

## Schools at Risk: Technology Applications to Assist in School's Emergency Management Initiatives

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**Abstract:** As threats of disasters continue to escalate, schools grow in their risk of natural or man-made incidents. According to the National Center for Education Statistics (2012), there were 33 school-associated violent deaths in primary and secondary schools in the United States from July 1, 2009 through June 30, 2010. Of the 33 students, staff, and nonstudent school-associated violent deaths, 25 were homicides; 5 were suicides; and 3 were legal interventions. The Center provided a report from U. S. principals indicating that 85% of public schools recorded one or more of these incidents of violence, theft, or other crimes taken place amounted to an estimated 1.9 million crimes. During 2009–2010, 60% of schools reported one of the specified crimes to the police, amounting to about 689,000 crimes — or 15 crimes per 1,000 students enrolled. In 2012, U. S. A. Today reported the Oikos University shooting where one student shot 10 people at the university; 7 of which died and another 3 were injured. Natural disasters, such as Hurricanes Katrina and Rita, caused devastation for schools in Mississippi and Louisiana leading thousands to be displaced. These were horrendous incidents jeopardized schools safety, and technology could have assisted in emergency management planning and early notification. In regards to these incidents, technology may not have prevented the incidents; but it may have helped mitigate, prepare, respond, and recover.

This paper will review emergency incidents that have impacted primary, secondary, and post-secondary schools, and emphasize the need for safety improvements. In addition, this paper identifies technologies new technologies and how such technologies enhance mitigation, preparedness, response, and recovery for man-made or natural incidents. Furthermore, it asserts that such technologies will improve emergency management planning, and strengthen the overall safety of schools.

**Key words:** incidents, mitigation, preparedness, responds, recovery

### 1. Introduction

Natural and man-made disasters escalate in today's society. From hazardous weather events to acts of violence, it is essential to have plans in place that effectively and efficiently manage emergency situations. Emergency Management is the paramount concern for both the general public and the academic community. The concern is due to potential loss of life, property, and a disruption of normal daily routines. These plans require continuous improvements of technology that will aid in proper planning, forecasting, detecting/securing, and information sharing. Since emergency incidents continue to increase, strategic plans and access to current

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technologies must be in place to provide immediate assistance, especially for vulnerable areas of the community (Buck, 2011). In many instances, schools are deemed as vulnerable communities.

Schools are a key component of our communities, and have the fundamental goal of providing an education in a safe environment. Primary, secondary, and post-secondary schools hold valuable assets — the students. There are also the administrators, faculty, staff, and other essential stake-holders who assist in developing and implementing educational programs to help students progress. Schools must have safety at the vanguard to promote a productive environment for the students and those who serve them. In addition, school officials should have functional emergency plans to manage incidents.

The U. S. Department of Defense (2010) defined “incident” as an episode caused by either human action or natural phenomena that requires action to prevent or minimize loss of life or property. Typically, those episodes are devised with the intent to pose harm to people, property, and the overall environment. Bennett (2011) contended that some incidents can expand geographic areas and impact people throughout the duration of the incident. These impacts can be severe, pose immediate or delayed health hazards, and possibly spread harmful contaminants throughout land and water. Incidents may create unreasonable risks. Although some incidents may not be avoided, there is a mechanism that aid in forecasting and handling disasters when they occur — Emergency Management.

## 2. Emergency Management

According to the Federal Emergency Management Agency (FEMA, 2007), Emergency Management is “the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters”. FEMA also contended that Emergency Management intends to endorse safer and less vulnerable communities with the ability to manage hazards and disasters. The mission of Emergency Management is to protect communities by coordinating all activities necessary to build, sustain, and improve the capability to mitigate against, prepare for, respond to, and recover from threatened or actual natural disasters, acts of terrorism, or other man-made disasters. Such disasters may include natural (e.g., hurricanes, tornadoes, typhoons, tsunamis, earthquakes, and etc.), and man-made (e.g., terrorism, bio-terrorism, pandemics, school violence, and etc.). Regardless of natural or man-made emergency incidents, there is an urgent need for earlier detection to minimize or prohibit the affects of disasters. Reddick (2010) indicated that the National Association Governors (NAG) established the first broad framework for Emergency Management in 1979 which serves as the foundation of the contemporary definition. This framework is the foundation of the functions of Emergency Management.

There are four functions in Emergency Management: mitigation, preparedness, response, and recovery. FEMA (2007) and Reddick (2010) explained each function as the following:

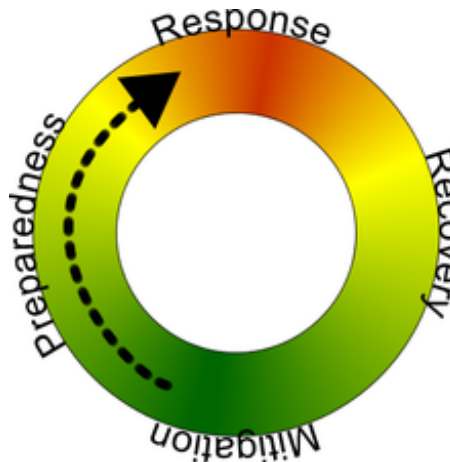
**Mitigation:** This attempts to prevent hazards from developing into disasters altogether or to reduce the effects of disasters. Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. This is achieved through risk analysis, which results in information that provides a foundation for mitigation activities that reduce risk.

**Preparedness:** Preparedness is a continuous cycle of planning, managing, organizing, training, equipping, exercising, creating, evaluating, monitoring and improving activities to ensure effective coordination. It is enhanced capabilities of concerned organizations to prevent, protect, respond, recover, create resources, and

minimize the effects of natural disasters, acts of terrorism, and other man-made disasters.

**Response:** The response phase includes the mobilization of the necessary emergency services and first responders in the disaster area. This is likely to include a first wave of core emergency services, such as firefighters, police, and ambulance crews.

**Recovery:** Recovery aims to restore the affected area to its previous state. It differs from the response phase in its focus; recovery efforts are concerned with issues and decisions that must be made after immediate needs are addressed. Recovery efforts are primarily concerned with actions that involve rebuilding destroyed property, re-employment, and the repair of other essential infrastructure.



**Figure 1: Four Phases of Emergency Management**

(Source: “Emergency Management” adapted from U.S. Department of Homeland Security and FEMA, 2007)

The U. S. Department of Homeland Security and FEMA recently decided to incorporate two additional terms “resilience” and “prevention” as part of the Emergency Management cycle. Resilience generally explains the four phases: an ability to recover from or straightforwardly adjust to misfortune or change. Prevention is 100% mitigation, by definition — alleviating the risk of threat (U.S. Department of Homeland Security, 2011). In implementing the four phases, technology incorporates systematic procedures to solve problems, and should be used to improve the effectiveness and efficiency in which potential emergency events can be lessened or prevented.

### 3. Use of Technology in Emergency Management

Information Technology (IT) is an integral tool in Emergency Management, and it assists in planning and time reduction. The internet is an example of IT that performs numerous capabilities that are vital in Emergency Management. The internet heightens awareness through web pages that inform citizens. The internet allows opportunity for community discussion groups, making disaster plans available online, providing educational disaster management material to schools, libraries, other community related places, and providing support for training or practice can be used to support cultural factors (Ozceylan & Coskun, 2008). Reddick (2010) stated that the internet can provide valuable information regarding emergency incidents. To those responding to an emergency incident, the internet allows responders to work with each other and across jurisdictions with the ability to hastily communicate and share resources. This is an inexpensive means to exchange information on

particular topics, which reaches across communities and national and international boundaries.

Reddick (2010) expounded on the use of wireless technology, geographic information systems (GIS), and remote sensing utilization in emergency management. He contended that wireless technology had aid in responding to an incident quickly and updating information. Troy (as cited in Reddick, 2010) indicated that wireless technology may include remote communication to responders and collection of digital data. Geographic Information Systems (GIS) is a system that captures, stores, manipulates, analyzes, manages, and presents all types of geographical data. Senior and Copley (as cited in Reddick, 2010) asserted that GIS technology enhances emergency management information systems by digitally capturing, storing, analyzing, and manipulating data. It queries and displays geographic information quickly and presents it in an understandable format.

Reddick further discussed that warning systems forecasts and gathers information on an approaching emergency and communicate that information the vulnerable parties. The author asserted that the National Weather Service has detection and warning systems, and Emergency Managers receive information to broadcast and caution those under potential threat. This is vital to schools, and it is important that schools have appropriate technologies to reduce or alleviate unwanted incidents.

#### **4. The School Incidents**

New technology is a pertinent for effective security on school campus. Schneider (2010) contended that technological advances continue to modify, and it is imperative to stay abreast of the changes. Basic understanding of technological advances and devices has become a requirement for well-informed school emergency planning. It is vital that technology be designated to the specific problem or incident for efficient planning and utilization. Schneider further contended that technology should be selected after the problems have been identified. After identified problems are prioritized, feasible solutions can be determined. Nevertheless, secondary and post secondary schools have their own unique problems and vulnerabilities that may render an emergency response.

On the secondary level, there may be bullying, cyber bullying, suicide, bombings, shootings, or other acts of violence. As time progress, such violent acts continue to rapidly escalate. Schuster (2009) reported that from 1999 to 2006, 116 students were killed in 109 school-associated incidents. As of 2012, this number still grows. On February 27, 2012, in Chardon, OH, 6 students were shot at Chardon High School. One student died at the scene, and 2 others died the following day. In addition, 1 of the 3 others wounded was reported to be in critical condition (NG & Lowe, 2012). In Brindisi, Italy, a three gas cylinder bomb hidden in a large trash bin exploded in front of the Morvillo Falcone High School. This resulted in killing one 16-year old female student being killed and 5 other students being injured (BBC News, 2012). Such catastrophes may have resulted from bullying or terrorist acts; however, similar incidents may occur in post-secondary environments (i.e., college and university campuses).

Colleges and universities do encounter these same incidents; however, there additional factors that result in violence or pose hazard on campuses. Known as one of the deadliest college campus massacres, 32 people (27 students and five faculty members) were killed by a 23-year-old senior English major, on the campus of Virginia Polytechnic Institute and State University (Virginia Tech) in two separate locations, about two hours apart: West Ambler Johnston Hall dormitory, where two were shot dead, and Norris Hall, where the remaining 30 were shot in an attack lasting nine minutes. The student committed suicide (CBS News, 2009). USA Today (2010) reported that a biology professor, denied tenure at the University of Alabama in Huntsville, shot 6 faculty members at a

faculty meeting. Three faculty members died in the shooting, and the biology professor was arrested after the shooting — charged with capital murder. These man-made incidents exist at schools in various forms; nevertheless, natural incidents (i.e., inclement weather) leads to possible closure, sudden evacuation, and destruction of facilities.

Since school administrators have safety as the utmost concern for students and staff, each school on all levels have plans that provide specific instructions in case on inclement weather. Inclement weather includes floods, excessive snow and ice, or other severe weather conditions. To better prepare schools for such, Barbara McNaught Wright, National Weather Service Meteorologist, developed a severe weather emergency plan that was adopted by schools on all levels around the country. The guide provides assistance to school administrators and teachers in developing a severe weather emergency plan for their school. Although the guide does not cover all situations, provides adequate information to serve as foundation (NWS, 2002). Today, school campuses have active plans where they clarify potential weather hazards for their specific area; engage in disaster drills; and test emergency warning devices. In Henryville, ID, Henryville Elementary School and Henryville High School sustained a direct hit of EF4 tornado. Satterly (2012) reported that administrators were forewarned of the severity of the storm and dismissed schools early. There were no fatalities or injuries due to tornado, however; several bus drivers taking children home were forced to stop and seek shelter. Although this was commendable, earlier notification and assistance were possible through technology. New technologies, such as mobile phones, social media, and modern security and detection devices greatly impact emergency management and its functions for schools.

#### **4.1 Mobile Phones**

Mobile phone technology is becoming a major tool in Emergency Management. Mobile phones serve as a major medium of communications, and students and school staff rely on this resource. With this in mind, Emergency Management (2011) stated that Personal Localized Alerting Network (PLAN) (formerly the Commercial Mobile Alert System — CMAS) was implemented by the federal government to make emergency alerts geographically targeted and available on mobile phones. The Emergency Management Magazine further explained that the free service send text-like messages to enabled devices based on the user's location. The emergency alerts are not stalled by user location congestion, and using cell towers, wireless providers will push the emergency alerts provided by government officials. Schools have incorporated similar alert systems, especially on secondary and post campuses, which send students warning of any incident or potential danger. Students can then notify others and immediately seek safety or evacuate if possible. Nevertheless, phone apps can greatly assist as well.

A vast majority of students own smartphones and consistently download phone apps. Most apps are for entertainment, communication, and information purposes. However, students, school staff, and administrators can download phone apps that forecast and give warning of those approaching hazards and incidents. In 2011, FEMA implemented a text messaging alerts and smartphone app to aid the general public, including the academic community, on preparation and disaster recovery. The public and the academic community may sign-up for to receive alerts by texting "PREPARE" to **43362** (4FEMA) for monthly preparedness tips. Those using the alerts may text also "INFO", "SHELTER", and "DRC" for general information, local shelter information, and local disaster recovery centers, respectively (FEMA, 2012).

According to Ellmers (2011), the new FEMA smartphone app will help make disaster preparedness and recovery information available for growing mobile society. To users, there is access safety tips for various disasters,

an interactive checklist for their emergency kits, emergency meeting locations and plans, and maps to help locate nearby shelters or FEMA Disaster Recovery Centers. Additional smartphone apps include smart-ICE storing current medical problems, medications, allergies, any need medical devices (i.e., defibrillators or pacemakers) medical history, past medical problems, surgeries, hospitalizations, immunizations; Droid 911 that locates you via GPS and finds the nearest hospital, police station, tow truck, ATM or bank, and etc; Peace of Mind (POM) takes your geographic location and when things happen that are in your area, whether it be a weather alert, whether it be an earthquake, tornado etc. and others (Romero, 2010). Schools on all levels will benefit by ensuring the all essential staff are knowledge able of such applications to ensure that they are equipment for all types of incidents. However, social media expanding and society relies greatly in it as a means of communication.

#### **4.2 Social Media**

As social media flourishes as a web-based and mobile based technology that establishes dialogue among individuals, organizations, and society at large, its presence in Emergency Management also enhances. Premiere emergency agencies, such as Red Cross and FEMA utilizing this method to ensure that the public had needed information. According to Yasin (2010), Federal Emergency Management Agency, state and local entities, and emergency operators are using social media and Web 2.0 technology to reach out and interact with the public and enhance communications among collaborators.

Yasin further stated that Social media, Web 2.0 (e.g., blogs, wikis, video sharing, and etc.) provide a way for emergency management personnel to resolve data and other types of interoperability and communications concerns. Social media allow emergency managers to distribute information to wider audiences, interact with the public, monitor social media networks current during a crisis, enhance situational awareness, improve information sharing and collaboration during an emergency, and share best practices and lessons learned. Some featured social media sites that premiere emergency agency, as well as state and local entities, are Facebook, Twitter, LinkedIn, YouTube, and others. Lopez (2011) asserted that numerous colleges and universities are promoting the use of social media among students to communicate during emergencies as lifesaving tools. Lopez provided examples where the University of Oregon's security staff uses social media to football games, and the UCLA's report of a person near campus with a crossbow in 2007. With social media reporting, it is imperative to ensure the information is not misleading, exaggerated, or presents excessive commenting. The web manager at University of Texas-Austin indicated that there should have been a Facebook alert about their campus shooting, and the comment section should have been disabled to reduce high volumes of response. With Facebook's popularity, the addition of an emergency application is instrumental.

The feature, b-Reddi, is an addition to Facebook where the user connects to three friends who serve as lifelines during an emergency incident. The sophisticated feature evaluates threat levels and specifies disaster categories, and it provides survival resource information in lieu of major disasters (Ellmers, 2011; FEMA, 2012). As social media use continue to aid schools in emergency preparedness, security and detection device leads in mitigating incidents.

#### **4.3 Security and Detection Devices**

Security and detection devices are critical in preventing an incident or reducing its affects. Such devices monitor designated areas, send alerts to emergency personnel of alarming events, restrict access, detect hazardous chemicals and weapons, and more. Schools greatly benefit from sufficient and useful security and detection devices. Schneider (2010) described the Emergency Notifications Systems for primary and secondary, and

challenged that these schools districts to enhance their systems. The author contended that contemporary notification systems would go beyond the standard warning bells and alerts, but they have the capacity to send such notifications as conducting surveys, advising of student absences or school closures or to recruiting volunteers on short notice to various types of devices.

Regarding detections, the traditional metal detectors are still in place on some school campuses. However, metal detectors are may be expensive, and a perpetrator may find alternative entrances to avoid the stationary detectors. Schneider indicated that hand wands may be are more affordable and portable. This will work when randomly chosen classroom for security scanning. In 2012, the New York Police Department is evaluating the Terahertz Imaging Detection, which measures the energy radiating from a body up to 16 feet away, and can detect anything blocking it, such as a gun (CBS New York, 2012). Once Terahertz Imaging Detection has been tested and adopted, this technology may help schools officials in detecting weapons before perpetrators enter on campuses.

## 5. Conclusion

The provided evidence explains how incidents affect society-at-large, and constant efforts must be made to improve preparedness. Since schools are one of the center-points of communities, effective and efficient mitigation, preparation, response, and recovery is vital. With increasing natural or man-made incidents, schools are becoming more vulnerable and approaches must be enforced to reflect the current age of technology. Such contemporary technologies will greatly assist in strengthening efforts that will minimize or alleviate potential harm to students, faculty, and the campus community at large. With safety being at the vanguard of societal concern, technological innovations must be developed and utilized in a manner that will strongly facilitate goals for a safer society, especially on school campuses.

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