Mainstreaming DISASTER RISK REDUCTION in the Philippines

LESSON EXEMPLARS
Science 1

DepED
DEPARTMENT OF EDUCATION

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FOREWORD

In response to the recurrent impacts of disasters in the country, the Department of Education initiated mainstreaming disaster risk reduction in education in 2007, together with the National Disaster Coordinating Council-Office of Civil Defense.

The initiative is one of the components of the project Mainstreaming Disaster Risk Reduction into Development Policy, Planning, and Implementation in the Education Sector (MDRD-EDU), which aims to inculcate resilient attitude among students, teachers, and the community where they belong. The project is envisioned as a sustained collaboration towards the realization of a global mission to reduce disaster impacts in the country through the education system.

Lesson exemplars and teacher/student modules on DRR have been developed for the secondary curriculum. Contained in the lesson exemplars are strategies and methods of teaching disaster risk reduction through modules on natural hazards in Science and in Araling Panlipunan for Grade 7 (First Year High School).

These lesson exemplars and modules are trailblazing efforts of participating agencies, which are mostly members of the NDCC and the MDRD-EDU TWG, motivated by the goal to educate our school children on the different kinds of hazards and how to respond to each of these when the need arises and to create a multiplier effect which will benefit the communities where they live.

The Department of Education would like to acknowledge the cooperation and assistance of all the agencies involved in the preparation of the lesson exemplars and teacher/student modules. We especially thank the Asian Disaster Preparedness Center (ADPC), the United Nations Development Programme (UNDP), and the European Commission Humanitarian Aid department (ECHO) for sponsoring the project and for the printing of these valuable materials.

JESLI A. LAPUS
Secretary

June 2009

INSTITUTIONALIZING DISASTER RISK REDUCTION IN THE CURRICULUM

The Philippines' geographic setting makes it vulnerable to geologic and hydrometeorological hazards. The country has more than 300 volcanoes, 22 of which are considered active or have had a record of eruption in the last 10,000 years. The country is also surrounded on both sides by active subduction zone systems, which generate large magnitude, and at times, tsunamigenic earthquakes. The archipelago is cut by numerous active fault systems that cause seismic hazards. About 20 earthquakes are recorded per day while at least one damaging earthquake occurs per year. In terms of hydrometeorological hazards, tropical cyclones bring strong damaging winds and heavy rains cross through the archipelago at an average of 20 per year, causing flash floods and, at times, landslides.

The education sector is vulnerable to the various hazards that frequently besiege the country. The destruction of school buildings and facilities, as well as educational materials, at the eventuality of disasters often results in suspension of classes, disrupting the learning process of students. On the other hand, teachers are overburdened in the aftermath of disasters as they are often volunteers and caregivers, as well as heads of evacuation committees. Furthermore, schools in the Philippines are primarily used as evacuation centers during disasters. As such, school facilities suffer damages due to a large number of evacuees. The use of school buildings, which are not designed to be emergency shelters, puts further strain on the already limited educational resources of most schools in disaster prone areas in the country.

The perennial effects of disasters on students and teachers in the country have led the Department of Education (DepEd) and the National Disaster Coordinating Council (NDCC) to undertake Mainstreaming Disaster Risk Reduction (DRR) in Education as a priority program. The program, which started its initial phase in January 2007-April 2008 and is currently being implemented on its second phase (September 2008-December 2009), is in partnership with the Asian Disaster Preparedness Center (ADPC) and the United Nations Development Programme (UNDP), with the support of the European Commission on Humanitarian Aid department (ECHO).

A Technical Working Group (TWG) was formed in 2007. The TWG consists of DepEd's Curriculum Division under the Bureau of Secondary Education; the country's planning agencies, namely, the National Economic and Development Authority (NEDA); the Department of Finance (DOF); and the National Disaster Coordinating Council (NDCC). The TWG initiated the development of DRR lesson exemplars and modules for Grade 7 (First Year High School) for Science and Social Studies subjects. The modules serve as reference materials for students and teachers while the lesson exemplars serve as guides for teachers in the delivery of their lessons.

Both the lesson exemplars and the teacher/student reference materials were reviewed and enhanced by the expanded TWG members last 14-

17 April 2009. The TWG members, aside from DepEd and NDCC-OCD, that contributed to enhance the materials in this document, include the following:

- Department of Health (DOH)
- Department of Public Works and Highways (DPWH)
- Department of Science and Technology (DOST)
  - Philippine Institute of Volcanology and Seismology (PHIVOLCS)
  - Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA)
- Department of Environment and Natural Resources (DENR)
  - Mines and Geosciences Bureau (MGB)
  - National Mapping and Resources Information Authority (NAMRIA)
- Office of the Presidential Adviser on Global Warming and Climate Change (OPACC)
- Philippine Information Agency (PIA)
- Technical Education and Skills Development Authority (TESDA)

The lesson exemplars contained in this document guide the teachers on the main hazards and DRR ideas that should be conveyed to the students, as well as the strategy of delivery, viz. motivation, activities, analysis, abstraction, and application. Lesson exemplars included in this document are:

- Climate Change
- Heat Wave
- Fire
- Landslide
- Tsunami
- Flooding
- Tropical Cyclone
- Tornado

The institutionalization of these lesson exemplars in the regular teaching of Science 1 aims to build the capacity of teachers on DRR and enable them to contribute to the resilience of students and communities.

Contents

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GLOBAL WARMING AND CLIMATE CHANGE

What do you know about

- greenhouse effect and global warming
- climate change
- causes of global warming and climate change
- effects of global warming

Introduction

Global Warming

The atmosphere is composed of a mass of gases that surrounds the earth. There are three levels of atmosphere closest to the earth: the troposphere, the stratosphere, and the mesosphere. In the stratosphere, a thin layer of ozone is present. This layer is important as it protects the earth from the harmful rays (ultraviolet rays) of the sun.

Solar energy, experienced as sunlight, passes through the atmosphere in the form of relatively short-wave energy. Some of this energy is absorbed by the earth while others are reflected back into space. But as the short-wave energy heats up the earth's surface, it radiates back in the form of longer-wave energy. This form of energy is gobbled up naturally by greenhouse gases, trapping heat in the earth's atmosphere.

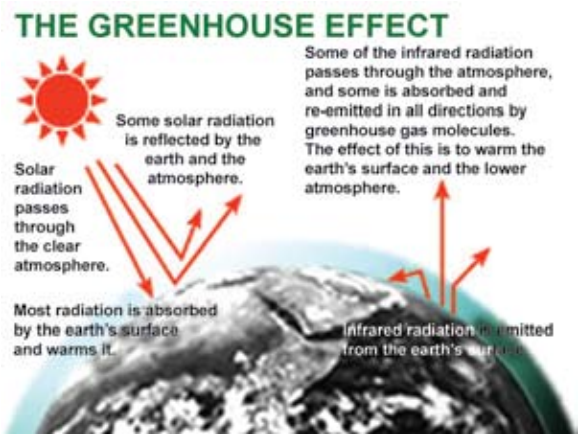


Figure 1

Similar to the effect of a greenhouse, the earth is warmed up because of the trapped heat, resulting in an increase in the earth's temperature. The accumulated gases in the atmosphere are called "greenhouse gases" while the increase in temperature is known as the "greenhouse effect." The greenhouse effect is a natural phenomenon. It balances and regulates the world's temperature and makes life possible on earth.

However, growing amounts of gases have reduced the efficiency of the greenhouse effect. Between 1950 and 2000, global carbon dioxide emissions went up from one billion metric tons to more than seven billion metric tons -- a 600% increase in the space of a half-century. This is largely the result of the continuous burning of fuels for energy, mostly gasoline for transportation and coal for electricity (OPACC, 2009).

Trapped in the earth's atmosphere, these gases have been accumulating over the past two centuries. Today, this vast and dramatic accumulation is upsetting the balancing function of the greenhouse effect. As a result, the world is becoming dangerously hot, resulting in a phenomenon called global warming. Global warming leads to changes in rainfall patterns, a rise in sea level, and a wide range of impacts on plants, wildlife, and humans.

Climate Change

Climate is the long-term average weather condition in a given place. Any long-term significant change in weather patterns such as changes in temperature, precipitation, wind, and humidity is called climate change.

Climate change (OPACC, 2009) is caused by the warming of the globe due to the extensive use of hydrocarbon fuels. These are basically coal, oil, and natural gas. The burning or use of these fuels results in carbon dioxide (CO_2) emissions.

Other greenhouse gases (GHG) that contribute to climate change are: methane, produced by waste and garbage; nitrous oxide from chemical fertilizers and animal manure; fluorinated greenhouse gases (or F-gases), which are man-made gases composes of sulfur hexaflouride (SF_6) and halocarbons such as chlorofluorocarbons (CFCs).

Objectives

General Objectives

- To introduce to the students the impact of greenhouse gases (GHG) and their relation to global warming and the threat of climate change
- To understand the risk caused by climate change and how it can be reduced through awareness and preparation

Specific Objectives

At the end of the lesson, students shall be able to:

- discuss what causes global warming, including adverse effects on human beings.
- identify greenhouse effect.
- identify ways to reduce the risk caused by climate change.

Main Ideas

- Global warming is a worldwide phenomenon that concerns all of us.
- Climate change needs serious concrete and specific actions in order to reduce its risks to humans, plants, and animals.
- All of us can do something about climate change.

Vocabulary

1. climate change – any long-term significant change in the average weather that a given region experiences such as temperature, precipitation, wind, and humidity.

2. global warming – an increase in the average temperature of the earth's near-surface air and ocean as a result of the increased concentration of greenhouse gases in the atmosphere.

3. greenhouse effect – a natural phenomenon that balances and regulates the world's temperature and makes life possible on earth.

4. solar radiation – solar energy that passes through the atmosphere in the form of light waves.

5 fluorinated greenhouse gases (F-gases) – man-made gases composed of sulfur hexaflouride (SF_6) and the families of gases known as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). F-gases are powerful greenhouse gases with global warming potentials many times that of natural greenhouse gases such as carbon dioxide. They also tend to remain much longer in the atmosphere than natural greenhouse gases. (http://www.environ.ie/en/, access, 2009)

6. carbon dioxide (CO_2) – a chemical compound composed of two oxygen atoms covalently bonded to a single carbon atom. It is a gas at standard temperature and pressure and exists in the earth's atmosphere in this state.

   Carbon dioxide is used by plants during photosynthesis to make sugars which may either be consumed again in respiration or used as the raw material to produce polysaccharides such as starch and cellulose, proteins, and a wide variety of other organic compounds required for plant growth and development. It is produced during respiration by plants, animals, fungi, and microorganisms that depend on living and decaying plants for food, either directly or indirectly. It is, therefore, a major component of the carbon cycle. Carbon dioxide is generated as a by-product of the combustion of fossil fuels or the burning of vegetable matter, among other chemical processes. Large amounts of carbon dioxide are emitted from volcanoes and other geothermal processes, such as hot springs and geysers and by the dissolution of carbonates in crustal rocks.

7. methane (CH_4) – the simplest alkane and the principal component of natural gas. Burning methane in the presence of oxygen produces carbon dioxide and water. The relative abundance of methane and its clean burning process makes it a very attractive fuel. However, because it is a gas at normal temperature and pressure, methane is difficult to transport from its source.

8. nitrous oxide (N_2O) – at room temperature, a colorless non-flammable gas, with a pleasant, slightly sweet odor and taste. It is used in surgery and dentistry for its anesthetic and analgesic effects. It is known as "laughing gas" due to the euphoric effects of inhaling it, a property that has led to its recreational use as an inhalant drug. It is also used as an oxidizer in rocketry and in motor racing to increase the power output of engines.

   Nitrous oxide reacts with ozone and is the main naturally occurring regulator of stratospheric ozone. Nitrous oxide is also a major greenhouse gas. Considered over a 100 year period, it has 298 times more impact per unit weight than carbon dioxide.

Subject Matter

Global Warming and Climate Change

References

http://www.environ.ie/en/, access 2009

Creeping Climate Change, Office of the Presidential Adviser on Global Warming and Climate Change, 2009

The Economics of Climate Change in Southeast Asia: A Regional Review (Sir Nicholas Stern-led UK-funded ADB Study), 2009
Inter-agency IEC materials on Climate Change, 2008-2009
Executive Order 774, 2008: Executive Order 785, 2009
Civil Service Memorandum on Earth day, Ocean and Environment Month, 2008
IPCC Report on Climate Change, 2007

Strategy

Motivation

Students are asked about their observations on weather changes in their community. This means experience of sudden changes of hot and cold weather at extreme rate of temperatures. Students share their observations and experiences in class.

Activity 1

On a sunny day, bring students outside of the classroom. Give them time to observe the sky and the outdoors. Let them check the temperature using a thermometer. Give students time to record their observations. (Teachers can also use this as a one week/one month experiment. Graph daily temperature and analyze at the end of the period.)

Guide Questions:

1. How did you feel while you were out observing the sky?
2. What can you say about the changing temperature in your locality?
3. How would you describe the quality of the air?
4. Try to remember a time when you were in the province. Do you see any difference or similarity in the condition of the atmosphere in the cities and in the provinces? Compare and contrast.

Activity 2

Divide the class into four groups. Assign one of the following topics to each group.

1. Burning of garbage and plastic
2. Uncontrolled emission of gas from vehicles
3. Emission from factories
4. Burning of fossil fuel

Brainstorm on its impact in the environment. Let the group report to the class the result of their discussion.

Analysis

1. What are the effects of pollution on our environment?
2. Describe the connection between the temperature, quality of air, and the smoke emitted into the air.
3. Explain the “greenhouse effect.”
4. How can we minimize the adverse effects of global warming?

Abstraction

Climate change and global warming are basically the result of human activities. Risk can be reduced by doing concrete and specific actions in the school, home, or even in the larger community.

Question:
What possible things can ordinary people do to protect the environment?

Application

Provide specific examples on what you can do in the school, home, or even in the larger community to help minimize the accumulation of greenhouse gas in the earth's atmosphere.

Things you can do to minimize Greenhouse Effect: (Ten earth saving tips by OPACC)

- Change your incandescent light bulbs to compact fluorescent lamp. The cumulative effect is enormous. Turn off unneeded lights. Bring natural sunlight into your home when it is feasible.
- Tune up your car if it is a gas guzzler. Better walk, bike, or use public transportation.
- Your house should not be too hot nor too cold! Clean vents, close unused vents, and change filters in the vents. Ceiling fans reduce cooling costs by more than half.
- Tame the refrigerator energy appetite! Do not set the thermostat too high. Even one degree makes a difference.
- Big users of energy are hot water heater, washer and dryer, and dishwasher.
- Buy green energy and invest in green stocks. Encourage use of electricity from renewable sources, solar panels, geothermal and wind power sources. Buy "green power." Invest in renewable energy companies.
- Plant trees. Water lawn sparingly or use recycled water to conserve energy.
- Use green charcoal, a Philippine substitute to charcoal from burnt wood.
- Buy recycled; help create a market. Before you buy, check to see if the product or its packaging is recyclable.
- Buy less, use less. Re-use in creative ways.

How can you share the knowledge learned in this lesson with your family and friends?

Evaluation

Explain how the following greenhouse gases enter the atmosphere because of human activities:

1. carbon dioxide
2. methane
3. nitrous oxide
4. flourinated gases

Closure

Life skills learned:

- It is the responsibility of each individual to protect and save the environment.

Concepts

- Recall why there is climate change.
- List down the causes of global warming.
- Define climate change.

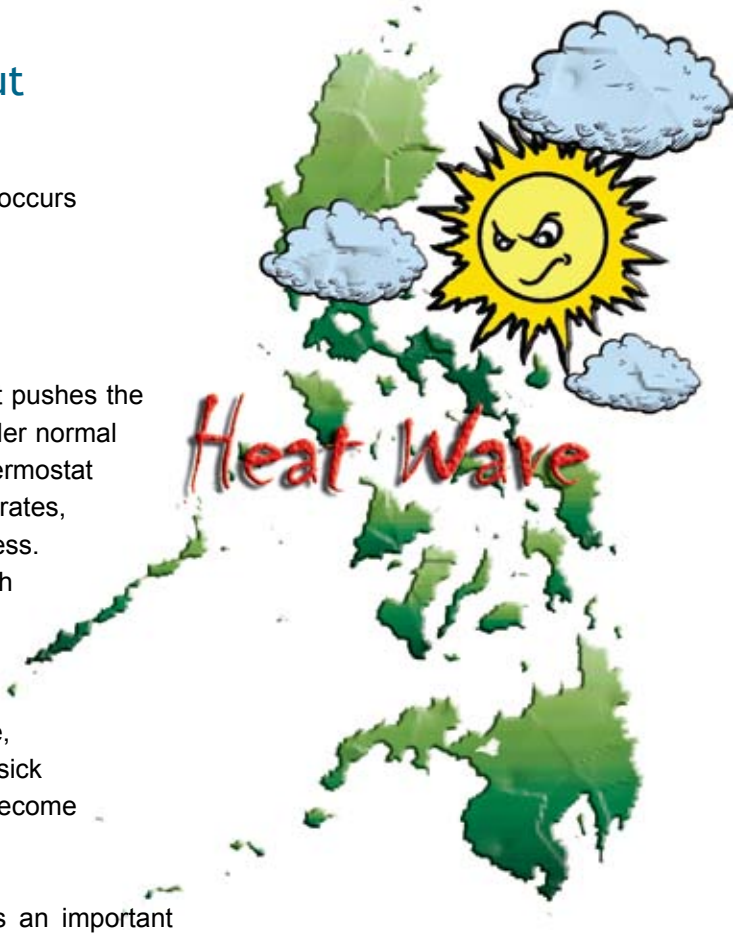
Critical Thinking

- Evaluate how the government is implementing the "Clean Air Act."
- Explain the greenhouse effect.
- State your commitment to save and protect the environment.

HEAT WAVE

What do you know about

- heat wave
- where and when heat wave occurs
- the effects of heat wave



Introduction

Heat wave can be dangerous as it pushes the human body beyond its limits. Under normal conditions, the body's internal thermostat produces perspiration that evaporates, cooling the body in the process. However in extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. Elderly people, young children, and those who are sick or overweight are more likely to become victims of extreme heat.

The duration of excessive heat is an important factor. Studies have shown that a significant rise in heat-related illnesses happens when excessive heat lasts for more than two days.

Objectives

General Objective

To increase students' understanding of heat wave, the factors that contribute to its occurrence, its impact on health, and preventive measures.

Specific Objectives

At the end of the lesson, the students will be able to:

- define heat wave.
- list down the effects of heat wave.
- develop a plan to minimize the impact of heat wave.

Main Ideas

- Heat wave is a period of abnormally and uncomfortably hot and humid weather that lasts from several days to several weeks. How it is defined in a particular region depends upon the normal conditions of that region.
- Different areas have different risks associated with prolonged heat.

Vocabulary

1. heat – a form of energy transferred from one object to another. It is energy in transit.

2. heat storm – an extended heat wave. It occurs when the temperature reaches 38 ° C for three or more consecutive days over a wide area.

3. temperature – the measure of the average kinetic energy of the atoms or molecules in an object. It is the hotness and coldness of the body.

4. humidity – the amount of water vapor in the air that varies from 1% to 4% by volume.

5. jet stream – a narrow band of high- level winds blowing in the troposphere at 97 km/hr or more and moving in meandering pattern, affecting the development and movement of other weather systems.

Subject Matter

Heat wave

Reference

See module on heat wave in Teacher / Student Modules.

Strategy

Motivation

Nowadays, everyone is experiencing weather differently. Daily high temperatures are observed for more than five consecutive days. What can you say about health-related effects of excessively hot weather?

Activity

- Lecture on the nature of heat wave
- Demonstration on emergency management by medical professionals and Red Cross volunteers

Analysis

- Open forum facilitated by teachers and selected students

Abstraction

- Everyone should know how to respond to heat wave because the effects of heat can happen very quickly.

Application

- Conducy return demonstration by students on procedures of emergency management for heat wave victims.
- Suggest public health measures during periods of heat wave.

Evaluation

Answer the following briefly:

1. Occurrence of severe heat waves causes health and environmental problems. Cite effects of heat waves on people and the environment.
2. Considering the danger caused by heat waves, enumerate measures to prevent experiencing its adverse effects.

Closure

Extreme heat is more than an issue of discomfort. It is dangerous because heat can cause severe health problems by straining the human body beyond its limits. In view of the foregoing, initiate a program in your school to help increase student awareness on heat wave, its adverse effects, and preventive measures.

FIRE

What do you know about

- fire
- causes of fire
- how fire hazards can be prevented

Introduction

The earliest use of fire by humans may have occurred as early as 1.4 million years ago. Evidence on this was found in Kenya – a mound of burned clay near animal bones and crude stone tools, suggesting a possible human campsite.

Objectives

General objective

To increase students' knowledge and understanding of fire hazards and how they can be prevented.

Specific objectives

At the end of the session, students shall be able to:

- understand the nature of fire.
- identify the causes of fire.
- suggest ways on how fire can be prevented in school and at home.

Main Ideas

Fire prevention

Vocabulary

1. Asphyxiation – difficulty of breathing due to lack of oxygen

2. Hazard – an event or occurrence that has the potential to cause harm to life and damage to property and the environment

3. Arson – deliberately setting fire to a property

Subject Matter

Fire: nature, causes, and prevention

Strategy

Motivation

Students will be asked to share newspaper clippings on fire incidents. Those who have personal experience or close encounter with fire may also be asked to share in class.

Question:

How would you feel if you were one of the victims of a fire?

Activity

Film viewing (if no film is available, use newspaper clippings as bases for the discussion)

Guide Questions:

1. What caused the fire?
2. Describe the damages caused by the fire.
3. List down possible impacts of fire on the lives of the victims.
4. What are the different ways of preventing fire?

Analysis

Have you observed peoples' reactions during fire in your place? How did they react to the incident? Describe the scenario. If you have not witnessed one, listen to your classmate who has experienced fire in the community.

Considering the damages as a result of fire, how does it affect the economic condition of the family, and the lives and properties of the victims?

Are there means to control/prevent fire?

Abstraction

Are you now convinced that we have to prevent fire? If yes, then what commitment can you give/share in your school, and in your community?

Application

What can you personally do to prevent the occurrence of fire in your homes?

During fire drills, what will you do in order that everybody will be active in joining the activity?

Evaluation

Answer the following questions:

1. Explain the nature of fire.
2. What are the major causes of fire?
3. Suggest ways on how you can prevent fire in your home and school.

Closure

Life skills learned:

- fire and its causes
- how to prevent fire

LANDSLIDE

What do you know about

- causes of landslides
- areas that are prone to landslide
- impact of landslides on lives and properties

Introduction

Landslide is a general term for the mass movement of soil, rock, debris, and earth materials downslope due to certain geological conditions and triggering events such as rainfall, earthquake, or man-made activities.

Landslide is destructive to infrastructure, livelihood, and human lives. It is likely to happen if the forces that prevent soil movement are exceeded by the forces that push it downwards. The pulling force is weakened by natural conditions such as the steep gradient of slopes, highly weathered and fractured rocks, and overloading by infrastructures (houses, buildings, etc.) built on the slopes. The downward push can be triggered by an earthquake, over-saturation of slope materials by rainwater, or a combination of both.

The landslide in Barangay Guinsaugon, St. Bernard, Southern Leyte on 17 February 2006 was the worst ever recorded rain-induced landslide in Philippine history. Forty hectares of land were buried and about 1800 deaths were recorded.

Objectives

General Objective

To provide students a better understanding of and information on prevention and reduction of landslide risk.

Specific Objectives

At the end of the session, students shall be able to:

- describe the nature of landslide and its adverse effects.
- identify the factors that may cause landslide.
- know the effects of landslide on the lives of people and the community as a whole.
- identify safety precautions that must be observed before, during, and after a landslide.

Main Ideas

Landslide is often blamed on illegal logging activities. However, based on actual ground observations and findings of the geologists of the Mines and Geosciences Bureau (MGB)-DENR, it has been established that deforestation is not the only cause of landslide.

While deforestation is considered an important factor, natural conditions affect landslide occurrences. Roots of trees can only hold and penetrate the ground to about 3-5 meters. This is the reason why in cases of severe landslides, no matter how thickly forested the mountain is, the roots cannot hold back the soil. Other factors that cause landslide are weight of slope, weak soil and rock strength due to high degree of fracturing and weathering, poor soil cohesion, steep slopes, and rapid soil erosion.

Vocabulary

1. landside – a general term for mass movement. It is a gradual to a more sudden downward movement of earth materials aided by gravity.

2. debris flow – a type of rapid mass movement of water-saturated debris (rock, soil, and mud) under the force of gravity

3. mitigating – identifying actions that will reduce, avoid, and compensate for adverse environmental impacts

Subject Matter

Landslide as a natural geologic hazard

References

See module on Landslide in the Teacher / Student Modules.
NDCC and MGB-DENR reading materials for students compiled and downloaded from the Internet

Strategies

Motivation

Ask students if they remember a particular landslide incident in the past. Talk about their experience or feelings about it.

Activity

View a video documentary on the Guinsaugon landslide. If video is not available, ask students to report on landslide occurrences:

- The 2006 landslide in Guinsaugon, St. Bernard, Southern Leyte
- The 2004 landslide in Quezon Province

Guide questions for discussion:

- What are the different types of landslides?
- What triggers the occurrence of a landslide?
- How can we reduce the risk caused by landslide?
- What are your insights on the incident?

Divide the class into two for the presentation of output.
Let each group present the results of their output in different creative ways (role playing, panel discussion, etc.).

Analysis

- Why is the Philippines prone to landslide? Give emphasis on Philippine geography and geology.
- How does landslide affect our country's economy?
- How can education help the youth to be more proactive in reducing landslide casualties in hazard-prone areas?

Abstraction

- Is it possible to reduce the risk of landslide? Explain.
- What lessons can you draw from the different geological hazards?

Application

Conduct a landslide awareness campaign in school.

Question:

- What awareness strategy or disaster preparedness plan can you give your classmates for them to share to their families?

Evaluation

On a sheet of paper, write your insights about landslide.

Closure

Life skills learned:

- Preparation of an information awareness campaign on landslide

Looking back:

Concepts

- Recall the different types of landslides.
- List down what to do before, during, and after a landslide.

Critical Thinking

1. Evaluate the role played by the national government (from the CD viewing) in mitigating hazards and in responding to the needs of the victims following a landslide event.
2. Explain the relationship between water volume and landslide.

TSUNAMI

What do you know about

- tsunami and its causes
- impacts of tsunami on lives and properties
- how to prepare for a tsunami

Introduction

Tsunami is a Japanese word meaning “harbor waves.” It is used as a scientific term to denote a kind of abnormal sea wave that causes damage to coastal communities. Tsunami usually occurs as a result of earthquakes under the sea. In some cases, tsunami is caused by submarine landslides, underwater volcanic eruptions, or in very rare instances, by meteorite impact. It can occur when the earthquake is strong enough to vertically displace large parts of the seafloor and move the mass of water over it. A series of waves is created similar to the concentric waves generated by an object dropped into the water. Most tsunamis originate along the Circum-Pacific Ring of Fire, a zone of volcanoes and seismic activity around the Pacific Ocean that is 32,500 kilometers long.

The worst tsunami disaster in history occurred on 26 December 2004. An earthquake with a magnitude of 9.0 generated a tsunami that struck the coastlines of 14 countries around the Indian Ocean. The earthquake’s epicenter was off the northwestern coast of Sumatra, Indonesia.

Latest studies show that the whole Philippine archipelago, due to its location in the equatorial typhoon belt and the Pacific Ring of Fire, is prone to tsunami and other impacts of climate change (OPACC, 2009).

Objectives

General Objective

- To increase students’ understanding and awareness of tsunami
- To better prepare students in the event of a tsunami

Specific Objectives

At the end of the lesson, students shall be able to:

- describe what a tsunami is.
- cite causes of tsunami.
- discuss the potential damages a tsunami can cause.
- recognize the natural signs of an approaching tsunami.
- list down safety measures that must be observed during and after a tsunami.

Main Ideas

- Tsunami is a series of waves which travel at a speed of 700-800 kilometers per hour (kph) in open sea (deep water). The speed decreases to 30-50 kph when it reaches the shoreline.
- Tsunami is a high-magnitude, sudden-onset event that can damage properties worth billions of pesos and can claim thousands of lives.

Vocabulary

1. tsunami – giant waves commonly generated by earthquakes under the sea
2. magnitude – the total amount of energy released by an earthquake
3. epicenter – location of an earthquake in the earth's surface
4. hazard – a natural event or phenomenon that has the potential to cause disruption or damage to humans and their environment

Subject Matter

Tsunami

References

Reading materials from major media websites, PAG-ASA and the National Disaster Coordinating Council (NDCC)
NDCC Hazard Maps Portals
Tectonic map of the world
Regional geologic setting [Asia]
Active faults and trenches map of the Philippines
Tsunami Hazard Map-Philippines
www.worldatlas.com/webimage/country/asia/asiaall.htm
www.observatory.ph/um/maps/gephys_tsunami.jpg
www.nationalgeographics.com/plate_tectonics.article.html

Strategy

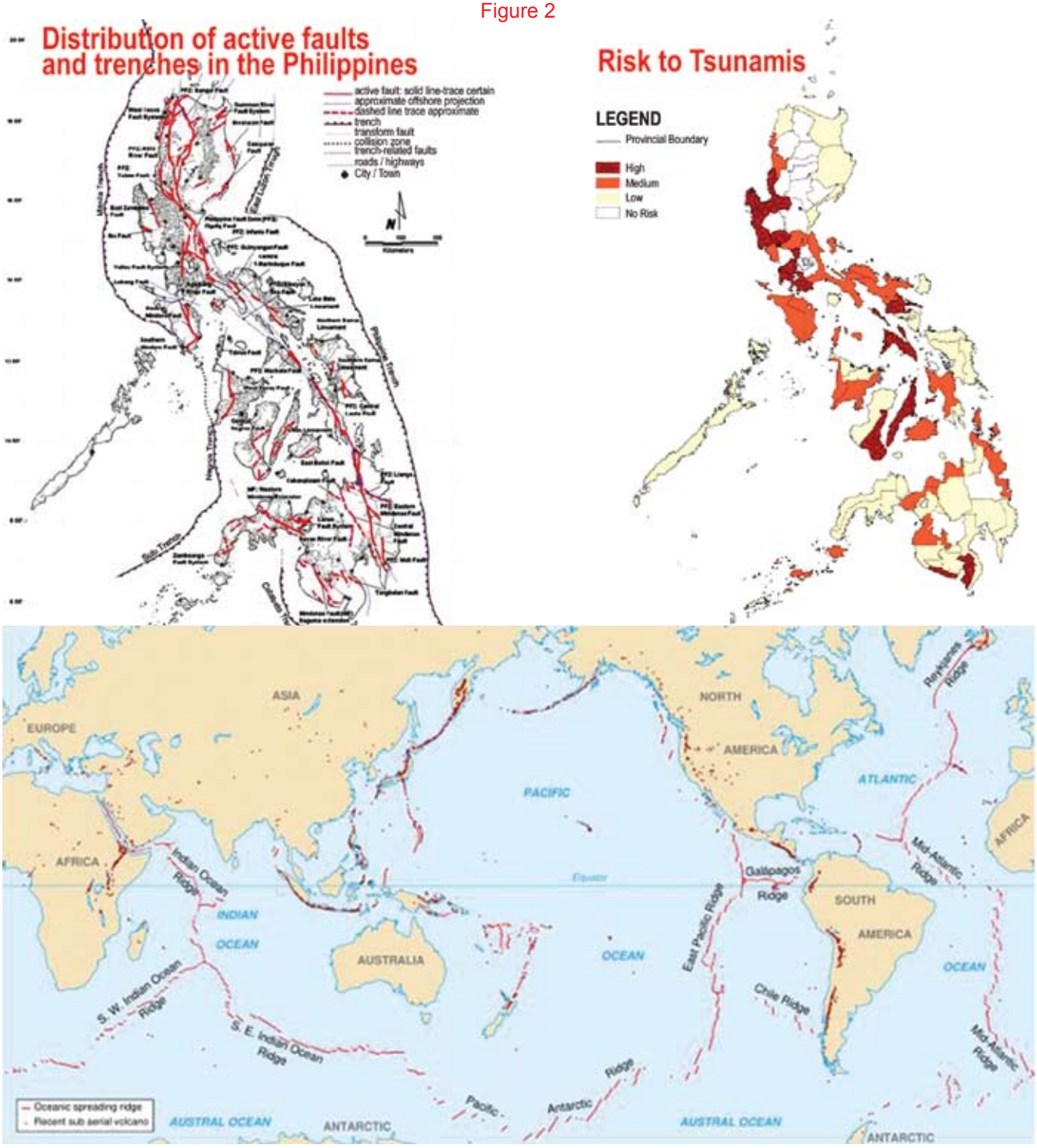
Motivation

Present a map of the world, Asia, and the Philippines. Give students time to analyze the maps. (If available, use the tectonic map of the world, regional geologic setting [Asia], and the active faults and trenches map of the Philippines.)

Questions:

a. What similarities and differences do you observe on the maps?
b. Identify specific areas that are prone to tsunami.

Figure 2



Activity

- Panel Discussion (or Role Playing with research materials made by students)
- Let students listen to panelists and ask them to prepare questions on tsunami.

Note: Panelists pretend to have experienced a tsunami.

- Topic for Panelist 1: What is a tsunami? Why and when does it occur?
- Topic for Panelist 2: What are the adverse effects of tsunami on lives, properties, and economy of the country?
- Topic for Panelist 3: What should be done before, during, and after a tsunami?
- Topic for Panelist 4: What family/school disaster plan can be developed specific to tsunami? What is being done by the national and local government in terms of tsunami mitigation and post-tsunami rehabilitation?

Tsunami

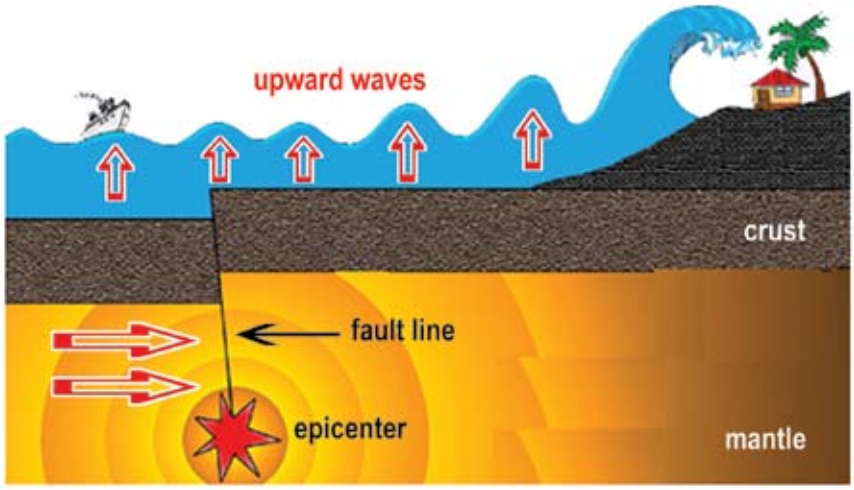


Figure 3
How tsunami is formed.

Analysis

Ask students about their insights on the discussion

Check students' understanding of the following:

- what tsunami is and is not.
- how tsunami is generated.
- what should be done before, during, and after a tsunami to save lives and properties.
- what is the government's role in tsunami mitigation and post-tsunami rehabilitation.

Abstraction

Tsunami occurs naturally and thus, cannot be prevented. Its adverse effects can only be mitigated and the risks reduced by knowing what to do before, during, and after a tsunami.

Application

Prepare a school/family disaster plan specific for a tsunami and be ready to share knowledge learned with friends and family members.

Evaluation

Write an essay on the topic: "When tsunami strikes."

Closure:

Life skills learned:

- How to prepare a family/school disaster plan focused on tsunami
- How to effectively share the knowledge learned with friends and family members

Looking back:

Concepts

- Recall the description of a tsunami.
- List down safety precautions that must be observed before, during, and after a tsunami.

Critical Thinking

- Evaluate the effectiveness of the disaster plan you prepared.
- Explain the causes of tsunami.

FLOODING

What do you know about

- occurrence of flood
- causes of flooding
- effects of flooding

Introduction

Flooding refers to the continuous increase in water levels causing rivers and other bodies of water to overflow, including drainage and water channels. Drainage is a naturally occurring channel formed by streams and rivers which removes water from land surfaces. Water channels – known also as waterways – can be either river canals or other routes that can be used for travel.

There are several causes of flooding. A flash flood is the sudden rise of water level with little or no warning at all, submerging low-lying areas. Flash floods usually happen in rivers situated in mountainous places.

Storm surge is an offshore rise of water associated with low pressure weather, typically a tropical cyclone. Storm surge is caused primarily by strong winds pushing on the ocean's surface. The wind causes the water to pile up higher than the ordinary sea level. Surface runoff occurs when soil is infiltrated to full capacity and excess water from rain, snow, and other sources flows over the land. Solid fragments of inorganic and organic materials may be carried by running water.

Ecologists also attribute flooding to human activities. Drainage systems fail because they cannot cope with the volume of water or are blocked by wastes thrown in the rivers or canals. High-rise buildings and subdivisions encroach on flood plains, obstructing floodways and causing loss of natural flood storage. With increasing development, previously open land areas are converted to paved roads, causing more runoffs.

People living on the banks of rivers and other bodies of water are endangered and need to rethink about evacuating their families. They can do this with the help of proper agencies so that they can readily adapt to a new environment. Meanwhile, citizens and local agencies can conduct cleanup campaigns or make their own community plan to become resilient or reduce the risk caused by flooding.

Objectives

General Objectives

To enable students to understand flooding, its causes and impact on humans.

Specific Objectives

At the end of the session, the students shall be able to:

- identify causes of floods.
- explain destructive effects of floods on humans.
- identify measures to prevent flood and the experience of flood hazards.

Main Ideas

- Flooding
- Destructive effects of floods on humans
- The experience of flood and preventive measures on flooding

Vocabulary

1. surface runoff – occurs when soil is infiltrated to full capacity and excess water from rain, snow, and other sources flows over the land. Solid fragments of inorganic and organic material deposited by wind, water, or ice may be carried by running water.

2. rainfall – water falling in drops from vapor condensed in the atmosphere. The quantity of rainfall is measured in millimeters (mm).

3. rain water – drops of fresh water that fall as precipitation from clouds.

4. drainage – the naturally occurring channel flow which removes water from the land surface.

5. water channels – known also as waterways. These can be either a river canal or other route that can be used for travel.

Subject Matter

Flooding, destructive effects, and preventive measures

References

Science and Technology, Dr. Lilia M. Rabago, et. al., SD Publication
Earth Science, The Philippine in Focus, UPNISMED, UP, Quezon City
Child Craft, Our World, World Book Inc.

Strategy

Motivation

A. Group the class into two.
B. Give each group pictures and clippings of recent flooding.
C. Let the students discuss their observations among themselves.

Activity

Group discussion

1. What do you think are the different causes of flooding?
2. What are the effects of flooding on the emotional, psychological, and economic conditions of the affected families?
3. How can you contribute to the prevention of floooding?

Analysis

1. Do you think the risks caused by flooding can be reduced? How?
2. What is your role in the reduction of these risks?

Abstraction

1. Flooding is a result of both natural and human activities.
2. The country experiences flood more particularly during the rainy season. Flooding can result in loss of lives and properties and damage to infrastructure and agriculture. Communication and transportation could be cut off, severely hampering commerce and industry.
3. Citizens can do something to adapt, become resilient, or reduce the risks caused by flooding.

Application

What to do before a flood:

- Find out the frequency of floods in your locality, especially in areas where the school is located. Research on previous occurrence of flood and its impact on the community.
- Know the flood warning system in your barangay. Consult your concerned agency and local barangay officials for information.
- Prepare an evacuation plan in case the water level rapidly rises.
- Get ready with a survival kit that contains transistor radio, flashlight, batteries, emergency cooking equipment, candles, matches, and first aid kit.

What to do during a flood:

- Stay calm and keep yourself informed.
- Switch off electricity and secure your homes before evacuating.
- Do not attempt to cross flowing streams unless you are sure the water is just below the knee.
- Avoid areas prone to sudden flooding and be careful of water-covered roads and bridges.
- Do not swim or ride a boat in swollen rivers.
- Eat only well-cooked food and drink only safe water. Boil drinking water to avoid water-borne diseases.
- School teachers and students may offer assistance in the event that the school becomes an evacuation center.

What to do after a flood:

- Avoid using lanterns or torches in case flammable materials are in use.
- Report broken utility lines (electricity, water, gas, etc.) immediately to appropriate agencies/authorities.
- Be sure that electrical appliances are checked by a competent electrician before switching them on.

TROPICAL CYCLONES

What do you know about

- weather and climate
- types of tropical cyclones

Introduction

Have you ever been caught in a heavy downpour and wished you had been warned ahead of time? You probably wished you had brought an umbrella and raincoat with you, worn appropriate clothes and shoes, and identified beforehand possible places to seek shelter from the rain.

Meteorologists look for weather clues to help predict weather. They use weather instruments to follow the progress of weather. These instruments help tell weather conditions and spot approaching weather disturbances over 300 kilometers away.

The Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) disseminates weather reports through the newspapers, radio, websites, facsimiles. These are forecasts or predictions of weather in the next 24 hours. The weather forecasts are interpretations of data collected from weather stations. Studies have shown that half of the average yearly rainfall in the Philippines is due to tropical cyclones.

Awareness of their impact and the precautionary measures that have to be observed should they occur can help save lives and properties.

Objectives

General Objectives

- To provide students knowledge and understanding of tropical cyclones and other weather disturbances as a hydro-meteorological phenomenon
- To provide information on how to prevent cyclone-related hazards from occurring

Specific Objectives

At the end of the session, students shall be able to:

- differentiate weather from climate.
- describe Philippine climate.
- identify tropical cyclones and classify according to the speed of their circulating winds.
- explain warning signals of a tropical cyclone.
- provide information on disaster preparedness relative to tropical cyclone.

Main Ideas

- Weather is the condition of the atmosphere in a particular place within a short period of time while climate is the average weather condition in a region over a period of time.
- The Philippines has a tropical climate with a high temperature that reaches above 20°C. Normally, temperature varies according to location, lower at the beginning and end of the year.
- Tropical cyclones refer to low pressure system with winds blowing in counter clockwise direction. The "eye" of the cyclone is the center of the circulatory wind.

Tropical cyclone

- Cyclone occurs in areas where the water is warmer than its surroundings (temperatures higher than 26°C). The warm, moist air above the water rises, causing low pressure. As air rises, it expands and cools off. Low pressure areas lead to cyclones if there is high wind velocity and a continuous supply of rising, warm moist air.

Vocabulary

1. shower – rain of short duration over a small area
2. precipitation – condensation of water vapor and its subsequent deposition on the earth's surface. Precipitation comes in the form of rain, snow, hail, and sleet.
3. tropical depression – tropical cyclone with maximum winds of not more than 63 kph
4. tropical storm – violent weather condition with winds of 63-117 kph
5. typhoon – type of tropical cyclone which develops over big bodies of water with winds of 118 kph or more

Subject Matter

Tropical Cyclones

References:

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Science and Technology I by Dr. Lilia M. Rabago and others, SD Publications Inc.
Earth Science, The Philippines in Focus, UPNISMED, University of the Philippines, Quezon City
Childcraft: Our World, World Book Inc.

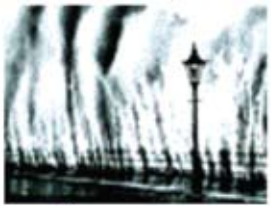
Strategy

Motivation

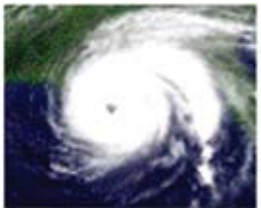
1. Ask the students how we can determine the signs of coming heavy rains, thunder, or lightning by observing the atmosphere outside their classroom.
2. Cite safety measures and other things to do to avoid physical and health hazards in relation to heavy rains, thunder, or lightning.
3. Film Viewing (optional)

Extreme Weather (Ultimate Guide to the Extreme Weather, Discovery Channel Kids)
Milenyo Clips (Province of Albay)

Tornado



Storm surge



Hurricane

Thunderstorm

Activities

1. Weather forecast:
   a. Teacher reads weather forecast for the day.
      Example:
      Philippine Daily Inquirer
      18 December 2000

      Metro Manila will have light passing showers. Extreme Northern Luzon and Eastern side of the Visayas down to Northeastern Mindanao will have occasional rains. Yesterday's extremes; High at 1:45 P.M. 29.8°C; low at 6:10 A.M., at 21.7°C. Sunrise today is at 6:13 A.M.; sunset at 5:29 P.M.

      Ask students what is their understanding of the above forecast.

   b. Use a Philippine map for a simulated weather forecasting tropical cyclone.

Figure 4
Television tropical cyclone forecast

2. Given the information below, differentiate the types of tropical cyclones

Type	Maximum Winds
Tropical Depression	Less than 63 km/hr
Tropical Storm	63-117 km/hr
Tropical Typhoon	118 km/hr or more

Analysis

1. After studying the sample weather forecast, answer the following:
   a. Identify important elements of the weather forecast.
   b. Describe the general weather condition for the next 24 hours.
   c. How are the temperatures recorded?
   d. What determines that rain is coming?

2. Given the data of the maximum winds blowing in each of the three types of tropical cyclones:
   a. Which is the strongest tropical cyclone?
   b. Which is the weakest?
   c. What makes the three types of cyclones different from one another?
   d. What kind of preparation is needed in the event of a depression, storm, or typhoon?

3. Discuss essential information on preparedness/mitigation, response, and rehabilitation when typhoon occurs.

Abstraction

1. Sample Weather Forecast
   Weather is the general condition of the atmosphere over a specified area (e.g. the Philippine territory) within a specified period of time (usually 24 hours from 8:00 A.M. onwards).

   Note: Climate will be compared with weather and this will lead to the discussion of the Philippine climate.

   Temperatures are recorded in the morning and in the afternoon to determine actual differences of the temperatures in a given forecast.

   Forms of precipitation are stated in the forecast as light passing showers and occasional rains.

2. Tropical cyclones are differentiated as follows:
   - If circulating wind has a speed of 63 km/hr or less, it is called tropical depression.
   - If the speed increases to 63 to 117 km/hr the cyclone is considered a storm.
   - If the wind speed is more than 117 km/hr the storm becomes a typhoon.
   - Typhoon is the strongest tropical cyclone, while the weakest tropical cyclone is tropical depression.

Application

Considering that the Philippines is prone to all kinds of natural disasters because of its geographical location and physical environment, adaptive and preventive measures should be undertaken. Essential information on preparedness/mitigation, response, and rehabilitation when such disturbances occur should also be studied. (Note: Teacher should provide essential information about given weather disturbances and explain preventive measures to the students.)

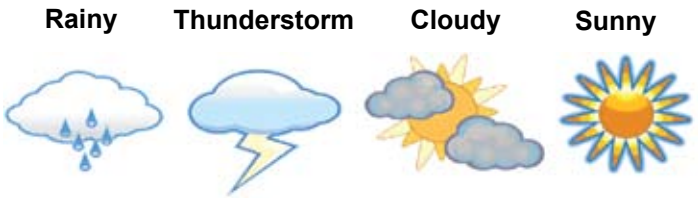


Figure 5
Weather forecast icons

Typhoon

What to do before a typhoon:

- Establish and maintain coordination with the Barangay Development Coordinating Council (BDCC).
- Ensure that homes and buildings can withstand heavy rains and strong winds. Houses and single level school buildings can be anchored by guy wires to strengthen the stability of structures.
- Learn about typhoons, their signs and warnings, effects and damages and how to protect children, important documents, and properties.
- Develop a Disaster Preparedness Plan.
- Participate actively in counter disaster response drills in your school or office.
- Listen to or watch latest radio and television news reports on the hazards of an impending calamity.
- Be aware of suspension of classes or invoked school-based decision.
- Prepare flashlight, umbrella, and jacket if necessary.

What to do during a typhoon:

- Monitor through radio or other reliable sources the latest official report of PAGASA on the typhoon.
- Stay indoors. Choose the most stable and safest place in your house and stay away from windows.
- Coordinate with the proper officials on possible immediate evacuation measures especially if your house or school is located in a low-lying area.
- Remain calm by keeping yourself informed of the latest development.

What to do after a typhoon:

- Attend to victims immediately. For minor cuts and wounds, apply first aid. Seek medical assistance at a disaster station or hospital.
- Check for damages and losses. Report these immediately to the authorized officials.
- Coordinate with the Barangay Officials for assistance.
- If in school, seek the advice of your teacher if you can be permitted to go home.
- Continually observe safety measures on your way home.

Evaluation

1. Explain the difference between weather and climate.
2. Describe the Philippine climate.
3. Describe the origin and formation of cyclones.

TORNADO

What do you know about

- tornado
- occurrences of tornado in the Philippines
- hazards brought about by tornado

Introduction

The tornado or "twister" is a destructive whirlwind that descends to the ground from thunderstorm clouds. If its dangling end touches close to the ground, it will create absolute destruction on anything in its path. Since there is no way to stop a tornado, understanding tornadoes is the key to preventing deaths.

Objectives

General Objective

To increase students' awareness and understanding of the science and impact of tornado in order to develop plans for mitigation

Specific Objectives

At the end of the lesson, students are expected to:

- define a tornado.
- describe the development of a tornado.
- list the impacts and damages caused by tornadoes.
- with the help of the teachers, formulate a plan of activites before, during, and after a tornado.

Main Ideas

- A tornado acts like a giant vacuum cleaner, sucking and carrying aloft objects along its path such as trees, structures, or debris, jumping across the ground in a narrow erratic movement.
- It can strike at any time of the day, but is much more frequent in the afternoon and evening. It may also develop when there are tropical cyclones.
- Most of the damage comes from its extreme winds. Wind speeds are estimated to exceed 450 km/hr and may last for a few minutes. Whenever a tornado strikes, it can leave a mark of destruction.
- Tornadoes are often obscured by rain or dust.
- Tornadoes strike in many areas of Luzon and Visayas but the highest incidence of tornado sightings and destruction has been reported in Mindanao.

Vocabulary

1. tornado – a localized windstorm over land surface characterized by a visible funnel-shaped, rapidly whirling cloud extending downward from the base of a dark cumulonimbus cloud (thunderstorm)

2. waterspout – a tornado that occurs or moves over a body of water

3. cumulonimbus mammatus – dense, low, rugged clouds that consist of pendulous globules (mamma is the Latin word for breast) that hang from the underside of the anvil of a thunderstorm cloud

Subject Matter

See Tornado in the Teacher / Student Modules.

Strategy

Motivation

Present a picture showing the aftermath of a tornado and let students describe or give their opinion on what they see.

Activity

Documentary film viewing about tornado

1. Pre-viewing questions (to be given to students before the viewing starts)
   - What are tornadoes?
   - How do tornadoes develop?
   - What are the damages caused by tornadoes?
   - How are you going to prepare if a tornado or waterspout occurs?
2. Viewing proper
   - Students are given time to watch the film and answer the pre-viewing hint questions
3. Post-viewing discussion

Abstraction

1. A tornado is a natural occurrence defined as a violently rotating column of air extending from a thunderstorm to the ground. It occurs anywhere and can occur at any time of the year.
2. People need to be aware of and prepare for the destructive effects of this natural phenomenon.
3. Preparedness information about the occurrence of a tornado is essential for safety.

Application

Students are instructed to develop a disaster plan at home, school, and when outdoors in order to ensure safety during the occurrence of tornadoes.

How to keep yourself safe:

- Be on the lookout for the precursory signs of an impending severe thunderstorm that could generate a tornado. “Go to a safe place,” but where is safe? The key word is down.
- If at work, home or in school, keep calm, take cover in any interior hallway and in the lowest place of a building, or under a piece of sturdy furniture and brace yourself. Stay away from windows.
- Secure outdoor objects (like garbage cans, garden tools, toys, signs, garden sets) if time permits.
- Lie down in any depression or crawl into culverts when a tornado is about to strike as it is considerably better than remaining upright.
- If driving a vehicle, stop and abandon it and seek shelter outside in the nearest depression, ditch, or ravine (but be aware of flash flooding).
- Tornadoes are generally short-lived. They come and go quickly. There may not be time for a warning.
- Be alert for the sudden appearance of violent winds, rain, hail or funnel-shaped cloud in your locality.

Evaluation

Ask students to answer the following:

1. Explain the formation and development of a tornado.
2. What can be done if basic services like water, gas, electricity, or telephone are cut off?

Illustrations and images in this document have been taken from the following sources:

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