TORNADO SAFETY EDUCATION IN PUBLIC SCHOOLS

by

Zephi Francis

A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Disaster Science and Management

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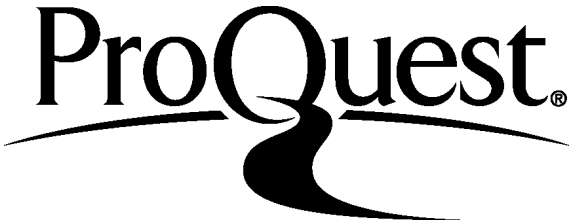

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ABSTRACT

On May 20, 2013, an EF5 tornado swept through Moore, Oklahoma. Before the severe weather reached the Greater Moore Regional Area, a tornado warning was issued. In particular, this thesis investigated: how a school district in Oklahoma responded to the tornado warning; the current tornado safety education curriculum in the school district; and the information kindergarten students knew about tornadoes or tornado safety prior to matriculating into the school system. In order to collect data, two surveys were created. There was a survey created for principals and a survey created for kindergarten teachers. In addition, several informal interviews were conducted with weather personnel in the Oklahoma area to help bolster survey data. The principals' surveys comprised of a mixture of open-ended and closed-ended questions. The teachers' survey were strictly open-ended questions. For all of the closed-ended questions, responses were reported in aggregate form. In reference to the open-ended questions, thematic coding was utilized. Responses from the principals' surveys revealed that schools in the district did have a systematic response plan in place to respond to tornadoes. However, principals mainly discussed tornado drills as the primary source of tornado safety education present in the schools. Although several principals did note that their science curriculum discussed tornadoes or tornado safety education. Plus, educating the wider community (parents and community members) about tornado safety education was nonexistent. Kindergarten teachers indicated that kindergarten students knew that tornadoes were dangerous weather events and that they need to take tornado protection action when a warning is issued before they started formal schooling (kindergarten). Lastly, recommendations to help make schools safer in future tornado events were provided.

Chapter 1

INTRODUCTION

Background of Disaster Event

Tornadoes (also known as twisters or cyclones) are spinning columns of wind that typically emerge from severe thunderstorms. This wind can be shaped in numerous ways such as a rope, funnel, cylinder or wedge. In order for a tornado to form, the spinning column of wind must extend from a cloud and touch the ground. Tornadoes are classified using the Enhanced Fujita Scale (EF-Scale) ranging from an EF0 (65-85 mph) to an EF5 (more than 200 mph). Additionally, post-tornado surveys are conducted to assess the extent of damage to the built and natural environments (Keller & DeVecchio 2012). The United States of America has more tornadoes than any other country and usually they occur in the spring and summer months in the Midwest, Southeast and Southwest. Furthermore, the largest number of injuries from all of the natural hazards are from tornadoes and they are the third leading cause of disaster-related property damage (Mileti 1999). In this study, an EF5 tornado that occurred in Moore, Oklahoma in Cleveland County will be the topic of concern.

When warning coordination meteorologist at the Norman National Weather Service (NWS)—Rick Smith,—arrived at his office on the morning of May 20, 2013, he discovered the weather data revealed a possibility of a tornado outbreak during the

late afternoon in the Newcastle and Moore Oklahoma areas. Immediately, Smith decided to send out a pre-warning message via e-mail to over 380 officials in the regional government, hospital and emergency management sectors (Barry & Schwartz 2013). The e-mail Smith sent at 8:06 a.m. read:

> First of all, our thoughts and prayers go out to all those impacted by the tornadoes yesterday, and to all the first responders, emergency management and relief agencies who are dealing with the aftermath. We are going to be dealing with more significant storms today, including the potential for tornadoes and giant hail. The risk for tornadoes will be highest along and south of I-44, including the OKC metro area. We expect storms to develop a little earlier than yesterday, maybe as soon as 1-2 pm. This is going to create serious issues if we have tornadic storms in the area at school dismissal time, and certainly during the afternoon drive time. Please be sure that schools in your area are aware of this risk and that they start thinking about what they will do if there are warnings at those critical times today. We are sending damage survey teams out, but they are going to be challenged to complete their surveys before more storms develop. We will post our findings as soon as possible. We will hold our routine 10 am. conference call today as scheduled, and we'll dig into the weather a little then. Let us know if you have any specific questions, comments, or concerns.

Along with the e-mail, NWS—Norman also disseminated pre-warnings using their social media accounts such as Twitter and Facebook. In Figure 1, one of their tweets from that day is shown. In Figure 2, there is the Facebook status update posted:

Figure 1: Tweet Posted by NWS Norman

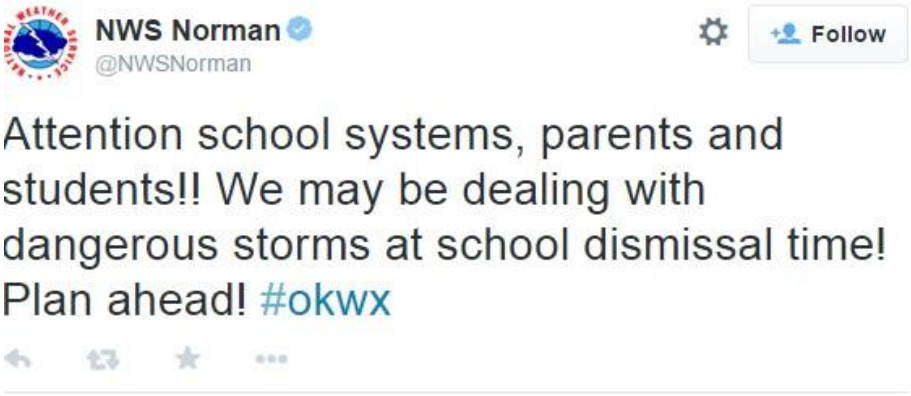

Figure 2: Facebook Message Posted by NWS Norman

These warning messages were sent out via social media prior to the storm. As a result, any organization or individual that followed the National Weather Service—Norman on Twitter or Facebook received a notice about the strong possibility of a storm outbreak later in the day. Additionally, citizens who received the message were strongly encouraged to share the information within their social networks.

Throughout the morning and afternoon, the NWS—Norman office continued to post information on their social media accounts. Also, the weather office participated in multiple online NWS Chats where they shared critical weather updates

with their partners. A timeline of their activities pre-tornado and post-tornado can be found at http://www.srh.noaa.gov/oun/?n=events-20130520-chronology. Around 1:10 p.m. CDT, NWS issued a tornado watch that was in effect until 10 p.m. CDT for several counties in central Oklahoma such as Canadian, Kingfisher, McClain, Pottawatomie, Cleveland, Lincoln, Oklahoma, Grady, Logan and Payne. At 2:12 p.m. CDT, NWS issued a severe thunderstorm warning until 3:00 p.m. CDT for Southeastern Canadian County, Northern Cleveland County, Northeastern Grady County, Northwestern McClain County, and Western Oklahoma County (NWS Forecast Office Norman 2013).

A little later in the day at 2:40 p.m., the NWS issued a tornado warning for Northwestern McClain County, Southern Oklahoma County, Northwestern Grady County, and Northern Cleveland County that was in effect until 3:15 p.m. CDT. Next, there was a tornado emergency issued when meteorologists and storm spotters saw a tornado near Newcastle. There was a tornado emergency for Moore and South Oklahoma City (NWS Forecast Office Norman 2013). After the tornado was spotted in Newcastle, it travelled to Moore, destroying numerous businesses, homes, a hospital and two schools. The schools destroyed were Plaza Towers Elementary School and Briarwood Elementary School in the Moore Public Schools District (Oxford & Schwartz 2013). The 2013 tornado's path covered a surface area of 4.6-miles-long and a half-mile-wide; it leveled 1,100 homes and damaged another 1,300. Unfortunately, there were also 24 serious fatalities, and seven were students at Plaza Towers Elementary School (Fernandez & Healy 2013).

Historically, there have been several tornadoes that have caused deaths in Oklahoma's schools. On January 4, 1917 in Vireton there were 16 deaths in a poorly constructed Indian mission school, in November 19, 1930 there were six deaths in Bethany, there was one death at an evening basketball practice in Granite on January 26, 1944, and on April 12, 1945 there were three deaths in Muskogee in a dormitory for the school of the blind (Brooks & Smith 2013). The Moore Public Schools district is itself no stranger to tornadoes. On May 3, 1999, a violent tornado destroyed Kelly Elementary School; the school's classes were let out for the day and no one who had been in the facility was injured. The school was rebuilt with the hallways created as safe rooms (Talley 2013). In addition, Westmore High School was badly damaged by that same storm (Branson-Potts 2013).

Before the two elementary schools were reached by this EF5 tornado on May 20, 2013, protective action was taken by students and teachers. For instance, Claire Gossett, a teacher at Plaza Towers Elementary, relocated her class to the hallway and then to a bathroom to seek shelter. Other teachers squeezed students into closets and shielded them with their own bodies as the tornado swept through Moore. According to Albert Ashwood, director of emergency management for the State of Oklahoma, Plaza Towers Elementary did not have a safe room. Later, the superintendent of the Moore Public Schools District, Susan Peirce, exclaimed that all the schools in the district are mandated by state government to perform tornado drills, and that the schools have exceeded those expectations (Fernandez & Healy 2013).

Two months following the May 20 tornado, my colleague and I from the Disaster Research Center (DRC) traveled to Moore, Oklahoma. Using questionnaires, we conducted face-to-face interviews with residents about the household protective actions that they took during the tornado outbreak. Many of the interviewees were parents and grandparents who told us that as soon as they found out a tornado was approaching Moore, they left home to retrieve their children from school. There was a bit of fear expressed by parents and grandparents, because the tornado was predicted to arrive around school dismissal time and they did not want their children on buses or walking home. Furthermore, in one particular interview, a mother informed us that she wasn't aware of any school policies about when or where to pick up her son in a post-tornado event. Hearing these narratives piqued my desire to conduct research on the impact of this disaster on an Oklahoma school district.

Purpose of Study

The Moore 2013 tornado serves as an unique opportunity to investigate the impact of a tornado on a school system in the Greater Moore Regional Area due to the fact that there was an actual severe storm during the schools' hours of operation. With that being said, the objectives of this study are:

1. To find out what the current K-12 tornado safety education practices are in a school district in Oklahoma.
2. To investigate teachers' perceptions of children's understandings and knowledge of tornado safety education.

3. To determine if students' tornado safety education knowledge is emerging over the school years (K-12).

The proposed research will be valuable to school and governmental officials, because they are responsible to the State government of Oklahoma for fulfilling mandatory requirements that public schools craft disaster risk reduction initiatives for tornadoes. School administrators in other tornado-prone areas should also benefit from these research findings.

In the following sections, there will be: an overview of the theoretical framework that will guide this research; a discussion of the importance of disaster education in schools; a literature review on the formats of disaster education; a presentation of the methods and analysis process; the results of the data analysis is revealed; and lastly a conclusion and discussion section is provided.

Chapter 2

THEORETICAL FRAMEWORK

Disaster Subculture

Sociologist, Harry Estill Moore, coined the term "disaster culture" in his book …and the winds blew (1964). After collecting data in the Gulf Coast for several years, he proposed the idea that in a geographical place that experiences frequent storms, cultural practices are created to cope with the extreme weather threats. Specifically, these coping mechanisms include social, psychological and physical adjustments made by residents. Additionally, Moore stated that in the Gulf Coast, there was an element of pride by citizens with respect to dealing with hurricanes. He highlighted a story about an elderly man in Port O'Connor who decided to face the dangers associated with Hurricane Carla; the man mentioned that he had lived on the sea for nearly 67 years and knew how to survive storms. During the same hurricane, several other elderly people refused to evacuate for two reasons: (1) in their past experiences, they had never fled a storm and (2) their homes had made it through storms in previous years with minimal or no damage. They believed that their homes were safe refuges. Another characteristic of the disaster culture is a community of interests; that is, the residents have common experiences that are uncommon to outsiders. In a disaster culture, residents behave in a way that will prevent or minimize danger and loss. Residents in disaster areas make feasible preparations to reduce the impact of an imminent disaster.

In the 1960s and 1970s, other researchers expanded Moore's concept of disaster culture. For instance, Anderson (1965) referred to Moore's phenomenon as a "disaster subculture." These researchers aimed to highlight that disaster subcultures existed within a wider culture. Subcultures are created by group members who reside in a social and ecological area that adapt to a pressing problem. Anderson emphasized that just because a community experiences a frequent threat, it does not mean a disaster subculture exists. Instead, group members have to interpret the disaster agent as continuous (recurring on a regular basis in the future) and create social mechanisms and operational procedures to lessen the impact of the future threat. Within a disaster subculture, Wenger and Weller (1973) differentiated between latent and manifest subcultural elements. Latent activities are comprised of actions that are appropriate before an imminent event, during the event, and in the immediate aftermath of the disaster. These behaviors are kept apart from the mainstream culture. On the other hand, manifest elements are cultural practices integrated into the dominant non-disaster culture. In most areas, latent practices are the norm in reference to cultural practices. Hayim (1996) gave examples of social settings where disaster subcultural behaviors played a role in a society. In these societies, when a disaster occurs, normal behavior is abandoned so that individuals can move into their role reserved for the disaster event. One of the examples he provided was of children in California schools who are taught to "Duck, Cover and Hold" when an earthquake occurs. In other words, these cultural practices are reserved specifically for a disaster event.

Wenger and Weller (1973) acknowledged that disaster subcultures can have both an individualistic and organizational component. At the individualistic level, members of the public are aware of disaster agents, warnings for the disaster agent, responses to protect themselves and their homes, and have a set of norms to interpret the events. At the organizational level, the disaster agent becomes the responsibility of an organization or network of organizations. Anderson (1965) discussed organizational disaster subculture by emergency organizations in Cincinnati that repeatedly experienced floods. Anderson observed that local organizations had extensive flood plans to increase inter-organizational cooperation in the event of flooding. The major organizations listed were police, fire, the Red Cross and the Public Works Department. These organizations were equipped with the personnel and equipment to manage the problems produced by flooding.

Wenger and Weller (1973) also described instrumental and expressive traits in disaster subcultures. Instrumental traits are things such as norms, technology, and special knowledge that allow individuals to prevent, predict, control and respond to an approaching disaster threat. Conversely, expressive traits often include beliefs and myths about the disaster agent and its relationship to the community. These traits help define how the agent is perceived. The last element of a disaster subculture Wenger and Weller (1973) discussed is the scope of occurrence. In some areas, the disaster subculture scope may be narrow. For example, in a flood area, the disaster subculture may only be in low-lying areas; in other communities, the disaster subculture may be broad and spread throughout the community.

In order for a disaster subculture to develop, Wenger and Weller (1973) outlined several factors. The first factor is that the community must experience a repetitive disaster event. The threat has to be recurring, and learning opportunities arise out of past experiences. In a disaster subculture, experience with a repeated disaster agent serves as a teacher of sorts. The recurrence of the disaster event increases the level of knowledge of the individuals in communities to perform appropriate and adaptive behaviors (Faupel et al. 1992). The second factor is that there has to be a period of forewarning. Events like floods, hurricanes, and tornadoes, all allow for some type of warning. The lead time (a time frame of safety before the disaster agent's impact) enables the community members to make adjustments to diminish the impact of the disaster agent by initiating the planned protective measures and conduct. Even though there are no official warnings for earthquakes, residents in the San Fernando Valley reported unusual behavior, earthquake weather, and personal intuition as predictors of an impending earthquake (Turner et al. 1986). The third factor is that there has to be damage to multiple segments of the community which covers a geographical area that is filled with human and material resources.

Wenger and Weller (1973) suggested that in Marietta, Ohio—which is referred to as a "flood town" –there were various activities to socialize newcomers into the disaster subculture. Activities included flood seminars and neighbors informing new residents about the proper flood behavior techniques. The process of passing on this knowledge is referred to as socialization. Socialization is defined as a lifelong process where citizens learn norms, cultural values, and expectations in a group where they

have membership. There are several major socialization agents: the family, schools, peers and the media. Parents have the responsibility to indoctrinate their children in the ways of society. Parents share with their children what is moral, correct, appropriate and important (Eitzen & Baca Zinn 2006). In reference to children who live in a disaster subculture, there are several institutions that pass on this cultural knowledge such as families, schools and the media. Berry and King (1998) surveyed 277 fifth grade students and 234 ninth grade students in Cairns, Australia about their cyclone knowledge and understanding. A majority of the student respondents reported that they received most of their information from their families and the media. According to Katada & Kanai (2008), there are coastal towns in Japan that are characterized as tsunami disaster subcultures, and knowledge and wisdom about tsunamis are passed from parents to children. Not only do parents have an essential role in passing on disaster knowledge, but schools have the potential to pass on information as well.

Schools as a socialization agent provide students with skills such as reading, math, and science that will enable them to take on adult roles. In addition, schools train children to be competitive, ambitious and conformers (Eitzen & Baca Zinn 2006). In the aftermath of the 1999 Oklahoma City tornado, the nearby community of Moore was also impacted. There was an absence of deaths of those aged five through 23 years old in these communities. One explanation cited the education that students had received in schools about self-protective actions (Brooks & Doswell 2002). Brooks and Doswell (2002) conducted a survey that was completed by 130 junior high

school students in two of Moore's schools. Of those surveyed, 70 percent of the sample reported that they learned tornado safety at schools. Survey results also indicated that 85 percent of the students took protective measures such as going to an interior bathroom or closet in their homes. Of those who sought shelter, all but one sought shelter in an area that was not recommended by the National Weather Service. The authors went on to argue that if citizens are going to take appropriate protective actions when they receive a warning, it is vital that they know what actions to perform. In light of the results by Brooks and Doswell (2002), schools have the opportunity to provide and establish safety education programs that are low-cost methods to lower tornado deaths.

In a geographical area where there is no tornado disaster subculture, there tends to be a lack of knowledge, understanding and preparation for tornadoes. A recent study (Lewis 2006) on perceptions of tornadoes by 304 college students in New England-area colleges in the United States found that: only nine percent of the students knew that tornado winds could reach over 300 miles per hour; only two-thirds knew the difference between a tornado watch and a tornado warning; only 50 percent knew what to do once they sought shelter in the basement; and 20 percent recalled learning about tornadoes in schools. The author also surveyed teachers from 23 elementary and middle schools in Massachusetts and Connecticut. Only three of their schools had ever conducted tornado drills. In the survey, teachers were asked to describe what would happen at the school if a tornado was imminent and teachers responded with "smooth response" or "orderly reaction and calmness." To put it in

another way, the teachers were not familiar with specific tornado responses to protect themselves or children in extreme weather events. Lewis also investigated the question about why New Englanders were less tornado savvy than citizens in the Midwest. Some of the explanations include: the American Midwest has more tornadoes, the topography in many Midwest states allows citizens to see the tornado miles away, and the media's attention to tornadoes in the Midwest heightens residents' awareness in those areas.

In 1986, a school nurse along with a coordinator of public information wrote a short article on Arrowhead Elementary School's tornado safety program located in Colorado (Johnson & Beck 1986). One June day in 1981, the school's students had already left for the day. During a late afternoon staff meeting, a secretary informed the remaining personnel that a tornado had touched down nearby. Prior to this incident, the school did not have an official tornado alert system to inform the staff about approaching tornadoes. This tornado incident highlighted that tornado preparedness was not a priority of the school. The school acknowledged their lack of preparedness. As a result, weather radios were installed in all of the Cherry Creek, Colorado schools. The school's nurse, the parent Health Committee, and the fire department created a tornado response procedure for the school. The safest shelter in the open classroom was designated and copies of the procedure were sent to all teachers. Staff from the fire department marked the most structurally sound walls for students to take shelter against in the event of a tornado. What is important here is that this school had not perceived tornadoes to be a threat, and as a result, they never

created procedures for appropriate responses to tornadoes until they experienced one in 1981.

Emergent Literacy Perspective

William H. Teale and Elizabeth Sulzby (1986) co-edited a book titled Emergent Literacy as a Perspective for Examining How Young Children Become Writers and Readers. In the book's introduction, the editors provided readers with a historical analysis of beliefs about children's literacy. In particular, Teale and Sulzby reported at one point in time, the dominant attitude about children's literacy development was that children developed literacy skills once they entered into a formal institution—a school. Researcher, Arnold Gesell, promoted this claim in the 1920s. Gesell framed children's literacy around a maturationalists' viewpoint. In short, children would mature to an appropriate age and then they would begin to read and write. An alternative to a maturation perspective was the interventionist standpoint. With respect to this perspective, infants were being taught and accumulated skills as they advanced in age. There is no specific age when literacy acquisition can begin. The emergent literacy perspective is tied to the latter stance. Teale and Sulzby claimed that research shows that children learn literacy skills between the ages zero and six, and that those formative years should not be ignored, because literacy skills materialize before children enter a formal institution. The authors go on to discuss why they used the word emergent. First, they stated that there is no one point in time a child becomes literate, rather it is a process. Second, as children acquire literacy skills, something new is developing in the child (knowledge

that was not previously there is attained). Lastly, emergent refers to forward looking/progressive (children's literacy is improving over time).

Other literacy scholars including Senechal and LeFevre (2002) distinguished between informal and formal home-based literacy activities. For example, when a parent is reading a bedtime story to a child, the focus is on the message of the story and illustrations. Of course the parent may give an explanation about the story, or the child could ask questions, but the nature of the interaction is informal. Senechal and LeFevre characterized formal literacy activities as a parent reading a book to the child and the parent is pointing out specific letters and saying their names and sounds. My point is that in the homes of children, there can be formal tornado safety education instruction or informal instruction. In the next section, there will be a discussion on how ideas from the emergent literacy perspective can be applied to a disaster subculture to help us understand how children acquire tornado safety education knowledge.

Applying the Emergent Literacy Perspective to a Disaster Subculture

This paper argues that a tornado disaster subculture has developed in the Greater Moore Regional Area. In order to define the Moore, Oklahoma area as a disaster subculture, characteristics for the development of a disaster subculture by Wenger and Weller (1973) are outlined. First, the Moore area has experienced numerous tornadoes in the past few centuries. The National Weather Service Weather Forecast Office has kept track of the number of tornadoes that have been in Moore from 1875 to present. Moore has been hit by 22 tornadoes that have ranged from an

EF0 to EF5 in that time frame. The second element is the forewarning that enables citizens to make the appropriate adjustments. In the 1950s and 1960s tornado warnings developed and were able to warn residents about impending storms. These warning were broadcasted via T.V. and the radio. The T.V. and radio stations received the warnings from the United States Weather Bureau. Outside tornado warnings (sirens) have been used since the 1970s. After a major tornado outbreak in 1974, there was a national movement to make the National Oceanic Atmospheric Administration's (NOAA) weather radios available to citizens so they could receive information in their own homes directly from the National Weather Service. Currently, as technology has advanced, citizens also receive tornado warnings on the internet or sent directly to their cell phones (Coleman et al. 2011). The last factor is that the disaster agent has a salient impact on human resources and materials. The Federal Emergency Management Agency reported that a year after the 2013 Oklahoma tornado, federal aid has surpassed $110 million dollars. These funds have been used to help people repair their homes, businesses and schools (FEMA 2014).

Since there is a tornado subculture in the Moore, Oklahoma area, ideas from the emergent literacy perspective can be utilized to examine children's tornado safety education acquisition. Teale and Sulzby (1986) made the claim that when literacy (reading and writing) is part of a culture, children begin to learn these skills during their developmental years (ages 0-6). In order to apply the emergent literacy perspective to a disaster subculture, this paper argues that children will acquire tornado safety literacy before entering formal institutions, because it is a part of the

general culture in this tornado-prone area. Tornado safety literacy in this context refers to children's knowledge and understanding of tornado protective action behaviors. When students enter schools, they learn additional tornado safety self-protective measures, which can reinforce what they have learned at home and also provide them with new information. As a result, their tornado safety education attainment is continuing to increase, although not necessarily in a linear or planned fashion. In other words, children are accumulating more knowledge when the household learning is coupled with the institutional (school) learning.

Chapter 3

DISASTER EDUCATION

Importance of Disaster Education

Johnson et al. (2014) wrote that disaster education includes teaching information about two components: (1) disaster risk and (2) methods to reduce injuries and damage from disaster agents. For the purpose of this thesis, tornado safety education is the type of disaster education under analysis. Tornado safety education is any training, activity, curriculum, or instruction that teaches information about tornado risks and techniques to decrease harm. This type of education can be facilitated in places such as homes, schools or community centers. This thesis project is interested in the tornado safety education offered by a school district in Oklahoma to its students and staff.

There are a number of reasons why research on disaster education is important. First, over the past 25 years, there have been several disaster events that have occurred while students were in school. Luna (2012) summarized a report by the United Nations Centre for Regional Development (UNCRD), stating that in 1988 there was an earthquake in Spitak, Armenia that killed 285 out of 302 students in one specific school. More recently, in 2008, a 7.9 earthquake in Sichuan, China occurred during school time and resulted in the deaths of 5,345 students and 7,000 school buildings collapsed (Consortium for Disaster Education Indonesia 2011). And of course, the 2013 Moore tornado that killed seven students.

Second, disaster education in schools allow for children to receive a formal education about hazards. Ronan and Johnston (2005) argued that many adults have been a student in a school setting at one point in their lives, so schools are an ideal setting to instill hazard education knowledge. In the opinion of Vitek and Berta (1982), hazard education should be mandatory between kindergarten through twelfth grade, because without a formal education, an individual will acquire very few accurate perceptions of extreme weather related hazards. Mitchell (2009) claimed, however, that hazard education is improbable to be a core standard of a school's curriculum due to an emphasis on other subject areas such as English or mathematics. Instead, hazard education content should be included in the physical and social sciences. To take a case in point, Watson and Tucci (2000) explained how middle school earth science classes were beneficial in a tornado outbreak that occurred in North Carolina in the middle of the night. It was suggested that the general education that young citizens previously received was responsible for the very few deaths in the event. Interviews with students revealed that they knew exactly what was happening and were able to take the appropriate protective measures.

Third, children can serve as conduits of disaster knowledge to their families. Experimental research has revealed that children and parents reported that youth hazard education programs increase home-based hazard adjustments (Ronan & Johnston 2003). In this specific example, children take the information that they have gained about earthquakes during school time and share it with their parents; and as a result, there is an increase in resilience at the household level. Additionally, a girl

named Tilly learned about tsunamis in her sixth grade geography class. Thus, during a 2004 vacation in Thailand, she was able to warn her parents and other vacationers on the beach of an impending tsunami in September of that year (Dufty & Stewart 2014).

Lastly, disaster education can potentially decrease vulnerabilities in disasters. At one point in history, it was thought that infants and children were not affected by frightening events, because they were too young to understand what was going on around them (Gibbs et al. 2014). As a result, Anderson (2005) stated that there has been a lack of research on children in disasters, but there needs to be more studies on youth because of their vulnerabilities in disasters. Typically, one group that is vulnerable in disasters are children. To make this point clear, Chowdhury et al.'s (1993) research on the 1991 Bangladesh cyclone showed that in regard to seeking shelter, some adults were able to seek shelter, but this was an obstacle for children and the elderly, and as a result, those two groups died at disproportionate rates. Also, children are emotionally and physically vulnerable in disaster events since they generally depend on adults to meet their needs (Peek 2008).

Forms of Disaster Education

Shaw et al. (2011) discussed three types of disaster education: formal education, non-formal education, and informal education. Formal education is characterized as instruction within a school, college or university. Typically, students—full-or part-time between 5-25 years old-are involved in formal education where they are progressing on a ladder of educational attainment. The structure consists of specific learning objectives, an organized time frame of instruction, and

educational support. The second type of instruction is non-formal education. Non-formal education can be described as educational instruction that may be practiced inside or outside of a formal educational system, and people of all ages may participate in the activities. The activities may provide life skills, work skills, adult literacy and culture. The last category is informal education, which provides learning opportunities that emerge from work, family and leisure events.

As suggested by Petal and Izadkhah (2008), there are several methods to employ formal and non-formal education for disaster education initiatives. Formal education consists of: developing curriculum about disaster risk reduction concepts and theories, curriculum infusion (integrating disaster risk education ideas into current curriculum), and creating a stand-alone course about disaster risk reduction. For non-formal education, the authors noted that the dissemination of disaster risk reduction knowledge comprises: dissemination of written materials (e.g., posters and signage), creative educational materials (e.g., comic books, videos and games), cultural and performing arts (e.g., poetry, dance, theatre and music), after school safety clubs, community-based service clubs, competitions and awards (e.g., drawing or writing competitions about disaster risk reduction knowledge), and involvement of parents and community members in disaster drills.

In his book Disaster Education: Race, Equity and Pedagogy, John Preston (2012) outlined several pedagogies (methods of instruction) pertinent to disaster education: affective preparedness pedagogies, performance pedagogies, banking and didactic pedagogies, and construction kit pedagogies. Affective pedagogies do not

deal with cognitive attainment, but with emotions. An example of this teaching method is the film Let's Face It which was produced by the Federal Civil Defense Administration (FCDA 1950). The film was expected to change an attitude of passivity toward nuclear attack to a more positive emotional response.

The second pedagogical technique is a performance pedagogy. Performance pedagogy is a rehearsal of an emergency situation. This method is supposed to acquaint individuals with the rules and pre-planned response to an emergency. Moreover, performance pedagogy allows for those who partake in the performance to assess what has taken place and to determine if improvements need to be made. Finally, performance pedagogy attempts to get rid of any intrapersonal barriers that would prevent appropriate response behaving from taking place. Banking and didactic pedagogies are a series of information that can be delivered in a home or a classroom setting. Normally, users don't refer to them in advance, but just know that the information exists in the case of an emergency event. Finally, construction kit preparedness pedagogies' purpose is to get citizens to create their own shelter and store their own equipment such as storing food and water that will help with survival.

Historical View of Disaster Education

In regard to schools, in the United States of America, disaster education has not always been a staple of schools' priorities. Historian, Terry Golway (2002), shared how a false alarm fire revealed a lack of emergency education and preparedness in a public schools in his book So Others Might Live: A History of New York's Bravest the FDNY from 1700 to the Present. In November of 1851, a teacher

at P.S. 26 Greenwich Village School in New York City became lightheaded, and several of her students rushed out of the classroom into an auditorium filled with students and screamed for water. Consequently, the students in the auditorium assumed there was a fire and panicked while rushing to exit the building. The school's doors were locked, so students could not exit. The Fire Department of New York (FDNY) was notified about a potential fire and responded to the incident, but had trouble getting into the school because the doors opened in-ward and there were hundreds of children in front of the main exit. Eventually, the firemen were able to enter only to find that 40 students died due to suffocation or being trampled. Golway went on to elaborate that this false alarm displayed that students were unaware of the appropriate response to a fire at school. This tragedy made national news and teachers nationwide took this opportunity to do fire drills with their children on their own accord. However, it wasn't until a few more fires at school in New York that the state decided to make fire drills mandatory in 1901. The false alarm fire at P.S. 26 Greenwich Village School served as a focusing event for schools in the United States to begin to think about how they should educate students about fire safety at schools. Birkland (1997) defined a focusing event as a sudden and rare event that causes harm in a concentrated geographical area. In addition, a community of interest (community members and government officials) look for a solution to problem which may have been a policy failure.

About a half century later, schools in the United States begun to educate and prepare students to respond to atomic bombs. At the time of the Cold War in the

1950s, there was a fear that the Russians would engage in nuclear war with the United States and that they would target public schools. Therefore, the Federal Civil Defense Administration (FCDA) along with the Department of Education (DOE) created an educational campaign to inform and prepare students for an atomic attack (Heath et al. 2007). According to Joanne Brown (1988), teachers embraced the civil defense activities because it served as a way to display their nationalism, and it provided a platform for schools to show how important they were to national security, which would justify federal aid to the public school systems. Duck and Cover was a nine minute animation clip that featured Bert the Turtle illustrating to students how to protect themselves (Mauer & Rizzo 1951). Jacobs (2010) wrote that films such as Duck and Cover and Atomic Alert were produced to educate students on how to survive an atomic attack. The films portrayed civil defense workers on the scene quickly after an attack to restore order. Both films focused on children being self-reliant, but Atomic Alert portrayed children as partners with adults in appropriately responding to an attack. These civil defense activities were primarily for war concerns, however they had a dual-use for events such as tornadoes and earthquakes (Preston 2012). It is argued that current tornado and earthquake drills were developed out of the duck and cover drills (Heath et al. 2007).

Currently, government officials in the state of Oklahoma mandate that schools have at least two tornado drills per school year. All students and staff are expected to participate in the tornado drills. Additionally, the drills should reflect procedures that are contained in a written plan that has been crafted by the district to protect children

against natural and man-made disasters (Oklahoma Legislative 2013). As an illustration, a student handbook for high school students in Moore Public Schools provides information about tornado drills (Moore Public Schools 2012). In a tornado event, an alert will be signaled over the intercom in a series of three buzzes. Students are supposed to shelter in their designated areas with their head on their knees and hands on the back of their necks facing a wall.

Specifically for tornadoes, multiple Federal agencies and national non-profit organizations have created disaster education activities and curriculum. NOAA's National Severe Storms Laboratory has created a series of tornado safety education resources for students (e.g., www.nssl.noaa.gov/education/students). There are several eBooks that illustrate the appropriate protective actions children should take depending on their location such as in a car or at home. In addition, NOAA created an Owlie Skywarn coloring book for tornadoes. Besides coloring, the book offers a lot of informative information such as the difference between a tornado warning and a tornado watch, the months tornadoes typically occur, protective action activities at school, in a home or a mobile trailer, and it ends with a tornado quiz for students to take. Besides NOAA's initiatives, FEMA has also created education activities for educators and students (e.g., www.ready.gov/kids/educators). One of their series is called BE a Hero! Youth Emergency Preparedness. There is information for grades 1-2, 3-5, 6-8, and 9-12. The curriculum has numerous activities to teach students what to do before, during, and after a disaster. The curriculum doesn't single out tornadoes, but it talks about all disasters in general. The material is still relevant for tornado

safety education. There is also a Disaster Master game about tornadoes provided online by FEMA which shares information about tornado protective action. Furthermore, the Red Cross offers several disaster education activities. One initiative highlighted on their website (http://www.redcross.org/prepare/location/school/preparedness-education) is the Pillowcase Project. A Red Cross worker gives a 60 minute presentation and encourages students to prepare for disasters and the students receive a pillowcase and are encouraged to create their own personal emergency supplies kit. The Red Cross also partnered with Disney to create the Mickey & Friends Disaster Preparedness Activity Book. It's an interactive online book. One of the sections is about tornado safety. In that section is gives information about tornado protective action. American Red Cross also has A Master of Disaster curriculum. A series of lesson plans tailored to teach children about disaster are featured on their website.

At times, tornadoes may serve as a focusing event for a community to create tornado safety education programs. In Kalamazoo, Michigan on May 30, 1990 a tornado made its way through the town in 22 minutes; there was 50 million dollars in damage to commercial businesses, industrial sites, churches and homes. In all, there were five deaths and many injuries, which resulted from airborne debris. Post-tornado public education efforts were developed. There were public education services implemented such as a local children's television show reviewing weather symbols that the local news media issues for a tornado watch verses a tornado warning. The television show also showed children how to respond in a weather emergency (Holder

1982). Another example is during the succeeding years of the 10th anniversary of the 1987 Black Friday EF5 tornado in Edmonton Toronto. City officials, the news media and citizens group created tornado education programs. Also, on the 10th anniversary of the storm, the local news media produced segments that featured what to do in the event of a tornado, and two local papers discussed safety tips in a tornado (Blanchard & Cook 2004).

Chapter 4

METHODS

Methods

The primary sources for this research relied on two electronic surveys that were created using the University of Delaware's Qualtrics web-based survey system. The first survey was developed for senior administrators (principals) in an Oklahoma school district located in the Greater Moore Regional Area. In order for respondents to be partake in the study, they needed to be present at the school on May 20, 2013. The principals' survey (Appendix A) was comprised of 27 structured open-ended and closed-end questions. Furthermore, there were skip patterns embedded in the survey design, if a question was not applicable to the respondent. In particular, this survey was concerned about: how the schools responded to the May 20, 3013 tornado; the schools' tornado safety education curriculum components; and the relationship the schools have with the wider community in regard to tornado safety education. The second survey (Appendix B) included nine structured open-ended questions and was created for kindergarten teachers in the district. This survey investigated: what students knew about tornadoes before entering school; the information teachers share with students about tornado safety education; and how tornado drills are conducted at the school.

In order to distribute the surveys, the researcher needed to submit a research request to the school district. The school district's own research request form, a

modified proposal, the two surveys, the informed consent document (Appendix C), and the Institutional Review Board (IRB) approval from the University of Delaware (Appendix D) were sent via e-mail to the district on October 3, 3014. A little over a month later, on November 10, 2014, the school district informed the researcher that the study was indeed approved. Since the research project was permitted by the district, the researcher was confident that the investigation had merit and was certainly relevant to the school district.

As mentioned earlier, the web-based survey method was utilized as the main data collection tool. A previous research study indicated that web-based surveys possessed a better return rate than other methods. Cobanoglu et al. (2001) conducted a study where they compared mail, fax, and web-based survey methods. The research team was interested in finding out more about the response rate and return speed of each method. The fax method had the shortest response time at 4.0 days, and web-based surveys came in second at 5.97 days, and mail had the slowest response rate at 16.46 days. However, in reference to survey completion, web-based surveys boasted the highest return rate at 44.21 percent, 26.27 percent for mail, and 17.0 percent for fax. Due to the fact that principals and teachers regularly check their e-mail accounts during the school year, this project wanted to use web-based surveys in hope of obtaining a high return rate.

Once the electronic survey was developed, an e-mail that contained a brief overview of the project along with brief instructions, an informed consent form (this document did not need to be signed), and the link to the web-based survey was sent to

a district administrator to distribute. This e-mail was sent to an e-mail LISTSERV of administrators in the district. Instructions in the e-mail noted that elementary schools principals were required to send the kindergarten survey out to teachers. As a result, there is no way to acknowledge exactly how many kindergarten teachers had access to the survey. Although we do know that there are 70 schools in the district and 54 of the district's schools had a kindergarten grade level. The survey was open for participation for one month. After three weeks, a reminder e-mail was sent out to principals' LISTSERV.

At the time of this study, there were 70 schools in the district, as a result, there were 70 administrators. After a month, there were four principals' surveys returned (two elementary, one middle, and one high school), which is a 5.71 percent response rate. In regard to the teachers, as mentioned earlier, there is no way to find out if all kindergarten teachers received the survey. However, there is an estimated 211 kindergarten teachers in the district. We have three completed surveys, which gives us a response rate of 1.42 percent response rate. It should be noted that the researcher did not have direct access to e-mails of respondents. Thus, the research project relied on bulk e-mail, and that may have hindered the response rates. In addition, because the survey was sent out around holidays (Thanksgiving and Christmas) and that may have been an inopportune to conduct the surveys. The researcher wrestled with allowing for the district to have more time to complete the surveys, but after careful consideration, the researcher decided to do a one time data collection effort. There are also strengths of using a web-based survey such as it did not cost any money to send out the survey

and the respondents could complete the surveys at any time. Also, confidentiality was maintained throughout the process. There is no way to connect a response back to anyone who participated in the survey. Lastly, to add more detail to the survey results, there were several informal interviews conducted with personnel in the Oklahoma area such as a local meteorologist, and a K-12 weather education outreach specialist.

Analytic Approach

The analysis involved the researcher entering the data into a spreadsheet into Microsoft Excel. For all of the closed-ended questions, frequencies were recorded and reported in aggregate form. In reference to the open-ended questions, the researcher read through responses and participated in a process referred to as thematic coding. According to Ritchie and Spencer (1994), in order to analyze qualitative data there are a few vital steps. First, familiarization is when the researcher immerses themselves in the data. They read notes, listen to audio recording, and study observational notes. As the researcher becomes familiar with the data, the second stage is identifying a thematic framework. Data reveals recurrent themes, and some emergent themes may be identified. Mapping and interpretation is also important. At that point, thematic coding will be utilized. Braun and Clarke (2006) referred to thematic analysis as a method where the researcher can identify and report a series of patterns that are levelheaded within the data. The researchers go on to say that a theme is a pattern that is revealed in the data that captures an important aspect of the research. There is no set number of times a theme has to occur in the data to count as a theme. As a result, the researcher's personal judgment is vital in determining what data to label as a theme. There is less

emphasis on quantity, but more emphasis on the theme illustrating an important topic in relation to the research question.

Chapter 5

RESULTS

Response to the May 20, 2013 Tornado

One of the primary objectives of this research project was to investigate how schools responded to the tornado warning issued on May 20, 2013. In the disaster education literature, the researcher could not find any refereed journal articles on this topic. In order to examine the tornado response of the schools, the administrators were first asked if their schools received a warning about the imminent tornado. All participating respondents replied with a yes. The major source of tornado warning information received by schools came from the media. The second most popular source principals cited was the National Weather Service (NWS). According to one principal, he/she learned about the tornado warning from a staff member/teacher. One principal reported the superintendent's office as a source of the tornado warning. None of the principals noted that they received a warning from local governmental officials. It should also be highlighted that the respondents were instructed to mark all of their tornado warning sources. Consequently, several respondents obtained tornado warning information from multiple sources.

The finding that the media was the main source of weather related information was consistent with tornado warning information typically received at the household level. Following the May 9, 1999 tornado, Collins and Kapucu (2008) acknowledged that most respondents in the Midwest relied on the media for early tornado warning information. The authors thought it was an interesting finding due to the fact that

outside tornado warnings are extremely prevalent in the area. Nevertheless, other research has shown that citizens at the household level typically rely on multiple sources of warning information. Most people (55 percent) in the Oklahoma City area following the May 3, 1999 tornado received warnings from various sources. Among the 65 households surveyed in this particular study, the most cited source was a warning from the television (89 percent), tied at second place was telephone call (37 percent) and outside siren (37 percent), FM/AM radio came in at (35 percent) and in last place was the National Oceanic and Atmospheric Administration Weather Radio (3 percent) (Hammer & Schmidlin 2002).

Without receiving a warning from a scientific agency like the NWS, schools in Oklahoma would not have been positioned to take tornado protective action. Agencies and public officials have a responsibility of sharing warning information, and they have to consider how the warning message will be made known to the public (Nigg 1995). In an informal interview, an employee of NWS—Norman explained the process of sending out its advisory warnings to various community stakeholders on May 20, 2013.

Meteorologist at NWS—Norman:

> The first thing we did early in the morning, in a public sense, was to use our social media accounts on Facebook and Twitter to put out targeted messages that mentioned schools and storms around school dismal times. We did this early in the morning before 8 a.m. We put out things like attention parents and schools. That was the public dissemination of that message. We have an e-mail list, and most weather service offices do something similar for emergency management and public safety. We had been briefing them on significant developments with the storms for a few days. On May 20, a similar messages went to the groups. Most of the users on the e-mail list are emergency

> mangers, but we do have some school systems. But what happens when we send an e-mail to the emergency manger, the emergency mangers tells the superintendent and then the superintendent reports to the principals. The message was widely distributed directly from us or by our partners. The third thing we did was a conference call at 10 o'clock with our emergency management partners and reiterated the message again.

What is important here is that the NWS—Norman has turned to modern modes of communication such as using social media or a bulk e-mail list to inform its citizenry about severe weather. In addition, NWS—Norman has multiple partners to help their agency disseminate warning information.

As mentioned earlier in this paper, we know that an official tornado warning was issued in several counties in Oklahoma at 2:40 p.m. From previous research studies, it's also known that receiving a warning is necessary in order to take protective action in a disaster event. Brown et al. (2002) examined protective action following the May 3, 1999 tornado. Research respondents mentioned the following sources caused them to take shelter: receiving a pager message/telephone call (94 percent); hearing tornado sirens (85 percent); seeing television warning (57 percent); seeing the tornado (12 percent); hearing standard radio (5 percent); seeing weather changes suggestive of tornado (4 percent); word of mouth (1 percent); and other (5 percent). Comstock and Mallonee (2005) reported that in 1999, (74.1 percent) of their research respondents took protective action in a safe area in their homes such as a storm shelter, basement or a room without exterior walls. In 2003, in a tornado outbreak in the same Oklahoma area, there were similar results at (73.1 percent). There has been multiple research projects about tornado protective action at the

household level due to the fact that most tornadoes occur in the evening. Although tornadoes can arise at any time. The researcher did not find any studies about protective actions taking during school time in the event of an actual tornado. Thus, in the next section we wanted to find out what were the school's pre-planned tornado response procedures.

Plans and Procedures

There are very few studies on disaster planning at schools. One specific study (Burling & Hyle 1997) reviewed school district plans in several states and interviewed administrators that had survived a disaster. The researchers divided states into numerous regions. In particular, Oklahoma was in region VI. The results showed that in this region, since these states dealt with predictable or seasonal hazards, the plans contained very few details, sparse guidance information, and a lack of partnerships with outside agencies. The authors argued that in these areas, school districts may think that because these disasters are expected, as a result, response should naturally kick in or individuals should just use common sense. With that being said, we wanted to investigate the tornado response plans that were in place in the Oklahoma school district.

We asked if the schools had a tornado plan. Expectedly in Tornado Alley, all schools reported that their school possessed a tornado response plan. Once the schools received a warning that a tornado was approaching, principals altered their staff and students. We asked principals the question "How did you alert students and staff about the tornado? Mark all that apply." The choices included siren, call to the

classroom, an announcement over the intercom, e-mail and other (specify). Using a tornado siren or making an announcement over the intercom were the main modes of alerting the school about the approaching tornado. It was apparent that the schools did systemically pre-plan tornado response in the event of a tornado.

Moreover, we were interested in finding out how effective their response was on May 20, 2013. The question asked was "How effective was this plan on May 20, 2013?" One principal chose not so effective. However, most principals chose effective. As a follow-up question, the principals were asked why they chose a particular response. Below are a few of the given responses.

Principal Respondent (Not So Effective):

> Does not say when to release students when a tornado warning is near dismissal time.

Principal Respondent (Effective):

> Students were moved to secure areas of the school within 5 minutes of the initial warning. The only way to truly know if the relocation is effective is if a tornado hits the building.

Principal Respondent (Effective):

> We discovered several elements of our check-out system that needed modifications, but otherwise it was effective.

Sometimes, disasters can serve as a window of opportunity for change. The comments from the principals revealed that there will need to be changes to their tornado response plans.

Then, we asked the principals "Since the May 20, 2013 tornado, has your school's tornado response plan changed? If so, what changes were made?"

Principal Respondent:

> Yes, we now allow parents to check out their students until they deem it too dangerous to do so. We have signs posted on all doors advising that all doors are locked EXCEPT the front office. We changed some student placement locations as well.

Principal Respondent:

> Secure areas were reviewed with district officials, emergency kits for lights out events have been created, and school evacuation plans have been revised.

These schools did not have tornado shelters, so some parents came to pick up their children when they found out about the tornadic weather. However, if a parent was not able to pick up their child, the students had to shelter in secure areas within the school.

Principals were asked to explain to us how tornado drills were conducted at their school. Below is a response from a principal.

Principal Respondent:

> Every other month we conduct pre-scheduled drills. The alarm is sounded, students are moved to a predetermined space within the building, students squat against the wall with their hands over their neck until the all clear is sounded. Drills are reported to a state agency, and are part of the accreditation process.

The state requires that schools conduct at least two tornado drills per academic year. It's noticeable that the schools in this district are conducting many more than the state's minimum. In addition, on the kindergarten teachers' survey, there was an open-ended question that asked them to discuss how they introduce tornado drills to

the students. There was a general theme that emerged. Tornado drills usually consisted of students going into the hallway and taking the duck and cover position against a wall. We also questioned principals about parents and community members participating in tornado drills. Only one principal reported that parents and community members participate in drills. The principal explained how this is done. Principal Respondent:

> All people in the building at the time of the drill participate, including parents and community members.

From this response it appeared that if a parent or community member happens to be in the building during a tornado drill, then they will participate. However, we were more concerned about finding out if parents or community members were ever invited to partake in a pre-planned tornado drill. For example, schools could notify parents about a practice tornado drill and allow them to practice picking their children up, or even reuniting with their child after a tornado warning has been issued. It does not appear that these type of activities are being offered.

Tornado Safety Education Curriculum

A dimension of this research project investigated tornado safety education. It was important to determine how teachers acquired information about tornado safety education in order for them to pass on the knowledge to their pupils. There was a question on the principals' survey about the tornado safety education training method of teachers and staff. The results showed that most of the information given to teachers are in faculty meetings and in-service trainings. Several respondents noted in

the "other" category that participating in tornado drills also served as a method of instruction. Using a video to convey information about tornado safety education was not utilized by any of the schools.

In reference to discussing tornado safety education curriculum in schools, we planned to use ideas from the emergent literacy perspective as mentioned in an earlier section of this paper. One of the main ideas behind the emergent literacy perspective was that students accumulated literacy (reading and writing) skills before they entered formal institutions. In order to find out what students knew about tornado safety education before they started school, we decided to survey kindergarten teachers. We asked kindergarten teachers an open-ended question about what students knew about tornadoes or tornado protective action. A few of the teachers' responses are below.

Teacher Respondent:

> They think it is a storm and they have to take cover if there is a tornado nearby.

Teacher Respondent:

> They know about weather and what they see and hear on T.V., Radio, social media, cell phone alerts they see their parents view and discuss.

Kindergarten students generally understood that a tornado is a weather event and that when one is the vicinity, they should take protective action**.** In addition, socialization agents such as the family and media shaped the children's ideas about tornadoes. In a tornado disaster subculture, we could expect that parents and the media discuss tornadoes more often than an area that never or rarely experiences tornado events. With that being said, we can argue that yes students do accumulate tornado safety

education knowledge before entering a formal school. Contrarily, in a geographic location where tornadoes are infrequent, some students may not know what a tornado looks like. For instance, an elementary teacher in California found out that a lot of her students had never seen a tornado until she showed a video in class. Moreover, she found websites that students could use to learn about weather and ways to protect themselves in disasters (Poteete 2004). Essentially, what I am arguing here is that when tornadoes are not part of the community's culture, there will be a lack of family members or the media agencies discussing tornadoes. As a result, schools have the opportunity to be a vital socialization agent that educates students about tornadoes.

Kindergarten teachers were asked to discuss the information that they shared with their students about tornadoes or tornado safety education.

Teacher Respondent:

> Yes, we talk about what to do if the news says there is a tornado. We also talk about tornado sirens. We talk about when you hear the siren you have to take cover immediately!

Teacher Respondent:

> Yes, I often read stories that include ways to stay safe and I teach in school procedures.

From the responses of the teachers, they do discuss tornadoes protective action with their students. However, there does not appear to be a formal curriculum set in place. Teachers take it upon their own accord and discretion to discuss tornadoes with their students. We should also note that there was a general agreement of kindergarten

teachers that for the most part that children do understand the information that the teachers provide about tornadoes and tornado protective action.

Earlier in the paper, we highlighted that the emergency literacy perspective promoted the belief that literacy skills emerge in regard to a forward looking progress as students matriculated through K-12 grades. Therefore, we wanted to find out if tornado safety education literacy would emerge from one grade level to another. There was a question that asked principals to choose any courses that tornadoes and tornado safety was included into the curriculum. Two elementary principals revealed that tornadoes/tornado safety was included in science courses. None of the principals noted that tornadoes or tornado safety education was included in courses such as English, math, history, health, or physical education. In the "other" category, several respondents wrote that tornado drills were the method in which information about tornadoes and tornado safety is conveyed.

There were two questions on the principals' survey that examined formal and non-formal teaching methods. None of the principals admitted to having formal tornado safety education curriculum content such as a stand-alone course, tornado education workshop, or integration tornado concepts and theories into the existing curriculum. In addition, none of the principals reported utilizing non-formal teaching methods such as posters and signage, comic books, videos, games, performing arts, after school safety club, writing competitions and drawing competitions.

We expected that as a student moved from primary school to secondary school, that there would be more courses that included tornado safety education in their

curriculum. The more classes that taught information about tornadoes and tornado safety, the more knowledge the students would accumulate over the years. Overall, from are responses, we cannot argue that the schools' curriculum is providing tornado safety education in order for children's understanding and knowledge of tornadoes to emerge in a forwarding looking progress as they matriculate through K-12 grades.

This Oklahoma school district did not use any of the Federal educational resources provided by FEMA or NOAA that were mentioned earlier in this paper. Also, there was a lack utilization of local organization that conduct tornado safety education outreach such as the Oklahoma Climatological Survey and Oklahoma Mesonet. A Spokesperson at the Oklahoma Climatological Survey and Oklahoma Mesonet explained some of the educational resources their organization offers for various grade levels.

Oklahoma Climatological Survey and Oklahoma Mesonet Employee:

> The most significant difference between elementary presentations and older students is the reading focus using children's books or more data/video focused for older students. For middle school students I may give them data about the number of tornadoes per county or a map showing the data plotted (depends on amount of time). We will see which counties have had more tornadoes and discuss why they think the numbers are higher (population-more eyes to see vs. rural areas with fewer eyes). We may look at long term trends in terms of casualties due to tornadoes. We talk about the history of tornado warnings, medical advances, transportation, tv/radio and now cell phone use, and how all these factors have helped us reduce the number of causalities. If I have internet access, we will look at radar and weather conditions for different case studies. We have had several major outbreaks that the kids have heard about and we will discuss what the data was telling us before the event and watch the radar data as the events unfolds. For high school students in addition to looking at case studies, we will talk about what the forecasters are looking for in the data to determine if a big event is about to happen. We do this through what we call a Weather Briefing. We read a forecast discussion and then go

> look at the data that the discussion talks about. What does a dew point map tell us? What are the patterns forecasters are looking for in a radar image? I have a box of instruments and disaster supply kit. We talk about knowing what county you live in and the differences between a watch and a warning. We talk about the importance of having a NOAA weather Radio with a battery back-up. With older students we might discuss various phone apps available that given weather information and the importance of not turning off the weather alters.

The Oklahoma Climatological Survey and Oklahoma Mesonet has outreach educators who go into schools and provide the information as noted above. These workers are employed by the state, so there is no cost for schools to bring this organization to schools. Depending on the need of the teacher, the outreach worker can stay at the school for one class period or the whole school day. It's obvious that the Oklahoma Climatological Survey and Oklahoma Mesonet organization emphasized their curriculum more on the science aspects of tornadoes, so the outreach workers typically coordinates workshop sessions with a science teacher. With that being said, even discussing the science aspects of tornadoes is a great way to segue into reviewing tornado safety protective measures. The outreach worker does give information about tornado protective action that is accompanied by the science of tornadoes.

Wider Community and Tornado Safety Education

This project was interested in finding out if the schools in this Oklahoma community were using their resources to educate the wider community about tornado safety education protective measures. We asked a series of questions: 1) are students expected to share with their families what they learn about tornadoes or tornado protective action measures? 2) are there take-home assignments about tornadoes or tornado protection actions for students to complete with their parents? and 3) are

parents/community members invited to the school for informational sessions about tornadoes and tornado protective action measures? In this district, educating the wider community was nonexistent. None of the principals replied yes to any of these questions. Davis et al. (2003) argued that disasters affect the whole community, and as a result, everyone living in the disaster-prone should be responsible for lessening the impact of the disaster. In addition, the authors stated that an important aspect of disaster education is public awareness. Nielsen and Lidstone (1998) emphasized that disaster managers acknowledge education as an important aspect of managing public safety. They cite how in Australia educational campaigns in regard to drinking and driving, safe sex, fire prevention and road safety have been successful. A research team in Costa Rica examined the transfer of environmental education concepts from children to their parents. They found that coloring books and homework was very successful in transferring information from teachers to students and finally to the parents. The activities tended to be collaborative and required parents and student interaction. Not only was there intergenerational knowledge transfer (information transfer from children to parents), but there was intercommunity knowledge transfer (information transfer from children/parents to community members), because in this Costa Rican village people live close together and converse frequently (Vaughn et al. 2003). Unfortunately, in Oklahoma we did not see the schools using their platform to engage in public education efforts in order to create a safer community.

Chapter 6

CONCLUSION AND DISCUSSION

Conclusion

The impact of the May 20, 2013 on the Moore Public Schools District undoubtedly served as a backdrop to begin discussing schools' tornado response plans and tornado safety education curriculum. Tornadoes in this geographic were recurrent, there was a pre-warning for citizens to make hazard adjustments before the tornado arises, and the tornado's scope impacted various segments of the community. As a result, in the Greater Moore Regional Area, we argued that a tornado disaster subculture did indeed exist. Since there was a tornado disaster subculture, we predicted that children would learn about tornadoes and tornado safety education before entering into kindergarten. Then, we believed that the schools would provide opportunities for children's tornado safety education knowledge to emerge as they matriculated from one grade level to another. In addition, we know that in a disaster subculture, organizations can be responsible for dealing with disasters. In this project, we wanted to examine the role of school in relation to educating the wider public in reference to tornado safety education.

It was apparent by the principals' responses that their schools had systematically prepared for tornado events. Every principal noted that their school had a tornado response plan and that their schools practiced tornado drills. We should remind readers that the Oklahoma state government requires schools to have tornado

response plans and practice tornado drills. However, in this district, schools exceeded the minimum requirement for the number of tornadoes drills each academic year.

On the morning of May 20, 2013, each principal did receive a tornado warning. The sources included the National Weather Service, the media, the superintendent's office and staff members. After receiving the tornado warning, principals alerted their faculty and student body by an announcement over the intercom or a tornado siren. The schools possessed a pre-planned tornado alert systems in order for teachers and students to be notified so that they could relocate to safe areas of the building and to take appropriate protective action.

Most principals agreed that their tornado response plans proved to be effective on May 20, 2013. One principal believed their school's tornado response plan was not so effective. There were several issues with the plans such as when to let students out when a tornado warning is near dismal time and a principal mentioned that their school needed to re-evaluate the check-out system. We know that parents did come to check out their children before the tornado, and that can create additional problems for the schools. It can be problematic if faculty and students are sheltered in place, and a staff member has to transport a student to be checked out.

This project was also interested in discovering what kindergarten students knew before they entered a formal institution. Most teachers claimed that students were familiar with tornado safety education techniques. The children acquired this knowledge and information from their family members and the media. In an area

outside of the Midwest or Tornado Alley, parents and the media may not discuss tornadoes or tornado safety with their children since tornadoes are rare or nonexistent.

In regard to tornado safety education curriculum, surprisingly, there did not seem to be much in place in the selected Oklahoma school district. Outside of the tornado drills, there did not appear to be many methods to teach children about tornadoes. A few elementary principals did mention that tornadoes or tornado safety education was discussed in the science curriculum. However, even at the elementary level, tornadoes or tornado safety was not reviewed in any of the other courses other than science. At the middle school and high school level, none of the principals noted that there was a tornado safety education curriculum. We anticipated that as children progressed through their educational ladder, that schools would provide an opportunity for their tornado safety education knowledge to progress in a forward looking fashion. In other words, the children's knowledge would increase over the years. From our results, we cannot confirm that to be true.

In a tornado disaster subculture, we sought to determine if the schools would be a socialization agent in reference to educating the wider community about tornadoes and tornado protective action. In this school district, educating the wider public was absent. Schools have an opportunity and a platform to educate parents and community members. New families may move into the area and may not be familiar with tornadoes, so schools have the potential to be the socialization agent that teaches families how to deal with tornadoes. However, it is quite possible that other organizations such as churches, non-profit organizations, media outlets and local civic

associations have already taken on the responsibility of educating the broader public. As a result, schools may not feel obligated to educate the wider adult public about tornado safety education.

Discussion

Future Research Issues. This research project focused on one school district in Oklahoma. Future research should examine tornado safety education in other school districts in Oklahoma and in other tornado-prone states. The tornado safety education curriculum could possibly vary in other districts and regions. In addition, we focused on tornado safety education. Future research could investigate whether in other geographic areas that experience other disaster events—like hurricanes or earthquakes—do children acquire safety education before they start schools and whether if natural hazard education is embedded in those schools' curriculum.

The current study also only focused on the perceptions of principals and kindergarten teachers. Another opportunity to extend this research is to interview students themselves to find out exactly what they know about tornadoes or tornado safety education before and after they start school. Moreover, interviewing parents to find out what they share with their children in regard to tornadoes during their early developmental stages would be a fruitful project.

Although, it was beyond the scope of this project, but examining the effectiveness of specific tornado safety education curriculum materials would be beneficial. Then, another opportunity for research would be to conduct a pre- and post-

test to find out exactly what children learned about tornado safety education after the curriculum was instituted. Implementing an experimental design that uses a control group of students who had not been exposed to this educational curriculum would discover whether the information was effective in its attempt to provide safety guidelines to the students. Moreover, replicating this design in a geographic region that did not frequently experience tornadoes or tornado warnings could provide additional support for using the concept of a "disaster subculture" where children learn how to protect themselves during tornado outbreaks as part of their normal socialization process, merely as a function of living in a tornado prone area.

Future research should also investigate when schools decide to make changes to their disaster response plans, procedures and building structure. For instance, does the disaster agent have to impact a nearby school before other school systems make changes or will schools make policy changes if the disaster impacts the local community without affecting schools? Or is it only when children are killed while they are at school that districts and communities will take action to retrofit their schools with safe rooms or refuges? If local school districts do not take proactive efforts to lessen future tornado impacts, statewide mandatory policies (and the resources to support them) may not be necessary in order to protect the lives and well-being of children when they are in the care of educational institutions.

Methodological Issues. There are several methodological implications that should be discussed with respect to this study. First, it is probable that relying on bulk email distribution by the school district may have yielded a lower-than-desirable

response rate in this research project. This researcher did not know the exact heading or message that was included in the bulk emails that accompanied the questionnaires. Having the direct email address of respondents—both principals and kindergarten teachers—would have allowed the researcher to personally address research respondents and to follow-up with them. Second, the time frame when the surveys were sent out was important. Distributing surreys around holidays (between Thanksgiving and the beginning of the New year) is known to yield lower response rates, especially for school personnel due to the many activities that take place near the end of a semester and in conjunction with holiday-related curricula. Unfortunately, the timing of this survey was dictated by other factors (e.g., the lengthy period of identifying an acceptable and willing district to participate in the study; and the deadline for completing the thesis defense in the Spring 2015 semester.

Recommendations for Tornado Threatened School Districts

Several recommendations for schools that experience tornadoes need to be made. First, school districts need to establish relationships with their local National Weather Service offices. A NWS-Norman meteorologist stated that many school systems are not aware of the services that they can offer. Employees of the NWS are available for consultation about weather-related events. They do and can offer advice and suggestions to school districts when contacted. Second, there are several meteorologists in the Oklahoma area who are encouraging schools to treat tornado events like snow storms. If the NWS believes that there will be a strong possibility of tornado outbreaks, schools should cancel the school day, or let parents remove their

children from school without the child getting penalized with an absence. The idea behind this suggestion is that children will be safer in their own homes than they are in the schools. This recommendation should only be taken into consideration if schools do not have safe rooms or basements. In addition, if children are to stay home, they need to have access to a storm shelter or other safe areas to protect themselves from tornadoes. Third, it's important that school districts continue to update and evaluate their tornado response plans. We found that some schools discovered problems with their plans during the May 20, 2013 tornado. A summary of the tornado response plan and procedures should be sent home to each parent so that they are familiar with practices schools will implement if a tornado warning is issued during the school day. Parents should be aware of the checkout system before a tornado, and the reunification plans after a tornado event. Also, local emergency management personnel should be utilized to review safe areas used in the building during tornado events. Fourth, schools in tornado-prone areas need to make sure information about tornadoes and tornado safety are embedded in the curriculum. In an informal interview, a weather outreach education specialist in the Oklahoma area mentioned that if natural hazards are discussed at all in schools, the material is normally tacked on at the end of the school year. Mitchell (2009) argued that due to common core standards, natural hazard education will not be a common core. As a result, schools have to integrate natural hazards information into the common core curriculum. Plus, non-formal educational methods can be utilized too as mentioned earlier in the paper. In addition, teachers may not be comfortable teaching about tornado topics because their

knowledge about them is low. Thus, it's important that teachers have classes and workshops on tornadoes. Fifth, it is important that schools consider architectural design of buildings. Schools should have secure areas or safe rooms for students to shelter in during a tornado event. Tornado safety education has to be coupled with structurally sound buildings in order to protect teachers and students from the harm of tornadoes. After the Moore 2013 tornado, it was reported that the two schools that were destroyed would be rebuilt with safe rooms. These safe rooms are costly, but they will better protect children in future tornado events. Sixth, schools have a great opportunity to educate the broader community in regard to tornado safety education. Schools can offer take-home assignments to foster collaboration with students and parents. Schools can also invite parents and community members to the school for informational sessions. This would be a great way to increase community disaster resilience.

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Appendix A

PRINCIPALS' SURVEY

Thank you for your willingness to complete the survey. First, what type of school are you an administrator at?

○ Elementary School ○ Junior High School ○ High School

My role at this school is?

○ Principal ○ Vice Principal ○ Other (specify)_____

The first set of questions are about the tornado that struck Moore, Oklahoma on May 20, 2013.

1. Were you working at this school at this time? Yes ○ No ○
2. Did your school receive a warning that the tornado was imminent? Yes ○ No ○ (If yes, please answer question 3. If no, skip to question 5)
3. Where did you get the warning from? Mark all that apply.
   - ○ Superintendent
   - ○ Media
   - ○ National Weather Service
   - ○ Teacher or staff member
   - ○ Local government official
   - ○ Other (specify)_____
4. How did you alter students and staff about the tornado? Mark all that apply.
   - ○ Siren
   - ○ Call to the classroom
   - ○ Announcement over the intercom
   - ○ E-mail
   - ○ Other (specify)_____
5. Does your school have a plan that outlines how students and teachers should respond to tornado warnings? ○ Yes ○ No (If no, skip to question 9)

6. How effective was this plan on May 20, 2013?
   - ○ Very Effective
   - ○ Effective
   - ○ Not So Effective
   - ○ Not Effective At All Effective

7. Can you tell me why you say that?

_____
_____
_____

8. Since the May 20, 2013 tornado, has your school's tornado response plan changed? If so, what changes were made?

_____
_____
_____

9. Since the May 20, 2013 tornado, what actions have been taken to make the school safer in the event of a tornado?

_____
_____
_____

10. How does your school inform parents about how the school will respond in a tornado warning? Mark all that apply.
    - ○ E-mail
    - ○ Letter
    - ○ Automatic phone call message
    - ○ Assembly
    - ○ Students relay the message to their parents
    - ○ Other (specify)_____

11. Thinking back to the May 20, 2013 tornado, approximately how many parents arrived at your school before the tornado struck?
    _____ (number of parents)
    _____ (no parents came)
    _____ (don't know)
12. Are teachers and staff trained to respond to tornadoes? Yes ○ No ○ (If yes, answer question 13. If no, skip to question 14)

13. How do teachers and staff receive this training? Mark all that apply.
    - ○ Video
    - ○ Faculty Meeting
    - ○ In-service training
    - ○ Other (specify)_____

In this section, we will ask several questions about your school's tornado safety education curriculum.

14. Formal tornado education is delivered to students in the following format(s)? Mark all that apply.
    - ○ Stand-alone course
    - ○ Teachers deliver a tornado education workshop during class time
    - ○ Integrating tornado risk reduction concepts and theories into the existing Curriculum
    - ○ Other (specify)_____

15. In what subject area(s) are tornadoes or tornado safety included? Mark all that apply.
    - ○ English
    - ○ Math
    - ○ Science
    - ○ History
    - ○ Health

- Physical Education
- Other (specify)_____

15. Does your school offer any of the following in relation to tornado safety education? Mark all that apply.
    - Posters and signage
    - Comic Books
    - Videos
    - Games
    - Performing arts (e.g. poetry, dance, music, theatre)
    - After school safety clubs
    - Community-based service clubs
    - Drawing competitions
    - Writing competitions
    - Other (specify_____
16. Does your school practice tornado drills? If yes, can you tell me how this is done?

_____
_____
_____

17. If your school has tornado education in the curriculum, tell me what are the strengths of the curriculum? (If yes, answer question 19. If no, skip to question 21)

_____
_____
_____

18. What would you like added to your school's tornado education curriculum?

_____
_____
_____

19. Were there any changes to the curriculum after the May 20, 2013 tornado? (If no, skip to question 21)

_____
_____
_____

Now, I would like to ask you some questions about your school in relation to the wider community.

20. Are students expected to share with their families about what they learn about tornadoes or tornado protective action measures?

    Yes ○ No ○

21. Are there take-home assignments about tornadoes or tornado protective actions for students to complete with their parents?

    Yes ○ No ○

22. Are parents invited to this school for informational sessions about tornadoes and tornado protective action measures?

    Yes ○ No ○

23. Are community members invited to this school for informational sessions about tornadoes and tornadoes protective action measures?

    Yes ○ No ○

24. Do parents ever participate in tornado drills? Yes ○ No ○
25. Do community members ever participate in tornado drills? Yes ○ No ○
26. (If answered yes to 25 or 26).Can you explain to me how that is done?

_____
_____
_____

This is the last section. I have one more question.

27. Is there anything else you would like to share to help me understand your school's tornado safety education curriculum or tornado response plan?

_____
_____
_____

Appendix B

TEACHERS' SURVEY

1. In general, what do kindergarten students know about tornadoes before they enter school?

   _____
   _____
   _____

2. In general, what do kindergarten students know about tornado protective measures before they enter school?

   _____
   _____
   _____

3. Do you include information about tornadoes or tornado safety protective measures in your curriculum? If yes, what?

   _____
   _____
   _____

4. How well do you think your students understand the information you provide about tornadoes and tornado protective actions?

   _____
   _____
   _____

5. In regard to tornado drills, when are they introduced to kindergarten students? How are they conducted in your school?

   _____
   _____
   _____

6. Do students understand the purpose of the drills? Why do you say that?

   _____
   _____
   _____

7. Do students understand tornadoes are dangerous? Why do you say that?

_____
_____
_____

8. Do you sense that children are afraid when you discuss tornadoes? If so, how do you lessen their fear?

_____
_____
_____

9. Is there anything else you would like to add to help me understand tornado safety education in your school?

_____
_____
_____

Appendix C

INFORMED CONSENT FORM

University of Delaware
Informed Consent Form

Title of Project: Children's Tornado Safety Education Acquisition: A Case Study of an Oklahoma School District.

Principal Investigator: Zephi Francis

Research Advisor: Dr. Joanne Nigg

You are being asked to participate in a research study. This document contains information about the project in regard to its purpose, your duties as a participant (if you agree to participate), and any risks and benefits associated with the study. Carefully read all the information provided in this document. If there are any parts of the document that are unclear, please ask the principal investigator to clarify. Your participation in this research project is entirely voluntary, and you can refuse to withdraw from the project at any time without any penalties. If you decide to participate in the study, you will be asked to complete an online survey.

WHAT IS THE PURPOSE OF THE STUDY?
The Disaster Research Center at the University of Delaware is conducting a project on tornado education in public schools. Tornado education is defined as any training, activity or instruction about tornado protective actions that take place during schools' hours of operation. We are interested in finding out about the tornado safety education programs that are utilized in schools. This study is also part of the principal investigator's master's thesis.
You are being asked to be a participant due to the fact that you are an employee of the (name of school district) and your area recently experienced a tornado during schools' hours of operation. We plan to conduct online surveys with all of the principals in the (name of school district) and kindergarten teachers in the same district.

WHAT WILL YOU HAVE TO DO?
The (name of school district) has disseminated an informed consent form (the document that you are currently reading) and a link to an online survey via an e-mail LISTSERV. If you decide to participate after reading this informed consent form, please answer the questions and electronically submit the survey. The survey created for principals should take no longer than 20 minutes. The survey for teachers should take no more than 10 minutes. In addition, there are no right or wrong answers. Just answer the survey questions to the best of your ability.

WHAT ARE THE POSSIBLE RISKS?
There are no legal, economic or financial risks associated with taking part in this study.

WHAT ARE THE POSSIBLE BENEFITS?
The data we collect will enable us to evaluate your school's tornado education programming. Our overall goal is to identify strengths of tornado programming in schools, and to offer suggestions worth adding to the tornado safety curriculum.

HOW WILL CONFIDENTIALITY BE MAINTAINED?
Most importantly, none of the answers you provide will be connected to your name, so confidentially will be maintained. In addition, all responses will be coded and analyzed by a computer, so it will be impossible to identify you. All responses will be reported in aggregate form. All of our findings will be given to each school. The research collected in this study will be held indefinitely in the Disaster Research Center's research archive. Lastly, in any future publications using this data, the name of the school district will never be mentioned.

WHO SHOULD YOU CALL IF YOU HAVE ANY QUESTIONS OR CONCERNS?
If you have any questions, please feel free to contact the principal investigator (Zephi Francis) at (302) 565-8992 or by email at zfrancis@udel.edu, or the research advisor (Dr. Joanne Nigg) at (302) 831-1984 or by email at nigg@udel.edu.
If you have any concerns about the rights of research participants, contact the University of Delaware's Institutional Review Board at (302) 821-2137.
If you complete the online survey, that is our acknowledgement that you have read and understood the informed consent form and have voluntarily agreed to participate.

Appendix D

IRB APPROVAL FORM

RESEARCH OFFICE 210 Hullihen Hall
University of Delaware
Newark, Delaware 19716-1551
Ph: 302/831-2136
Fax: 302/831-2828

DATE: September 15, 2014

TO: Zephi Francis
FROM: University of Delaware IRB

STUDY TITLE: [570888-2] Children's Tornado Safety Education Acquisition: A Case Study of Moore, Oklahoma

SUBMISSION TYPE:

Amendment/Modifi

cation

ACTION: APPROVED

APPROVAL DATE: September 15, 2014
EXPIRATION DATE: July 10, 2015
REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # *(7)*

Thank you for your submission of Amendment/Modification materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation. Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a

dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office. Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact Nicole Farnese-McFarlane at (302) 831-1119 or nicolefm@udel.edu. Please include your study title and reference number in all correspondence with this office.