unit and ensure all materials and equipment are available
- review entire section (sub-unit) and ensure all materials and equipment are available prior to beginning this section
- meet with teacher-librarian or visit the library to obtain print materials, multimedia and software related to weather
- contact elders or weather resource people in advance of their appearance in class
- set up reading centre to include a variety of books on weather (see reference and resource list)
- make up bulletin board display using the unit title Weather, It's Right or Not or "School Name" of Meteorology include headings Weather and Weather Patterns (with pictures of the atmosphere, cold and warm fronts, the water cycle, and clouds), Weather Investigations and Forecasting (with samples of weather station instruments, weather forecasting maps, and Northern Ojibway and Cree weather forecasting expressions), and Weather Conditions and Adaptations (with pictures of human and animal responses to weather, traditional Northern Ojibway and Cree seasonal shelters, and weather and technology)
- replace original pictures and samples with copies of student work from each lesson on bulletin ensuring that by the end of the unit all students have at least one piece of work displayed
- make up weather word and phrase cards for use throughout the unit
- develop a summative weather and weather patterns test upon completion of this section

Accommodations

All students must be given opportunities to achieve the overall and specific expectations described in *The Ontario Curriculum, Grades 1–8*. To meet the range and diversity of student abilities that teachers will encounter a variety of teaching and learning strategies, and assessment tools and techniques have been provided in this section. An examination of the IEPs of exceptional students may help teachers select appropriate learning and assessment strategies.

Further, teachers must acknowledge and accommodate cultural and language differences. The use of strategies that include letting students learn from other students, promoting holistic learning, fostering active learning techniques, and encouraging cooperative learning may be necessary for Aboriginal and English as a Second Language students.



Lesson 1: Weather and Climate

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) explain the difference between weather and climate and the factors that influence both of these systems (e.g., temperature, moisture, wind, air pressure, the sun);

Values and Attitudes

(2) show a desire for knowledge and understanding by listening attentively, observing, asking questions and investigating independently (curiosity);

(3) listen to, be considerate of, and honour others around them (respect for others).

Planning Notes:

- review content on weather and climate
- make a giant bristol board thermometer divided into 3 cm sections from 0° C to 30° C for the reading centre
- organize student table of contents with the same or similar unit, section and lesson headings
- create fill in the blank definitions for weather and climate
- locate TV and VCR or collect assorted magazines, newspapers showing a wide range of weather examples

Content:

Introduction

Whether it's right or not, the weather affects our lives in many ways. The weather influences when and where we go out. It is particularly important in northern Ontario with the extremes of weather found in this area. The weather is especially meaningful for the Northern Ojibway and Cree whose way of life based on the land still exists. Their careful observations of the environment told the Northern Ojibway and Cree what to expect. Nowadays with modern forecasts and forecasting, we know what to expect with different degrees of certainty. Sometimes the forecasts are right and sometimes they are wrong because the weather often changes in minutes. Weather, it's right or not, is important to us all.

Weather

The weather is often a topic of conversation, but what is the weather? Weather is the state of the air (atmosphere) at a specific place for a short period of time. It includes temperature, moisture, pressure, winds, clouds, and precipitation. Most of the weather occurs in the troposphere, a layer of air that extends upward 10–16 km from the earth's surface.

Climate

Frequently associated with the weather is the word climate. It is the average weather of an area over a long period of time. Meteorologists (people who study and predict the weather) decide a region's climate by looking at its average monthly and annual temperature, its average monthly and annual precipitation (rain or snow), and its vegetation.

The Humid Continental climatic region, found in most of northern Ontario, is characterized by long cold winters and short warm summers. The temperatures, in this climatic region, generally vary on average from - 25°C in January to + 20°C in July. In addition, this climatic region receives about 60 cm of precipitation a year. The vegetation located in northern Ontario consists of tundra found along the coast of Hudson Bay and northern James Bay, swamp or muskeg found inland as part of the Hudson Bay Lowlands, and boreal forest found throughout the Canadian Shield.

Teaching and Learning Strategies:

- ask students to describe how the weather and weather forecasts affect them
- explain unit title: *Weather, It's Right or Not*
- describe entire unit to students

- have students brainstorm weather words that they know about weather
- list words on black board or chart paper

- have students set up notebooks using table of contents with the same or similar unit, section and lesson headings

- ask the question: What is weather?
- place definition on black board
- remove key words
- have students copy complete definition into notebooks

- repeat with words related to climate
- ask the question: What is climate?
- place definition on black board
- remove key words
- have students copy complete definition into notebooks

- in small groups have students brainstorm the things they want to know about the weather
- put these questions on chart paper and address these questions throughout the unit sections as they appear

- explain that during the unit have each student will read one book from classroom or school library on weather and put their name, title of book, and author on giant thermometer when they have completed reading the book of their choice

- show best available video on weather, e.g., *Exploring Weather* or *Weather*
- or have students collect pictures from magazines, newspapers, showing a wide range of weather examples for their notebook cover page

Assessment and Evaluation:

(1) fill in the blanks definitions on weather and climate using marking scheme;
(2) and (3) group listening skills using diagnostic checklist, e.g., shows a desire to learn through listening as a member of a large group; shows a desire to learn through listening as a member of a small group; shows responsibility for listening efficiently and effectively; recognizes and respects the need of others for group listening

note: unless otherwise indicated assessments are formative, individual student, and teacher evaluated

Resources:

Print Materials: Ganeri, A. (1987). *Weather Facts*; Kahl, J. D. (1992). *Wet Weather*; Mason, J. (1988). *Weather and Climate*; Ministry of Natural Resources.; (1981). *West Patricia Land Use Plan: Background Information*; Toole, S. (1985). *Moosonee District Background Information*.

Milliken General Science Transparency/Reproducible Books. (1986).

Weather; The Solski Group. (1999). *Weather*; S & S Learning Materials. (1991). *All About the Weather*.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*; Colgren, J. (1993). *Exploring Weather*; Eyewitness Living Earth Series (35 mins.). (199x). *Weather*.

Manipulatives: bristol board, chart paper, and markers, fill in the blank definitions, TV and VCR, or assorted magazines, newspapers showing a wide range of weather examples

Lesson 2: Air Temperature and the Sun

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) explain the difference between weather and climate and the factors that influence both of these systems (e.g., temperature, moisture, wind, air pressure, the sun);

Values and Attitudes

(2) evaluate the outcomes of a scientific investigation (critical mindedness);
(3) recognize and accept accountability to others for decisions made and action taken (responsibility to others).

Planning Notes:

- review content on air temperature and the sun
- locate globe, flashlight, and lamp without shade for demonstrations

Content:

Introduction

Many factors determine the state of the atmosphere. These factors are air temperature, air pressure, and air moisture. Before discussing these factors, we need to understand that the air is a mixture of invisible gases and tiny particles. The most significant gases in the air are nitrogen (78%) and oxygen (21%). Other gases make up the remaining 1% of the air. One of these other gases is water vapour. In addition, the atmosphere contains microscopic particles produced from soil erosion, volcanic eruptions, ocean salt spray, and pollutants. These small particles and water vapour are essential for cloud formation and precipitation.

Air Temperature and the Sun

Contrary to popular belief most of the atmosphere is not directly heated by the sun's rays. Instead the sun's rays heat the earth's surface that in turn heats the lower atmosphere or troposphere through a process called radiation. This process causes the heating and cooling of the air. The heating and cooling of the air usually changes from day to night, from season to season, and from elevation to elevation.

Day and Night

In the first place, air temperature generally changes from day to night. It is usually warmer during the day because the sun's rays heat the earth's surface at this time. During the night, the heat from the earth's surface radiates into space causing the air temperature to fall.

Seasons

Secondly, air temperature changes from season to season. The seasons occur because of the tilt of the earth's axis, not its distance from the sun. In the winter, the northern hemisphere, tilted away from the sun, has shorter days and receives less heat due to the lower angle the sun's rays strike the earth's surface. As the seasons gradually change from winter to spring, the days get longer. The northern hemisphere receives more heat because the sun's rays hit the earth's surface at a higher angle. In the summer, the northern hemisphere, now tilted towards the sun, has longer days and

receives even more heat due to the higher angle the sun's rays strike the earth's surface. As the seasons change from summer to fall, the days get shorter. The northern hemisphere receives less heat in the fall because the sun's rays hit the earth's surface at a lower angle. As winter approaches the cycle continues.

The Northern Ojibway and Cree seasons also reflect the cyclical changes in the natural world shown in the weather and in environmental conditions:

- (1) spring—siikwan,
- (2) break-up—miloskamin (the land and the waters are starting to thaw),
- (3) summer—niipin (hot weather)
- (4) fall—takwaakan,
- (5) freeze-up—mikiskaaw (the land and the waters are starting to freeze),
- and (6) winter—pison (cold weather).

Elevation

Finally, air temperature changes with the elevation. The air temperature falls 6.5°C with each 1000 m increase in elevation or height. Less heat is radiated from the earth's surface to the upper levels of the troposphere.

Teaching and Learning Strategies:

–review terms weather and climate with emphasis on temperature, moisture, air pressure and winds

–discuss the importance of the sun on the atmosphere, e.g., it heats the atmosphere through radiation that affects temperature, moisture, air pressure and winds

–ask students the following questions: When do the lowest temperatures occur? the highest? Why do we have changes in temperature from day to night?

–discuss the rotation of the earth

–demonstrate this with a globe and a flashlight (sun)

–locate community on globe and mark with tape

–have student stand with globe so that it can be rotated

–turn off lights and shine sun on globe while student slowly rotates globe

–ask students to describe areas of day and night

–relate to changes in temperature

–ask the following questions: What season is the coldest? the warmest? Why do we have changes in temperature from season to season?

–discuss the earth's tilt and its effects on the seasons

–demonstrate this using globe and lamp without a shade (sun)

–identify northern and southern hemispheres on globe

–stand with globe so that north pole is tilted towards your body (winter)

–walk clockwise around sun slowly keeping the globe tilted in the same position

–stop at each quarter and have students name the season (winter, spring, summer, fall) in the northern hemisphere

–highlight the angle of sunlight that reaches the northern hemisphere in each season

–ask students the following question: What happens to the temperature as you climb up a large mountain?

–discuss air temperature change and elevation

–have students write a short newspaper article about the coldest most uncomfortable day in their lives

–have students make an outline using the 5 Ws and H–Who, What, When, Where, Why and How in notebooks

–have students complete draft and final copies as time permits or during free time

Assessment and Evaluation:

(1) large group oral descriptions of temperature and the sun using anecdotal comments, e.g., understands influence of sun on air temperature, the effect of the earth's tilt on the seasons, and temperature change with elevation; and individual newspaper article on the coldest day using marking scheme; (2) and (3) large group observations using anecdotal comments, e.g. draws logical conclusions from demonstrations; shows accountability for listening efficiently and effectively to conclusions made

Resources:

Print Materials: Ganeri, A. (1987). *The Weather Facts*; Mason, J. (1988). *Weather and Climate*; Minister of Supply and Services. (1976). *Weather Ways*.

Creative Teaching Press. (1995). *Investigations in Science Weather*; Learning Resources. (1996). *Weather*; S & S Learning Materials. (1991). *All About the Weather..*

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*.

Manipulatives: globe, flashlight, and lamp without shade

Lesson 3: Air Moisture and Air Pressure

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) explain the difference between weather and climate and the factors that influence both of these systems (e.g., temperature, moisture, wind, air pressure, the sun);

Values and Attitudes

(2) evaluate the outcomes of a scientific investigation (critical mindedness);
(3) recognize and accept accountability to others for decisions made and action taken (responsibility to others).

Planning Notes:

- review content on air pressure and air moisture
- locate 2 small mirrors, newspaper, and old thin 30 cm wooden ruler for demonstrations
- locate weather poems
- make short note on temperature, air moisture, and air pressure

Content:

Introduction

In addition to air temperature and the sun, air moisture, and air pressure are other factors that determine the state of the atmosphere.

Air Moisture

“It’s not the heat, it’s the humidity,” is an expression often heard during the hot summer months. The humidity or air moisture refers to the amount of water vapour in the air. Air that contains the maximum amount of water vapour is said to be saturated or have 100% relative humidity. If the air contains half of the maximum amount of water vapour, then it has a relative humidity of 50%. Dry air or air with low humidity has little or no water vapour. Moist air or air with high humidity has varying degrees of water vapour present.

The maximum amount of water vapour in the air depends on the temperature. A rise in temperature produces an increase in the amount of water vapour the air can hold; a drop in temperature causes a decrease. The temperature at which the air becomes saturated is called the dew point. Cooled saturated air contains more water vapour than it can hold. The excess water vapour changes, through condensation, into small water droplets crucial for the formation of fog or clouds.

Air Pressure

The atmosphere is constantly pressing down on the earth’s surface. This is because the gases and microscopic particles in the air have weight. It is the weight of the air that causes air pressure. As the elevation increases, the air pressure decreases because there is less air pressing down on the earth’s surface. While some changes in air pressure are due to differences in elevation, other

changes are due to the temperature of the air. Near the north and south poles the air is constantly cooled. This cold air is heavier (or more dense) than warm air so it presses down more on the earth's surface exerting a high pressure. Near the equator the air is heated directly. Warm air is lighter so it presses down less on the earth's surface applying a low pressure.

Teaching and Learning Strategies:

- review air temperature and the sun

- ask students to name the seasons
- explain that the Northern Ojibway and Cree were careful observers of changes in the land and named six seasons according to these changes
- read poems about weather and seasons, e.g., *Whatever the Weather*
- encourage students to write a poem about their favourite season in notebooks, e.g., 5 line cinquain—line 1: one word subject; Line 2: two adjectives; Line 3: three verbs; Line 4: four-word phrase; Line 5: one-word synonym (word that almost means the same thing as the subject)

- discuss air moisture or humidity and its relation to temperature
- demonstrate this using small mirror held at room temperature and small mirror held at freezing by being placed outside or in a refrigerator freezer
- let student go to staff room refrigerator and pick up mirror
- have student blow on mirror at room temperature
- have students describe their observation (some condensation)
- have students blow on mirror at freezing
- have students describe their observations (more condensation on mirror held at freezing because the cooled saturated air contains more water than it can hold and condenses more on the mirror)

- discuss air pressure
- demonstrate this using ruler and newspaper
- place a few sheets of newspaper flat on table so that one side touches the edge
- place an old thin 30 cm wooden ruler under the newspaper so that half is exposed
- hit ruler hard with fist
- have students describe their observations (the ruler should break due to the air pressure exerted on the paper), you may have to practice this with different sizes of newspapers and thicknesses of wood

- hand out note on temperature, air moisture, and air pressure to be pasted (stapled) in notebooks

Assessment and Evaluation:

(1) poem on the seasons using marking scheme; large group oral descriptions of air moisture or humidity and air pressure using anecdotal comments, e.g., understands relation of humidity to temperature and relation of air pressure and temperature; (2) and (3) large group observations using anecdotal comments, e.g. draws logical conclusions from demonstrations; shows accountability for listening efficiently and effectively to conclusions made

Resources:

Print Materials: Franco, B. (2001). *Whatever the Weather* (weather poems); Ganeri, A. (1987). *Weather Facts*; Mason, J. (1988). *Weather and Climate*; Minister of Supply and Services. (1976). *Weather Ways*.

Creative Teaching Press. (1995). *Investigations in Science Weather*; The Solski Group. (1999). *Weather*; S & S Learning Materials. (1991). *All About the Weather*.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*.

Manipulatives: 2 small mirrors, newspaper, and old thin 30 cm wooden ruler, note on temperature, air moisture, and air pressure

Lesson 4: Winds and Air Masses

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) identify the effects of air pressure (e.g., low pressure air masses associated with mild temperature and create conditions that cause storms or clouds; high pressure air masses are cooler and are often associated with clear weather conditions);

Relating Science and Technology to the World Outside the School

(2) recognize how the movement of large-scale air masses affects regional weather in Ontario (e.g., high pressure systems from the Arctic are associated with clear and cool weather; Atlantic systems are associated with cloudy skies; Pacific systems are associated with a variety of different weather conditions);

Values and Attitudes

(3) control their actions or feelings which may be demonstrated by listening attentively, observing quietly, asking questions properly, and participating effectively (self-control).

Planning Notes:

- review content on winds and air masses
- locate overhead projector, wall map of Canada, transparency/reproducible *Weather*, p. 6, and blank reproducible maps of Canada

Content:

Introduction

Planetary-scale weather systems refer to systems that range from thousands of kilometres in size and last several weeks. These systems include winds and air masses that cover large portions of the earth.

Winds

Air always moves from areas of high pressure to areas of low pressure. This air movement, from areas of high pressure to low pressure, produces wind. The winds do not blow in straight lines from high pressure to low pressure because the earth rotates on its axis. The result of this rotation, called the Coriolis Effect, pushes the winds in the northern hemisphere to the right, and in the southern hemisphere to the left. In the northern hemisphere, north winds, air moving from the north to south, shift to the west, while south winds shift to the east.

Furthermore, the rotation of the earth causes the winds to form three distinct wind belts north of the equator, and three belts south of it. The three belts found in the northern hemisphere include the polar easterlies, westerlies, and northeast trade winds.

In the northern hemisphere, the cold polar winds and warmer westerlies, meet and produce strong winds known as the jet stream. The jet stream is found high in the troposphere. As fall arrives, the jet stream moves into the United States carrying colder seasonal weather with it. In the spring, the jet stream retreats towards the polar regions of Canada bringing milder weather to northern Ontario. The jet stream influences the movement of air masses, lows, and fronts.

Air Masses

Air masses develop over large areas that have consistent characteristics. These air masses may cover thousands of square kilometres of area, and contain uniform moisture and temperature.

Continental air masses formed over land are dry, while Maritime air masses formed over oceans are moist. Arctic air masses, the coldest, form over the ice and snow of the north. Polar air masses are Arctic air masses warmed during their southward movement. Tropical air masses, the warmest, form over the equator.

The air masses found in Canada, described by their place of development, relative moisture and temperature, are as follows:

- (a) Continental Arctic—formed over the high Arctic, northern snow covered regions, dry and cold
- (b) Maritime Arctic —formed over the Arctic ocean and northern lakes, moist and cold
- (c) Maritime Polar (2)—formed over the northern parts of the Pacific and Atlantic oceans, moist and cool
- (d) Maritime Tropical—formed over the Gulf of Mexico and the Caribbean Sea, moist and warm

In the northern hemisphere, the zone where cold and warm air masses meet is called the Polar front. Generally, the cold Arctic and Polar air masses lie north of the Polar front, while the warm Tropical air mass extends south of this front. The advance and retreat of cold air masses at different places causes the Polar front to appear wave-like along its border.

Weather in Air Masses

Although air masses have uniform moisture and temperature as they develop, the weather in these air masses changes as they move from place to place. As an air mass passes over a warm surface, it becomes warmer, and as it moves over a cold surface an air mass becomes cooler. When air masses go across lakes, vegetation, or wet ground, the moisture content in them may become higher. If an air mass is forced over a mountain range it loses moisture as precipitation, and consequently becomes drier as it descends on the opposite side. Air masses largely determine the weather found in large-scale systems.

Teaching and Learning Strategies:

—review factors (temperature, air moisture and air pressure) that influence the weather

—discuss winds in relation to air pressure

—illustrate with overhead transparency/reproducible *Weather*, p. 6

—have students use blank reproducible or draw map and label north pole, south pole, polar easterlies, westerlies, southeast trades, northeast trades, equator, the jet stream, and degrees latitude in their notebooks

–note that the jet stream (relatively strong winds) is where the polar easterlies and westerlies meet in the northern hemisphere

–discuss air masses found in Canada in relation to their place of development, relative moisture, and temperature and affect on weather in northern Ontario

–illustrate their locations on wall map of Canada

–read locations of air masses and have students find them on wall map of Canada

–have students use blank reproducible map of Canada or draw map and label Arctic, Pacific, and Atlantic oceans, Gulf of Mexico, Continental Arctic, Maritime Arctic, Maritime Polar, and Maritime Tropical air masses

–ask students the following: What kind of weather (moisture and temperature) does a Continental Arctic air mass bring? Maritime Arctic? Maritime Polar? and Maritime Tropical?

–note that the Polar front is where cold and warm air masses meet, it is not the same as the jet stream which influences the movement of these air masses

–have students place this information on map with each air mass

–have students paste (staple) maps in notebook

Assessment and Evaluation:

(1) self-evaluated map of wind belts using marking scheme; (2) self-evaluated map of air masses using marking scheme; (3) observations using rating scale (rarely, sometimes, usually), e.g., listens attentively, observes quietly, asks questions properly, and participates effectively

Resources:

Print Materials: Ganeri, A. (1987). *Weather Facts*; Minister of Supply and Services. (1976). *Weather Ways*.

Milliken General Science Transparency/Reproducible Books. (1986).

Weather.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*.

Manipulatives: overhead projector, blank transparency/reproducible *Weather*, p. 6, wall map of Canada, and blank reproducible maps of Canada

Lesson 5: Lows and Highs

Specific Expectations:

The students will be able to

Understanding Basic Concepts

- (1) recognize large-scale and local weather systems (e.g., fronts, air masses, storms);
- (2) identify patterns of air movement (e.g., low pressure and high pressure);

Values and Attitudes

- (3) be receptive to new and different situations and show a willingness to accept evaluation and constructive criticism (openness);
- (4) develop a willingness to put up with anything that annoys, troubles or hurts without losing self-control (patience).

Planning Notes:

- review content on lows and highs
- locate ball pump and tape for demonstration
- locate weather system map from newspaper or internet
- create worksheet similar to that found in *Weather*, p. 5b

Content:

Introduction

Large-scale or synoptic weather systems refer to systems that range from 10 to hundreds of kilometres in size and last up to a week. These systems include lows, highs, and fronts that cover portions of North America.

Lows and Highs

In North America, lows form when warm Tropical air masses push into the Polar front creating areas of low pressure. Low pressure areas generally contain rising warm air. Due to the rotation of the earth, these lows are associated with winds blowing counterclockwise. These winds blow towards the centre of the low that contains the lowest pressure causing the less dense air to rise. As the air cools, it becomes saturated forming clouds and precipitation.

Also, highs or areas of high pressure are identified with winds blowing clockwise. High pressure areas generally contain heavier (or more dense) sinking cold air. Winds in these areas blow away from the centre of the high pressure. As the air sinks, it warms and becomes less saturated.

Weather in Highs and Lows

Highs bring clear dry air with them. In high pressure areas, the weather north of the Polar front mainly consists of cold dry air. The weather south of this front contains warm dry air. Lows bring cloudy, warm, moist air in the summer, and cloudy, cool, moist air in the winter. These lows or depressions may take three or four days to travel across Canada.

Teaching and Learning Strategies:

–review winds and air masses

- demonstrate low and high pressure with ball pump
 - seal end of hose with tape
 - have student pull ball pump plunger up and release it
 - ask students what keeps the plunger up
 - have student push down on the plunger
 - ask student what happens
 - ask students whether the air pressure is high or low and predict what happens when the plunger is let go
 - explain high and low pressure in relation to cold and warm air temperature
-
- hand out weather system map from newspaper or from the internet
www.theweathernetwork.com/wmaps/index.asp see system maps: short term and long term under active weather select weather system
 - ask students what the symbols L, H, thick white line (if present), and thin white (or black) lines describe (areas of low pressure, areas of high pressure, the jet stream, areas of equal air pressure)
 - explain highs and lows in relation to direction of the winds, and patterns of movement across Canada
 - ask students to describe the kind of weather highs and lows bring
 - hand out worksheet on highs and lows similar to that found in *Weather*, p. 5b, but using Canadian map and examples
 - have students paste (staple) weather systems map and worksheet into their notebooks

Assessment and Evaluation:

(1) self evaluated worksheet on highs and lows using marking scheme; (2) and (3) large group observations using anecdotal comments, e.g., takes time completing work correctly; shows willingness to accept evaluation and constructive criticism on neatness of work and notebook

Resources:

Print Materials: Ganeri, A. (1987). *Weather Facts*; Minister of Supply and Services. (1976). *Weather Ways*.

Creative Teaching Press. (1995). *Investigations in Science Weather*; Milliken General Science Transparency/Reproducible Books. (1986). *Weather*.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*.

Web Sites: www.theweathernetwork.com/wmaps/index.asp

Manipulatives: ball pump, tape, weather system maps from newspaper or internet, worksheet

Lesson 6: Cold, Warm, and Occluded Fronts

Specific Expectations:

The students will be able to

Understanding Basic Concepts

- (1) recognize large-scale and local weather systems (e.g., fronts, air masses, storms);
- (2) identify patterns of air movement (e.g., low pressure and high pressure);
- (3) compare outdoor air movement with indoor air movement (e.g., as hot air rises, cold air takes its place; the warmest rooms in a house are usually the upstairs bedrooms);

Values and Attitudes

- (4) use imagination in solving problems by becoming resourceful, innovative and intuitive (creativity);
- (5) recognize and accept accountability to themselves and others for decisions made and action taken (responsibility to themselves and others).

Planning Notes:

- review fronts
- locate overhead projector, transparency *Weather*, p. 5, and reproducible *Weather*, p. 5a
- collect 6 shoe boxes or small sized boxes
- ensure construction paper and scraps, cottons balls, string, glue, scissors, and markers are available if required

Content:

Introduction

In addition to lows and highs that cover large portions of North America, the winds in lows often bring air masses together forming fronts.

Fronts

Because as many as three air masses in summer or four air masses in winter may be present in North America, two or three fronts may exist depending on the season. The formation of fronts occurs when air masses of different temperature and moisture meet one another. There are three types of fronts: cold, warm, and occluded.

Weather in Fronts

When the front edge of a cold (Arctic or Polar) air mass pushes into a warm (Tropical) air mass, the heavier, colder air cuts underneath the warm air. As the warm air lifts upwards, the warm air cools. It becomes saturated and forms clouds along the front producing rain or snow. Sometimes heavy rain, strong winds, thunderstorms, and hail arise when the cold front moves quickly.

Similarly, when the front edge of a warm air mass pushes against a cold air mass, the warm air rises and cools. As the warm air becomes saturated, clouds form on the cold side of the front. Light to moderate precipitation usually accompanies these warm fronts.

Sometimes faster moving cold fronts overtake warm fronts and push the warmer air over it. When the cold air completely lifts the warm air off the ground, it becomes occluded. Light precipitation often occurs at occluded fronts.

Indoor Movement of Air

The movement of air in fronts is similar to that experienced indoors. As hot air rises, cold air takes its place. Consequently, the warmest rooms in a house are usually those located upstairs. In addition, the hottest area around a stove is above it near the ceiling.

Teaching and Learning Strategies:

- review lows and highs using weather system map from newspaper or from the internet from previous lesson
- discuss fronts in relation to lows and air masses
- ask students what the following describe: lines with triangles (cold front), lines with semicircles (warm front), lines with triangles and semicircles facing opposite directions (occluded front) and dashed lines (elongated areas of low pressure)
- ask the following: How can we determine which way the front is moving? Are fronts most associated with lows or highs?
- discuss fronts and weather found in them
- illustrate with over head transparency/reproducible *Weather*, p. 5, and briefly introduce types of clouds
- have students complete reproducible *Weather*, p. 5a or similar teacher-made one
- have students paste reproducible in notebook
- divide class into 6 small groups
- have each group create 3D diorama in shoe box for one of the following: warm, cold, or occluded fronts
- each diorama should be labelled to include name of front, names of air masses making contact, direction of frontal movement using arrows, and names of clouds along the front
- encourage students to be creative, e.g., use different colours of construction paper for air masses and backgrounds, cotton balls for clouds, string for rain etc
- or have each group compare and contrast cold and warm fronts in paragraph form
- in small groups mention that the movement of air outdoors is similar to that experienced indoors
- ask students to name the hottest and coldest places in the house and why this is so
- display dioramas or comparison paragraphs near weather bulletin board

Assessment and Evaluation:

(1) self evaluated reproducible *Weather*, p. 5a or similar teacher-made one on fronts using marking scheme; (2) small group, peer evaluated 3D dioramas depicting fronts, or warm and cold front comparison paragraphs using marking scheme; (3) small group oral discussion on outdoor/indoor movement of air using anecdotal comments, e.g., understands similarities of air movement inside and outside; (4) and (5) small group observations using anecdotal comments, e.g. uses imagination by becoming resourceful, innovative, and intuitive; shows accountability for listening efficiently and effectively to others and following plans of action

Resources:

Print Materials: Cosgrove, B. (1991). *Weather*; Ganeri, A. (1987). *Weather Facts*; Mason, J. (1988). *Weather and Climate*; Minister of Supply and Services. (1976). *Weather Ways*.

Milliken General Science Transparency/Reproducible Books. (1986).

Weather.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*.

Web Sites: www.theweathernetwork.com/wmaps/index.asp

Manipulatives: overhead projector, transparency *Weather*, p. 5, reproducible *Weather*, p. 5a, shoe boxes or small sized boxes (6), construction paper and scraps, cottons balls, string, glue, scissors, and markers

Lesson 7: The Water Cycle

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) describe the water cycle in terms of evaporation, condensation, and precipitation;
(2) describe the ways in which energy from the sun affects weather conditions (e.g., evaporation of water results in condensation, which in turn results in precipitation);

Developing Skills of Inquiry, Design, and Communication

(3) communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labelled diagram of the water cycle);

Values and Attitudes

(4) develop feelings of self-worth which may be demonstrated by cheerfulness, participation, risk-taking, volunteering or accepting challenges (self-esteem);
(5) pursue a problem or task to its completion (perseverance).

Planning Notes:

- review the water cycle and clouds
- locate overhead projector and transparency *Weather*, p. 2
- locate frying pan, small cooking pot, water, hot plate and ice for demonstration

Content:

Introduction

The precipitation that accompanies cold, warm, and occluded fronts makes up one part of the water cycle. Water on the earth continually changes from one form to another through condensation, precipitation, and evaporation. This endless change of water from one form to another is called the water or hydrologic cycle.

The Water Cycle and Clouds

Clouds play an important role in the water cycle. If the air in clouds has high relative humidity, then water vapour condenses on cloud droplets. As these droplets become heavier they form raindrops. If the water in the clouds is below the freezing temperature, then ice crystals and supercooled droplets in these clouds form snowflakes. Most of the precipitation produced by clouds falls into the oceans that make up 70% of the earth's surface. In addition, the oceans contain 97% of the water found on earth. The remaining 3% consists of fresh water found in ice caps, glaciers, rivers, lakes, and ground water. All the fresh water eventually flows into the oceans. Because of these factors, the oceans provide most of the water vapour in the air. The sun's heat energy changes water (a liquid) from the oceans into water vapour (a gas) through a process called evaporation. As the water vapour in the air is cooled, it condenses into water droplets and the cycle continues.

Teaching and Learning Strategies:

- review cold, warm, and occluded fronts

- ask students the following: Where does the precipitation (rain or snow) in fronts come from?
- discuss water cycle, emphasizing the role of the sun, using transparency from *Weather*, p. 2

- demonstrate this using frying pan, cooking pot, and hot plate
- place water in bottom of frying pan
- boil water over hot plate
- have students observe what happens
- ask the following: What is another name for steam? What is the change from water (liquid) to gas (water vapour) called? (evaporation)
- place ice in small cooking pot
- hold small cooking pot over top of boiling water
- have students observe what happens
- ask the following: What happened, at first, on the bottom of the cooking pot? What is this change from a gas (water vapour) to water (liquid) called? (condensation) What happened a little while later? (drops of water fell into the frying pan) What is this process called? (precipitation)

- have students make a diagram of the water cycle (including the sun) in their notebooks, label the parts of the water cycle, and draw arrows to show the movement of water

- have students write a description of the water cycle in notebooks to accompany the diagram

Assessment and Evaluation:

(1), (2) and (3) water cycle diagram and written description using rubric; (4) and (5) observations using anecdotal comments, eg., shows cheerfulness, shows participation, shows risk-taking, shows volunteering or accepting challenges, and completes tasks independently

Resources:

Print Materials: Ganeri, A. (1987). *Weather Facts*; Kahl, J. D. (1992). *Wet Weather*; Mason, J. (1988). *Weather and Climate*.

Creative Teaching Press. (1995). *Investigations in Science Weather*; Milliken General Science Transparency/Reproducible Books. (1986). *Weather*.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*.

Manipulatives: overhead projector, transparency *Weather*, p. 2

Lesson 8: Clouds and Precipitation

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) explain the formation of clouds and the effects of different cloud formations on weather and climate (e.g., create a model of a cloud in a jar and relate it to the water cycle; describe the relationship between the formation of cumulonimbus clouds and thunderstorms);

Developing Skills of Inquiry, Design, and Communication

(2) communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labelled diagram of the water cycle);

Values and Attitudes

(3) show initiative in beginning tasks, working independently and solving problems (self-reliance).

Planning Notes:

- review cloud formation, cloud types, and precipitation
- locate overhead projector, transparencies *Weather*, p. 3 and 4, and *Weather* reproducibles 2b, 3a and 3b
- create note on cloud type and precipitation

Content:

Introduction

The Northern Ojibway and Cree and other keen observers of nature used clouds as a way of forecasting the weather. Specific types of clouds suggest the approach of cold, warm, and occluded fronts. At the advancing edge of a cold front, cumulus clouds begin to develop followed by cumulonimbus clouds. As the cold front passes these clouds disappear and a few cumulus clouds remain. At the leading edge of a warm front, wisps of cirrus clouds appear first. Cirrostratus, altostratus, and nimbostratus clouds follow soon after. Occluded fronts often show a combination of clouds commonly found in cold and warm fronts.

Cloud Formation

All clouds are formed in the same way. Clouds form through a process called condensation, by which water vapour (a gas) changes into water (a liquid). For condensation to occur, the air must have high relative humidity, small particles on which water vapour can condense, and cooling air. The air cools by moving over a cold surface or by lifting due to frontal movement. When the air cools, water vapour attaches to small particles called condensation nuclei and forms small droplets of water. This results in the formation of cloud droplets or drizzle, but not necessarily rain or snow. As the air continues to cool, the amount of visible cloud droplets increases making clouds.

Cloud Types

Meteorologists describe clouds by their appearance and their height above the ground. Using appearance, people who study the weather divide clouds into three families: (1) cirrus or wispy,

feathery clouds; (2) cumulus or puffy clouds; and (3) stratus or layered clouds. Using height above the ground and appearance, meteorologists have named 10 cloud types. These cloud types, arranged from the top of the troposphere to the bottom are as follows: cirrus, cirrostratus, cirrocumulus, altostratus, altocumulus, stratocumulus, stratus, nimbostratus, cumulus, and cumulonimbus.

Precipitation

Knowing specific cloud types provides information on the form of precipitation that may come from them. The following chart shows the cloud types and associated precipitation:

Cloud Type	Form of Precipitation
stratus and stratocumulus	drizzle—very small droplets of water (less than 0.5mm) freezing drizzle—drizzle that freezes on impact
altostratus and nimbostratus	rain—large water droplets (greater than 0.5 mm) snow—clusters of white or translucent ice crystals
altocumulus, cumulus, and cumulonimbus	rain showers—rain that starts and stops suddenly snow showers—snow that starts and stops suddenly
cumulonimbus	hail—round balls of ice
any rain producing cloud	ice pellets—raindrops frozen into ice snow pellets—snow covered in ice

Teaching and Learning Strategies:

- review the water cycle and clouds
- handout *Weather*, p. 2b reproducible to students
- discuss cloud formation
- note that water on the earth’s surface becomes water vapour through evaporation
- have students complete *Weather*, p. 2b reproducible in large group with teacher
- take students outside and ask them to observe and identify any clouds in the sky
- or have students observe and identify clouds from classroom windows
- discuss cloud types
- illustrate with transparencies *Weather*, p. 3 and 4
- have students complete *Weather* reproducibles 3a and 3b independently or in pairs
- explain that the Northern Ojibway and Cree were/are keen observers of nature and used clouds as a way of forecasting the weather
- ask students the following: Why was and still is important?
- hand out note on cloud type and precipitation

–have students read cloud type or form of precipitation and ask questions on them, eg., What type of precipitation do stratus and stratocumulus clouds bring? What kinds of clouds bring hail? etc

–have students paste (staple) reproducibles and note on cloud type and precipitation in notebooks

Assessment and Evaluation:

(1) and (2) questions and answers on Weather reproducible 2b and classroom question using marking scheme; (3) *Weather* reproducibles 3a and 3b using anecdotal comments, e.g., shows initiative in beginning tasks, working independently and solving problems

Resources:

Print Materials: Cosgrove, B. (1991). *Weather*; Kahl, J. D. (1992). *Wet Weather*; Minister of Supply and Services. (1976). *Weather Ways*.

Milliken General Science Transparency/Reproducible Books. (1986).

Weather.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*.

Lesson 9: Thunderstorms

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) explain the formation of clouds and the effects of different cloud formations on weather and climate (e.g., create a model of a cloud in a jar and relate it to the water cycle; describe the relationship between the formation of cumulonimbus clouds and thunderstorms);

Developing Skills of Inquiry, Design, and Communication

(2) communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labelled diagram of the water cycle);

Values and Attitudes

(3) evaluate the outcomes of a scientific investigation (critical mindedness);

(4) control their actions or feelings which may be demonstrated by listening attentively, observing quietly, asking questions properly, and participating effectively (self-control).

Planning Notes:

- review thunderstorms and lightning and thunder
- locate long balloons for demonstration
- ensure poster paper (11x17) and markers are available

Content:

Introduction

The formation of cumulonimbus clouds sometimes leads to the development of thunderstorms. These storms happen quite frequently in northern Ontario.

Thunderstorms

Thunderstorms form when cold fronts move quickly through an area of warm moist air or when isolated moist air masses heat up in the daytime. In the latter, thunderstorms form in the afternoon and early evening on hot, summer days. As the daytime air heats up, it rises, cools and forms cumulus clouds. As strong updrafts of warm moist air reach higher into the atmosphere, these updrafts produce huge cumulonimbus clouds and precipitation. This precipitation, heavy rain or hail, causes downdrafts leading to high winds. In northern Ontario, thunderstorms do not usually last longer than an hour from beginning to end.

Lightning and Thunder

Lightning and thunder accompany thunderstorms. Lightning occurs when a positive charge accumulates on the top of cumulonimbus clouds and a negative charge develops at the base. The discharge or release of electricity contained in these clouds causes lightning. Most lightning takes place between these clouds and the ground, but may take place within them. Thunder results from the air heated by the lightning as it releases its charge. As the heated air quickly expands outwards, it crashes into the surrounding cold air creating a wave that has the sound of thunder.

Teaching and Learning Strategies:

- review cloud formation, cloud types, and precipitation

- discuss thunderstorms
- ask students the following: When do thunderstorms occur? How long do thunderstorms usually last?
- have students describe the formation of thunderstorms with a diagram or note using the following words (placed on chalk board): updrafts, cumulus clouds, warm moist air, cumulonimbus clouds, precipitation, heavy rain, hail, downdrafts, high winds.

- discuss lightning and thunder
- demonstrate this using carpet or two long balloons
- have student rub feet on carpet
- darken room and have student touch metal doorknob or other piece of metal
- or have student take two long balloons and rub them over their clothing without letting them go or touching each other
- darken room and have student bring balloons close together slowly without touching
- have students observe what happens (spark or flash of light)
- explain what happens

- discuss thunderstorm safety by asking students the following questions: Is it safe to swim or boat during a thunderstorm? What should you do if you are caught outside in an open area during a thunderstorm? Would you be safer in a forest or in an open area? Should you seek shelter under a lone tree? Is it safe to use electrical equipment during a thunderstorm?
- place responses on chalk board
- have students design a poster on thunderstorm safety rules to share with other students in the school

- have students fold and paste (staple) poster in notebooks

Assessment and Evaluation:

(1) and (2) diagram or note on thunderstorms using marking scheme, and thunderstorm safety rules; (3) and (4) large group observations using rubric (rarely, sometimes, usually, consistently), e.g., draws logical conclusions from outcomes, listens attentively, observes quietly, asks questions properly, and participates effectively

Resources:

Print Materials: Cosgrove, B. (1991). *Weather*; Ganeri, A. (1987). *Weather Facts*. Carson-Dellosa Step-by-Step Science Series. (1995). *Weather & Climate*; Creative Teaching Press. (1995). *Investigations in Science Weather*; The Solski Group. (1999). *Weather*; S & S Learning Materials. (1991). *All About the Weather*.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*.

Web Sites: www.weather.about.com/cs/thunderstorms
www.mb.ec.gc./air/severewthr/ak00s09.en.html

Manipulatives: long balloons, poster paper (11x17) and markers

TWO: Weather Investigations and Forecasting

Overall Expectation

By the end of this section, students will:

- investigate the major climatic factors associated with weather, and design, construct, and test a variety of instruments for recording various features of the weather.

Overview

The weather instruments and forecasting section begins with an examination of weather information gathering, and the how meteorologists make weather forecasts from this information. Next, weather observation stations and the variety of weather instruments that volunteer weather observers use are discussed.

Following this, weather investigations involving the construction, demonstration, and testing of student-made weather instruments are presented. Subsequently, an inquiry into the scientific way of knowing and investigations using student-made or purchased instruments are dealt with. In addition, conventional science weather forecasting is covered using weather station observations and weather system maps. This section ends with an explanation of Native ways of knowing and an investigation of traditional Northern Ojibway and Cree weather forecasting expressions.

Lesson Titles and Sequence

Lesson 1: Weather Information Gathering and Forecasting

Lesson 2: Weather Station Instruments

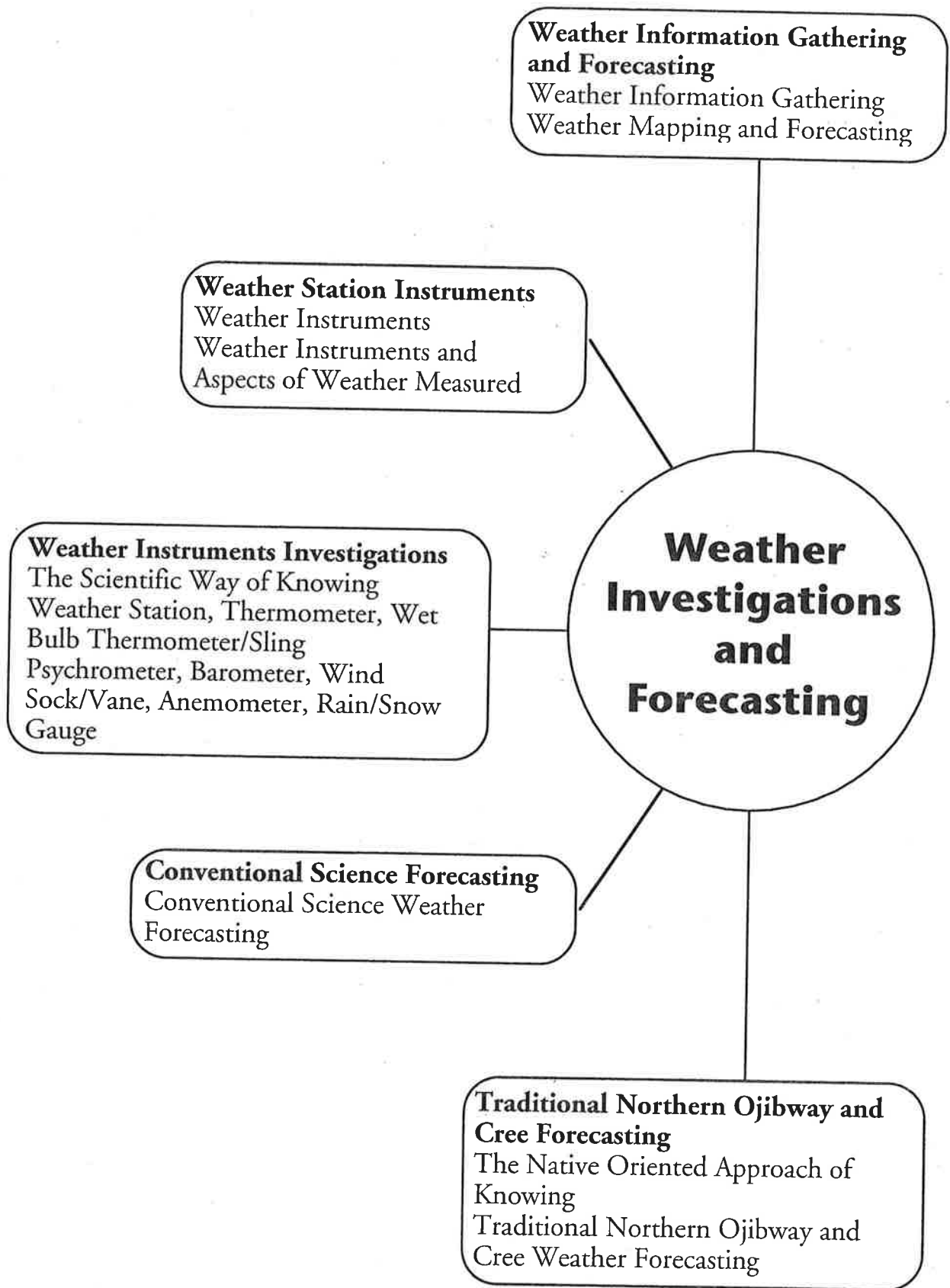
Lesson 3: Weather Instruments Investigations

Lesson 4: Conventional Science Forecasting

Lesson 5: Traditional Northern Ojibway and Cree Forecasting

Planning Notes

- review entire section (sub-unit) and ensure all materials and equipment are available prior to beginning this section
- contact elders or weather resource people in advance of their appearance in class
- invite other classes and parents to see weather station instruments, investigations, and forecasting techniques upon completion of this section
- develop a summative weather investigations and forecasting test on students demonstrating student-made or purchased weather instruments, presenting weather investigations, explaining science forecasting, or describing traditional Northern Ojibway and Cree forecasting to other classes and parents



Lesson 1: Weather Information Gathering and Forecasting

Specific Expectations:

The students will be able to

Relating Science and Technology to the World Outside the School

(1) explain how advances in technology and science have enabled humans to make predictions about the weather (e.g., microwave beams are used to reflect cloud cover; satellite images of the earth allow us to track weather patterns on a larger scale than was previously possible);

Values and Attitudes

(2) learn that science and technology is open-ended, constantly changing, empirical and humanistic (reality orientation);

(3) show a desire to work hard with steady, careful effort (diligence).

Planning Notes:

- review content on weather information gathering and weather mapping and forecasting
- locate weather system maps (from Lesson 5 Highs and Lows) or obtain current maps
- locate overhead projector and transparency/reproducible *Weather*, p. 11
- create true or false statements for weather information gathering worksheet

Content:

Introduction

Planetary-scale and large-scale weather systems occur across continents, countries, and provinces. Collecting, analyzing, and exchanging information on these systems requires the cooperation of many people and nations. Whether it's right or not, improvements in weather information gathering have produced more accurate weather forecasts.

Weather Information Gathering

Approximately 10,000 weather stations around the world gather information on weather systems and on the state of the air. Satellites, weather balloons, radar, airplanes, ships, ocean weather buoys, and volunteer weather observers collect weather information.

Polar-orbiting and geostationary satellites provide information on cloud patterns in weather systems that cannot be observed from the earth's surface. Polar-orbiting satellites (NOAA) circle the earth in a north-south direction. These satellites orbit between 800 km and 1100 km above the earth's surface and photograph a strip 3,500 km wide. Geostationary satellites (GEOS) remain stationary above the equator; they orbit at the same rate as the earth rotates. These satellites orbit about 36,000 km above the earth's surface and photograph large areas of the hemisphere. Most satellite photographs or images, such as those seen on television, come from geostationary satellites. Images showing cloud patterns indicate the development and movement of lows, highs, and fronts. These images allow weather forecasters to make predictions 24 or 48 hours ahead.

Weather balloons supply information on the state of the atmosphere at different heights above the earth's surface. These balloons carry instrument packages called radiosondes that hold weather instruments used to measure air temperature, moisture, and pressure. As these balloons rise in the atmosphere, they send data transmissions to weather stations on the ground. Once weather balloons reach a height of 30–40 km, they burst and drop back to the earth's surface by parachute.

Radar gives information on areas of precipitation and the movement of the air in weather systems. Weather stations send two kinds of radar: reflected and Doppler. Reflected radar monitors returning radar signals reflected from snow, rain or hail. This type of radar reveals areas of precipitation up to 400 km from the station. Doppler radar monitors changes in the movement of rain, snow or dust (the Doppler effect). This type of radar recognizes the movement of precipitation towards or away from the weather station to a distance of 200 km. Reflected and Doppler radar allows weather forecasters to determine the size, strength, and direction of approaching storms.

Airplanes, ships, and ocean weather buoys yield information on the state of the air over the oceans and at sea. Commercial aircraft and oceangoing vessels report weather information during their travels, while ocean buoys floating in ocean currents transmit data about the weather at sea level.

Weather Mapping and Forecasting

All the weather information collected by satellites, weather balloons, radar, airplanes, ships, ocean weather buoys, and volunteer weather observers is sent to supercomputers around the world. One of these supercomputers is operated and maintained in Dorval, Quebec. These computers use mathematical models to analyse weather information and produce weather maps that plot temperature, humidity, air pressure, wind speed, wind direction, cloud cover, and precipitation. The accuracy of these weather maps varies due to incomplete information, human errors, and technical errors. Furthermore, the mathematical models used to develop weather maps only approximate the state of the atmosphere.

The weather maps produced display high and low pressure areas marked with an H or L. Thin lines or isobars found on weather maps represent areas of the same air pressure joined together. Isobars close together suggest strong winds. Bold lines with triangles show cold fronts, while lines with semicircles symbolize warm fronts. The direction of the triangles and semicircles indicates the direction of frontal movement. Occluded fronts are drawn with triangles and semicircles facing in opposite directions.

It is from these weather maps that meteorologists at the Meteorological Service of Canada (MSC), using experience and intuition, make predictions on expected future weather conditions. Environment Canada issues these predictions as weather forecasts, watches, warnings, and advisories to the public and various organizations such as The Weather Network™, newspapers, radio and television stations. Short range forecasts are the most accurate, while long range forecasts (6–10 days) are less accurate. Monthly and seasonal forecasts are even less accurate, but provide information on general trends, e.g., wetter or drier than normal conditions. Advances in technology and science have made predicting the weather easier and have made weather forecasts more accurate.

Teaching and Learning Strategies:

- remind students during the unit that each student will read one book from classroom or school library on weather and put their name, title of book, and author on giant thermometer when they have completed reading the book of their choice
- explain unit title: *Weather, It's Right or Not* as it relates to this section
- describe entire section to students
- have students examine current weather system map from newspaper or from the internet www.theweathernetwork.com/wmaps/index.asp see system maps: short term and long term under active weather (beside s and l term) select weather system or maps from Lesson 5: Highs and Lows
- review weather symbols
- ask students the following: Where do meteorologists get this information from?
- place responses on chalk board
- discuss weather information gathering e.g., satellites, weather balloons, radar, airplanes, ships, and ocean weather buoys
- illustrate with overhead transparency/reproducible *Weather*, p. 11
- have students complete true or false statements on weather information gathering worksheet
- explain what happens with all of the weather information collected
- show enlarged maps from newspaper or from the internet www.theweathernetwork.com/wmaps/index.asp see icon maps: under current and short term select current Canadian
- ask students the following: What do meteorologists do with this information?
- describe the different kinds of predictions emphasizing forecasts
- place the following question on chalk board: Has technology and science made predicting the weather easier and forecasts more accurate? Explain your answer, whether, it's right or not. (Students may wish to describe the technology and people involved with predicting and forecasting the weather.)
- have students answer question in their notebooks:
- have students paste weather information gathering worksheet in notebooks

Assessment and Evaluation:

(1) true or false statements on weather information gathering worksheet and technology and science answer using marking scheme; (2) and (3) observations using anecdotal comments, e.g., shows a desire to learn that science and technology is open-ended, constantly changing, empirical and humanistic through listening and speaking as a member of a large group; shows a desire to work hard with steady, careful effort

Resources:

Print Materials: Cosgrove, B. (1991). *Weather*; Ganeri, A. (1987). *Weather Facts*; Kahl, J. D. (1992). *Wet Weather*; Mason, J. (1988). *Weather and Climate*.

Milliken General Science Transparency/Reproducible Books. (1986).
Weather.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*.

Web Sites: www.theweathernetwork.com/wmaps/index.asp

Manipulatives: weather system map from newspaper or internet, overhead projector, and transparency/reproducible *Weather*, p. 11

Lesson 2: Weather Station Instruments

Specific Expectations:

The students will be able to

Developing Skills of Inquiry, Design, and Communication

(1) design, construct, and test a variety of weather instruments (e.g., weather vane, anemometer, rain gauge, wind sock, hygrometer);

Values and Attitudes

(2) pursue a problem or task to its completion (perseverance);

(3) work together effectively (cooperation);

(4) show concern for safety (safety-mindedness).

Planning Notes:

- review content on weather instruments
- locate overhead projector and transparencies/reproducibles *Weather*, pp. 8, 8a, 9, and 9a
- locate materials to design, construct, and test weather instruments
- locate commercial weather instruments
- prepare large weather chart on bristol board for keeping track of the weather

Content:

Introduction

Besides satellites, weather balloons, radar, airplanes, ships, and ocean weather buoys used to gather weather information, thousands of volunteer weather observers in Canada collect weather information. These volunteers use weather observation stations that contain a variety of weather instruments.

Weather Instruments

Some instruments found at weather stations are as follows: thermometers, wet bulb thermometers, hygrometer or sling psychrometers, barometers, wind socks or vanes, anemometers, Campbell Stokes recorders, and rain/snow gauges. Each of these weather instruments measures a particular aspect of the atmosphere.

Weather Instruments and Aspects of Weather Measured

weather instrument	aspect of weather measured	units
thermometer	temperature	degrees Celsius (°C)
wet bulb thermometer/ hygrometer/sling psychrometer	moisture (humidity)	degrees Celsius (°C)
barometer	pressure	millibars (mb)
wind sock or vane	wind direction	NSEW
anemometer	wind speed	kilometres per hour (kph)
Campbell Stokes recorder	sunshine	hours (h)
rain/snow gauge	precipitation	millimetres (mm)

All these weather instruments are kept inside ventilated shelters off the ground.

Teaching and Learning Strategies:

- review content on weather information gathering and weather mapping and forecasting
- explain that volunteer weather observers also collect weather information from weather stations
- ask students the following: What weather instruments are found at weather stations?
- place responses on chalk board
- discuss weather instruments and ask students: What aspect of weather is measured? In what units are readings measured?
- illustrate with overhead transparencies *Weather*, pp. 8 and 9 and commercial weather instruments
- have students complete reproducibles *Weather*, pp. 8a and 9a, omit statement 2 on 8a
- have students paste reproducibles in notebooks
- explain that the class will be making weather instruments for a weather station of their own
- in small groups have students design and construct one of the following: thermometer, wet bulb thermometer/hygrometer/sling psychrometer, barometer, wind sock/vane, anemometers, and rain/snow gauge for class weather station
- in small groups have students test their weather instruments against purchased

commercial weather instruments

—several days of observations may be required to complete this

thermometer

- calibrate student-made thermometer with commercial thermometer by determining high and low temperature and predicting intervals between;
- compare temperature readings of student-made thermometer with commercial thermometer;

wet bulb thermometer/hygrometer/sling psychrometer

- compare moisture readings of student-made wet bulb thermometer/hygrometer/sling psychrometer with commercial wet bulb thermometer/hygrometer/sling psychrometer;

barometer

- compare air pressure readings of student-made barometer with commercial barometer;

wind sock/vane

- compare wind direction readings of student-made barometer with commercial wind sock/vane

anemometer

- compare wind speed of student-made anemometer with commercial anemometer;

rain/snow gauge

- compare rainfall registered by different-sized student-made rain gauges and commercial rain gauge

—have students demonstrate and explain how their models are used emphasizing aspect of weather measured and units used

—post weekly weather chart

—have students take turns reading and recording information about the weather from commercial weather station instruments for the remainder of the unit, just like volunteer weather observers

—include date and time of observation, temperature, air pressure, moisture (humidity), estimated wind speed, wind direction, kinds of clouds, and kind and amount of precipitation on weather chart,

Assessment and Evaluation:

(1) small group weather instrument design, construction, testing, and demonstration using marking scheme; (2) and (3) small group observations using diagnostic checklist, e.g., shows positive attitude with others, listens effectively, speaks effectively, interacts with others, assumes group roles, completes group tasks effectively and efficiently; (4) small group observations using checklist, e.g., develops the habits of mind required for safe participation in science and technology activities by maintaining a well-organized and uncluttered work space, follows established safety procedures, identifies possible safety concerns, suggests and implements appropriate safety procedures, carefully following the instructions and

example of the teacher, consistently shows concern for their safety and that of others

Resources:

Print Materials: Tannenbaum, B., and H. Tannenbaum. (1989). *Making And Using Your Own Weather Station*.

Carson-Dellosa Step-by-Step Science Series. (1995). *Weather & Climate*;
Milliken General Science Transparency/Reproducible Books. (1986). *Weather*; S & S Learning Materials. (1991). *All About the Weather*;

Multimedia and Software:

Web Sites: Weather Instruments and Tools

<http://www.miamisci.org/hurricane/weathertools.html>

Making an Air Thermometer

<http://www.allstar.fiu.edu/aero/Experiment9.htm>

Making a Anemometer

<http://www.allstar.fiu.edu/aero/Experiment10.htm>

Making a Wind Vane

<http://www.allstar.fiu.edu/aero/Experiment11.htm>

Making a Weather Vane

<http://www.allstar.fiu.edu/aero/Experiment12.htm>

Making a Windsock

<http://www.allstar.fiu.edu/aero/Experiment13.htm>

Making a Barometer

<http://www.allstar.fiu.edu/aero/Experiment14.htm>

Making a Hygrometer

<http://www.allstar.fiu.edu/aero/Experiment15.htm>

Make Your Own Weather Station

<http://www.miamisci.org/hurricane/weatherstation.html>

Manipulatives: overhead projector and transparencies/reproducibles *Weather*, pp. 8, 8a, 9, and 9a, weather instrument materials dependent on resources used, commercial weather instruments, bristol board

Lesson 3: Weather Instruments Investigations

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) predict local weather patterns using data from their own observations of weather and from weather reports;

Developing Skills of Inquiry, Design, and Communication

(2) formulate questions about and identify needs and problems related to objects and events in the environment, and explore possible answers and solutions (e.g., test a variety of fabrics for their waterproofing or insulating properties);

(3) plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;

(4) compile data gathered through investigation in order to record and present results, using tally charts, tables, and labelled graphs produced by hand or with a computer (e.g., record both qualitative and quantitative data from observations of weather over a period of time; use a thermometer to read and record the results);

(5) communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labelled diagram of the water cycle);

(6) use appropriate vocabulary, including correct science and technology, in describing their investigations and observations (e.g., use terms such as *temperature*, *precipitation*, *humidity*, *wind chill factor*, *barometric pressure*, and *cloud cover*);

Values and Attitudes

(7) examine facts honestly and impartially to form conclusions (objectivity);

(8) recognize and accept accountability to themselves and others for decisions made and action taken (responsibility to themselves and others).

Planning Notes:

- review weather instruments investigations and the scientific way of knowing

Content:

Introduction

Many weather investigations follow the scientific way of knowing based on the accumulation of facts and the relationships among these facts. Knowledge derived from these facts and relationships is called scientific knowledge.

The Scientific Way of Knowing

The scientific way of knowing emphasizes careful observation and experimentation. Observations based on particular experiences may lead to the generation of questions about the world. From these questions, investigations or experiments, consisting of hypotheses, materials, procedures, results, and conclusions, are developed.

Teaching and Learning Strategies:

—hold student-made or commercial weather instruments up and ask the following:
What aspect of weather does this measure? In what units are readings measured?

—discuss scientific way of knowing emphasizing observation and the scientific method

—organize students in small groups for investigations

—ensure each group of students uses different weather instrument than used in Lesson 2: Weather Station Instruments

—have students gather and order data from one of the weather investigations listed below

thermometer—temperature

Q: When do the highest and lowest temperatures occur daily?

- record temperature every hour from dawn (sunrise) to dusk (sunset) on weekend
- record high and low temperatures and cloud conditions over a period of several days or weeks and use these observations to predict change in weather

wet bulb thermometer/hygrometer/sling psychrometer—air moisture or relative humidity

Q: Does a change in air moisture or relative humidity predict a change in the weather?

- calculate air moisture or relative humidity using relative humidity chart (most charts are in ° F)
- record relative humidity over a period of several days or weeks and use these observations to predict change in weather

Q: Does the relative humidity change from place to place?

- record and compare relative humidity at various places nearby

barometer—air pressure

Q: Does a change in air pressure predict a change in the weather?

- record air pressure over a period of several days or weeks and use these observations to predict change in weather

Q: What is the relationship between air pressure and a change in elevation?

- estimate elevation at different places (e.g., lake shore, river bank, hills) using commercial barometer knowing pressure falls 0.25 mm for each three m above sea level

wind sock/vane—wind direction

Q: Does change in wind direction predict a change in the weather?

- record wind direction over a period of several days or weeks and use these observations to predict change in weather

anemometer—wind speed

Q: Does wind speed affect how fast the weather changes?

- estimate wind speed using the Beaufort Wind Scale
- record wind speed over a period of several days or weeks and use these observations to predict change in weather

rain/snow gauge—precipitation

Q: Does a change in cloud formation predict a change in the weather?

•record cloud types and use these observations to predict change in weather

Q: What forms of precipitation do different cloud types produce?

•read and record precipitation daily and observe types of clouds associated with it

–have students record data in notebooks using tally charts, tables, or labelled graphs

–have students communicate procedures and results of these investigations in written form and to the class

–all student notebooks should contain the following scientific method: question, e.g., Q: When do the highest and lowest temperatures occur daily?; hypothesis, e.g., highest temperature occurs at noon, lowest temperature occurs at midnight; materials, e.g., thermometer; procedures, e.g., record temperature every hour from dawn (sunrise) to dusk (sunset) on weekend; data, e.g., table showing time and temperature; results, e.g., temperature increased from dawn to 2:00 pm and then decreased to dusk; conclusion, e.g., highest temperature at 4:00 pm and lowest temperature at 7:00 am

Assessment and Evaluation:

(1), (2), (3), (4), (5), and (6) small group weather investigation using marking scheme or rubric, e.g., question, hypothesis, materials, procedures; data, results, conclusion, and presentation to class; (7) and (8) small group observations using anecdotal comments, e.g., forms logical conclusions from data gathered honestly and impartially through investigation; uses imagination by becoming resourceful, innovative, and intuitive; shows accountability for listening efficiently and effectively to others and following plans of action

Resources:

Print Materials: Tannenbaum, B., and H. Tannenbaum. (1989). *Making And Using Your Own Weather Station*.

Milliken General Science Transparency/Reproducible Books. (1986).

Weather; The Solski Group. (1999). *Weather*.

Multimedia and Software:

Web Sites:

Manipulatives: commercial weather instruments, Beaufort Wind Scale, relative humidity chart

Lesson 4: Conventional Science Forecasting

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) predict local weather patterns using data from their own observations of weather and from weather reports;

Developing Skills of Inquiry, Design, and Communication

(2) compile data gathered through investigation in order to record and present results, using tally charts, tables, and labelled graphs produced by hand or with a computer (e.g., record both qualitative and quantitative data from observations of weather over a period of time; accurately use a thermometer to read and record the results);

(3) communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labelled diagram of the water cycle);

(4) use appropriate vocabulary, including correct science and technology, in describing their investigations and observations (e.g., use terms such as *temperature, precipitation, humidity, wind chill factor, barometric pressure, and cloud cover*);

Values and Attitudes

(5) recognize, value and enjoy another's language, traditions, and culture (appreciation for another's culture);

(6) control their actions or feelings which may be demonstrated by listening attentively, observing quietly, asking questions properly, and participating effectively (self-control);

(7) use resources together (sharing).

Planning Notes:

- review scientific way of knowing and weather forecasting
- pre-record weather broadcast from local TV news station
- locate TV and VCR
- locate weather system maps from newspaper or internet for three or four days

Content:

Introduction

Besides weather forecasts provided by Environment Canada, individuals can create forecasts from weather station observations and by examining the movement of weather and weather patterns on weather system maps from newspapers or the Internet.

Teaching and Learning Strategies:

- review scientific way of knowing (method)
- explain that this is only one way of knowing about the world, but it should be

appreciated for some of its advances in technology and science

–show TV news weather broadcast

–ask students to describe what is included in a typical weather broadcast, e.g., temperature ($^{\circ}$ C), relative humidity (%), wind (direction and speed), probability of precipitation (POP), cloud cover

–have students make weather predictions based on weather station observations from weather chart for three or four days

–or make weather predictions based on examining the movement of weather and weather patterns on weather system maps from newspaper or internet for three or four days

–have students compile data

–all student notebooks should contain weather forecast for the next day, e.g., temperature ($^{\circ}$ C), relative humidity (%), wind (direction and speed), probability of precipitation (POP), cloud cover in table or written form

–have students communicate their predictions (weather forecasts) either orally similar to those given on news broadcasts to the whole group, or in written form similar to that found in newspapers or on the internet

–in pairs have students compare weather predictions based on weather station observations with those based on examining the movement of weather and weather patterns on weather system maps from newspaper or internet

Assessment and Evaluation:

(1), (2), (3), and (4) weather forecast using marking scheme or rubric, e.g., temperature ($^{\circ}$ C), relative humidity (%), wind (direction and speed), probability of precipitation (POP), cloud cover in table or written form; (5) and (6) observations using anecdotal comments, e.g., recognizes, values, and enjoys the scientific way of knowing; listens attentively, observes quietly, asks questions properly, and participates effectively; and shares materials

Resources:

Print Materials: Wyma, B. (1995). *Investigations in Science: Weather*; Froman, J. (1996). *Activities for Grades 3–6 Weather*.

Multimedia and Software:

Web Sites: www.theweathernetwork.com/wmaps/index.asp

Manipulatives: weather broadcast from local TV news station, TV and VCR, weekly weather chart, weather system maps from newspaper or internet

Lesson 5: Traditional Northern Ojibway and Cree Forecasting

Specific Expectations:

The students will be able to

Understanding Basic Concepts

(1) predict local weather patterns using data from their own observations of weather and from weather reports;

Developing Skills of Inquiry, Design, and Communication

(2) compile data gathered through investigation in order to record and present results, using tally charts, tables, and labelled graphs produced by hand or with a computer (e.g., record both qualitative and quantitative data from observations of weather over a period of time; accurately use a thermometer to read and record the results);

(3) communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labelled diagram of the water cycle);

(4) use appropriate vocabulary, including correct science and technology, in describing their investigations and observations (e.g., use terms such as *temperature, precipitation, humidity, wind chill factor, barometric pressure, and cloud cover*);

Values and Attitudes

(5) listen to, be considerate of, and honour themselves (respect for themselves);
or listen to, be considerate of, and honour everything in the world (respect for the Creator);

or listen to, be considerate of, and honour parents around them (respect for parents);

or listen to, be considerate of, and honour elders around them (respect for elders);

or listen to, be considerate of, and honour others around them (respect for others);

or listen to, be considerate of, and honour plants and animals around them (respect for plants and animals);

or listen to, be considerate of, and honour the land around them (respect for the environment);

(6) recognize, value and enjoy their own language, traditions, and culture (appreciation for their culture);

(7) develop a concern for the welfare of others and working towards a common good (societal responsibility);

(8) show feelings of interest or concern which may be demonstrated by the kind treatment of others (caring).

Planning Notes:

- review Native oriented approach of knowing and traditional Northern Ojibway and Cree weather forecasting expressions
- locate elders or persons knowledgeable with life on the land and weather forecasting

Content:

Introduction

In addition to scientific knowledge, another way of knowing follows a Native oriented approach based the accumulation of wisdom and the relationships between people, animals, plants, and the environment. Knowledge acquired through wisdom and from these relationships is called traditional ecological knowledge (TEK). Conventional scientific and traditional Native approaches to understanding are equally valid ways of perceiving the world. A combination of these ways of knowing may lead to a greater understanding of the world and the weather.

The Native Oriented Approach of Knowing

The Native oriented approach of knowing stresses extended observation, imitation, and social and environmental feedback. Observations based on experiences in daily family and community life on the land may lead to continued relationships with the local environment. Imitation of bush skills and land-based activities maintains traditional ecological knowledge. Conversely, social feedback (through interactions with elders, people knowledgeable with life on the land, family members, and community members) and environmental feedback (through interactions with the land) refines this kind of knowledge. Using this holistic approach, the most important teacher is the land; however, additional teachers could be people, animals, plants, or other natural occurrences in the environment. The traditional Native approach of knowing does not need confirmation through conventional scientific methods.

Teaching and Learning Strategies:

- ask students to examine their predictions from Lesson 4: Conventional Science Forecasting
- ask students whether they're right or not and have them explain (not enough information may have been gathered to make an accurate forecast)
- describe Native oriented approach of knowing emphasizing observation, social feedback, environmental feedback, and respect
- this approach does not need to be confirmed through conventional scientific methods
- ask students the following: How did the Northern Ojibway and Cree forecast the weather?
- discuss traditional Northern Ojibway and Cree weather forecasting expressions
- have local elder or person knowledgeable with life on the land describe some Northern Ojibway and Cree weather forecasting expressions

- have students make weather predictions based on three or four traditional Northern Ojibway and Cree weather forecasting expressions listed below, e.g., *temperature, wind, precipitation, and general weather conditions*
- or make weather predictions based on three or four local student collected traditional weather forecasts from elders or persons knowledgeable with life on the land

temperature

- halo around sun is close to it indicating cold weather for four or five days
- bright halo above the sun in morning or evening indicates cold weather is coming
- bright Northern lights cover entire sky indicates that it will be extremely cold
- reddish-orange Northern lights on southern side indicates warmer weather for about three days

wind

- direction of falling stars indicates wind direction for the next day
- Northern lights moving east to west indicate wind

precipitation

- small black flies coming every day indicate rain
- cracking ice making large booming sounds indicates snow
- owls calling at night indicates snow

general weather conditions

- red sky at sunrise indicates bad weather with rain or wind
- red sky at sunset indicates good weather
- skies clearing up over the bay after being cloudy for a few days indicates clear weather

—from *Voices from the Bay*, pp 79–82

temperature

- if lard is soft, it will be warm
- if the axe is blue, it will be cold
- if the fire is white, it means it will be cold and if it's red, it will be warm
- if you see many stars at night that means it's going to be a cold night
- if you see just a few stars at night that means it's going to be warm
- when cutting wood, if it is hard to cut, there will be warm weather and if it's easy to cut, there will be cold weather

wind

- if you cut down a tree and it echoes in the north direction that's where the wind will come from
- when wind is blowing hard it will stop later
- if the wind comes in gusts from the northwest repeatedly, there will be no wind that night
- when Northern lights are on one side of the sky, the wind is from the opposite direction
- when the Northern lights are dancing it will be windy
- Northern lights in the summer or winter means the wind will pick up the next

day, and it will come from the south

–if you see a shooting star at night where it went, that's where the wind will come the next day

precipitation

–when you see Northern lights in the summer, soon after we will get rain

–if you're out at night and hear an owl you can tell it is going to snow the next day

general weather conditions

–if birds sound happy it will be a good day

–if birds don't sound happy it will be a bad day

–when wind is blowing from east to north, nice weather will continue

–when wind is blowing from west to north, bad weather will start and continue for a long time

–a bright sunset means it's going to be a good day tomorrow

–lights on each side of the sun means it's going to be bad weather the next day

–if the sun or moon has rings around them, something like the northern lights, it means bad weather will come in one or two days time, sometimes the bad weather will last a long time—about one and a half weeks

–if it's snowing in the day time, the bad weather will last a long time

–if you see the sunrise and about 10 or 15 minutes later the sun disappears, that means it's going to be a bad day

–when trees have a hard sound when the wind blows through them, there's going to be bad weather

–in open water when you see a muskrat swimming with his tail held high out of the water you know it will be stormy

–usually a rabbit doesn't walk when there's going to be bad weather . . . when he walks during bad weather there's going to be nice weather

—from *Indian Weather*

–discuss respect for all things

–have students collect information based on traditional Northern Ojibway and Cree weather forecasting expressions

–all student notebooks should contain three or four traditional Northern Ojibway and Cree weather forecasting expressions, direct observations on the land for each expression (environmental feedback), comments by elder or person knowledgeable with life on the land for each expression (social feedback), and refinements to each expression if required

–have each student communicate orally one of their predictions (weather forecasts) and findings to the class

- ask students to examine their predictions
- ask students whether they're right or not and have them explain (forecasting expressions are related to specific areas of the land and elders have noticed changes in weather conditions)

Assessment and Evaluation:

(1), (2), (3), and (4) traditional Northern Ojibway and Cree weather forecasting expressions using marking scheme or rubric, e.g., direct observations on the land (environmental feedback), comments by elder or person knowledgeable with life on the land (social feedback), and refinements; (5), (6), (7), and (8) observations using checklist, e.g., listens to, is considerate of, and honours the Creator, parents, elders, others, plants and animals, and the environment around them; recognizes, values and enjoys the Native oriented approach of knowing; develops concern for the welfare of classmates, teachers, and elders; shows feelings of concern for classmates, teachers, and elders

Resources:

Print Materials: Adult Education Class. (1974). *Indian Weather*; McDonald, M., L. Arragutainaq, and Z. Novalinga. (1997). *Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion*; Suzuki, D., and P. Knudtson. (1992). *Wisdom of the Elders*.

Multimedia and Software:

Web Sites:

Manipulatives: local elders or persons knowledgeable with life on the land and weather forecasting

THREE: Weather Conditions and Adaptations

Overall Expectation

By the end of this section, students will:

- examine how weather forecasts influence decisions concerning human activity and how humans have adapted to a variety of weather conditions.

Overview

The weather conditions and adaptations section begins with a brief description of how humans and animals adapt to changing weather conditions. Next, the influence of weather conditions on Northern Ojibway and Cree shelter building is presented. This section ends with a discussion on how weather conditions influence science and technology activities and events.

Lesson Titles and Sequence

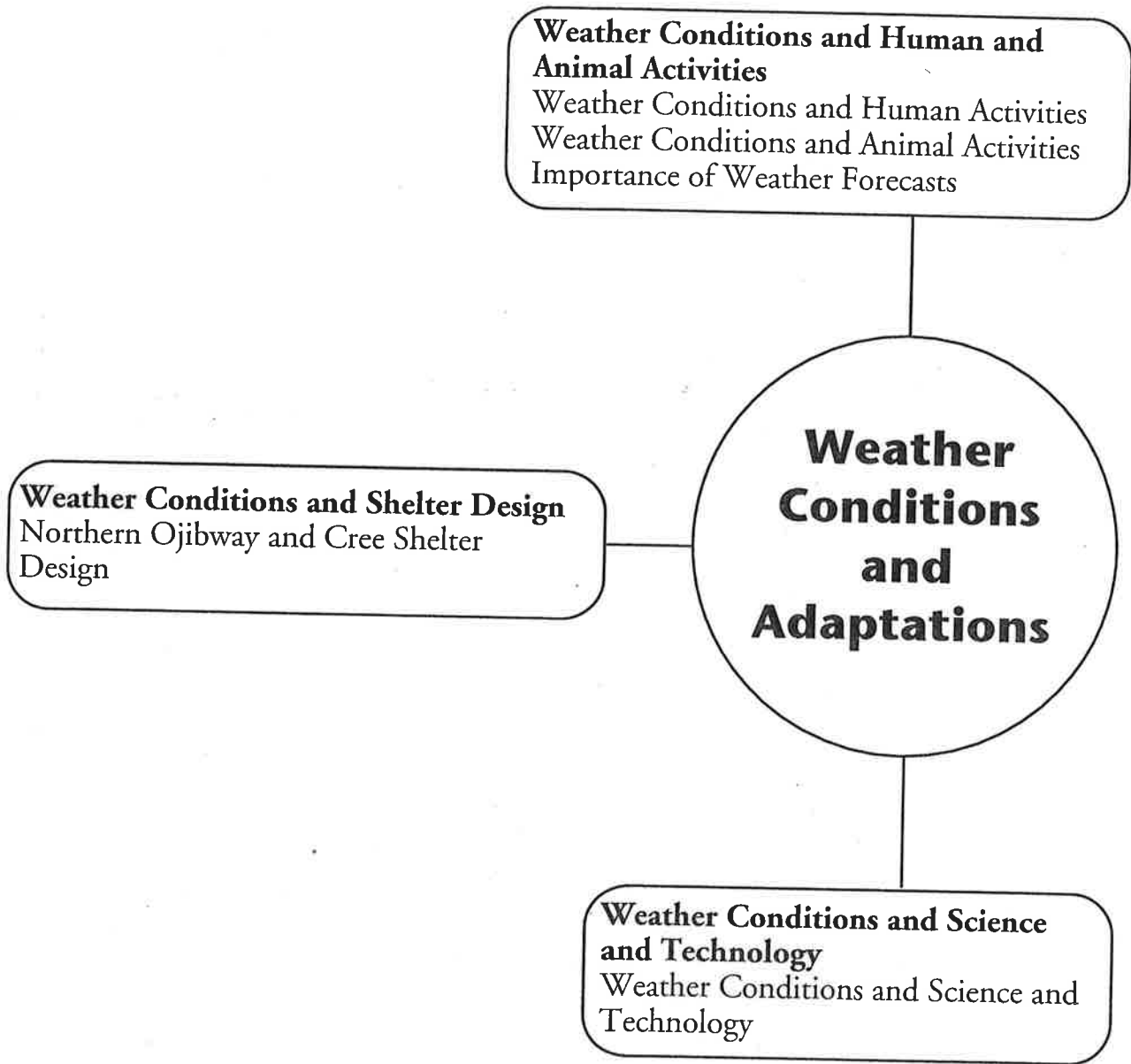
Lesson 1: Weather Conditions and Human and Animal Activities

Lesson 2: Weather Conditions and Shelter Design

Lesson 3: Weather Conditions and Science and Technology

Planning Notes

- review entire section (sub-unit) and ensure all materials and equipment are available prior to beginning this section
- develop Lesson 3: Weather Conditions and Science and Technology as a summative weather conditions and adaptations test
- create “School Name” of Meteorology certificates of graduation for each student



Lesson 1: Weather Conditions and Human and Animal Activities

Specific Expectations:

The students will be able to

Relating Science and Technology to the World Outside the School

- (1) describe ways in which weather conditions affect the activities of humans and animals (e.g., people refrain from strenuous physical activity in extreme heat; farmers plant crops when the soil is moist; animals hibernate in extreme cold);
- (2) understand and explain the importance of weather forecasts for people in certain occupations (e.g., farmers, pilots);

Values and Attitudes

- (3) feel or express thanks for the good things that the Creator has given them and others (thankfulness);
- (4) recognize and accept accountability to others for decisions made and action taken (responsibility to others).

Planning Notes:

- review weather conditions and human activities, weather conditions and animal activities, and importance of weather forecasts
- locate different kinds of weather poetry

Content:

Introduction

Weather conditions affect the activities of humans and animals whether it's right or not. Both react to changes in the weather. The weather tells humans and animals when and where to go, and what to do. However, humans and animals adapt to the weather and changing weather conditions for different reasons.

Weather Conditions and Human Activities

Humans adapt to the weather and changing weather conditions for quality of life reasons. People in warmer climates wear light loose fitting clothing to trap cool air, while those in colder climates wear heavier layered clothing or furs to keep out the cold. Extreme weather conditions, such as heat, cold, and wind, keep people indoors and prevent them from attending various activities. Airports delay departures and arrivals when storms, blizzards, or fog occurs. In addition, drivers reduce speed in response to these conditions. People board up their homes and move to safer areas before the arrival of tornadoes and hurricanes, preventing a loss of life and property.

Weather Conditions and Animal Activities

Animals adapt to changing weather conditions for survival reasons. With the onset of colder temperatures, Canada and Snow geese migrate south to areas where food is more plentiful. Caribou relocate inland from the coastal areas for shelter away from winter winds and deep snow. Moose move from lake shore and swampy areas to stretches along river banks for similar reasons. Black bears settle in dens for the winter. Other animals such as marten, beaver, otter, mink, and coloured fox remain active year round and have adapted to the changing weather conditions of

northern Ontario. Skunks and squirrels hibernate during the cold winter months. Fish stay well below the layer of ice that forms in the winter. Frogs and salamanders overwinter in the mud at the bottom of ponds and marshes. Insects move to the forest floor for protection from the colder weather.

The amount of precipitation plays a role in determining the survival of animal populations. In times when little rain falls, ponds go dry and fish die off. Muskrat populations die out due to competition for habitat or in their movement to other places to live. Conversely, small animals drown when ponds and rivers overflow during extended periods of rainfall. Larger animals, such as moose and deer, starve if too much snow falls making them unable to obtain the necessary food.

Importance of Weather Forecasts

Knowing weather conditions is important to Northern Ojibway and Cree hunters, trappers, and fishers. They need to understand weather forecasts for their livelihood and survival. Hunters, trappers, and fishers need to understand short and long range weather forecasts to bring the appropriate tools and equipment with them. In addition, they need to understand seasonal weather forecasts to ensure a good harvest.

Awareness of weather conditions is important to pilots, sailors, and farmers for their livelihood. Pilots and sailors need to understand weather forecasts for safety reasons. High winds and severe storms can cause difficulties for airplanes and ships. By avoiding these winds and storms, pilots and sailors ensure delivery of goods and services on time. Farmers need to understand seasonal forecasts to plant, spray, and harvest their crops. Adequate temperature and moisture are crucial for crop success.

Major companies have a stake in knowing seasonal weather conditions. Predictions of cold damp weather cause pharmaceutical companies to produce more cold and cough medicines. If weather conditions are favourable to increased pollen production then these companies produce more allergy medicines. Seasonal forecasts of warmer weather cause dairy companies to manufacture more ice cream.

Teaching and Learning Strategies:

–remind students during the unit that each student will read one book from classroom or school library on weather and put their name, title of book, and author on giant thermometer when they have completed reading the book of their choice

–ask students to describe how the weather and weather conditions affect them,
Whether, It's Right or Not

–describe the word adaptation

–ask students the following: Why do we adapt to changes in the weather?

–ask students several questions on ways we adapt to changes in the weather, e.g., What kinds of clothing did the Northern Ojibway and Cree use to keep out the cold in the past? What do you do when it is really hot outside? What type of weather conditions cause the school to close? the airport? etc.

-list responses for these on blackboard

-ask students the following: Why do animals adapt to changes in the weather?
-ask students several questions on ways animals adapt to changes in the weather, e.g., What do Canada and Snow geese, caribou, moose, black bears, other fur bearing animals, skunks and squirrels, fish, frogs and salamanders, and insects do when the colder temperature arrives in the fall and winter? etc.
-place responses on chalk board
-have students make a chart showing animals and adaptations made to survive in notebooks
-have students illustrate one of these animal adaptations with a drawing

-ask students the following: Why is it important for Northern Ojibway and Cree hunters, trappers, and fishers to know about weather forecasts? pilots, sailors, and farmers? major companies?
-place responses on chalk board
-have students use responses to create sentences describing the importance of weather forecasts for Northern Ojibway and Cree hunters, trappers, and fishers; for pilots, sailors, and farmers, and for major companies in notebooks

-explain that in spite of the changing weather conditions we should be thankful for what the Creator has given us, i.e., the animals and birds don't complain about weather

-read selected poems, e.g., *Weather Poems for all Seasons*
-have students create a poem on being thankful for the weather in notebooks
-have students complete draft and final copies as time permits or during free time

Assessment and Evaluation:

(1) large group oral responses on human adaptations using anecdotal comments, and animal adaptations chart with drawing using marking scheme; (2) importance of weather forecasts sentences using marking scheme; (3) poem expressing feelings of thankfulness using marking scheme; (4) large group observations using anecdotal comments, e.g., shows accountability for listening efficiently and effectively to others and following plans of action

Resources:

Print Materials: Ganeri, A. (1987). *Weather Facts*; Hopkins, L. (1994). *Weather Poems for all Seasons*; Ontario Ministry of Natural Resources. (1974). *Background Information and Approach to Policy: Northwestern Ontario*; Reidman, S. (1977). *How Wildlife Survives Natural Disasters*; Toole, S. (1985). *Moosonee District Background Information*.

S & S Learning Materials. (1991). *All About the Weather*.

Lesson 2: Weather Conditions and Shelter Design

Specific Expectations:

The students will be able to

Relating Science and Technology to the World Outside the School

(1) explain how climatic and weather conditions influence the choice of materials used for building shelters (e.g., bricks are often used in cold climates, stone and marble in warmer climates);

Values and Attitudes

(2) recognize and accept accountability to the environment for decisions made and action taken (environmental responsibility);

(3) show honesty (truthfulness);

(4) recognize, value and enjoy their own language, traditions, and culture (appreciation for their culture).

Planning Notes:

- review Northern Ojibway and Cree shelter design
- locate research materials, e.g., encyclopedias and CD-ROMs

Content:

Introduction

Climatic and weather conditions influence the choice of materials used for building shelters. In the southwestern United States, the Anasazi Indians constructed houses with stone or adobe (mud) that absorbed the daytime heat keeping the interiors of these dwellings cool. In the Arctic, the Inuit still build igloos with snow. The insulating properties of snow keep warmth inside these shelters. These Native people adapted to the weather conditions found in their environment.

Northern Ojibway and Cree Shelter Design

The Northern Ojibway and Cree used many strategies to protect themselves from the extreme weather conditions found in northern Ontario. Traditional shelters, built according to the season, used materials readily available from the land. In the fall, these people constructed shelters along western shores of lakes (away from the prevailing winds), near the base of hills, or in clearings surrounded by thick stands of trees. These shelters or earth lodges (*ashkikana*), built with closely laid poles covered with brush or grass (sod), protected its occupants from the wind. When winter came, the Northern Ojibway and Cree packed snow around the base of this lodge to improve insulation. The earth lodge remained comfortable even when temperatures fell well below zero. In the spring, the people constructed conical lodges (*migwama*) made out of 20–40 poles covered with caribou skins or brush. This type of shelter provided protection to its residents from the rain and the wind. During the hot days of summer, the occupants moved the covering aside allowing the air to circulate. Today, the Northern Ojibway and Cree live in frame houses made of conventional materials shipped in from the south.

Teaching and Learning Strategies:

–review weather conditions and human activities, weather conditions and animal activities, and importance of weather forecasts

–explain that weather conditions have influenced the choice of materials used for building shelters, e.g., Inuit snow igloos and Anasazi Indian mud shelters

–describe Northern Ojibway and Cree shelters

–ask students the following: What traditional shelters did the Northern Ojibway and Cree make in the fall? the spring? What materials were they made from? Why were these materials used? Is this good? How do these traditional shelters differ from today's houses? Why are these materials used? Is this good?

–have students research shelters past and present from encyclopedias and CD-ROMs

–have students organize information using point form notes in notebooks including name of builder, name of shelter, building materials used, and weather conditions of the area

Assessment and Evaluation:

(1) shelters and weather conditions point form notes using marking scheme; (2), (3) and (4) large group oral discussions on weather conditions and Northern Ojibway and Cree shelters past and present using anecdotal comments, e.g., recognizes Northern Ojibway and Cree accountability to the environment; accepts Northern Ojibway and Cree accountability to the environment for decisions made and actions taken; shows honesty; and recognizes and values traditional Northern Ojibway and Cree shelter design

Resources:

Print Materials: Ganeri, A. (1987). *Weather Facts*; Hollander, J. (1999). *The More We Get Together*; Honigmann, J. (1956). The Attawapiskat Swampy Cree: An Ethnographic Reconstruction in *Anthropological Papers of the University of Alaska*, various encyclopedia.

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*; McClelland & Stewart. (2000). *Canadian Multimedia Encyclopedia Plus*; Microsoft. (2000). *Microsoft Encarta 2000*.

Lesson 3: Weather Conditions and Science and Technology

Specific Expectations:

The students will be able to

Relating Science and Technology to the World Outside the School

(1) explain how weather conditions influence activities and events related to science and technology (e.g., launching the space shuttle);

Values and Attitudes

(2) recognize and accept accountability to themselves for decisions made and action taken (responsibility to themselves);

(3) recognize, value and enjoy another's language, traditions, and culture (appreciation for another's culture);

(4) recognize, value and enjoy the world in which we live (appreciation for the world around them).

Planning Notes:

- review weather conditions and science and technology
- locate "School Name" of Meteorology certificates of graduation

Content:

Introduction

In spite of modern technological advances, weather conditions influence activities and events related to science and technology.

Weather Conditions and Science and Technology

The weather affects technologically advanced equipment such as space shuttles, satellites, solar energy cells, and windmills. Strong winds and thunderstorms often delay space shuttle launches. Frequently rescheduled landings or landings at alternate sites occur for the same reasons. The sun produces solar flares that disrupt communications equipment and interfere with satellite transmissions. In addition, solar activity interferes with short wave radio reception and causes surges in power lines. Solar energy cells and collectors require bright sunny days for heat and power production. Wind farms, with large groups of windmills, require steady winds to generate electricity. Weather conditions affect all these technologies.

Teaching and Learning Strategies:

–review Northern Ojibway and Cree shelter design

–explain that weather conditions have influenced activities and events related to science and technology

–ask students the following: How does the weather affect the space shuttle? satellites? solar energy cells? windmills?

–place responses on chalk board

–have students research one of these technologically advanced pieces of equipment from encyclopedias, CD-ROMs, or the internet

–have students organize information using point form notes in notebooks including description of piece of equipment (What is it?), purpose of equipment (Why is it used?), explanation of how equipment works (How does it work?), and outline of weather conditions that affect this equipment (What weather conditions affect its use?)

–have students complete draft paragraph and final copy from these notes

–upon completion of unit present “School Name” of Meteorology certificates of graduation

Assessment and Evaluation:

(1) technological equipment and weather paragraph using marking scheme; (2), (3), and (4) observations using anecdotal comments, e.g., shows accountability for listening efficiently and effectively and following plans of action; recognizes, values, and enjoys science and technology; recognizes, values and enjoys the world in which we live

Resources:

Print Materials:

Multimedia and Software: IBM. (1999). *World Book Multimedia Encyclopedia 1.0*; McClelland & Stewart. (2000). *Canadian Multimedia Encyclopedia Plus*; Microsoft. (2000). *Microsoft Encarta 2000*.

Web Sites: <http://spaceflight.nasa.gov/>

<http://www.howstuffworks.com/space-shuttle.htm>

<http://www.noaa.gov/satellites.html>

<http://www.howstuffworks.com/satellite.htm>

<http://www.howstuffworks.com/solar-cell.htm>

<http://www.windpower.dk/>

Manipulatives: “School Name” of Meteorology certificates of graduation

Reference and Resource List

The following materials may be useful for the *Weather, It's Not Right or Not* resource and curriculum document. It is recommended that these materials be previewed prior to their use or purchase to determine grade appropriateness. Inclusion of these materials here does not suggest an endorsement of them or of the publishers mentioned.

Print Materials:

Resource and Curriculum Document References

The following materials were used in the development of this curriculum and resource document. The author gratefully acknowledges their use.

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Carson-Dellosa Step-by-Step Science Series. (1995). *Weather & Climate*. London, ON: Scholar's Choice Moyer.

Creative Teaching Press. (1995). *Investigations in Science Weather*. London, ON: Scholar's Choice Moyer. ISBN: 1574716093

Cosgrove, B. (1991). *Weather* (part of Eyewitness Books Series). Toronto: Stoddart Publishing Co. ISBN: 0679807845

Froman, J. (1996). *Activities for Grades 3-6 Weather*. Vernon Hills, IL: Learning Resources, Inc. ISBN: 1569119457

Ganeri, A. (1987). *Weather Facts*. London: Usborne Publishing. ISBN: 086020975X

Hollander, J. (1999). *The More We Get Together*. Timmins, ON: Ojibway and Cree Cultural Centre. ISBN: 0919523137

Honigmann, J. (1956). The Attawapiskat Swampy Cree: An Ethnographic Reconstruction in *Anthropological Papers of the University of Alaska*. R. Leinbach and J.W. Stone, eds. Fairbanks: University of Alaska Press. (phone: 907-474-7288)

- Learning Resources. (1996). *Weather*. Mississauga, ON: Quality Classrooms. ISBN: 1569119457
- Kahl, J. D. (1992). *Wet Weather*. Markham, ON: Fitzhenry & Whiteside. ISBN: 0822525267
- Mason, J. (1988). *Weather and Climate*. Englewood Cliffs, NJ: Silver Burdett Press. ISBN: 0382242554
- McDonald, M., L. Arragutainaq, and Z. Novalinga. (1997). *Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion*. Ottawa, ON: Canadian Arctic Resources Committee. ISBN: 0919996752
- Milliken General Science Transparency/Reproducible Books. (1986). *Weather*. London, ON: Scholar's Choice Moyer. ISBN: 1558630899
- Ministry of Education and Training. (1998). *The Ontario Curriculum, Grades 1-8: Science and Technology*. Toronto: Queen's Printer. ISBN: 0777864444
- Ministry of Natural Resources. (1981). *West Patricia Land Use Plan: Background Information*. Toronto: Queen's Printer.
- Minister of Supply and Services. (1976). *Weather Ways*. Ottawa, ON: Supply and Services Canada.
- Ontario Ministry of Natural Resources. (1974). *Background Information and Approach to Policy: Northwestern Ontario*. Toronto: Queen's Printer.
- Reidman, S. (1977). *How Wildlife Survives Natural Disasters*. New York: David McKay Company, Inc. ISBN: 0679203664
- S & S Learning Materials. (1991). *All About the Weather*. London, ON: Scholar's Choice Moyer. (Canadian) ISBN: 1550352261
- The Solski Group. (1999). *Weather*. London, ON: Scholar's Choice Moyer. (Canadian) ISBN: 1550352229
- Suzuki, D., and P. Knudtson. (1992). *Wisdom of the Elders*. Don Mills, ON: Stoddart Publishing Co. ISBN: 0773725202
- Tannenbaum, B., and H. Tannenbaum. (1989). *Making And Using Your Own Weather Station*. Toronto: Franklin Watts. ISBN: 0531106756

Toole, S. (1985). *Moosonee District Background Information*. Toronto: Queen's Printer. ISBN: 0772905207

Wyma, B. (1995). *Investigations in Science: Weather*. Cypress, CA: Creative Teaching Press. ISBN: 0003482802

Teacher Resources

The following additional materials may be useful for the implementation of this curriculum and resource document.

Carson, M. K. (2000). *Great Weather Activities*. Markham, ON: Scholastic Canada. ISBN: 0590221817

Carson, M. K. (2000). *The Wow's and Why's of Weather*. Markham, ON: Scholastic Canada. ISBN: 0590365088

Discovery Box Series. (1997). *Discovery Box: Weather*. Markham, ON: Scholastic Canada. ISBN: 0590926748

Milliken. (1999). *Discover! Weather*. London, ON: Scholar's Choice Moyer. ISBN: 0787704350

Teacher and Student Resources

The following additional materials may be useful for the implementation of the teaching and learning strategies found in this curriculum and resource document.

Weather Fiction—Reading

Barrett, J. (1978). *Cloudy With A Chance of Meatballs*. New York: MacMillan. ISBN: 0689707495

Bellairs, J. (1984). *The Dark Secret of Weatherend*. Toronto: Bantam. ISBN: 0553156217

Carlstrom, N., and N. Dyer. (1995). *The Snow Speaks*. Toronto: Little, Brown & Company. ISBN: 0316128309

Cech, J. (1992). *First Snow, Magic Snow*. New York: Four Winds Press. ISBN: 0027179710

Howe, J. (1995). *Pinky and Rex and the Double-Dad Weekend*. New York: Atheneum Books. ISBN: 0689808356

Lasky, K. (1995). *The Gates of the Wind*. San Diego: Harcourt, Brace and Company. ISBN: 0152042644

Mayo, G. (1989). *Earthmaker's Tales: North American Indian Stories About Earth Happenings*. Walker and Company from Markham, ON: Fitzhenry & Whiteside. ISBN: 0802768407

Pearson, S. (1988). *My Favourite Time of the Year*. New York: HarperCollins. ISBN: 0060246820

Polacco, P. (1990). *Thunder Cake*. New York: Scholastic Inc. ISBN: 0698115813

Skofield, J. (1984). *All Wet! All Wet!* New York: Harper & Row. ISBN: 0060257520

Stanely, S. (1993). *The Rains Are Coming*. New York: Green Willow Books. ISBN: 0688109489

Szilagyi, M. (1985). *Thunderstorm*. New York: Bradberry Press. ISBN: 0027885801

Tresselt, A. (1988). *White Snow, Bright Snow*. New York: Mulberry Books. ISBN: 0688082947

Wilder, L. (1994). *Winter Days in the Big Woods*. New York: HarperCollins. ISBN: 0064433730

Wisniewski, D. (1991). *Rain Player*. New York: Clarion Books. ISBN: 0393020215

Woods, P. (2001). *Stormy Weather*. W. W. Norton & Company from Toronto: Penguin Books. ISBN: 0393020215

Weather Fiction—Poetry

Franco, B. (2001). *Whatever the Weather*. Markham, ON: Scholastic Canada. ISBN: 0439216206

Hopkins, L. (1994). *Weather Poems for all Seasons*. New York: HarperCollins. ISBN: 0064441911

Yolen, J. (1993). *Weather Report: Poems*. New York: Saint Martin's Press. ISBN: 1563971011

Weather Non-fiction–Information

Berger, M., G. Berger, and R. Sullivan. (2001). *Can It Rain Cats and Dogs?* Markham, ON: Scholastic Canada. ISBN: 0590130838

Bortz, F., A. Bortz, and M. Shepherd. (1999). *Dr. Fred's Weather Watch: Create And Run Your Own Weather Station.* Toronto: McGraw-Hill. ISBN: 0071347992

Bower, M. (1994). *Experiment with Weather* from Lerner Publications distributed by Markham, ON: Fitzhenry & Whiteside. ISBN: 1587282496

Hodgson, M. (1999). *The Basic Essentials of Weather Forecasting.* Toronto: General Publishing. ISBN: 0762704780

Kahl, J. D. (1999). *Weather.* National Audubon Society First Field Guides distributed by Markham, ON: Scholastic Canada. ISBN: 0590054880

Lerner How's The Weather? Series. (1992–97). *Wet Weather* (ISBN: 0822525267), *Weatherwise* (ISBN: 0822525259), *Thunderbolt* (ISBN: 0822525283), *Storm Warning* (ISBN: 0822525275), *Weather Watch* (ISBN: 0822525291), and *Hazy Skies* (ISBN: 0822525305) all by J. D. Kahl distributed by Markham, ON: Fitzhenry & Whiteside.

Philips, D. W. (1998). *Blame it on the Weather: Strange Canadian Weather Facts.* Toronto, ON: Key Porter. ISBN: 1550139681

Suzuki, D. (1990). *Looking at Weather.* Toronto, ON: Stoddart. ISBN: 0773751416

Taylor, B. (1993). *Weather and Climate.* New York: Kingfisher Books. ISBN: 0753455099

Wyatt, V. (2000). *Weather FAQ.* Toronto: Kids Can Press distributed by London, ON: Scholar's Choice Moyer. ISBN: 1550745824

Multimedia and Software:

CD-ROM

IBM. (1999). *World Book Multimedia Encyclopedia 1.0.* (www.worldbook.com)

McClelland & Stewart. (2000). *Canadian Multimedia Encyclopedia Plus.* (www.tceplus.com)

Microsoft. (2000). *Microsoft Encarta 2000.* (www.microsoft.com/)

Queue, Inc. *Learning About Weather and Climate*. (www.queueinc.com)

Suburst Technology. *Everything Weather*. (www.sunburst.com)

Weathersense. *Weather Workstation*. (www.weathersense.com/software/.html)

Zane Publishing. *Junior Science: Understanding Weather and Climate*.
(www.zane.com)

Video

Apollo Educational Video. (1988). *Weather Volume 1*. Oklahoma City, OK: Concord Video.

Colgren, J. (1993). *Exploring Weather*. Niles, IL: United.

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National Geographic. (1993). *Atmosphere: On the Air*. Mississauga, ON: National Geographic Educational Services.

Transit Series (20 mins.). (2000). *Air: Climate*. Montreal, QC: National Film Board of Canada.

Weather Channel or Weather News Broadcast.

Weather Fundamentals Video Series (6 vol. set 23 mins. each). (1998). *Climate & Seasons, Clouds, Hurricanes & Tornadoes, Meteorology, Rains & Snow, and Wind*. Georgetown, ON: The Educational Media Company.

Internet

Science and Technology

Space Shuttles (USA)

<http://spaceflight.nasa.gov/>

<http://www.howstuffworks.com/space-shuttle.htm>

Satellites (USA)

<http://www.noaa.gov/satellites.html>

<http://www.howstuffworks.com/satellite.htm>

Solar Cells (USA)

<http://www.howstuffworks.com/solar-cell.htm>

Wind Power (Denmark)

<http://www.windpower.dk/>

Weather Folklore, Proverbs, and Indigenous Wisdom

Weather Folklore

<http://www.schools.ash.org.au/folklore.htm>

Weather Glossary

The Weather Office Alphabetical Weather Glossary

<http://www.weatheroffice.com/faq/Glossary/expandglos.asp>

Weather Information

The Weather Network

<http://www.the-weather-network.com>

Environment Canada WeatherOffice

http://www.weatheroffice.ec.gc.ca/canada_e.html

Meteorological Service of Canada Weather

<http://www.msc-smc.ec.gc.ca/weather-e.cfm>

Thunderstorms

<http://www.weather.about.com/cs/thunderstorms>

<http://www.mb.ec.gc.ca/air/severewthr/ak00s09.en.html>

Weather System Maps

<http://www.the-weather-network.com/wmaps/index.asp>

The Weather Channel (USA)

<http://www.weather.com>

The Online Guides: Meteorology (USA)

[http://ww2010.atmos.uiuc.edu/\(Gn\)/guides/mtr/home.rxml](http://ww2010.atmos.uiuc.edu/(Gn)/guides/mtr/home.rxml)

Weather Graphics Technologies (USA)

<http://www.weathergraphics.com>

World Meteorological Organization (WMO)

<http://www.wmo.ch>

Weather Station Instruments

Make Your Own Weather Station (USA)

<http://www.miamisci.org/hurricane/weatherstation.html>

Weather Tools (USA)

<http://www.miamisci.org/hurricane/weathertools.html>

Making an Air Thermometer (USA)

<http://www.allstar.fiu.edu/aero/Experiment9.htm>

Making an Anemometer (USA)

<http://www.allstar.fiu.edu/aero/Experiment10.htm>

Making a Wind Vane (USA)

<http://www.allstar.fiu.edu/aero/Experiment11.htm>

Making a Weather Vane (USA)

<http://www.allstar.fiu.edu/aero/Experiment12.htm>

Making a Windsock (USA)

<http://www.allstar.fiu.edu/aero/Experiment13.htm>

Making a Barometer (USA)

<http://www.allstar.fiu.edu/aero/Experiment14.htm>

Making a Hygrometer (USA)

<http://www.allstar.fiu.edu/aero/Experiment15.htm>

Weather FAQs

WeatherOffice Frequently Asked Questions

<http://www.weatheroffice.com/faq/>

Environment Canada Frequently Asked Questions

http://weather.ec.gc.ca/faq_eshtml#weather4

Weather Lesson Plans

Gander Academy Weather Theme

<http://www.stemnet.nf.ca/CITE/weather.htm>

The Weather Channel (USA)

<http://www.weather.com/education/wxclass/lessonplans/>

Manipulatives: (in order of appearance)

bristol board

chart paper

markers

TV and VCR

assorted magazines and newspapers showing a wide range of weather examples

globe

flashlight

lamp without shade

2 small mirrors

old thin 30 cm wooden ruler

overhead projector

transparencies from *Weather*

wall map of Canada

ball pump

tape

weather system maps from newspaper or internet

6 shoe boxes or small sized boxes

construction paper and scraps

cottons balls

string

glue

scissors

long balloons
poster paper (11"x17")

weather instrument materials dependent on resources used
commercial weather instruments

- 10 classroom thermometer (552-00380, p. 251)
- student thermometers (552-00302, p. 251)
- weather centre with weather measurement tools which includes
 - barometer (552-02027, p. 251)
 - hygrometer (552-02028, p. 251)
 - compass (552-02026, p. 251)
 - rain guage (552-00840, p. 251)

Wild Weather Kit. (552-02128, p. 251) all from Mississauga, ON: Quality Classrooms

or weather centre which includes thermometer, hygrometer, barometer, and compass (219-2030, p. 340)

- weather vane (228-8875, p. 340)
- anemometer (228-8880, p. 340)
- rain guage (453-22050, p. 340)
- classroom thermometer (219-380, p. 340)
- 10 student thermometers (219-302, p. 340)

Water Cycle Model Activity Set (313-8882, p. 340) all from London, ON: Scholar's Choice Moyer

weather broadcast from local TV news station

local elders or persons knowledgeable with life on the land and weather forecasting

"School Name" of Meteorology certificates of graduation

Publisher and Distributer Contacts:

Chapters/Indigo (internet: <http://chapters.indigo.ca>).

The Educational Media Company Children's Videos catalogue-fall 2000 update (phone:1-800-565-8437, fax: 1-888-873-7147, email: orders@ed-u-media.com).

Fitzhenry & Whiteside (phone: 1-800-387-9776, fax 1-800-260-9777).

Quality Classrooms 1999-2000 catalogue (phone: 1-888-517-8282, fax:1888-246-7475).

Scholastic Canada 2001 catalogue (phone: 1-800-268-3848, fax: 1-800-387-4944, email: custserv@scholastic.ca).

Scholar's Choice Moyer 2001 catalogue (phone: 1-800-265-1095, fax: 1-800-363-3398, email: scholars@wwdc.com).

Appendix 1: Weather Glossary

Air masses consist of a large areas of air that has uniform moisture and temperature.

Air moisture or humidity refers to the amount of water vapour in the air.

Air pressure is the weight of the air on the earth's surface measured as kilopascals.

Air temperature is the hotness or coldness of the atmosphere expressed in degrees.

Anemometer is an instrument that measures wind speed expressed as kilometres per hour (kph).

Atmosphere is the air surrounding the earth.

Barometer is an instrument that measures air pressure expressed as millibars (mb).

Campbell Stokes recorder is an instrument that measures sunshine expressed as hours (h).

Cirrus clouds are high-level wispy, feathery clouds.

Climate is the average weather of an area over a long period of time.

Clouds are visible water droplets or ice particles in the atmosphere.

Condensation is a process where water vapour (a gas) changes into water (a liquid).

Coriolis effect refers to the force of the earth's rotation that pushes the winds in the northern hemisphere to the right, and in the southern hemisphere to the left.

Cumulus clouds are detached puffy clouds.

Dew point is the temperature at which the air becomes saturated (contains the maximum amount of water vapour).

Doppler radar monitors changes in the movement of rain, snow or dust (the Doppler effect).

- Drizzle** consists of very small droplets of water (less than 0.5 mm).
- Evaporation** is a process where water (a liquid) changes into water vapour (a gas).
- Forecasts** are descriptions of the most significant weather conditions expected.
- Freezing drizzle** consists of drizzle that freezes on impact.
- Fronts** are boundaries between two different air masses brought together by winds in lows. There are three types of fronts: cold, warm, and occluded.
- Hail** consists of round balls of ice.
- Highs** or areas of high pressure are identified with winds blowing clockwise.
- Humidity** or air moisture refers to the amount of water vapour in the air.
- Ice pellets** consist of raindrops frozen into ice.
- Jet stream** is the boundary where cold polar winds and warmer westerlies meet and produce strong winds. The jet stream influences the movement of air masses, lows, and fronts.
- Lightning** is the discharge or release of electricity contained in clouds.
- Lows** or areas of low pressure are associated with winds blowing counterclockwise.
- Meteorologist** is a person who studies the earth's atmosphere.
- Meteorology** is the study of the earth's atmosphere.
- Planetary-scale weather systems** refer to systems that range from thousands of kilometres in size and last several weeks. These systems include winds and air masses that cover large portions of the earth.
- Precipitation** is the form of water in the atmosphere, e.g., rain, snow, hail etc.
- Radar** gives information on areas of precipitation and the movement of the air in weather systems. Weather stations send two kinds of radar: reflected and Doppler.

Rain consists of large water droplets (greater than 0.5 mm).

Rain showers consist of rain that starts and stops suddenly.

Reflected radar monitors returning radar signals reflected from snow, rain, or hail.

Relative humidity is the ratio of water vapour in the air and the maximum amount of water vapour that the air could hold if saturated expressed as percent.

Satellites provide information on cloud patterns in weather systems that cannot be observed from the earth's surface.

Scientific knowledge is based on the accumulation of facts and the relationships among these facts through careful observation and experimentation.

Seasons are periodic changes in air temperature due to the tilt of the earth's axis.

Snow consists of clusters of white or translucent ice crystals.

Snow showers consist of snow that starts and stops suddenly.

Snow pellets consist of snow covered in ice.

Stratus clouds are low-level layered clouds.

Synoptic weather systems refer to systems that range from 10 to hundreds of kilometres in size and last up to a week. These systems include lows, highs, and fronts that cover portions of North America.

Thermometer is an instrument that measures air temperature expressed as degrees Celsius (°C).

Thunder is the sound produced from air heated by lightning as it crashes into the surrounding cold air.

Thunderstorms refer to heavy rain or hail and high winds produced by cumulonimbus clouds. Lightning and thunder accompanies thunderstorms.

Traditional ecological knowledge (TEK) is based the accumulation of wisdom and the relationships between people, animals, plants, and the environment through extended observation, imitation, and social and environmental feedback.

Water cycle or hydrologic cycle is the endless change of water from one form to another.

Weather is the state of the air (atmosphere) at a specific place for a short period of time, and includes temperature, moisture, pressure, winds, clouds, and precipitation.

Weather balloons supply information on the state of the atmosphere at different heights above the earth's surface. These balloons carry instrument packages called radiosondes that hold weather instruments used to measure air temperature, moisture, and pressure.

Wet bulb thermometer or sling psychrometer is an instrument that measures air moisture (humidity) expressed as degrees Celsius ($^{\circ}\text{C}$).

Wind is the horizontal movement of air.

Wind chill is the cooling effect of wind and temperature on a body measured as wind chill factor.

Wind sock or vane is an instrument that measures wind direction from the North, South, East, and West.

Appendix 2: Sample Assessment Tools

Group Listening Skills **Checklist** for Section 1: Lesson 1 (p. 17)

Large Group Listening Skills	yes	no
shows a desire to learn through listening as a member of a large group		
shows a desire to learn through listening as member of a small group		
shows responsibility for listening efficiently and effectively		
recognizes and respects the need of others for group listening		

Individual Student Observations **Rating Scale** for Section 1: Lesson 4 (p. 26)

Individual Student Observations	rarely	sometimes	usually
listens attentively			
observes quietly			
asks questions properly			
participates effectively			

Individual Student **Anecdotal Comments (Records)** for Section 1: Lesson 7 (p. 33)

Janie shows cheerfulness in classroom activities. Ananias shows participation by responding to questions. Jimmie takes risks by volunteering answers. Anna volunteers for classroom activities. Roger completes tasks independently.

Traditional Northern Ojibway and Cree Weather Forecasting **Rubric** for Section 2: Lesson 5 (p. 59)

Category/ Criteria	Level 1	Level 2	Level 3	Level 4
Understanding of basic concepts	shows little understanding of the Native way of knowing	shows some understanding of the Native way of knowing	shows understanding of the Native way of knowing	shows thorough understanding of the Native way of knowing
Inquiry and design skills (environmental and social feedback)	<p>makes few observations on the land</p> <p>obtains few of the required comments from elder or person knowledgeable with life on the land</p> <p>gives little attention and detail to gathering data, recording and presenting results</p>	<p>makes some observations on the land</p> <p>obtains some of the required comments from elder or person knowledgeable with life on the land</p> <p>gives some attention and detail to gathering data, recording and presenting results</p>	<p>makes most observations on the land</p> <p>obtains most of the required comments from elder or person knowledgeable with life on the land</p> <p>gives attention and detail to gathering data, recording and presenting results</p>	<p>makes all observations on the land</p> <p>obtains all (or almost all) of the required comments from elder or person knowledgeable with life on the land</p> <p>gives thorough attention and detail given to gathering data, recording and presenting results</p>

<p>Communication of required knowledge</p>	<p>orally communicates predictions and findings to class with little clarity and precision</p> <p>rarely uses appropriate traditional weather forecasting vocabulary orally</p>	<p>orally communicates predictions and findings to class with some clarity and precision</p> <p>sometimes uses appropriate traditional weather forecasting vocabulary orally</p>	<p>orally communicates predictions and findings to class with clarity and precision</p> <p>usually uses appropriate traditional weather forecasting vocabulary orally</p>	<p>orally communicates predictions and findings to class with consistent clarity and precision</p> <p>consistently uses appropriate traditional weather forecasting vocabulary orally</p>
<p>Relating of science and technology to each other and to the world outside the school (weather prediction refinements)</p>	<p>gives limited explanations showing understanding of connections between predictions and local community</p>	<p>gives partial explanations showing understanding of connections between predictions and local community</p>	<p>gives complete or nearly complete explanations showing understanding of connections between predictions and local community</p>	<p>always gives complete explanations showing understanding of connections between predictions and local community</p>

The *Weather, It's Right or Not* resource and curriculum document is designed to provide content and teaching and learning activities for the expectations identified in the Earth and Space Systems strand: Grade 5 Weather from the Ontario Curriculum: Science and Technology.



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