Natural Disasters are Naturally Engaging

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Introduction

I left for work on that March morning in 1993. Overnight, a storm had arrived and it covered the roads with a couple inches of white stuff. Having driven through snow before I didn't think much of it as I pulled onto the highway. I was about halfway to work when I discovered that this wasn't typical winter weather. That day brought something known as the '93 Superstorm. The snow was in actuality inches of ice which covered everything. This discovery cost me a car and a long trek home, which included a ride-along in a tow truck and a walk (through the Superstorm) along railroad tracks. I miss that car but to this day that storm and the days that followed as Pennsylvania thawed out stuck in my mind. Natural disasters are like that. They stick in your memory. Certainly if you live through one or are impacted by one, like when I retired my Camaro, but also if you follow the event on the news and watch footage of nature unleashed. There is a reason that even a minor storm gets hours upon hours of television coverage. Natural disasters draw attention, they are engaging, and they leave a memory in your head. All of these qualities are highly desirable in a lesson. Natural disasters can become a vehicle for delivering content to students.

My content is delivered at Kathleen Wilbur Elementary School in New Castle, Delaware. Wilbur is a large school of almost 1,200 students. Our 1,200 come from diverse backgrounds. They come from mansions, motels, and everywhere in between. I teach in one of the nine kindergarten classes found at the school. In each of these nine rooms you will find students of varying skill levels. Some will have grown as they attended years of preschool. Some will have learned much from Sesame Street, an older sibling, or an inspired parent. Other students may never have held a book before. Throughout last year my class ranged between 20 and 22 students. As the year closed, I had 22 students on my roll. I had an even split between male and female students (though this is actually atypical.) My class was predominantly (55%) of African-American descent. The rest (45%) of my class was pretty evenly split between Caucasian, Hispanic, and Asian backgrounds. Seven of my students were pulled out during the day to receive English Language support. Throughout the school year three of my students were regularly pulled from class to receive additional academic support. I also had one student who would go out weekly to receive behavioral intervention support, as well as a student who had an Individualized Education Plan put in place in his preschool setting. These numbers are pretty common among kindergarten classes at Wilbur and I anticipate a similar class makeup in future years.

Content

Natural disasters can be devastating to communities. Hurricanes Katrina, Sandy, and Michael were massive storms that destroyed or severely impacted the communities that fell in their paths. “The disasters were the result of extreme events of natural phenomena operating at the high end of the energy scale for a short period of time in a restricted area.”[1] In simpler terms, nature is sometimes like a hammer, it focuses a lot of force in a relatively small area and it strikes fast. The effect of one of these hammer strikes varies greatly from community to community. Things that factor into the level of effect would include early warning and preparedness, past experience with the type of disaster, and the presence or lack of natural hazards in the effected area.

A hazard could be described as “a source of danger whose evaluation encompasses these elements; the risk of human harm, such as injury, trauma, or death; the risk of property damage; and the acceptability of the level or degree of risk.”[2] Hazards are natural conditions or elements such as a river (which could flood), a steep slope (which could lead to mud or rock slides), or a coastline (in hurricane prone regions) that may make an area more vulnerable to a natural disaster. Hazards and weather events can lead to disasters, which put lives and property at risk. In fact, “severe weather causes about 75% of the yearly deaths and damages from natural disasters.”

When we begin to consider lost lives and damaged property, it is easy to understand why scientists study disaster events. These studies often focus on mitigation. Mitigation focuses on the minimization of the effects of natural disasters. Mitigation studies how the Earth’s physical systems interact with human systems and the built environment. The Earth’s physical systems would include physical geography, climate and weather patterns. Human systems could include things like population growth and placement, governmental regulation and laws, access to resources, and people causing changes to the natural world around them. Infrastructure is human construction, buildings, roads, dams, and levees. An example of the interactions of these disparate systems might work like this; flooding is a recurring issue in some areas. Due to this undesirable trait of the land, property values fall. A lower socioeconomic population moves into the area. Cheaper housing structures are developed to meet the needs of the new population. Another flood comes along. The cheaper structures do not fare well. These systems working in conjunction with each other lead to more devastating disasters in the future. When examining this dynamic it may seem reasonable that strengthening building codes may help mitigate a future disaster, or an effort should be made to build structures that could either contain or redirect rising waters. In the second example, a social solution – paying attention to the vulnerability of certain segments of the community – would also be an important consideration.

We can exert some degree of control over the human systems and infrastructure but to think that we can control the Earth's physical systems (even with improving technology) is a fallacy. Pure forces of nature are hazards that we must live with. We can try to understand how these events work and we can learn from our past experiences to better allow us to minimize damages to property and loss of life.

Tornado

"Tornados are the most violent of all atmospheric storms."[3] To me tornados, or twisters, are terrifying. In my defense, I have no experience with tornados. However, "many people seem to be comfortable with the events of their home area."[4] I may be able to ease my fears, and those, too, of my students by gaining an understanding of these events. Tornados are formed when large, cool air masses interact with large, warm air masses. The greater the difference in temperatures, the more energy the storm can channel. "The Great Plains region of the central United States plays host to about 70 percent of the tornados that occur on Earth."[5] The area has earned the moniker of "Tornado Alley". "The air masses that move across North America come mainly from several large source areas. The polar air masses are cool to cold, while the tropical air bodies are warm to hot."[6] Tornado Alley is an enormous stretch of flat open space. Cold air from Canada and the Arctic region can travel uninterrupted down through the area. At the same time, warm to hot air, off the Gulf of Mexico, can travel north through the area unimpeded. When these airs collide, the conditions to spawn a tornado are present. Tornados can happen at any time, especially in this region. They are, however, most likely to occur between late spring and early summer and usually late in the afternoon or the evening. This time of year lends itself to a clash of air masses as the equatorial waters are heating up and the winds from Canada still carry a big chill. Tornados often occur later in the day when the area has had a full day of sunlight to add extra heat and energy to the equation. Tornados can cause massive damage by unleashing strong winds. These winds can cause damage in two distinct ways. One way, winds cause damage is by blowing directly into buildings and trees. They can blow buildings and trees over or even carry them away. The objects picked up by the winds of a tornado can become dangerous, even deadly projectiles. Sometimes these winds can rush in a lifting motion, tearing the roofs off structures. Tornados have reduced entire communities to rubble in short order. Tornados frequently take a toll on human lives as well. They are particularly dangerous to people in less than sturdy homes. Mobile homes typically have not fared well in these storms. People are also severely injured or killed when they are struck by debris, carried by a twister. We cannot stop these storms. But we can prepare and plan for a tornado event.

Prior to a tornado it is important to develop a plan in the event of an occurrence. A key part of this plan is to identify and communicate with family a safe place or retreat location. In a tornado, a safe place would be low or under the ground without any exterior windows. This type of room would offer great protection against flying debris. If no basement is available, an interior, windowless room, such as a bathroom could offer

protection. These could be good safe places. Within that safe place, you should stock some safety supplies. These supplies typically include a flashlight, a battery operated radio, a first aid kit, and possibly a whistle (to summon help if needed). It is important to keep in mind that every family may have specific needs to be addressed by these safety supplies. For example, if a member of the household requires medications, those meds should be included. If there are pets, their safety and needs should be considered, as well. Beyond this planning, proper grounds keeping around your home could help. Keeping close by trees trimmed and pruned can lessen the chance of injury or death due to falling branches, or limbs. Dead trees should also be removed as they could be among the first to collapse in challenging weather.

In the case of a tornado, early warnings are measured in minutes and seconds, not days. There are two types of alerts that are issued in the United States by the National Weather Service: watches and warnings. It is important to understand the distinction between the two. Storm watches are a notification that the local weather conditions are ripe for a tornado. A watch is similar to when a doctor reports that smoking, obesity, and high blood pressure and conditions for a heart attack. If these conditions are present, you should be mindful of them and aware of what they could indicate. A warning means a tornado is actually happening. A tornado has been sighted or is indicated on weather radar and you should take cover. In medical terms, your chest is tightening, you have difficulty breathing, and your heart is racing. Get to medical help immediately. Being aware of and responding to watches and warnings is an important way to minimize risk in the event of a natural disaster. During an event it is also important to listen to the weather service for the all clear sign.

Following an event, being cautious is also critical. A homeowner should evaluate damage taken during the storm and assess the safety of the structure. While performing this evaluation, people should be mindful of trees that may topple and any downed power lines. Injuries can occur after the tornado has passed as people leave their shelters, walk through impacted areas looking for loved ones or property, and while they attempt to clean up debris. Should a tornado occur it is reasonable to assume that emergency services may not be able to respond to a call for help for some length of time. Tornados can be frightening, and they cannot be avoided or stopped, but with proper planning and preparation we can lower the chances of injury, or loss of life.

To the students, I will be describing the conditions needed for a tornado as a recipe. This is easily understandable to them. The recipe for a tornado starts with open space to allow wind blow freely. To that base we add energy in the form of one part cool to cold air mass and one part warm to hot air mass. Allow them to swirl together and you could have a tornado. Tornado Alley has these ingredients. It also has mountain ranges to the east and the west that help ‘funnel’ the winds from the north and south together.

Flood

"Floods are the most widespread natural hazard in the world."[7] Wherever you live, floods can occur. The reason for this is that there are many different causes of flooding. Flooding can be associated with a very strong thunderstorm that delivers a mass of rain in a very short time period. Rain that falls for days on end can also lead to a flood. In a coastal area, storm surge from the oceans can cause flooding. In cooler climates, breakup of winter ice can cause flow issues in rivers and streams, which backs water up. In places of elevation, mudslides and logjams can dam rivers and cause floods. Infrastructure failures such as those to dams or levees also add to flooding concerns. With all of these very different causes, it is little wonder that floods are so commonplace across the globe. Although floods can happen anywhere, in certain locations flooding is easily predictable. "What has happened in the past provides the best forecast for future events."[8] Roads and neighborhoods that have flooded in the past are going to flood again. The opposite does not hold true. A place that hasn't been prone to flooding can become a common site for floods. This change could be the result of development or even global warming.

Advanced warning is helpful in mitigating damages and injuries from flooding. It could be interesting to share with students that nature also can alert us of upcoming flood conditions, if we know what to look for. Rising water levels in creeks or streams may indicate that a larger flood is imminent. The water in those streams may turn cloudy or muddy in advance of an event. Also, earthworms migrate to the surface of the ground to escape waters.[9] Unlike a tornado warning, which provides seconds or minutes of preparation time, flood warnings can sometimes come up to days before an expected event. Some simple things can be done to prepare for a flood. Unplugging electronics would be advisable if floodwaters could reach the level of wiring in the home. Rugs can also be rolled up and placed above floor level to better protect them from damage. Outside the house, you may consider securing items such as chairs, garbage cans, or anything that could be swept away in rising waters. In areas prone to flooding, people often place sandbags around their homes in an attempt to divert waters. Despite these precautions, history is the best guide of how effective these mitigating strategies could be. In areas typical of extreme flooding, evacuation may be suggested and is certainly advisable. Once flooding begins it may be too late to get out of the area.

"More than half of all flood deaths occur in vehicles."[10] People often do not consider the danger of water when they are driving. Every time my local community gets heavy rain, the local weatherperson reiterates that you should never drive through floodwaters. Yet, every time my local community gets heavy rain that same local news station shares footage of abandoned cars stuck in water, or rescuers pulling people from cars in boats. Moving water is shockingly powerful. As little as six inches of water can move or stall out a car. When water reaches the depth of a foot, vehicles float, and two feet of water can simply carry a vehicle away. Should you be in a car stuck in rising waters, you should put down power windows. Those window could are electronic and could be

disabled by the water. If possible abandon the car and seek higher ground, but do not go out into rushing water.

Beyond the hazard that floodwaters present when motor vehicles are added to the mix they are also a concern in and around the house. During flooding conditions it is best to get to higher floors of a home. Try to climb above the surface of the water. Floods often overflow sewer systems or collect leakage on roadways or other places. They can then carry toxins or chemicals, which could cause illness. Should you contact floodwaters, you should definitely wash off very well. For this same reason, you should never eat food that has come into contact with floodwaters or even drink tap water immediately after flooding conditions.

The only ingredient required for a flood is a lot of water. There are many delivery mechanisms for this water and many of them are listed above. I would, however, restate that in places where flooding has happened in the past, it will most likely continue to reoccur.

Hurricane

Hurricanes combine the destructive capabilities for both the tornado and the flood. The combination for high winds and rising waters can be devastating. In fact, hurricanes are so damaging and regular that they are "the only natural disaster that is given a human name."[11] Hurricanes "are heat engines that convert the heat energy of the tropical ocean into winds and waves."[12] These storms are "born" in tropical waters, typically in late summer. As the Caribbean waters are heated, throughout the summer, there is a build up of energy. Hurricanes are a mechanism for these hot waters to release some heat energy. Obviously, hot tropical waters are a requirement for a hurricane. There must also be a humid air mass, which is common in tropical areas and weak upper level winds blowing in the same direction.[13] When these ingredients come together it can create a mix of swirling wind and rain around a low-pressure center.

Hurricanes can vary in strength. They are categorized by this strength from a category 1 (weakest) to a category 5 (strongest and most dangerous). Category 1 hurricanes typically carry strong winds. These winds could be damaging to poorly constructed homes and buildings. They also pose a danger as they can lift debris and launch it about. Flying debris is always hazardous. These storms can knock down trees and power lines. Category 2 storms have all the features of category 1 storms, but the winds are stronger and the danger posed by flying debris is increased. These storms can easily tear an older roof from a building. Once a roof is removed the wall of the structure and considerably weakened and may collapse. Typically, in this level of storm, power loss is widespread to total for at least some time. Category 3 storms are more powerful and often block roadways with multiple fallen trees. Electric and water services are heavily effected and destruction of buildings is more severe and widespread. When a storm is categorized as

level 4, it can make an area uninhabitable for weeks or months. It brings loss of services and widespread massive destruction to buildings and infrastructure. A level 5 hurricane is truly catastrophic. In a storm of this strength flying debris becomes a serious threat even to people located inside buildings. These storms also topple so many trees that rescue and recovery efforts are severely hampered. The issues I've described in this section are almost entirely due to the strong winds of a hurricane. But these storms move across massive amount of water as they travel. They gather water, which they dump in torrential downpours and can create massive storm surges of water. Surges are waves of water propelled into coastlines by the high winds. These massive waves and heavy rains bring with them all the problems associated with flooding. It is important to note the hurricane strength is rated solely on wind speed. Even relatively lowly rated hurricanes can devastate a community with flooding waters. If for example a category 1 or 2 storm strikes a coastal community at high tide the flooding can be very severe.

Hurricanes typically land anywhere along the southern and eastern U.S. coastlines, from Texas all along the coast to New Jersey or even into Maine. Within this wide range are several highly populated cities. Fortunately, hurricanes can be tracked and meteorologists can often narrow down where they may land. Thanks to this we often have days of advanced notice prior to an event. Government officials generally have adequate time to make recommendations on matters of evacuations. Because of the typical level of destruction and disruption cause by these storms, it is not uncommon for evacuation orders to be issued. However, due to a variety of circumstances, not everybody heeds the warnings and leaves the impacted area.

Once warning of an impeding hurricane is received, there are many things we can do to help mitigate the situation. Clearing gutters is a simple first step that could help keep heavy rain from working its way into the foundation of a home. Also worthy of consideration would be secure loose outdoor items and shutting the valves on propane tanks, as they could become airborne. Another good in turn weakens the roof. Closing interior doors can help level this pressure issue, aiding the structural integrity of the roof. If evacuation is not ordered or heeded moving to a center room of the house that doesn't not have windows is advisable. Basements are not good, safe locations in a hurricane situation. Unlike in the event of a tornado, hurricanes bring flooding, and that water could easily make its way into homes and flood basements. One thing that is not often thought of is securing important documents. Following an event, you may need insurance or property ownership documents. It is also important to keep copies of important prescriptions that may be needed in case of a refill. Documents of identification like driver licenses or social security cards could be needed as well.

There are some things that you can do to remain safe in the aftermath of a hurricane. Foremost is to follow the recommendations from local authorities. If they are suggesting that you wait to return home, it is best to wait if you can. When you do return home, it is safest to do so during daylight. Keep in mind that not all, structural damage to a building

is readily visible. Also, use your nose. If you smell gas, leave the area and call it in to the gas company and local fire department. Drive very carefully paying special attention to the roadways. Be wary of water, sinkholes, downed trees or branches, and power lines.

The ingredients of hurricanes are found in equatorial waters. You need a hot sun heating and storing energy in the ocean waters. Added to the warming waters we mix in humid warm air and winds blowing in a common direction. These ingredients can come together around low air pressure and the recipe for a hurricane is complete.

Earthquake

Earthquakes are "a sudden shaking or rupture in the earth caused by the release of accumulated stresses in the crust."[14] At this time, we cannot accurately predict the timing of an earthquake. This is because we do not truly understand the science behind these events with enough clarity to make a prediction. We can assume that locations that have previously experienced quake activity, will do so again at some point. We can sometimes narrow the timing down by looking at the duration of time between prior events and trying to find a pattern. The best way to avoid earthquakes is to not go where earthquakes have occurred in the past. But this is not a guarantee that an event won't happen and for many people it is unreasonable to avoid areas of earthquake activity. These areas may be home. If avoidance isn't a viable option, preparation and knowledge of these events is helpful. Also, just because a place doesn't typically receive earthquakes, doesn't mean it can't. Delaware rarely experiences an earthquake, yet on August 23rd 2011, as I was preparing my classroom for the start of a new school year, the lights began to sway and the ground began to shake. Delaware experienced the effects of an earthquake that was centered in Virginia. There are many areas where earthquakes are a common occurrence. Often these areas are atop fault lines. Fault lines are where two of the Earth's tectonic plates meet. As these plates slide against, over, or under each other, they can trigger quakes. The effects of an earthquake take many forms. The primary effect of an earthquake would be a new feature produced by the quake. An example of this could be a new fissure in the ground. There are also transient effects of earthquakes. Transient effects are events that are sometimes set of as an aftereffect of the quake. Tsunamis are one transient effect. When an earthquake occurs under the surface of the sea, it can send an enormous wave of water plowing into the shoreline. These tsunamis are especially hazardous because the initiating earthquake may not even have been felt before the wave arrives, potentially catching local populations unaware. Sand blows are another transient effect of quakes. Sand blows occur when a fissure opens in the ground and the pressure under the surface of the earth is released in a sort of "sand volcano". Finally, there are secondary effects of quakes. These would include landslides, damage to structures and infrastructure, and even secondary fires. Earthquakes can radically alter affected communities.

Residents of California or other earthquake prone regions can do many things to lower the risks posed by these occurrences. Heavy and tall appliances like refrigerators or furniture such as a bookcase can be bolted to walls. These simple precautions can aid in limiting injury or breakage should one be overturned in a quake. Cabinets can be fitted with latches, which protect the contents from spilling and the residents from being harmed by falling plates and cups. Preparing an emergency kit, similar to the one outlined in the tornado section, could also be helpful in an emergency. During a quake the safest choices would include staying indoor until the shaking has stopped and dropping to the floor and covering your head. Following a quake it would be wise to listen to situation reports on the radio or television (if power is still operational) and to take many of the precautions related to power lines, and gas previously mentioned in other sections. It has been said that; "earthquakes don't kill people, buildings do."[15] To prevent these killings, higher standards of building codes are required in quake prone regions.

There are different ingredients for earthquakes but I will focus on plate tectonics. I may even use those words because kindergarteners love learning big words. I certainly wouldn't require them to recall the term though. I will describe plate tectonics by comparing it to putting a puzzle together. The earth is made up of many large pieces called plates. All of our ground, the buildings, the people and the animals live on these plates. The plates fit together somewhat like a jigsaw puzzle. Sometimes the different pieces (plates) slip or slide along each other. When this happens it causes the earth to shake. Everything on the earth shakes too. They can be large shakes or tiny shakes.

Blizzard

"Blizzard times are tough times, they test your ability to live."[16] Blizzards are winter storms. They bring harsh cold, snow, sleet, ice, and winds. These are indeed tough conditions. Blizzards can kill, and they often do. These winter storms typically cause fatalities in four distinct ways. Most prominently they can lead to heart attacks. Shoveling snow is hard. It is physically, demanding exercise. We are usually bundled up and our body is producing heat while we do the labor. However we don't always feel hot because the temperature around us is so cold. For people not used to hard exercise this combination is hazardous. It is best when shoveling during a blizzard, to do a little, rest, do a little more, and so on. Driving and blizzards make for a deadly combination. Roadways become slippery and cars are involved in collisions. Much like cars slide on ice, many people are injured in slip and fall accidents just walking about. Finally, if outdoors in a blizzard the chances of getting lost (especially in uncommon settings) and freezing is very real. This may seem strange but it can be hard to see through blowing snow and it is not uncommon to become disoriented. Blizzards also are frequently accompanied by a loss of power. Trees limbs and sliding cars can and often do take down power lines. With a loss of power comes a loss of heat and often times water. Sometimes power may not return for days or weeks after a winter event. A very real danger comes in the form of generators. Generators can return power during an outage. Generators are a

great resource to have at your disposal. However, many people use them improperly. Generators must always be used outdoors where there is adequate ventilation. They should never be brought indoors. A generator running indoors could put residents in danger of carbon monoxide poisoning. Of secondary concern with power outages, people should be wary of food spoilage. If refrigerators cannot run, they cannot keep food. Do not eat spoiled food. We should consider power outages are certainly an inconvenience for most, but for some people an outage could put them at substantial risk. Consider the impact of a power loss on a person who counts on medical technology. It would be wise to have a plan in place for these people.

The best plan for getting through a blizzard is to just ride it out. We generally have adequate warning to prepare for a coming blizzard. Preparation may mean stocking up on bottled water, milk, and bread (judging by supermarket shelves prior to any anticipated snow, most people know this.) Another way to prepare is to fill the bathtub with water. This water can be used to flush a toilet in the event of a power outage. When the storm is over, pace yourself and shovel out or hire someone to clear your lane.

There are two ingredients for a blizzard. The recipe calls for cold (below freezing) temperatures and precipitation. That's it! Most everywhere in the United States receives at least some precipitation. Some locations can receive a great deal of the wet stuff. In the United States, the cold is brought around with the fall, winter, and sometimes spring seasons. I will be discussing with the kids that in our country, the farther north a place is, generally, the colder the winters can be. That being stated, there are definitely times when the south of our country gets its share of cold temperatures too.

Volcano

Volcanoes are visually very engaging. They are also exceedingly dangerous. Volcanoes cannot be avoided. Much like flooding, if you live near a volcano that has erupted before, you live with a known risk. Volcanoes are hazardous in many ways; they can cause harm with pyroclastic falls. These are rocks ejected from a volcanic vent. Upon landing they can damage cars, houses, and infrastructure. They can also injure or kill people and animals. Pyroclastic flows are also dangerous. They are superheated mixtures of rock and debris that move like an avalanche in the area of the volcano. Lava flows are also very dangerous, though they are generally slow moving, and are directed by the topography. If someone is cautious and keeps their distance lava flows shouldn't be too much of a worry. Volcanic gases are spewed from volcanoes also. These gasses are toxic and can be deadly. They are also not as easy to spot as molten liquid slowly moving across the ground. The key to being safe in a volcano is to follow the local advisories. If an evacuation is called for get out early.

The ingredients required for a volcano would be difficult for students of this age to understand. Basically they require the subterranean pressure and the density of magma to

exceed the density of the rocks and earth above them. That is a lot of not kindergarten or even primary student vocabulary and concepts to tackle. Instead I will simple relate them to a bottle of soda. If you shake it up and whole bunch and the lid comes off the liquid shots out of the bottle. Volcanoes are a little like that. Underground is full of pressure, and if the surface above that pressure is weak enough, lava, steam, gases, and rock can be shot out of the ground.

Mental Mapping of the United States

Below are maps that that I will use with my class. They indicate areas that have a heightened vulnerability to particular natural disasters and areas that also present regional features that I would like my students to add to their mental maps of the United States. It should be noted and I will be mentioning to my students that many of these disasters can and do occur in other places around the country including our local community, just not as often as in the shaded regions.

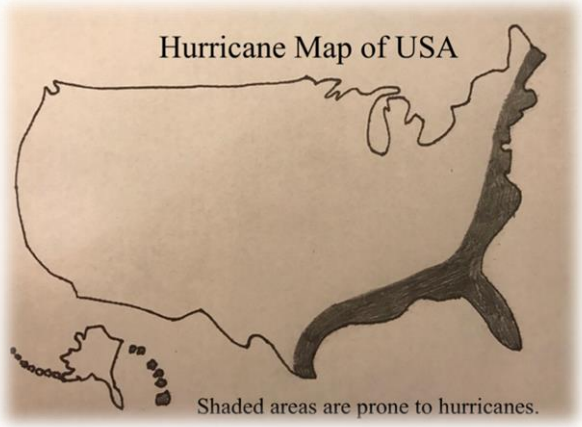

Figure 1: The shaded regions of this map are in close proximity to ocean waters. These waters are seasonally warmed to a degree that hurricanes may affect these areas directly.

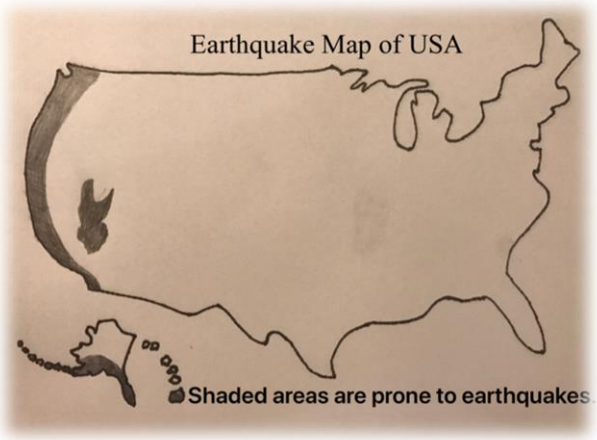

Figure 2: The shaded regions of this map are in proximity to fault lines. I will describe fault lines as a place where two separate pieces of earth lie next to each other similar to a jigsaw puzzle.

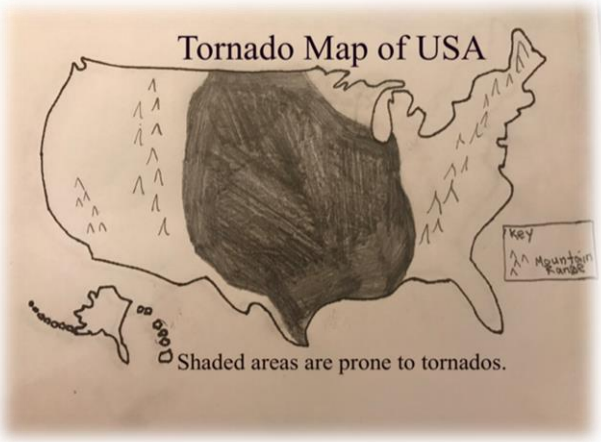

Figure 3: The shaded region is vast and flat. It is bordered on the east and the west by mountain ranges (which I'd also like to input onto the mental maps of my students). These mountains funnel in the cool winds from the north and the warm winds of the south creating the Earth's most perfect spot for making Tornados.

Figure 4: The shaded region is in the northern part of the country. These are also the regions that are most likely to have very distinct seasons. I will note to the students that southern areas can also receive blizzard (they are just less common) and that when these storms occur in the south of the country, they can present large challenges for those communities.

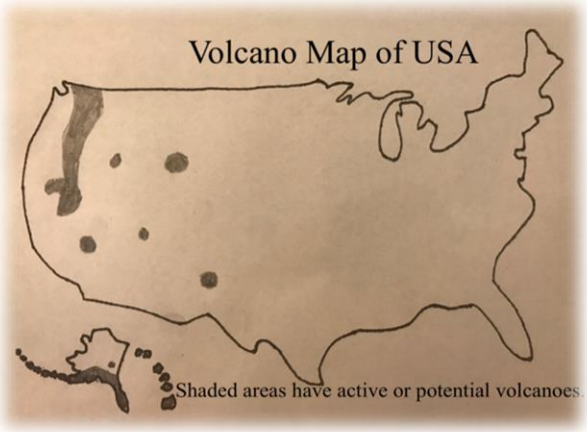

Figure 5: This map shows the location of active or potentially active volcanoes in the United States.

A map of flooding in the United States was not included as flooding literally can occur anywhere in the country. While some communities are particularly prone to flooding issues due to proximity to rivers, coastlines, or the like, flooding really can occur at any location.

Children and Disasters

Familiarity breeds comfort, especially in children. For the most part disasters are not familiar events. There is a reason the schools are mandated to perform monthly fire drills. The drills make us better prepared and less likely to panic in the event of an actual fire. We can practice disaster drills too. If there are common disasters that occur in our communities, perhaps we should. During an emergency, children can be frightened. This is especially true if the adults are showing a great deal of fear. We can help calm them by behaving calmly ourselves. Practicing disaster drills can help reduce some of the fear associated with these occurrences. We should also be honest with our kids. If we let them know that we are scared too and we continue to maintain calm, it may inspire them to overcome their fears as well.

Disaster can certainly be frightening. Drilling can help, but children also respond well to normalcy, even in abnormal circumstances. Throughout the disaster, keep children close as much as possible. Separation from parents usually is a cause for concern in them. Routine is also a good thing, so when its time for bed, get them to sleep. In the midst of a natural disaster, we lack control and so to do kids. Any chance that we may have to allow them some degree of control is worth taking. Something as simple as allowing them to choose a book to read may help give them some sense of control. Children also respond well to being a helper. Find ways to let children help prepare for the disaster, help during the disaster, and help get things back to normal after the disaster. Prior to a disaster have the children help pack an emergency kit. Ask them what book or toy they might like to pack in their box. Ask them to be in charge of carrying a certain item into the safe room. This kind of thing gives them something to do and may take their mind off the event (if only just a little bit.) During an event they could help by holding a little brother or sister's hand to calm them. Perhaps they could be in charge of holding a flashlight. After the event, they could help in some small way (provided its safe) with the clean up. Children are very resilient and bounce back from things better than many adults. They can be helpers, they can be calm, and they can be brave. We just have to model how.

Teaching Strategies

When designing a lesson or activity my number one focus is finding something that will engage the students. During my many years spent in education, I have found that engaged and excited students generally do not become discipline problems. I also know that engaged students are students whose minds are open and soaking up knowledge like a sponge. I anticipate that focusing on extreme natural events will serve to focus my students and aid in the retention of content delivered throughout these engaging lessons.

My required kindergarten content will focus on Common Core State Standards (CCSS) in the area of English Language Arts, and on standards found in the Delaware State Social Studies Standards. I will also address Next Generation Science Standards (NGSS) in relation to patterns in nature.

We will be using several Non-fiction texts to learn about natural disasters. The use of non-literary texts seems to be a focus of much standardized testing in later grades. Practicing these skills in kindergarten is not only a requirement of the CCSS, it is also good practice in preparing my students for their future. As my students discover information about tornados, blizzards, and other natural hazards they will be strengthening their ability to understand informational texts, to find connections between two pieces of separate information, and gaining skills in understanding unknown vocabulary.

I will be guiding my class in developing geographical and civic skills required by the Delaware State Standards in Social Studies. In kindergarten we begin leading the students in the process of developing a "mental map". I will use the power of natural disasters to aid students in beginning a "mental map" of the United States. I will then delve into civics as we look at how people can work together in a team to prepare, get through, and recover from a natural disaster. The students will certainly see that being part of a team in that sort of circumstance (or many everyday tasks) is often preferable to working alone.

Finally, we will track natural disasters throughout the (school) year and across the country in an attempt to identify patterns. Where are tornados most likely to occur? In what months do blizzards typically form? These are just two questions that we can tackle as we look for patterns in our natural disaster data.

This unit will require my students to think critically and to work rigorously. They will be strengthening many kindergarten skills across multiple subject areas. They will have a better understanding of disaster science and be better prepared the next time the power goes out in their neighborhood.

Class Activities

In this unit I am choosing to teach about six different natural disaster events: tornados, floods, hurricanes, blizzards, earthquakes, and volcanoes. Two of these are fairly common in my community. Three others have occurred here, but are pretty rare. Volcanoes haven't impacted my home yet, but they are so engaging to students that I will address them. There are many other disaster events that could also be covered in this unit; wildfires and mudslides would be a couple that I could explore if students bring them up or if they are prominent in the news at the time of my teaching this unit.

Each of these six events will go through the cycle of activities one through four. I will be pacing my lessons based on the students in my class from year to year. I may get through two or more activities in a given day and I may get through less.

Activity One: Video Leads to Reading; Reading Leads to Learning

The introduction of each natural disaster will start with a short video clip. I do not have a specific clip in mind for any event, however a quick search of Youtube or other websites like National Geographic will list hundreds of footage choices. I highly recommend that prior to sharing any video with class, you screen the video to scan for inappropriate material. The video will serve to engage the students, introduce the topic, and to activate prior knowledge. Some of the students will remember weather events that they have experienced and begin making connections. It is wise to be mindful that some students could have bad experiences in their past and that these lessons could bring memories to the surface. Discussing natural disasters and extreme weather events is a useful activity as the learning may lessen the fright factor and raise a level of preparedness associated with these events, but we should remain sensitive to our students' concerns. The screening will also give each child a little knowledge of the event should they have no prior experience.

Following the screening, I will lead the class through the creation of a KWL chart. KWL stands for; what do we know? What would we like to know (though I prefer, what do we wonder)? What did we learn? I will give my students an opportunity to turn and talk with a peer to share ideas about what they each know. This should only take a minute and gives both students an opportunity to verbalize their ideas before sharing. We will then begin the chart by sharing what they already know about the event. As an example, students many state; "blizzards have snow" or "they are cold". I will record student thoughts on our chart. As 'K' on our KWL chart is completed, students will turn back to their partner and share any wonders they may have about the event. Once they have had this opportunity, they will circle back to me and we will fill in the 'W' part of the chart with what they would like to know about the particular disaster. Typically, this part of the chart is difficult for my students as they blur the line between telling a story and asking a question, but with guidance we can usually come up with an adequate list of wonders. After the 'K' and 'W' potions of the chart are complete we will move on leaving the 'L' (what we learned) until the end of the lesson.

At this point in the activity I will introduce an appropriate informational text about the topic. I have found several good books from National Geographic Kids and Time for Kids. There are many non-fiction books available that explore natural phenomena. As I read through the book, I will ask questions to check for understanding or to highlight a point I would like them to notice. Much like I advise the prescreening of a video, I also advise pre-reading the text. This simple act allows you to develop questions, note discussion points, and identify new vocabulary words.

At the close of reading we will fill in the 'L' of our KWL; what have we learned. Students will again turn and talk and then share out to the class their new information. I will record these ideas on the chart and draw the activity to a close.

Activity Two: These Mental Maps Are Disasters

I will start this activity by revisiting our KWL chart from the previous lesson. This will activate our knowledge and get us ready to extend our learning on the topic. I will then refer to a blank outline map of the United States. My students will turn and talk about everything they remember about the map. Typically, the kids start off knowing very little. Many can identify Florida, some know where Delaware is located, but there usually isn't much more than that. I hope to change that through this activity. I will put together a 'recipe' for making a natural disaster (see the content section above for specifics). I will use a tornado as an example. The 'recipe' for a tornado goes like this, have some open space where winds can get going, add one part warm to hot air mass, add one part cool to cold air mass, and mix together. I will then post a symbol for tornado (likely an inverted triangle with swirling lines throughout) onto the map in the Great Plains region. I will post other tornado symbols throughout "Tornado Alley". We can then begin a discussion about this region of the country. What must this area have if it can 'make' tornados? I will guide the students towards; it must have a lot of space, there must be cool winds and hot winds. I can then add to our map symbols to show that the south (Gulf of Mexico) is typically hot and the north (Canada) is usually cool. I will also add in the Rocky and Allegheny Mountain Ranges. We can discuss how the ranges can funnel the winds together. We are beginning to develop a mental map of the country. It will be important to note that Tornados can pop up anywhere (including Delaware), but that the center of the country is where they develop most commonly. As we add to the map throughout the various natural events we are studying, we will enlarge our mental map and deepen our understanding of the physical geometry and the climactic regions of our country.

Activity 3: Patterns of Disasters

This activity is not something that I will schedule. This activity follows current events throughout the school year as natural disasters and extreme weather occur. When an event is in the news, I will refer back to our class map. This will allow the students to recall the map and our prior lessons throughout the school year, ultimately strengthening our mental maps. When an event does occur, I will place a marker on our map at the location of the event. The marker will also include the date of occurrence. As the months pass and we post several map markers, we should be able to explore any patterns in what we are seeing. I would anticipate the discoveries that many hurricanes occur in the late summer, blizzards are typically winter affairs, and that tornados happen a lot in the spring or early summer. Events like earthquakes and volcanoes don't align with changing weather patterns, but should a few occur, there may still be patterns to explore. We can possibly find patterns with the locations of these events that would confirm our learning from Activity Two. Examining patterns in nature is very much aligned with Next Generation Science Standard practices.

Activity Four: Preparedness and Recovery

For the final activity we will examine how we can prepare ourselves for potential disasters, as well as how we can help our families and communities recover. Many tips regarding preparation, survival, and even recovery are detailed in the content section above. I will certainly share those tips during this activity. I will also focus on people who can perform important roles during recovery efforts. I will ask the students to brainstorm a list of community helpers who can offer aid during a disaster. I anticipate that they will respond with police, firefighters, paramedics (though I'm certain they won't use the term), and doctors to name a few. I am also fairly certain that they will not include themselves in that list. I will make a point of sharing that everyone can help the community (or family) in a disaster. Focusing what children can do will not only allow them to be of assistance, but it can also give them something to feel good about even as circumstances may not warrant feeling good. My students could help out by holding a younger sibling's hand or keeping an eye on pets. They could make peanut butter (or something simple) sandwiches. Kids might help by carry the flashlight. They can help with clean up (provided it is safe to do so). These simple task will give them confidence that they can make a difference in an emergency. That confidence can in turn make the situation seem more manageable. Plus, they will be taking a minor chore or duty off someone else (who is probably overloaded at that time). This is also a great opportunity to demonstrate that many situations are more easily handled by a team, than alone. Members of a team can support each other. Working in a group can make the task feel less impossible. These discussions will directly link to Delaware Social Studies Standards in the area of Civics.

Appendix

Common Core State Standards

RI.K.1: with prompting and support, ask and answer questions about key details in a text.

This standard will be addressed repeatedly throughout the unit, during readings and discussions.

RI.K.3: with prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.

This standard will be addressed as we compare and contrast disaster events and how we prepare for and cope with them.

RI.K.4: with prompting and support, ask and answer questions about unknown words in a text.

This standard will be addressed repeatedly throughout the unit as we work with vocabulary related to disasters.

Delaware State Social Studies Standards

K.C4.1: Students explain why people would work together to do something.

This civics standard will be addressed as we discuss preparing for and recovering from disaster events.

DE.K.G1: Students will develop a personal geographic framework, or ‘mental map’, and understand the uses of maps and other geographics.

Geography standard will be addressed as we use maps to track disasters and seek patterns about where and when natural disasters occur in the United States.

Next Generation Science Standards

K-ESS2-1: Use and share observations of local weather conditions to describe patterns over time.

This standard will be addressed as we track natural disasters (related to weather) and seek to find patterns about locations of and dates when these events typically occur.

K-ESS2-1 Crosscutting Concept: patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

This standard will be addressed as we track natural disasters (related to weather) and seek to find patterns about locations of and dates when these events typically occur.

Resources

Abbott, Patrick L. *Natural Disasters*. 4th ed.

Good resource for general knowledge about what causes disasters.

Fredericks, Anthony D. *Investigating Natural Disasters through Children's Literature: an Integrated Approach*. Teacher Ideas Press, 2001.

This resource provides ideas for integrating Children’s Literature into this or a similar unit.

Kieffer, Susan W. *The Dynamics of Disaster*. W.W. Norton & Company, 2014.

Useful resource about disaster with many stories that illustrate the power of these events,

Knopf, Alison. “Preparing Children for Natural Disasters.” *The Brown University Child and Adolescent Behavior Letter*, vol. 33, no. S11, 2017, pp. 1–2., doi:10.1002/cbl.30255.

This is a useful resource to gain insight into helping children through the preparation, survival of, and recovery from a natural disaster.

Kostigen, Thomas M. *Extreme Weather Survival Guide: Understand, Prepare, Survive, Recover*. National Geographic, 2014.

Resource that outlines how to prepare for, survive, and recover from natural disasters.

Kovach, Robert Louis. *Earths Fury: an Introduction to Natural Hazards and Disasters*. Prentice-Hall, 1995.

Good source about what causes and how we can mitigate natural disasters.

Monmonier, Mark S. *Cartographies of Danger: Mapping Hazards in America*. University of Chicago Press, 2008.

Useful maps of disaster locations throughout the United States.

Schneider, Bonnie. *Extreme Weather*. Palgrave Maamillan, 2012.

Resource that advises what to do during and after natural disasters.

Smith, V. Kerry, et al. “Adjusting to Natural Disasters.” *Journal of Risk and Uncertainty*, vol. 33, no. 1-2, 2006, pp. 37–54., doi:10.1007/s11166-006-0170-0.

An interesting resource that looks at the impact of natural disasters through the lens of insurance coverage.

Tierney, Kathleen J. *The Social Roots of Risk Producing Disasters, Promoting Resilience*. Stanford Business Books, 2014.

A good resource for an overall understand of Disaster Sciences.

Notes

[1] Abbott, Patrick L., *Natural Disasters*, 1.

[2] Kovach, Robert Louis, *Earth's Fury: An Introduction to Natural Hazards and Disasters*, 2.
[3] Schneider, Bonnie, *Extreme Weather*, 30.
[4] Kovach, *Earth's Fury*, 296.
[5] Ibid, 291.
[6] Ibid, 278.
[7] Ibid, 133.
[8] Ibid, 334.
[9] Schneider, *Extreme Weather*, 55.
[10] Ibid, 50.
[11] Kovach, *Severe Weather*, 302.
[12] Ibid, 303.
[13] Ibid, 304.
[14] Ibid, 23.
[15] Abbott, *Natural Disasters*, 114.
[16] Kovach, *Earth's Fury*, 283