Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
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Severe Weather Trackers

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I am currently a first grade teacher at John C. Daniels School in New Haven, Connecticut. John C. Daniels was the first dual language program implemented in the city. Being a dual language school means we teach every child English as well as Spanish. For the first two years, grades kindergarten and first, children learn their academic foundational skills in their dominant language of English or Spanish. They are exposed to the opposite language as a second language, where they begin to learn the very basics of that language. Beginning in the second grade, children learn all of their academic skills in both languages. There is only one other school like ours in New Haven, which makes our programs stand apart from the other schools in the city.

Our school is located in the Hill section of the city, which is one of the poorest areas in New Haven. As a result, the majority of our students come from a low income household. All of the children in the school are provided with a free breakfast as well as lunch. Home life can be difficult for most of the children. They come from single parent homes or a two parent home and some are in the care of DCF or are living with relatives because their parents, for one reason or another, cannot care for them at this time. Our school community is racially diverse, which allows the children to interact with many different types of people on a daily basis.

With these children in mind, I developed a science unit titled, Severe Weather Trackers, to utilize in my classroom. Through this five week unit, the children will learn about different types of severe weather. Along with the study of severe weather, the children will learn about choosing meteorology as a career and what it takes to get there. Bringing the idea of a career to children in this community would be beneficial because they may never realize this could be an option for their future. This unit will help them get excited about science and weather and possibly a future career to consider.

This unit will fulfill the weather portion of the district's first grade science curriculum. The standards that will be addressed are:

1. Children will address, describe, question, classify and experiment (1.2s)

2. Children will understand that tools help scientists make better observations, measurements and are the equipment for investigations (5.2s).

Overall, my goals for this unit are to get the children excited and engaged in scientific inquiry. The children will be learning about severe weather through hands-on experiments, video clips and pictures. The more

children are able to do and see, the more impact their learning is going to have on them. I also want the children to learn how meteorologists contribute to the field of science and our society. I want them to see what an interesting job they have, but also how difficult it can be. Most of all, I want the children to gain an interest in weather and have fun! Severe weather is a very interesting topic with plenty of excitement to keep the children's' attention and participation.

The first two weeks, the topic of severe weather will be introduced. I will explain to the children what severe weather is and what will happen in the next five weeks in the classroom. The children will then begin to learn about the different types of severe weather that they will experience living in the northeast. Children will learn the basic facts of how these events occur and what damage they have caused or could cause. I will concentrate on hurricanes, thunderstorms and nor'easters. I will use stories, videos, and the children's own personal experiences as my means of teaching the topics. One activity the children will participate in is exploring coloring books that describe severe weather storms in kid friendly terms.

The third week of the unit, I will begin to broaden our experience with severe weather by introducing events that do not happen near us but around the world. Children will learn about how these events occur and what types of damage they have or could have caused. We will primarily discuss tornadoes. Children will learn about tornadoes through books, videos and hands-on experiences. For example, the child will be making their own tornadoes as a class activity.

The fourth week, children will review the topics that have been discussed as well as begin to discuss the careers of severe weather meteorologists and storm chasers. Children will learn what a meteorologist is and what he/she actually does at work. Storm chasers will also be introduced. The children will find out what happens in a typical day of storm chasing. Children will watch clips from the National Weather Channel as well as other video clips of meteorologists. Children will also study the different types of equipment that meteorologists use to help them predict the weather. Finally, the road to becoming a meteorologist will be discussed. At the end of the week, children will practice giving a forecast on one of the severe weather events that have been discussed throughout the unit.

The fifth and final week will be spent tying all of the elements together. Children will become meteorologists, as they give forecast on a severe weather event that they put together, with help from their parents and teachers. They will use the information they have learned over the last four weeks to describe a couple of facts that they have learned about their event. The forecasts will be taped and at the end of the week, the class will watch them.

After the five weeks, my hope is that the children will have a better understanding of the different types of severe weather that are going to be covered in the unit. I hope the children will walk away from the unit with the ability to share the knowledge they learned with their classmates as well as any adults at home. Lastly, I hope that they have a better understanding of the job a meteorologist does and what types of tools and education help them forecast the weather. Most importantly though, I hope the children have fun while learning and begin to take an interest in the weather not only in our area, but around the world.

Background of Basic Weather Terms

Convection

Abbot describes the process of convection as, "the transmission of heat in flowing water (or air)" (Abbot, 274). Or in simpler terms, convection is the process of hot fluid air rising and cold falling.

Water Condensation Boosting

There is hot and rising water vapor in the atmosphere, when the air reaches lower pressure zones, the temperature drops. This drop in temperature causes water within it to condense out. As a result, heat is released and all of the heat that was present has now been eliminated.

Upwelling Air

Air rises and expands, because the air rises, the temperature drops but there is no release of heat. Once the temperature goes down, because the air has risen, water vapor condenses out and releases heat. The heat that is released makes the air rise even faster because the upwelling effect is sucking air in behind it at a faster rate.

Coriolis Effect

The Coriolis effect can be easily defined as the movement north from the equator, where an object is always going to turn towards the East, its right side. For example, if an object was standing at the equator trying to move north, it will always veer towards its right side as it tries to move away from the equator. As the object is moving, it has the speed of the equator air behind it and it is moving much faster than the air to the E or the right of it. As a result, the object begins to veer right as the objects underneath it are moving at a slower rate.

Severe Weather

The weather channel defines severe weather as any destructive weather event, but usually applies to localized storms such as blizzards, intense thunderstorms, or tornadoes. For this unit, I will concentrate on nor'easters, thunderstorms, hurricanes and tornadoes. All of these are powerful storms that have cost large amounts of money as well as caused numerous fatalities.

Nor'easters

Winters storms, otherwise known as nor'easters, are one of the most common forms of severe weather that we see living in the northeast. The weather channel defines a nor'easter as a mid-latitude cyclonic storm occurring off the east coast of North America. A nor'easter gets its name from the continuously strong northeasterly winds that blow in from the ocean ahead of the storm and over coastal areas. A nor'easter is formed when, "a low-pressure system moves up the northeastern United States coastline, its counterclockwise circulation on its western or landward side draws cold air down from the north. Meanwhile, its eastern or seaward side picks up moisture from the Atlantic Ocean to feed into the cyclone," (Abbot, 279). In other words, a nor'easter is formed when cold Canadian air and warm Atlantic moist air low pressure zones brings them together and crashes into one another. An air mass can be described as a large region above the Earth with a uniform temperature and moisture level. Most winter storms are formed in the northeast when an air

mass of cold, dry Canadian air moves south and interacts with a warm, moist air mass moving north from the Gulf of Mexico.

For a winter storm to develop three things need to be present: cold air mass, moist warm air mass and lift. Cold air is required for a snow storm to develop. There needs to be freezing temperatures in the clouds as well as near the ground in order to make snow and/or ice. Lift is required to raise the moist air to form the clouds and in return cause precipitation to form. Last, but of course not least, moisture needs to be present to help form the clouds and precipitation.

There are a couple of different stages that we can see during a nor'easter. For example, the storm can consist of snow, sleet and freezing rain. In one storm we can see all of these elements and in others we may see only one or two. Each storm is uniquely different and depending on the levels of the three ingredients present we will see different types of precipitation. Snow is formed in the top layer of the storm because it is usually cold enough to create snowflakes. Snowflakes are made out of a collection of ice crystals that cling to each other as they fall down towards the Earth. Snow will continue to fall as long as the temperature stays at or below 0 degrees Celsius from the base of the cloud to the ground. As with anything, there are varying types of snow ranging from light to heavy accumulation. Snow flurries are the lightest form of snow that falls, leaving behind no accumulation because it only lasts for a very short duration of time. Next on the scale are snow showers, these leave us with a small amount of accumulation and last for brief intervals of time where there are light and then heavy snow falling. Next are snow squalls, which consist of heavy snow showers that last for a brief amount of time. Although the showers do not last long, they can leave behind a significant amount of snow because they are accompanied by strong and gusty winds. Then there are blowing snow showers which reduce visibility because they are, as the name implies, wind-driven. Last, but not least, are blizzard showers. These consist of snow showers as well as blowing snow showers. As a result, the winds accompanied by this storm can be as strong as 35 mph and can last for at least 3 hours!

Another type of weather condition we can see during a nor'easter is sleet and hail. Sleet forms from snowflakes that have only partially melted when they fall through a shallow layer of warm air. As a result, when they hit the next layer of colder air they instantly re-freeze and hit the ground as frozen rain drops that bounce off the ground.

The last type of weather we can see within a nor'easter is freezing rain. Freezing rain is formed when snowflakes completely melt because they have fallen through an even warmer layer of air. When the drops continue to fall towards the ground, they do not have time to refreeze before hitting the next layer of cold air. Since they did not have enough time to refreeze, they instantly freeze when they come into contact with anything that is less than 0 degrees Celsius. As a result, extremely dangerous and slippery conditions occur.

Thunderstorms

A thunderstorm can easily be defined as a rain shower in which you hear thunder. Thunderstorms fall under the classification of severe weather when they contain one or more of the following things: three-quarter inch or greater size hail, winds that gust in an excess of 57.5 mph and/or a tornado (www.nssl.noaa.gov). A thunderstorm, on the average, lasts for about 30 minutes and is usually 15 miles in diameter (www.nssl.noaa.gov). There are approximately 2,000 thunderstorm taking place, all around the world, at any given moment in time. As a result, there are approximately 100,000 thunderstorms throughout the year (www.nssl.noaa.gov). Out of these 100,00, only 10% are actually categorized as severe weather thunderstorms (www.nssl.noaa.gov). For a thunderstorm to develop, there are three basic ingredients that need to be present. These ingredients are: moisture, rising unstable air and a lifting mechanism to provide the

"nudge". (To find a full description of water condensation and upwelling air, please refer back to the section on background information).

A thunderstorm goes through three stages of development. They are: the developing stage, the mature stage, and the dissipating stage. Stage one, as I just mentioned, is the developing stage. During this stage a cumulus cloud is pushed up by a rising column of air. The cloud begins to look like a tower as it continues to be pushed upwards. During this stage there is little, if any, rain but there can be some lightning. This is a very short stage of the thunderstorm, only lasting 10 minutes. The next stage in development is the mature stage. In this stage, the updraft continues to feed the growing thunderstorm and precipitation begins to fall. As a result, a downdraft begins to form, where air is being pushed downward. During this stage, we are must likely going to see hail, heavy rain, frequent lightning, strong winds and/or tornadoes. When you look into the sky during this period, you will notice that the storm takes on a black or dark green appearance. The final stage of development is the dissipating stage. During this final stage, a large amount of precipitation is produced letting the downdraft overcome the updraft. The rain begins to decrease in intensity but the amount of lightning still remains at very dangerous levels. (www.nssl.noaa.gov)

There are 4 different types of thunderstorms that can develop. The first type of thunderstorm is the single cell storm. These are the weakest form of thunderstorms. They only last for 20-30 minutes and do not normally cause any severe damage. Although they usually do not cause severe damage, they can produce some unpleasant weather conditions. During this type of storm we will see the elements of thunderstorms such as rain or hail but just at a weaker degree. The second type of thunderstorm is the multicell cluster storm. These are the most common form of thunderstorms that we will see. As the name suggests, this storm is comprised of a cluster of cells that move along as one single unit. Within the cluster each cell is at a different phase of the thunderstorm life cycle. The mature cells are the ones that can be found in the center of the storm while the dissipating cells can be found on the outer regions of the storm. Each cell within the cluster stays active for about 20 minutes. The entire cluster can stay active for several hours. During these storms we can expect to see hail, flash floods and possibly even weak tornadoes. The third type of thunderstorm is called the multicell line storm or also known as the squall line storm. This storm is comprised of a long line of storms that have a continuous and well-developed gust front at the leading edge of the line. The line may be solid or it can have gaps and/or breaks in it. During these storms we can expect to see hail that can be the size of a golf-ball, heavy rainfall and weak tornadoes. These storms are especially known for producing strong downdrafts. These strong downdrafts can cause a portion of the squall line to pass right by other parts of the line. The last type of thunderstorm is also the most powerful and life threatening, it is called the supercell storm. Although these types of storms are rare, they are highly organized and can cause a huge amount of damage. The supercell, just like the single-cell, has one main updraft. But unlike the single-cell, the supercell's updraft is extremely strong. It can reach speeds of 150 to 175 mph (www.teacher.scholatic.com). The rotation of these storms are also very unique and set them apart from other thunderstorms. During these storms, winds come in from different directions and cause the rotation in which precipitation is produced. When this precipitation is produced in the updraft, the strong upper-level winds blow it downward. As a result, very little precipitation falls back into the updraft and therefore expands the life of the storms, allowing them to survive for long periods of time. During these storms we can expect to see giant hail and violent tornadoes.

One of the major contributors of damage during thunderstorms are the strong winds that can be produced by them. In fact they "account for half of all severe reports in the lower 48 states and is more common than damage from tornadoes," (www.nssl.noaa.gov). Wind speeds during a thunderstorm can reach up to 100 mph but those that reach 50-60 mph and above are classified as damaging winds. There are 7 different types of damaging winds that we can see during thunderstorms, they are: straight-line winds, downdrafts, downbursts,

microburst, gust front, derecho and bow echo. The first type of winds are called straight-line. The National Severe Storms Laboratory defines them as, "any thunderstorm wind that is not associated with rotation, and is used mainly to differentiate from tornadic winds," (www.nssl.noaa.gov). The next type of winds are downdrafts which can be described as a small-scale column of air that quickly sinks toward the ground. These winds are a direct result of a strong downdraft. The third type of winds are downbursts, which are strong downdrafts consisting of horizontal dimensions greater than 2.5 miles resulting in damaging winds that are on or near the ground (outward burst). These winds can start out as microburst and then spread out over a wider area. The fourth type of winds are microbursts which are small concentrated downbursts which produce an outward burst of damaging winds at the surface (www.nssl.noaa.gov). These winds are generally small in size and last a short period of time (5-10 minutes) but can reach speeds of up to 168 mph. The fifth type of winds are called gust front. These winds are the leading edge of rain cooled air the come and clash with warmer thunderstorm inflow. Gust fronts are comprised of wind shifts, temperature drops and gusty winds which are out ahead of the thunderstorm. Next are derecho winds. Derecho is of Spanish origin and means "straight ahead" (www.nssl.noaa.gov). Derecho winds develop when a new thunderstorm forms along the edge of an outflow boundary. An outflow boundary is, "a surface boundary formed by horizontal spreading of thunderstorm cooled air," (ww.nssl.noaa.gov). These winds are usually produced during the summer months when thunderstorms form over the plains and northern plain states. These winds are especially dangerous because they are capable of covering a large area and can last for an extended period of time. The seventh and final type of winds are bow echo winds, which consist of radar echo winds that are linear but then bend outward resulting in the bow shape. These winds can be over 300km in length and last for hours while producing large amounts of damage at the ground level.

Lightning is another dangerous and damaging feature found in thunderstorms. The National Severe Storms Laboratory defines lightning as, "a gigantic electrostatic discharge between the cloud and the ground, other clouds, or within a cloud" (www.nssl.noaa.gov). The creation of lightning is a very complicated process to explain. There are two different theories that seem to support how clouds build up electrical charges that in turn produce lightning, they are: precipitation and convection theories. Precipitation theory describes the creation of lightning as different size raindrops, hail or graupel, having either a positive or negative charge, that collide with heavier particles that carry negative charge to the cloud bottom. As a result, lightning occurs. On the other hand, according to convection theory, it is believed that updrafts transport positive charges close to the ground up through the clouds while downdrafts carry the negative charges down to the ground. Within clouds there are negative and positive areas that grow creating an electric field between the oppositely-charged thunderstorm base and top (www.nssl.noaa.gov). A large amount of charge has to build before this electric field can overpower the atmosphere's insulating properties. Currents of electricity force a path through the air until it makes a connection with something. The current is then discharged as a flash of lightning. Most lightning occurs within the storm cloud, in fact it accounts for 75-80% of all lightning that is created (www.nssl.noaa.gov). There are two different types of lightning that occur: ground flashes and cloud flashes. Ground flashes consist of flashes of lightning that hit the ground. On the other hand, cloud flashes, are lightning flashes that occur within the clouds.

Tornadoes

Tornadoes will be the next severe weather phenomenon covered in my unit. Tornadoes descend from thunderstorms and consist of violently rotating columns of air. They can reach speeds of up to 300 mph. In order for a tornado to form there are 3 types of air that must be present in the environment. First, there must be instability within the atmosphere. Close to the ground, we find a layer of warm and humid air with strong south winds. In the upper atmosphere, we find colder air and strong west or southwest winds. This means that

the air closer to the surface is much less dense than the air higher in the atmosphere. If we gave the warm air an initial push to move upwards into the atmosphere, it would continue rising, sending it to mix with the much colder air in the higher part of the atmosphere. As a result, the combination of the two different types of air would cause the tornado's parent thunderstorm. The second element needed is a change in the speed and direction of wind. The cold front dives underneath the warm front, or in other words, they slide by each other. Air then becomes trapped between the two fronts and gets stuck. As a result, the air begins to tumble and turn. The storm then grasps the air and pulls it up causing an upwelling of air. This in turn causes a low pressure zone at the bottom because the storm is sucking air off the ground. Since the air is turning in-between the two fronts and now more air is being picked up, the tube begins to spin faster. The wind shear then tilts the storm allowing more time for the storm to get tighter and last longer. Last, a layer of hot, dry air between the upper and lower layers is needed. When all of these elements combine a thunderstorm is formed and from a severe thunderstorm a tornado is produced.

When compared to other countries, more tornadoes occur in the United States. Australia is also known to have a large amount of tornadoes, but still less then the United States. The make-up or geography of the United States makes it an ideal place for a tornado to develop because it brings all of the necessary elements together. For example, the Rocky Mountains are to the west, the Gulf of Mexico is to the south and there's a terrain that slopes downward from west to east. This area of land is known as "Tornado Alley". Approximately 500 tornadoes occur within this area each year (www.teacher.scholastic.com). The average for the United States is only 1,000 per year (www.teacher.scholastic.com). So, as you can see, most of the tornadoes that occur in the United States, occur within the boundaries of "Tornado Alley". The states with the highest risk of experiencing a tornado are also those that reside within "Tornado Alley." They are: Arkansas, Iowa, Kansas, Louisiana, Minnesota, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota and Texas. Tornadoes typically occur between April and June because of the unseasonable warm and humid spring weather.

Tornadoes are measured using the Fujita Tornado Damage Scale developed by Dr. T. Theodore Fujita, also referred to as "Dr. Tornado." The scale was created in 1971 and it is used to estimate the strength of a given tornado based on the winds associated with it. The scale ranges from F0 to F5, going from lowest danger to highest danger. A tornado given a score of F0 means the winds reached speeds from 40 to 72 mph. On the other hand, a tornado given a score of F5 means the winds reached speeds from 261 to 318 mph.

Hurricanes

The final type of severe weather that will be addressed in my unit are hurricanes.

Hurricanes are formed over tropical water and can be range from 60 to 1,000 miles in diameter. They start as a cluster of stronger thunderstorms, known as a tropical disturbance, that move across the ocean. The tropical wave begins by spinning around a center of low pressure known as a tropical depression. When the winds with that tropical depression reach a speed 0f 40 mph or higher, the storm then changes into a tropical storm. At this point in time, the storm is given a name. Scientists give hurricanes names so that people are able to track the storm with greater ease and tell one storm from another. Official storm trackers have a list of names readily available which are used on a 6 year rotation schedule. The list, complied from the National Hurricane Center, can be viewed at: http://www.nhc.noaa.gov/aboutnames.shtml. Once the 21 names that have been chosen for the year have been used, the Greek alphabet is used to help name the storms. Names are retired once they have been given to a hurricane that has caused an enormous amount of damage. Once the winds reach a speed of 74 mph or greater, the storm is called a hurricane or a "tropical cyclone". The conditions in the atmosphere must be just right for the tropical storm to develop into a full blown hurricane. In order for a

hurricane to occur there are a couple of conditions which need to be met. First of all, water temperature within the tropical ocean must be at least 80 degrees F. The warmer water gives the hurricane the energy it needs to keep growing and moving. There also needs to be a low wind shear from the top to the bottom of the atmosphere. In other words, there cannot be light winds on the ocean's surface and stronger winds at high altitude over the storm. If these conditions exist then the hurricane can be ripped apart and will stop developing. The last element needed is something to get the tropical wave spinning. Most of the time a low-pressure system, also known as a front, moving from the land to over the ocean helps develop the storm. Hurricanes have an eye which consists of calm winds and low pressure. Surrounding the eye of the storm is an eyewall consisting of internal thunderstorms which have high winds and heavy rain.

Hurricane season, as it is referred to as, lasts for 5 months (June 1 to November 30). Most hurricanes occur within in these months because of the rising water temperature in the ocean. Typically hurricanes last from 2 to 14 days, moving from east to west and reaching speeds up to 30 mph. The size of a hurricane is measured by the Saffir-Simpson Scale and range in intensity from 1 to 5. The scale measures 3 types of activity within a hurricane: wind speed, air pressure and storm surge. "The storm surge is a 50 to 100-mile-wide dome of water that sweeps across the coastline near where a hurricane makes landfall," (www.teacher.scholastic.com/activities/wwatch). Hurricanes which range in categories 3, 4, and 5 are referred to as intense or major hurricanes. These hurricanes are responsible for over 70% of the damage in the United States, although they only account for 20% of all hurricane strikes. Hurricanes die when they move over cold water or over land where they get cut off from its source of energy. Hurricanes rely on water vapor that evaporates from warm ocean water for their energy. Once that energy source is gone, they are no longer able to survive.

Careers in Meteorology

Meteorology is the science of the atmosphere. The term meteorologist is from an ancient Greek term meteor, or "things in the air," (www.weatherclassroom.com). It can be defined as, "a scientist who studies the atmosphere and atmospheric phenomena," (www.weatherclassroom.com). The ancient Greek observed clouds, winds and rain and tried to find the connection between them. In prehistoric times, weather watchers were the holy men who forecasted the weather for the rest of the tribe. The father of meteorology is Aristotle. He was the first person to not only study the atmosphere but also write a book about it (Meterologica, 340 B.C.). The first person to invent the thermometer was Galileo; other scientists went on to invent more accurate thermometers. RADAR began being used during World War II and today we use a very complex set of equipment to help us predict the weather. These pieces of equipment include: computers, satellites, more sophisticated Doppler RADAR and NEXRAD. All of these are used to study, forecast, analyze and predict the weather. Today meteorologists can be employed by the government, universities, television and radio stations, at nuclear power plants, airports, farms and fisheries, insurance companies, investment companies and much more. Their work far exceeds forecasting the weather, although this is a very important part of the job in our society which we heavily rely on. They can work in atmospheric research, teaching, and various other kinds of applied meteorology.

Meteorologists require the help of various instruments to help get their job done. The first types of instrument used are instrumented aircraft. These are airplanes that are equipped with measuring and sampling instruments and are used to observe different kinds of weather. One example is a "hurricane hunter." These

aircrafts fly into the eye of the hurricanes. Another instrument that meteorologists use is RADAR. RADAR stands for, "radio detection and ranging." It was originally developed to detect enemy aircraft that flew under the cover of clouds or darkness. Today RADAR is also used by meteorologists to detect and measure rain and other precipitation. Doppler, which is a special kind of radar, can also measure wind speed and direction. This tool has become the best way to detect tornadoes and other kinds of severe weather. It also serves as a key element of the new wind-shear detection and warning system that many major U.S. airports have adopted. The last two instruments that are most commonly used by meteorologists are satellites and computers. Satellites are able to measure temperature, winds and other qualities of the atmosphere at different levels. They are also the most valuable tools for meteorologists because they cover the entire surface of the Earth. Computers also play a major role in the forecasting of weather. Meteorologists, using computer programs, can simulate the weather and therefore make a prediction about what is going to happen with our weather. Since they can make the weather happen quickly on the computer, they use it as a guide to what is really going to happen in the "real world". True predictions can only be made a couple of days at a time because our atmosphere's circulation is such an unpredictable system.

There are approximately 20,000 meteorologists currently working in the field and another 1,000 meteorologists enter the field each year. In order to become a meteorologist, students should start their building their foundation in science and math in high school. This means that students should take as many classes in science and math as possible such as physics, chemistry, and earth science. A foreign language would also be a helpful tool for a meteorologist to have. After graduating from high school, the next step is finding a university that offers a degree in meteorology. There are many universities in the United States that offer such programs. Another route to a career in Meteorology that is not as limited as a degree in meteorology would be math, physics or engineering. All of these degrees will allow a graduate to work in the field of meteorology but also expand beyond it or go in a different direction if they choose too.

A Day in the Life of a Storm Chaser

A storm chaser is someone who chases storms. This is a very dangerous but exciting job! These scientists risk their lives with every chase in order to gain more information on the storm in which they are chasing. They also provide us with wonderful resources such as pictures and video footage of what happens during these storms. A typical day starts off by collecting data. This is done via the internet, where storm chasers look at satellite and radar maps, charts showing wind direction and strength, maps of temperatures and information on watches and warnings. After the storm chaser analyze all of the information, he/she picks a target for where storms might develop. The storm chaser may have to travel quite a distance to get to the destination but he/she does it because it's all part of the job. The storm chaser spends a large amount of time in their cars traveling from one severe weather storm to another. On the way, he/she may stop at a wireless connection spot (restaurant, coffee shop) to check weather updates. He/she mainly look at the same information they did that morning to see if changes have been made. For example, has the weather progressed or did the storm die down? The storm chaser may also travel with a GPS system (Global Positioning System). This system allows them to use his computer to track his location as he continues to move towards his target. He may also have the weather radio on in addition to radio scanners and small weather computers. More advanced storm chasers use a program called WxWorx to get data in their cars, while others use satellite internet. Along with his equipment, the storm chaser must go by what his eyes see and what signs the skies are giving him. The

chaser looks for towering cumulus clouds that can be the first stage in the formation of a supercell. Next he looks for other cloud features that are telltale signs that something big is going to happen. If the chaser sees the storm begin to develop into a tornadic supercell, he tries to play it safe by staying to the southeast of the storm. Once the chaser has "caught" his storm, he takes pictures, video or just observe what happens. Once it turns dark, the chaser calls it a night mainly because he can no longer see what is happening within the storm. When the sun rises, the chaser is back on his computer looking for a new storm. If storm chasing sounds like an exciting career or just an exciting adventure, there are tours that you can take where you ride along with a storm chaser in hope of finding the big storm. (www.skydiary.com)

One of the most recent movies dedicated to the lifestyle of storm chasers is "Twister" which was produced in 1996. Although this movie is not suitable for first graders to watch in its entirety, it can be used to show how tornadoes form and what they look like in action. Although most of the science portion is not completely valid, it will provide a visual representation for the students as they learn about tornadoes and what storm chasing involves. For example, in the movie cows fly within the tornado. Although cows have been killed by tornadoes, there has never been a citing of flying cows. The way the tornadoes are depicted and how quickly they progress is also stretched in order to complete the dramatic story line. Although there are some parts that extend reality, the experiment involving Dorothy is based on a real-life experiment. A group of researchers from the National Severe Storms Laboratory tried to put a 55-gallon drum equipped with sensors in the path of a tornado in the 1980s (www.skydiary.com). Their instrument was named TOTO (Totable Tornado Observatory) but it never experienced a direct hit by a big tornado. More video clips of storm chasers in action can be found at, www.stormvideo.com. There is also a website (www.stormeyes.org/tornado/vehicles) that has pictures of vehicles are used in storm chasing which students will find very interesting.

Lesson Plans

Lesson 1: Sounds of Thunderstorms

Objectives:

Students will describe the different sounds they hear during a thunderstorm.

Students will write about the sounds they hear.

Materials:

CD: Thunderstorm and Rain Sounds by Natures Music, CD player, 1 piece of paper for each child, pencils, crayons.

Preparation:

Before beginning the lesson, make sure the CD is in the player and that the player is near the carpet.

Lesson:

1) The teacher will begin reviewing what the children have learned about thunderstorms.
2) The children will sit in a circle on the rug.
3) The teacher will explain to the students that they will be listening to a CD that has recorded thunderstorms. She will ask to the students to listen carefully to the sounds as they will have to describe them later.
4) Then the teacher will ask one student to turn off the lights.
5) Once the lights have been shut off, the teacher will play the CD.
6) Once the CD is done, the teacher will ask the students what they heard. As students are called on, the teacher will record their answers on the board.
7) After calling on a number of students, the teacher will ask the students to return to their seats.
8) Once the students are seated, the teacher will remind the students of the sounds they heard on the CD. She will tell them that they will be writing about those sounds today. Each student will receive a piece of paper, a pencil and some crayons. They are to draw a picture of what they heard and then write about it.
9) After giving the directions and checking that all students understand, she will then have one student pass out paper, one pass out pencils and one pass out crayons.
10) Once the students have received their supplies, they may begin working.
11) The students will be given a time slot of 20 minutes to complete their picture and writing.
12) The teacher will signal for the students to begin cleaning up when the 20 is over.
13) After the students have cleaned their area and returned supplies to their areas, the students will again have a seat on the carpet.
14) The students will then take turns sharing their pictures and writing.

Lesson 2: Twister in a Jar

(adapted from http://eo.ucar.edu/webweather Web Weather for Kids)

Objectives: Students will make a tornado.

Materials:

8 oz jar with a lid, water, vinegar (1 teaspoon per jar), clear liquid dish soap (1 teaspoon per jar), pinch of glitter, small cups, Twister Trouble (The Magic School Bus Chapter Book #5), Twister the movie.

Preparation:

Before presenting the lesson, pick a tornado clip from the movie Twister that is appropriate for first graders. Have the video or DVD stopped at the clip you want the students to see.

The teacher should also have the water, dish soap and vinegar pre-measured in individual cups for each student that will be participating. This will allow the students the freedom of following the teacher's directions but physically doing the steps by themselves, hopefully without making too big of a mess!

Lesson:

1) The teacher will begin the lesson by having the children sit on the carpet, facing him/her.
2) The teacher will introduce the topic of tornadoes to the class. He/she will explain that today the students will be learning more about how tornadoes are made and what damage they can cause.
3) The teacher will then begin reading the book, Twister Trouble by Ann Schreiber. It describes tornadoes in kid-friendly terms. Ms. Frizzle bring the children to Weatherama Theme Park where the major attraction is riding a tornado! Throughout the book, the students will learn all the basics (how they are formed, what they look like, etc) of tornadoes.
4) After the teacher finishes the book she will have the students sit back at their seats.
5) The teacher will then explain that the students will be making their very own tornadoes.
6) The teacher will call on students to help pass out the supplies to each student.
7) The teacher will walk the students through the process, by demonstrating each step before allowing the students to do it.
8) Each student will hold his/her jar in front of them and take the lid off.
9) Using the water in their first cup, the students will fill their cups ¾ full.
10) Then they will add 1 teaspoon of vinegar and 1 teaspoon of dish soap to their jars.
11) Next, the teacher will walk around the room and each student will add a small amount (a sprinkle) of glitter to their jars.
12) Last, the students will place the lids back on their jars.
13) The students will then twist their jars to see a vortex like a tornado form.
*If you would like, you could add small monopoly size houses to the jars and the students can watch them spin around in their tornado.

14) Finally, the students will be able to see what a real tornado would look like. The teacher will play the clip from Twister.
15) To end the lesson, the teacher will review the basics of tornadoes and the students will participate in a question and answer session.

Lesson 3: Weather Broadcasters

Objectives:

Students will research a specific severe weather topic (hurricane, tornado, nor'easter or thunderstorm).

Students will present a weather broadcast to the class.

Materials:

Video camera, access to the internet, books related to severe weather topics.

Lesson:

1) After learning all about severe weather, the teacher will introduce the final activity in the unit, broadcasting their own weather. This lesson will take all weak to complete.
2) The teacher will ask each student to pick a type of severe weather to research.
3) After assigning what students are going to research, the teacher will present the websites and books that the students can use.
4) The teacher will write the websites on the board (a list can be found on my resource page).
5) The teacher will then allow students to either use the internet or book area during different time intervals throughout the week (during center time would work the best).
6) The teacher will sit with each student on Wednesday to discuss his/her progress and to see what information they have already. By this point, the students will probably have pictures and some information that probably doesn't make sense to them.
7) The student will take the information home, along with a note from the teacher that describes what the class is doing. For homework, the students are to work on what they are going to present with their parents.
8) On Thursday, the teacher will again check in with the students and help fine tune their work. The students should present pictures of their topics and give a couple of facts that they have learned about the topic.
9) After the teacher has approved the presentation, the students will be given time to finalize their presentation. This includes rewriting their script and their picture displays. Pictures should be displayed on colorful construction paper and big enough for the class to see when the student is standing at the front of the room.
10) On the final day, Friday, the classroom will turn into a weather news room. Each student will be given a turn to broadcast their event. The students will remain seated at their desks while one student presents. The teacher will video tape each presentation.
11) On Monday, the class will watch their presentations as the ending to the unit.

Resources

Dan's Wild Weather Page: www.wildweather.com

Dan Satterfield (Meteorologist) Huntsville, AZ

Education World: www.educationworld.com

Lesson plan ideas for teaching weather.

Local Weather Channel: www.wtnh.com

Broadcasts of weather and able to watch the Doppler Radar system.

Nick Walker, The "Weather Dude": www.wxdude.com

Nick Walker from the Weather Channel. Includes information and songs for children, list of book related to weather topics, blank maps and links to free materials to help teach weather.

NOAA Education: www.nss.noaa.gov/edu/

Information on various weather topics.

Scholastic Weather Watch: www.teacher.scholastic.com

Links to tornado video clips, able to experiment with weather tools, and information on severe weather.

Web Weather for Kids: http://eo.ucar.edu/webweather/

Information on severe weather, activities and experiments.

Weather Channel Classroom: www.weatherclassroom.com

Information on various weather topics, lesson ideas and activities.

World Weather Information Services: www.worldweather.org

Abbott, P.L., *Natural Disasters Fourth Edition* , McGraw-Hill, New York, 2004