Evaluating Disaster Education

Programs for Children

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Abstract

This research aimed to generate new theories on how to evaluate the outcomes and societal impacts of disaster education programs for children. In the last decade, disaster education programs for children have been promoted as an innovative approach to disaster risk reduction, based on several theories about the benefits of these programs. Due to limited research on these programs, widely held assumptions about the relationships between program outcomes and societal improvements in disaster risk reduction remain unchallenged.

The thesis uses case studies of evaluations to explore ways to improve the evaluation of disaster education programs for children. To build on previous research, this study began with a methodological review of program evaluations in order to characterize the tradition of evaluation methods. Based on the finding that few evaluations examined program theories, program theory models were developed for two case study evaluations of disaster education programs for children.

The first case used quasi-experimental methodology to underpin an impact evaluation of ShakeOut, an earthquake and tsunami drill in two Washington State school districts. The program logic suggested that drills provided children with adequate understanding of protective actions to prevent injuries and deaths during a disaster. The second case used process evaluation to explore the implementation of *What's the Plan, Stan?*, a free, voluntary disaster teaching resource distributed to New Zealand primary

schools. The process logic suggested that increased promotion of the resource would increase its uptake and use.

The case studies revealed that some program theories common to many disaster education programs for children are faulty. The findings of the ShakeOut evaluation suggest school drills, as they are currently practiced, do not teach all children adaptive response skills. The *What's the Plan, Stan?* evaluation identified several intervening and deterrent factors influencing the resource's uptake and use, suggesting increased national promotion of the resource is unlikely to increase its use. In both case studies, the application of theory-based evaluation methods helped to articulate unknown influencing factors and develop meaningful and feasible outcome indicators for both quantitative and qualitative research methods. Ongoing research is needed to refine outcome indicators of programs' societal impacts.

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Operational definitions

The definitions below describe the key concepts underpinning this research.

Disaster

Disaster is a natural or human-caused hazard that is "a serious disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources" (United Nations International Strategy for Disaster Reduction Terminology, 2007a). Disasters include destructive hazards such as earthquakes, tsunamis, storms, blizzards, tornados, wildfires, floods, pandemics, nuclear emergencies, chemical spills, and terrorism, among others.

Disaster risk

Disaster risk is the potential for negative impacts from disasters including loss of life, injuries and damage to assets, functions, and services (UNISDR Terminology, 2009).

Disaster risk reduction

Disaster risk reduction is instrumental action "to minimize vulnerabilities and disaster risks throughout a society in order to avoid (prevent) or to limit (mitigate and prepare for) the adverse impacts of natural hazards, and facilitate sustainable development" (United Nations Children's Fund, 2012, p. 3).

Disaster preparedness

A definition of disaster preparedness is adapted from the UNISDR's definition of preparedness, namely "the knowledge and capacities developed by governments, professional response and recovery organisations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions" (UNISDR Terminology, 2007b). In the field of emergency management, preparedness is one of four functional phases of the conceptual disaster management cycle that includes preparedness, response, recovery, and mitigation (Mushkatel & Weschler, 1985).

Public education

Public education is the emergency management practice of training and educating members of the public (Peek & Mileti, 2002). The New Zealand Ministry of Civil Defence & Emergency Management (2007, p. 7) describes public education as actions that "build public awareness and understanding by individuals and communities of hazards….that ultimately will lead to action towards preparedness." Public education is distinct from the emergency management concept of *public information,* which is defined by the U.S. Federal Emergency Management Agency (2013c, para. 1) as the "processes, procedures and systems to communicate timely, accurate and accessible information on the incident's cause, size and current situation to the public, responders and additional stakeholders (both directly affected and indirectly affected)."

Disaster education

For the purpose of this research, "disaster education," also referred to by some scholars as "hazards education," is used as short hand for a public or curricular education initiative that includes the theory and practice of teaching two incorporated subjects: 1) disaster and hazard risks and 2) disaster risk reduction, preparedness, and/or protective actions. In practice, it is common for programs described as disaster or hazards education to teach only the causes of disasters; however, these programs do not meet the definition of disaster education for the purpose of this research.

Evaluation

Evaluation is "an applied inquiry process for collecting and synthesizing evidence that culminates in conclusions about the state of affairs, value, merit, worth, significance, or quality of a program, product, person, policy or plan" (Fournier, 2005, p. 139). In *program evaluation*, the object of evaluation is a program, described as an arrangement for providing a service or conducting professional action (Kushner, 2005, p. 334). Program evaluation has two purposes: 1) assessing the outcomes and impacts of a program and 2) examining the process of the program and its implementation.

Outcome indicators

In the practice of evaluation, outcomes are benefits or changes among individuals or populations during or after participating in program activities and outcome indicators are defined as "specific, observable and measurable characteristics or change that will represent achievement of the outcome" (United Way of America, 1996, p. xv).

Effectiveness

Effectiveness is "the degree to which something is successful in producing a desired result" ("Effectiveness," 2014). Measurement of the outcomes and impacts of a program can contribute to the understanding of the program's worth or success. However, the indicators and concepts used to evaluate the effectiveness of any one program can vary widely depending on the evaluation design and the intended audience. Also, in practice, evaluations of program effectiveness do not always capture the detrimental outcomes of programs; therefore, a measurement of positive outcomes alone may not be an adequate measure of the overall merit or worth of a program (Davidson, 2005, p. 122).

Program implementation

Program implementation is defined as "a specified set of activities designed to put into practice an activity or program of known dimensions" (National Implementation Research Network, n.d.). Program implementation deals with *program integrity*, which incudes five main dimensions: adherence, dosage, quality of delivery, participant responsiveness, and program differentiation (Dane & Schneider, 1998). The evaluation of program implementation provides insights into how the program is being conducted and how it can be improved (Rossi, Lipsey, & Freeman, 2004).

Chapter 1: Introduction

1.1   Overview

The following chapter provides an overview of the background and context of the research subject, including disaster impacts on societies and children, the history of public disaster education, the rise of disaster education programs for children, models of children's educational programs, and international policy goals and current progress. The chapter ends with the rationale for the research and a description of the thesis structure.

1.2   Disaster impacts

Despite advances in infrastructure and technology, disasters continue to cause casualties and destruction requiring years, if not decades, of physical, economic, and emotional recovery of communities and individuals. In 2013, the United Nations Global Assessment Report on Disaster Risk Reduction somberly stated that in the past three consecutive years, direct economic losses from disasters totaled more than $100 billion, not including uninsured losses (UNISDR, 2013). Worse, recent natural disasters have caused some of the largest human death tolls in history: the 2011 Tohoku earthquake and tsunamis in Japan resulted in nearly 20,000 deaths (Nakahara & Ichikawa, 2013), the 2004 Indian Ocean tsunami resulted in more than 130,000 deaths (Frankenberg, Gillespie, Preston, Sikoki, & Thomas, 2011) and the 2010 Haiti earthquake caused more than 222,000 deaths and 300,000 injuries (Guha-Saphir, Vos, Below, & Ponserre, 2011). New Zealand and the United States, the locations of the case studies in this body of

research, have also been impacted by significant disasters in recent years. New Zealand is still recovering from the impacts of 2011 Christchurch earthquake, which resulted in 185 deaths and catastrophic damage to the city's central business district, much of which has now been leveled for rebuilding (GNS Science, 2011). Meanwhile, in addition to major droughts, floods, tornados, and wildfires, the United States has been affected by several devastating hurricanes, including Hurricanes Katrina in 2005 and Sandy in 2012, both of which affected multiple U.S. states and resulted in large-scale relocations of children and families (Rappaport, 2013).

Although scientific evidence used to predict trends in natural hazards and their impacts is not conclusive, the Intergovernmental Panel on Climate Change (2013a) has assembled substantial evidence that climate change is causing a global increase in the types, frequency, and severity of climatic hazards and weather events such as droughts, floods, hurricanes, cyclones, and wildfires. The organization's risk assessments indicate that over the next two decades, there is a high probability of increased average temperatures, ocean warming and sea level rising, and reduced air quality. A recent IPCC assessment report for policymakers states, "It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century" (IPCC, 2013b, p. 17). Although scientists suggest that some of the negative impacts of climate change could be mitigated through environmental conservation and pollution regulation measures, such as substantial and sustained reductions of greenhouse gas emissions, some environmental impacts are already irreversible (IPCC, 2013b, p. 19).

Several other human factors are increasing communities' vulnerability to all types of weather-related, geological, and manmade hazards. Donner and Rodriguez (2008)

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argue that changes in population growth, density, and distribution have intensified

people's disaster vulnerability as populations are increasingly inhabiting areas more

prone to natural hazards, such as coasts and urban areas. Urbanization is also creating

stress on local water resources and supplies, and increasing erosion, sedimentation, air

pollution, urban runoff, sewage overflows, and the spread of infectious disease (United

States Geological Survey, 2013). The impacts of increased urbanization are particularly

extreme in low-income countries that lack affordable housing, basic infrastructure, public

health services, and access to education (Patel & Burke, 2009). From a disaster response

perspective, increased urbanization also poses a number of emergency management

challenges such as the need to facilitate large-scale evacuations and temporary housing,

address damage to dense pockets of critical infrastructure, and obtain adequate insurance

for the high costs of demolition and rebuilding.

Increasing poverty and wealth inequality globally is also increasing regional

vulnerability to disasters. Fothergill and Peek (2004) provide a review of a wide range of

evidence of how poverty reduces capacities for all stages of the emergency management

cycle, from disaster education and preparedness, to disaster response and recovery.

Disaster prevention is also more challenging for low-income communities, particularly

when disaster-resistant housing and insurance are out of reach (Donner & Rodriguez,

2008; Masozera, Bailey, & Kerchner, 2007). In addition to the need for economic capital

to make hazard adjustments, communities require social capital to handle change and

uncertainty, and absorb disturbances like disasters. A jurisdiction that lacks the capacity

to develop partnerships, self-organize, and learn from previous events is less likely to

recover from system failures caused by disasters (Berkes, 2007). Children are particularly

endangered by these social disadvantages when they are unable to participate in community-level decisions, policy-making, and actions to address their own community's disaster risks.

This study begins in the context of disaster impacts on children. Although there are few statistics on the exact number of children affected by natural and human-caused hazards globally, the United Nations (Wisner, 2006, p. 33) estimated that roughly 1 billion children under the age of 15 live in countries with high seismic risk, and Save the Children UK (2007, pg. 2) estimated that more than 175 million children are affected by climate-related disasters each year. Many scholars and policy makers have argued that children are particularly vulnerable to disasters compared with adults because of their nascent physical, psychological, and cognitive abilities; their dependence on adults for protection and safety; and the negative impact disasters can have on children's development and academic performance (Bullock, Haddow, & Coppola, 2010; Kronenberg et al., 2010; Masten & Narayan, 2010; National Commission, 2010; Osofsky & Osofsky, 2013; Peek, 2008; Seballos, Tanner, Tarazona, & Gallegos, 2011; Snider, Hoffman, Littrell, Fry, & Thornburgh, 2010; Weiner, 2009; Zahran, Peek, & Brody, 2008;). Although most children have the propensity towards being resilient to the impacts of disasters, in the immediate aftermath of an event, children may face a higher risk of death and debilitating injuries, displacement from their home and school, separation from family, economic hardship, grief and anxiety, all of which can negatively impact their behaviors, educational progress, and overall wellbeing (Masten & Narayan, 2012; Peek, 2008). For a small portion of children, these impacts will affect them long-term (Osofsky, 2004).

The protection of children during disasters is critical because children have unique physical and psychological attributes that make them especially susceptible to injury and death during disasters. Due to differences in breathing rate, skin permeability, innate immunity, and fluid reserve, children are vulnerable to extreme heat and cold, exposure to the elements, and food, water, and vector-borne illnesses (Balbus & Malina, 2009; Chung, Danielson, & Shannon, 2008). Also, reports on youth injury and mortality during earthquakes and tsunamis, including the 1999 Kocaeli earthquake in Turkey, the 2010 Haiti earthquake, and the 2011 earthquake and tsunami in Japan, indicate that children are more likely than adults to sustain physical traumas such as serious head and multisystem organ injury, falls, dehydration, hypothermia, and drowning (Kolbe et al., 2010; Nakahara & Ichikawa, 2013; Ramirez, Kano, Bourque, & Shoaf, 2005; Weiner, 2009). A local shortage or lack of physicians skilled in pediatrics, common in both developed and developing countries, also increases risks to children's survival and recovery from injuries (Burke, Iverson, Goodhue, Neches, & Upperman, 2010; Burnweit & Stylianos, 2011).

Children also face psychological impacts from disasters and are challenged by the fact that they often cannot seek their own counseling or coping resources (Prinstein, La Greca, Vernberg, & Silverman, 1996). Children affected by disasters have been found to be at higher risk for mental health issues such as post-traumatic stress disorder and childhood traumatic grief, increased aggression, delinquency or withdrawal, comorbid conditions, and declining academic performance (Aptekar & Boore, 1990; Jaycox et al., 2007; Pane, McCaffrey, Kalra, & Zhou, 2008; Peek, 2008; Peek & Richardson 2010; Pfefferbaum, Houston, North, & Regens, 2008). Further, separation from family and

displacement from home and school after disasters can exacerbate the social, environmental, and psychological stress experienced by children and their families (Pane, 2006; Picou & Marshall, 2007).

Research has found that children's class and race may also determine some of the risks children face during disasters. Fothergill, Maestas, and Darlington (1999) reviewed studies that found non-white communities in the United States are more vulnerable to natural hazards due to economic inequalities, language barriers, housing density, poor building construction, community isolation, and cultural insensitivities. Research with children and families after Hurricane Katrina indicated that poor families had fewer options for evacuation and temporary housing (Masozero et al., 2007). Some faced new threats to children's safety, such as sheltering with strangers and lack of safe play spaces (Weems et al., 2007). Also, in a study of New Orleans youth following Hurricane Katrina, Fothergill and Peek (2008) found that African Americans, including children and teenagers, experienced physical assaults and lack of police protection in emergency shelters, and were grossly stereotyped in the media. Similar social and racial inequalities during disasters are present in many other countries (Donner & Rodriguez, 2008; Oliver-Smith, 1996). For example, a focus group study in New Zealand revealed that Ethiopian, Afghan, and Bhutanese families in Canterbury lacked access to resources during response and recovery from the 2011 Christchurch earthquake due to their limited English skills and the lack of employment and community involvement opportunities (Marlowe & Lou, 2013).

Some scholars argue that children's dependence on adults also increases their susceptibility to disaster trauma since children may not yet have effective communication

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and self-preservation skills (Boon et al., 2011; Fothergill & Peek, 2006). Because children are physically and developmentally vulnerable, parents and caregivers must be prepared to protect children during emergencies and cope with their own recovery. Research has found that teachers and parents often underestimate the extent of children's distress after a traumatic event and have difficulty discerning emotional problems in children (Reich & Wadsworth, 2008; Ronan, 1996). Further, children's coping and recovery often reflect that of their parents and other caregivers. Some studies have found children's displays of anxiety, depression, substance abuse, and other harmful behaviors were associated with parents who were not coping with their own trauma (Norris et al., 2002; Osofsky & Osofsky, 2013).

Responsibility for children's protection in disasters extends beyond children's households. Even if children's parents are prepared for disasters at home, many children are in the care of schools and childcare providers during the day and must rely on the leadership and coordination of other adult guardians during and after an emergency (Kubicek, Ramirez, Limbos, & Iverson, 2008). Several studies and government reports have indicated that many schools and childcare providers have inadequate emergency plans and often do not plan or practice for the full range of possible emergency scenarios (GAO, 2007; Hull, 2011; Öcal & Topkaya, 2011; Ramirez, Kubicek, Peek-Asa, & Wong, 2009; Shores et al., 2009; Stuart, Patterson, Johnston, & Peace, 2013). Also, following disasters, schools are often unprepared to identify and address children's mental health needs, or handle an influx of displaced students that must be incorporated with the preexisting student population (Jaycox et al., 2007; Johnson & Ronan, 2014; Pane et al., 2008; Reich & Wadsworth, 2008; Rowley, 2007).

There are a number of ways that emergency management agencies and disaster response organizations work to address communities' vulnerability and increase disaster resilience. In addition to developing and maintaining hazard monitoring, warning, and response systems, emergency management also teaches residents about disaster risks and strategies to prepare for and respond to disasters. Education on self-protection is essential because, during an emergency, individuals and communities may not have immediate access to emergency service providers and may be isolated from support for long periods (King, 2000). However, there are a number of challenges to effectively educating a diverse population that has many different needs, priorities, and methods of access to information. The following section gives an overview of the rise of public disaster education over the last half-century and the more recent focus on disaster education programs for children.

1.3   History of disaster education

Although some community and individual vulnerability to the ecological forces of climate change and natural disasters is inevitable, vulnerability is moderated in many aspects by individual and system-level resilience and adaptive capacities for disasters. There is evidence that most fatalities, injuries, and damage caused by disasters are preventable and disaster preparedness measures such as home hazard adjustments can improve disaster outcomes and facilitate a more efficient recovery (Levac, Toal-Sullivan, & O'Sullivan, 2012). There is also evidence that communities can more effectively recover from disasters if individuals in the community collaborate and share resources, a process that requires leadership, flexibility, decision-making skills, and trusted sources of accurate information to help deal with uncertainties (Norris et al., 2008). Thus, disaster

education is intended to provide people the knowledge and tools for disaster risk reduction, a process broadly defined as "a combination of actions, processes, and attitudes necessary for minimizing underlying factors of vulnerability, improving preparedness, and building resilience" (Global Education Cluster, 2012, p. 2).

The objective of disaster education is to provide knowledge and skills, and motivate individuals and groups to take actions that reduce their own disaster vulnerability, even when faced with other personal and community priorities (Nielsen & Lidstone, 1998). For several decades, it has been widely assumed that an educated public is better able to prepare for and respond to disasters, and that disaster education is a practical and cost-effective tool for hazard management (Dunbar, 2007; Nielsen & Lidstone, 1998; Ronan & Johnston, 2005; Sorensen, 1983; Victoria, 2009). This theory extends from logic and empirical findings that low awareness and unrealistic risk perceptions negatively impact people's preparedness, responses to hazard warnings, self-protective actions, and recovery (Drabek, 1986; Lindell & Perry, 1992; Mileti & Sorensen 1990; Paton, Smith, & Johnston, 2005; Tierny, Lindell, & Perry, 2001).

Public disaster education is generally recognized as a population-based form of education provided by hazard management authorities in electronic and print media, mass mailings, commercials, campaigns, presentations, and safety courses provided by organizations like the Red Cross (Clover, 1996; Nielsen & Lidstone, 1998). Historically, these methods have primarily targeted adults with information on disaster risks and ways to prepare their households, such as creating family emergency plans, purchasing home and rental insurance, and stockpiling food, water, and supplies (Faupel, Kelley, & Petee, 1992; Mileti et al., 2004). In the last two decades, there has been an increased

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international policy focus on disaster education as a hazard management strategy. The United Nations designated the 1990s as the *International Decade for Natural Disaster Reduction*, which included a call for "measures, as appropriate, to increase public awareness of damage risk probabilities and of the significance of preparedness, prevention, relief and short-term recovery activities with respect to natural disasters and to enhance community preparedness through education, training and other means, taking into account the specific role of the news media" (United Nations, 1989, Section B, 3-e). As the discipline of emergency management has evolved, public education strategies have become a core component of most national and state emergency management frameworks. For example, the New Zealand Ministry of Civil Defence and Emergency Management (MCDEM) published *The Way Forward – Strategic Framework for the National CDEM Public Education Programme 2006 – 2015*, outlining the implementation of several public education approaches (MCDEM, 2007). These include targeted media campaigns, a central website entitled *Get Ready, Get Thru* (http://www.getthru.govt.nz/) that is translated in multiple languages, an annual Disaster Awareness Week promoted through news media, and the development of teaching resources for schools. The United States Federal Emergency Management Agency (FEMA) uses similar approaches to public education, including a central information website entitled *Ready.gov* (http://www.ready.gov/), the designation of September as National Preparedness Month, and distribution of cooperative agreement grants to U.S. states to fund public education campaigns at the state and local level (FEMA, n.d.).

Although disaster education is ubiquitous and championed by many scholars, emergency managers, and preparedness advocates, few people adequately prepare for

disasters and there is little evidence of substantial changes in behavior and social norms due to knowledge gained through public education (King, 2000; Lindell & Perry, 2000; Paton et al., 2005, 2010; Redlener & Berman, 2006; Ronan et al., 2008; Sorensen, 1983). For example, in a large telephone survey of Americans only months after Hurricanes Katrina and Rita in 2005, Redlener and Berman (2006) found that less than half of respondents had a family emergency preparedness plan that all members of the family knew about, and of those that did report having a plan, only 31% reported having all the main elements of preparedness, such as two days of food and water, a flashlight, a portable radio and spare batteries, emergency phone numbers, and a designated meeting place. The authors also found only a third of respondents were familiar with emergency or evacuation plans in their community. Similarly, research sponsored in 2013 by MCDEM found that their national public education campaign *Get Ready, Get Thru* prompted 82% of people who saw the ads to prepare or think about being prepared as a result of the campaign; nevertheless, only 17% of New Zealanders reported being fully prepared for disasters, a proportion that fell after an increase in preparedness levels following the 2011 Christchurch earthquake (MCDEM, 2013).

To address these poor responses to public education initiatives, a growing body of research has focused on identifying factors beyond knowledge that influence vulnerability, motivation to prepare, and resilience and adaptation, some of which relate specifically to the role of disaster education in motivating behavior change (Becker et al. 2012; Berkes 2007; Gallopin 2006; Manyena 2006; Norris et al. 2008; Paton 2006, 2013; Paton and Johnston 2001; Pennings and Grossman 2008). Although several empirical studies have concluded that exposure to disaster education can increase recipients'

knowledge and awareness of disaster risks and increase levels of household preparedness (e.g., Faupel et al. 1992; Levac 2012; McKay 1984; Mileti 1999; Rodriguez et al. 2007; Ronan and Johnston 2005; Sattler and Marshall 2002; Slovic et. al 1984), it appears that research findings on elements of effective education are not being widely applied to current public education initiatives. The United Nations' 2011 Global Assessment Report stated that only 20 out of 168 nations reported substantial progress in public awareness of disaster risks and risk reduction strategies since 2005 (UNISDR, 2011, Section: Global Efforts, para. 6).

In recent years, many preparedness educators have been testing new methods to motivate disaster risk reduction through public education. In an attempt to achieve more effective uptake in educational programming, a policy-changing theory has emerged: a culture of safety and preparedness can be cultivated through the education of children.

1.4 Rise of disaster education for children

Today, there is a strong international consensus that disaster education should be provided directly to children as a method of improving children's resilience and communicating disaster risk reduction information to children's households and the wider community (Lintner, 2006; Mitchell, Tanner, & Haynes, 2009; Selby & Kagawa, 2012; Sharpe & Kellman, 2011; Shiwaku & Fernandez, 2011; UNESCO, 2013; UNISDR, 2007b). There are now several international policy frameworks promoting and monitoring the execution of disaster and climate change education programs for children and national curriculum integration efforts. In 2005, 168 member states of the United Nations endorsed the *2005-2015 Hyogo Framework For Action* (HFA), agreeing to five

priority actions to reduce disaster risks globally, including Priority for Action #3: *Use knowledge, innovation and education to build a culture of safety and resilience at all levels* (UNISDR, 2005, p. 18). The HFA supports the theory that "disasters can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities" (UNISDR, 2005, p. 9). The integration of disaster risk reduction education in school curricula is one of four "Core Indicators" of progress towards the HFA Priority for Action #3 (UNISDR, 2007a, p. 24). Key education activities under the HFA include the incorporation of disaster preparedness and prevention activities in schools and universities, the introduction of disaster risk reduction learning in textbooks, teacher training and school safety plans, and the use of schools and school children in community emergency management planning (Cameron & Norrington-Davies, 2010). The United Nations also launched the 2006 World Disaster Reduction Campaign "Disaster Risk Reduction Begins at School," which encouraged schools worldwide to implement disaster education and improve the physical safety of school buildings (UNISDR, 2007b).

These campaigns and the *2005-2014 UN Decade for Education and Sustainable Development,* which advocates for the curricular incorporation of sustainable development issues like climate change and disaster risk reduction, have been the impetus for a sustained international policy focus on the introduction of school-based disaster education (Wisner, 2006). At the heart of these campaigns is the idea that children represent the future generation of adults who will embody the collective values and culture of disaster prevention (UNICEF et al., 2011). Children are viewed as vehicles

of disaster preparedness and prevention in the future as well as in the present. This optimism is reflected in many United Nations reports that discuss the active role of children in "child-centered" disaster preparedness activities and their role in influencing adults to take action (Plan International, 2010; Selby & Kagawa, 2012; UNICEF, 2012; Wisner, 2006).

Since the early 2000s, many countries have implemented disaster education policies at the national and local level; however, few of these policies have been established in law or regulation. In New Zealand, disaster preparedness is a significant policy focus that has intensified in response to the 2011 Christchurch earthquake, which resulted in 185 deaths and significant damage (GNS Science, 2011). Because hazard education is only a minor part of the New Zealand Curriculum and not widely taught in schools, New Zealand's *2006-2015 Strategic Framework* for public education included the incorporation of disaster education in school curricula as a major goal. To implement this, in 2006, the New Zealand Ministry of Civil Defence and Emergency Management developed and disseminated *What's the Plan, Stan?,* a free, voluntary resource for teaching disaster science and preparedness in New Zealand primary schools (MCDEM, 2006). Other policies for children's education on disaster response and protective actions include compulsory school fire drills, regulated by schools' boards of trustees, which have been in place for at least a century (Macaulay, 2004). Some schools also voluntarily conduct drills for earthquakes, tsunamis, and other sudden-onset emergencies (Johnston et al., 2011). More than 2,000 schools participated in the 2012 ShakeOut event, a nation-wide "drop, cover, and hold" earthquake drill (McBride, Becker, Coomer, Tipler, & Johnston, 2013).

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Similar to New Zealand, the United States also has a long history of mandatory fire drills in schools, but because of the devolved nature of public education, there are no requirements at the national or state level for disaster education to be included in school curricula (Schothorst, 2012). Thus, disaster education proponents in the United States have primarily focused on the development of teaching materials and instructional strategies (Mitchell, 2009). After Hurricane Katrina, which particularly affected low-income children and families, there has been a strong policy focus on the impacts of children in disasters. In 2009, the U.S. Congress established a two-year National Commission on Children and Disasters to review "disaster-related laws, regulations, programs, and policies to assess their responsiveness to the needs of children and make recommendations to close critical gaps" (National Commission, 2010, p. 7). Although disaster education for children was a focus of the Commission's work, no new policies, laws, or funding mechanisms were put in place at the Federal level to further school-based disaster education. However, FEMA established a renewed focus on the education and training of children and youth by establishing an interagency Children's Working Group and a child-led Youth Preparedness Council, and by streamlining several existing Federal educational websites for children into a single site entitled *FEMA For Kids* (http://www.ready.gov/kids). In 2010, FEMA and the Department of Education also held a National Summit on Youth Preparedness to discuss the future of disaster education programs for children, and compiled a *Catalogue of Youth Disaster Preparedness Education Res*ources, providing links to more than 75 programs and resources in use at the state and local level (FEMA, 2013a).

New Zealand and the United States are just two examples countries with national public education strategies focused on children. Internationally, a wide range of disaster education programs for children has been documented, including formal and informal school-based, community, and extracurricular programs (Selby & Kagawa, 2012; Wisner, 2006). In most countries, education on disaster risk reduction and preparedness is not yet formally integrated in school curricula; therefore, disaster education for children is often facilitated through children's programs and resources developed by emergency management agencies, child advocacy organizations, and universities (Selby & Kagawa, 2012). There are many methods of delivering disaster education to children ranging from basic school emergency drills to the dissemination of teaching materials for school teachers' voluntary use, extracurricular workshops and training programs for children and youth, and self-study websites. The next section provides a brief overview of these various methods of delivery.

1.5 Models of disaster education programs for children

Science and geography education worldwide embodied the earliest roots of disaster education by providing students an introduction to the science of geophysical and meteorological hazards such as earthquakes, volcanoes, floods, tornados, cyclones, and tsunamis. Two things have traditionally been missing from such curricular lessons: the social and economic impacts of these hazards and practical measures to prevent or protect against their consequences (Petal, 2008). During the twentieth century, many other forms of disaster education have emerged, beginning with the introduction of teaching children school safety procedures.

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1.5.1   School drills

Although there is very little literature about the history of school drills
internationally, it is known that school fire drills became a routine practice in both the
United States and New Zealand in the first quarter of the twentieth century (Heath, Ryan,
Dean, & Bingham, 2007; Macaulay, 2004). Today, most U.S. states and many countries
require schools to conduct fire drills during the school year (Krisberg, 2007), and some
schools voluntarily conduct drills for other local hazards. School drills are used to teach
students and staff basic safety and response procedures for emergencies that may happen
during the school day, such as building evacuation for fires, "drop, cover, and hold"
under a table for earthquakes, and "shelter-in-place" for tornados and school shootings.
Drills help school leadership test and validate emergency responses plans while, at the
individual level, they teach children self-protective behaviors (Heath et al., 2007). School
drills are perhaps one of the oldest and most common forms of disaster education for
children and are generally believed to be a good approach for preventing injuries and
deaths and improving children's resilience to disasters (Heath et al., 2007; Hull, 2011).
However, schools drills are generally not utilized as a method of teaching children
disaster preparedness and prevention strategies. For expediency, most schools emphasize
the memorization of basic response skills by conducting drills at regular intervals at
expected times and locations, typically during class when students are at their desks (e.g.,
Central U.S. Earthquake Consortium, 2011; Johnston et al., 2011; Lund, 2013; Petal,
2008; Ramirez et al., 2009). It is very uncommon for school drills to incorporate lessons
or discussions on disaster science, household disaster preparedness strategies, or disaster

prevention, although this is a frequent policy recommendation (Johnson, 2011; Lund, 2013; Ramirez et al., 2009).

1.5.2   Classroom curriculum infusion

While much less common than school-based emergency response drills, classroom teaching of disaster risk reduction topics is taking place in some schools through the voluntary efforts of schools and teachers who are motivated to teach on the subject (Selby & Kagawa, 2012). In a UNICEF-sponsored review of national experiences integrating disaster risk reduction in pre-university curriculums, Selby and Kagawa (2012) found that the most common approach to school-based disaster education is the infusion of disaster-related themes and topics in classroom subjects, particularly in Physical and Natural Science subjects. Many countries promote the use of specially developed units, modules, lesson plan templates, and readings that allow teachers to incorporate disaster topics and activities into the standard curriculum at specific grade levels. For example, in 2004, Cambodia developed new textbook chapters for Geography and Earth Studies, a separate student textbook, and a *Teacher's Manual* for grade 8 to support teaching on floods, a significant local hazard, as well as volcanic eruptions, earthquakes, hurricanes, drought, and deforestation (Selby & Kagawa, 2012, p. 88). In Japan, some schools include dedicated courses on disaster risk reduction, such as Maiko High School, which provides unique co-learning courses for students and teachers on disaster management, disaster prevention, and the relationship between disasters and human society (Shiwaku & Shaw, 2008). In the United States, some classrooms have used *Masters of Disasters*, a curriculum resource developed by the American Red Cross that includes prepared activities and videos featuring kids to teach disaster safety and

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preparedness lessons specifically tailored for kindergarten through grade 8 (Wachtendorf, Brown, & Nickle, 2008).

New Zealand also took this approach to classroom curriculum integration by distributing *What's the Plan, Stan?*, a free teaching resource that can be used to infuse topical disaster lessons into the primary school curriculum (MCDEM, 2006). The resource includes prepared lesson plans and classroom activities to teach on a wide range of New Zealand hazards, including earthquakes, tsunamis, volcanoes, and floods. The curriculum resource also provides resources on protective strategies, household preparedness, and discussing feelings and emotions. A closer examination of *What's the Plan, Stan?* is provided in Chapter 7, which discusses findings from an evaluation of the program's national implementation.

There is also a growing body of research on emergent curricula after disasters that include activities such as expressive writing and art activities, science lessons, disaster preparedness lessons, and practice of school emergency drills (e.g., Buchanan, Casbergue, & Baumgartner, 2010; Degnan et al., 2004; Johnson & Ronan, 2014; Shreve, Danbom, & Hanhan, 2002; Silverman, 1999; Smith & Williams-Boyd, 2007; Tucker, 2004; Zevenbergen, Sigler, Duerre, & Howse, 2000). After both the 2010 Darfield earthquake and the 2011 Christchurch earthquake in New Zealand, scholars documented examples of teachers executing emergent curriculums on earthquake science and disaster preparedness due to the events' significance to New Zealand and student interest (Johnson & Ronan, 2014; Taylor & Moeed, 2013). Johnson and Ronan (2014) argue that responsive curricular activities could be a feasible method of addressing the psychosocial

impacts of disasters on children in the classroom, particularly in schools enrolling children displaced by disasters.

1.5.3 National curriculum integration

A few nations have formally incorporated disaster risk reduction education into the standard or compulsory school curriculum. For example, in Iran, earthquake awareness and preparedness is taught in all school levels using "formal and informal means including special materials in the textbooks, stand-alone texts, films, nationwide 'safety drills' for children of all ages, writing and drawing competitions and exhibitions, paintings and posters in educational environments, as well as using songs, games, puzzles, and other educational tools" (Petal & Izadkhah, 2008, p. 3). In 2005, Turkey added disaster risk reduction to the compulsory curriculum for grades 1 through 12 to help students to learn protective actions and identify practical steps to reduce disaster risks with their families (TR Ministry of Education et al., 2005). The new curriculum requirements were implemented through a large-scale cascading training program of 21,700 teachers who delivered "Basic Disaster Awareness Instruction" to 2.4 million students throughout Turkey's high seismic risk zones. Also, Colombia's Educational Secretariat redesigned national standards to include both theoretical and practical pedagogic guidance on disaster risks, protective strategies, response, and mitigation; more than 1,000 teachers have been trained in the subject matter and school emergency management (Coca, 2007).

1.5.4 Community education

Community-based organizations, museums, and extracurricular programs are also key providers of disaster education for children. Boy Scouts and Girl Scouts, and the Teen Citizen Emergency Response Team (CERT) program in the United States, are just two examples of community programs that provide children experiential training in emergency preparedness and response skills (Black & Powell, 2012; Jang, Johnson, & Kim, 2011). Other examples described by Mulyasari, Takeuchi, and Shaw (2011) include town watching, an education program in Japan where young students, teachers, and community members collectively observe and identify the high-risk areas in a jurisdiction, such as mountains, coastal areas, plains, or residential areas; and GEOMobil, a mobile library of disaster risk reduction materials and books utilized by schools in Indonesia to provide in-class programs for children and information to teachers. Many national agencies and organizations also sponsor public educational websites for children, such as *FEMA For Kids*, which house children's stories, facts, videos, activities, and games to help children learn about disaster preparedness on their own (Ryan, Hocke, & Hilyard, 2011).

1.6   Policy goals and progress

The increasing development and investment in disaster education programs for children reflect an international consensus that these initiatives produce some gain in individual and community resilience to disasters (Wisner, 2006). In 2011, the UN released a report stating that disaster education programs for children aim to "contribute to a *drastic shift* in mentalities and perceptions as well as behavioral change towards a

more proactive preventative approach to disasters. Children, as 'tomorrow's leaders' and key 'agents for change' are recognized as the primary targets of these efforts" (UNICEF et al., 2011, p. 19). The question is, how is the effectiveness of disaster education programs for children being measured? Also, how do we know that disaster education programs for children are not based on the same faulty premises of disaster education programs for adults, which have been shown to be ineffective in motivating substantial behavior change?

There have been some national-level efforts to meet the goals of the HFA's *Priority For Action #3*. The 168 signatory nations of the HFA committed to meeting several "Core Indicators" of progress, including "disaster risk reduction elements included in basic curricula" (UNISDR, 2008, p. 45). Scoring for this indicator is based on quantitative measurements such as the percentage of school curricula including disaster risk reduction elements and coverage by grade level (UNISDR, 2008, p. 45). To receive the highest score of "Level 5," countries must provide evidence that "disaster prevention is fully incorporated, in a cross-cutting fashion, throughout basic and secondary education" and "society as a whole receives the benefits of this cultural change" (UNISDR, 2008, p. 45). Overall, very few countries have reached Level 5 for this indicator, prompting UNISDR to conclude in 2010 that "commitment to the Hyogo Framework for Action (HFA) has not yet consistently translated into safer and more resilient communities" (Cameron & Norrington-Davies, 2010, p. ii). Both the United States (Schothorst, 2012) and New Zealand (Hamilton, 2013) have achieved Level 4 of this scoring which means "incorporation at some educational levels is significantly advanced, but still without impact on the culture as a whole" (UNISDR, 2008, p. 45). The

United States noted the difficulty of measuring progress in a devolved school system, and New Zealand noted the need for better strategies to encourage teachers to incorporate disaster education using their national teaching resource, *What's the Plan, Stan?*

Culture change may remain out of reach if there is little to no study of how to implement effective education initiatives. Several authors have found there is very little formal evaluation of disaster education programs for children and their effectiveness achieving desired learning and behavioral outcomes (Anderson, 2005; FEMA, 2010b; Ronan & Johnston, 2005; Ronan & Towers, 2014; Selby & Kagawa, 2012). In a case study of curricular integration of disaster risk reduction in 30 countries, Selby and Kagawa (2012, p. 35) concluded, "assessment of student learning is the least considered and least developed element of disaster risk reduction education." Further, the authors found "only sporadic anecdotal evidence of the development of evaluation mechanisms to determine the efficacy of disaster risk reduction curriculum when hazard threatens or disaster strikes" (p. 59). Although research in this area is growing, there is currently no scholarly consensus on what counts as credible evidence of effectiveness of disaster education programs for children, whether measured in a pre-disaster or post-disaster context. Assessment of program outcomes appears limited to descriptive case studies (e.g., Plan International, 2010; Reyes et al., 2011; Shiwaku & Fernandez, 2011; Selby & Kagawa, 2012; UNICEF et al., 2011; Wisner, 2006). Also, Selby and Kagawa (2012, p. 55) note that while almost all curriculum developers intend to reach as many students, teachers, and schools as possible, some nations' plans for "going to scale" have been based on unfounded optimism or have not been developed. Therefore, realistic

examinations of program implementation and curricular integration are needed to determine the scalability and reach of education methods.

1.7   Rationale for the research

At the outset of this research in 2011, the extent and breadth of research on the impacts and implementation of disaster education programs for children were not well-defined. Relatively few empirical studies of disaster education for children are cited in the scholarly literature and United Nations reports promoting the benefits of disaster education for children.

To address this gap, this research aimed to:

1) *Illuminate the current state of evaluation of disaster education programs for children, including evaluation methodologies and outcome indicators currently used to define program impacts;*

2) *Address a gap in the current evidence base by building new theories of evaluative outcome indicators that could be used to test the underlying assumptions and theoretical constructs of programs; and*

3) *Test these new indicators in case studies using different evaluation paradigms and methods, and compare the findings of each case study with that of previous evaluation research.*

The overarching research question is:

How can we measure the outcomes and societal impacts of disaster education

programs for children?

1.8   Thesis structure

This thesis is presented by paper. Following a review of seminal studies and key
theories on the impacts of disaster education programs for children (Chapter 2) and an
overview of the research methods (Chapter 3), the first paper (Chapter 4) presents a
systematic methodological review of 35 evaluations identified in the published and grey
literature.[1] By categorizing the methodological components of the current body of
evaluations, this paper provides insights on current approaches to evaluating the
effectiveness of educational interventions that teach children and youth about hazards,
disaster preparedness, and disaster risk reduction, including the research methods and
outcome indicators used, approaches to analysis, and common research limitations. The
conclusion summarizes the state of the art in evaluation of disaster education programs
for children, including the limitations of previous research, promising outcome
indicators, and opportunities for future research.

The second paper (Chapter 5) draws on contemporary research in evaluation
theory and methods and discusses how the application of theory-based evaluation
methods could improve the quality of research in this field, and help identify and refine
meaningful outcome indicators of program impact and implementation. The paper

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[1] Grey literature is literature that cannot be found easily through scholarly databases and repositories of
published material; these include internal reports, working papers, white papers, or preprints by
government agencies or research groups (Debachere, 1995).

provides a detailed description of processes used to reconstruct program theories based on two different program theory models. The models are featured in the evaluation case studies following.

The third paper (Chapter 6) is a case study of a theory-based impact evaluation of *ShakeOut*, an earthquake and tsunami drill in two Washington State school districts. Based on a program theory model of program outcomes, the evaluation uses a unique set of outcome indicators that test children's knowledge application and response skills for different earthquake and tsunami scenarios using a quantitative pretest and posttest questionnaire. The purpose of this case study was to test the proposed outcome indicators and examine how quantitative evaluation designs could be used to assess learning outcomes such as problem solving skills and adaptive response capacities. Through analyzing both population and individual-level changes in children's responses to the questionnaires administered, this study examined children's maintenance and improvements in correct knowledge as well as maintenance of incorrect knowledge and changes from correct to incorrect answers after ShakeOut. Some results of this study challenge the assumption that perfunctory emergency drills provide all children an adequate understanding of protective actions that will effectively prevent injuries and deaths among children during a real emergency. The chapter also discusses the quality and feasibility of the outcome indicators and ways in which the indicators could be improved.

The fourth paper (Chapter 7) is a case study of a theory-driven process evaluation of *What's the Plan, Stan?*, a free, voluntary disaster teaching resource that was distributed to all New Zealand primary schools as part of an effort to integrate disaster

education nationally in school curricula. Based on a program theory model of program use, qualitative focus group and interview data gathered by the author in 2011 and quantitative national survey data gathered by the Department of Internal Affairs in 2012 were analyzed and compared to identify intervening, facilitating, and deterrent factors of uptake and use of the resource. The results of the evaluation reveal implementation challenges unrelated to the quality of the teaching resource, such as lack of awareness of the resource, low prioritization of the subject in schools, and teacher training expectations. The conclusion discusses the relevancy of these lessons for other nations pursuing national curriculum integration through the dissemination of voluntary teaching resources. The findings of this study reaffirm the importance of measuring implementation outcomes of programs intended for scale. The chapter also discussed the quality and feasibility of the outcome indicators.

The final chapter (Chapter 8) provides a summary of the research undertaken and the results, and the unique contributions of the research to the subject of evaluating disaster education programs. The chapter provides recommendations to improve evaluation methods, and highlights the need for evaluation to be understood as a theoretically informed approach using meaningful outcome indicators and age-appropriate data collection methods.

Chapter 2: Literature Review

2.1   Introduction

The following chapter provides a review of the literature relating to disaster and hazards education for children. Advocacy for the development and dissemination of disaster education programs for children rests on several key theories. Some theories possess a strong base of empirical evidence, while other theories have been challenged in recent years by mixed findings and observations, or a lack of research. This chapter includes a review of seminal studies on disaster education for children summarized beneath five key theories, and concludes with a summary of research gaps and future directions.

2.2   Key theories of disaster education for children

2.2.1 *Disaster education for children can increase children's hazard awareness, realistic risk perceptions, and knowledge of protective actions*

There is strong international consensus that disaster education for children can increase children's hazard awareness, realistic risk perceptions, and knowledge of protective actions. Dr. Kevin Ronan and Dr. David Johnston conducted some of the first correlational and quasi-experimental studies of disaster education programs for children, as well as general studies of children's hazard risk perceptions, that have been cited frequently by policy makers and other scholars in the field. In 2001, Ronan and Johnston (2001a) published the first exploratory correlational study of 560 schoolchildren to assess factors associated with child- and parent-reported home hazard adjustments, as well as

children's risk perceptions, knowledge of response-related protective activities, and hazard-related emotional factors (discussed further below). The authors concluded that hazards education was associated with increased hazard awareness, more realistic risk perceptions, more knowledge of risk mitigation, and increased home hazard adjustments, and thus, "hazards education programs for youth provide one gateway through which communities can increase their resilience to the effects of a major hazardous event" (p. 1055). That same year, they published a similar correlational study with 440 schoolchildren that had more mixed results (Ronan & Johnston, 2001b). They found that children involved in hazards education programs demonstrated more stable risk perceptions and greater awareness of hazard-related protective actions compared to non-educated children. However, in this study they found no differences in household preparedness as a function of education. The limitations to both these studies were that they were not able to rule out other explanations for the differences among children, and children's exposure to disaster education was determined by child reports, which may be vulnerable to response and memory biases.

In 2010, Ronan, Crellin, and Johnston published a replication of the former correlational study with a few added variables of interest (Ronan et al., 2010). The study's findings were similar to those of the 2001 study indicating higher levels of correct knowledge and home hazards adjustments among the children who participated in hazard education programs. However, from the added variables examined, they found no differences in family emergency planning and practice. They also reported some unexpected findings. Education administered by schoolteachers was associated with a decreased number of hazard adjustments. Also, incorrect knowledge and hazard-related

anxiety were associated with an increased number of home hazard adjustments. The authors surmised that children's anxiety likely reflected their parent's anxiety, which may explain the higher levels of preparedness in those children's households.

Ronan and Johnston (2003) also published the first quasi-experimental study to examine the hypothesized benefits of hazard education programs for children. The authors randomized classes of children to two different treatments: a "usual condition" that consisted of a reading and discussion, and an "emergency management" condition that consisted of the usual condition combined with emergency management focused teaching and home activities. They found both conditions produced benefits, but particularly the emergency management condition, which produced more child- and parent-reported hazard adjustments, likely because the condition included home activities while the other did not. However, the authors noted that the study lacked a non-intervention control group, and the pre-intervention questionnaire provided to both children and parents may have influenced the increase in home activities. In 2012, Ronan, Crellin, and Johnston published a second quasi-experimental study of children who participated in school education component for a new tsunami warning system (Ronan et al., 2012). Unlike the 2003 study, this study did not have a comparison group, but rather used the previous findings to ''benchmark'' the new findings in order to raise confidence that changes in knowledge and behaviors were due to the education program itself and not other factors such as maturation, history, retesting, or regression to the mean. As in the 2003 study, they found an intervention effect for an increase in children's awareness and knowledge, home hazards adjustments, and preventative self-protective behaviors designed for tsunamis and other disasters. Despite these findings, the authors were

reluctant to designate the education program as wholly effective since roughly a quarter of students still did not have knowledge of the new tsunami warning system at posttest.

Ronan and Johnston were also involved in correlational studies of hazards education for children led by Kirsten Finnis (Finnis, Johnston, Ronan, & White, 2010; Finnis, Standring, Johnston, & Ronan, 2004). In a cross-sectional survey of children in Christchurch, Finnis et al. (2004) found that Christchurch children had better knowledge of safety behaviors and a greater number had participated in disaster education programs compared to children who participated in similar studies in Auckland and Washington State (U.S). Nevertheless, the Christchurch children had fewer reports of home preparedness plans and practices than their peers. A similar study by Finnis et al. (2010) of youth in the Taranaki region of New Zealand found that the students' hazard awareness and risk perceptions were reasonably accurate (with the exception of flooding) and hazard education was found to be associated with increased awareness of some hazard risks. However, students reported relatively low levels of household preparedness, family emergency plans and home practices.

Gulay (2010) published the only known experimental study of disaster education for children, which examined the influence of parent participation in an earthquake education program for children age 4 to 6 years old. Gulay randomized 93 children to two treatment groups (with and without parent participation) and one non-intervention control group, and verbally administered a mixed methods questionnaire to children that included Likert-type scale questions and one open-ended question ("What are the three most important things that should be available in the earthquake bag?"). The author found a significant intervention effect on children's correct knowledge of earthquakes and

preparedness strategies, and found parent participation also significantly improved children's correct answers to the survey questions. However, the author also reported a high number of non-responses, particularly for the open-ended question, which calls into question the efficacy of the data collection tool.

Other empirical studies of knowledge gained through children's disaster education include a study of a school earthquake safety program in Nepal (Shiwaku et al., 2007), which found that information-based education methods, like lectures, can improve children's risk perceptions. However, the authors concluded that information alone did not instigate preparedness actions and children's involvement in community activities is necessary. In a pretest-posttest study of the Disaster Awareness Game for children, Clerveaux, Spence and Katada (2010) found the game was effective in educating children about hazards. Kirikkaya, Çakin, Imali, and Bozkurt (2011) also cited evidence in the Turkish literature, including a pretest-posttest study by Çelen and Üner (2002) that found earthquake-related training delivered in a vocational high school increased students' knowledge, and a study by Özgüven and Öztürk (2006) that found students' knowledge level increased after a basic 90-minute earthquake awareness training provided in primary schools.

Beyond these empirical studies of disaster education programs for children, much has been written about the benefits of disaster education for children based upon observations and descriptive case studies. There is a large number of non-empirical case study reports describing national level programs, school programs, community initiatives, and "innovative approaches" to children's disaster education worldwide (Cameron & Norrington-Davies, 2010; Mitchell et al., 2009; Plan International, 2010; Reyes et al.,

2011; Selby & Kagawa, 2012; Shiwaku & Fernandez, 2011; ThiMyThi & Shaw, 2013; UNICEF et al., 2011; Wisner, 2006). These descriptions of programs are wholly positive, and include accounts of children learning new information, practicing protective actions, and enthusiastically implementing disaster preparedness strategies in their schools, homes, and communities.

The literature also includes a few articles detailing the use and implementation of different teaching methods, although none tested learning outcomes from the methods. Mitchell, Haynes, Hall, Choong, and Oven (2008) described their experience delivering a hazards course to middle school students, where students used GIS software to develop projects mapping hazard risks in their community. Battersby, Mitchell, and Cutter (2011) discussed the development of an online hazards atlas for K-2 students in South Carolina. Naya (2007) gave a glowing review of students' participation in an online "Natural Disaster Youth Summit," where students learned about disaster risk reduction through discussion and collaboration with other students around the world. Among these case studies, several of the authors suggest formal program evaluation is needed. Nonetheless, all of the authors concluded with a statement of support for disaster education and affirmed children's disaster education improves children's knowledge and awareness of disaster risks and preparedness strategies.

In sum, the literature provides evidence that disaster education for children can increase correct knowledge of risks, protective actions, and preparedness strategies, and in some but not all cases, exposure to disaster education has been associated with higher levels of household preparedness. However, the existing empirical studies have not adequately distinguished disaster education for children as the cause of household

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preparedness measures, planning and practice, or community preparedness measures. While it is safe to conclude that children's disaster education has value as a purveyor of knowledge, these programs may be missing the principal objective of motivating children and their households to take actions that reduce their disaster vulnerability. A lack of empirical evidence measuring a causal link between children's disaster education and disaster risk reduction activities may stem from inadequate research methods and outome indicators, or stem from a flaw in programs' content and delivery, or both. Much literature on children's disaster education could be characterized as descriptive advocacy pieces, and not scholarly research.

2.2.2   *Children can learn self-protective actions for disasters*

There is a widely accepted theory that children can be taught self-protective actions for disasters, which include skills such as evacuation for fires, "drop, cover, and hold" for earthquakes, evacuation to high ground for tsunamis, and shelter-in-place for tornados (Finnis et al., 2004; Green & Hart, 1998; King & Gurtner, 2005; Peek, 2008; Ronan & Johnston, 2003, 2005; Slovic, Fischhoff, & Lichenstein, 1981). One of the main ways children learn protective actions for disasters is through school drills, which are perhaps the oldest and most common form of disaster education for children. The practice of regular emergency drills in schools internationally symbolizes the consensus that repetitive drills are a good approach for improving disaster response and preventing injuries and deaths among children (Brodkin & Coleman, 1994; Heath et al., 2007; Hull, 2011).

Izadkhah and Hosseini (2009) suggest this notion has its roots Piaget's theory that children are learners and architects of their own understanding and have the capacity for self-instruction and self-correction (Piaget & Inhelder, 1969). There is a substantial amount of literature on the benefits of experiential and practice-based learning, and social learning in groups (Ballantyne, Fien, & Packer, 2001; Birmingham, Pechman, Russell, & Mielke, 2005; Jones, Kazdin, & Haney, 1981; Moon, 2013; Silva, 2009; Vosniadou, 2001; Wilson, 1997). In relation to teaching children self-protective actions for disasters, Ronan and Johnston (2005) stressed that repeated practice of self-protective skills could improve children's self-confidence and resiliency to disasters, particularly when children have the opportunity to receive constructive feedback during drills. Also, Finnis et al. (2004, p. 11) argued, "knowing the types of hazards, their recurrence intervals and appropriate protective behavior should help mentally prepare a child for a hazard event, helping them understand what happens and that they have the power to help themselves." The authors suggest this learning also has a community benefit, stating "knowledge of protective behavior will decrease a child's vulnerability if alone or unsupervised and will decrease a family's vulnerability as the child can act independently and, depending on age, can help others who are unaware of the correct actions to take" (p. 11).

Few, if any, studies have examined the influence of school drills and other forms of disaster education on children's responses during a real disaster (Ramirez et al., 2009). However, there are storied accounts of children self-protecting during disasters. For example, children who experienced Christchurch earthquake in 2011 provided first-hand accounts of getting under a desk or "making a turtle" during ground shaking on a website documenting children's experiences ("When My Home Shook", 2012). There are also

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heroic instances of young children saving lives that have been attributed to the knowledge and skills they learned from disaster education. In 2004, 10-year old British school student Tilly Smith vacationed with her family in Thailand and made international news when she noticed ocean signs of the impending tsunami, learned recently in a school geography lesson, and alerted the entire beach to evacuate to high ground (Owen, 2005). Also, when Cyclone Sidr hit Bangladesh in 2007, 7-year old Lamia Akter, who participated in a disaster education program sponsored by Action Aid, passed on a cyclone warning alert to her family and neighbors, which resulted in them safely evacuating (Anderson, 2010, pp. 12-13).

Learning outcomes from school drills are mainly evaluated through visual observations of children repeating the response skills and participating in group safety procedures (e.g., Central U.S. Earthquake Consortium, 2011; Green & Petal, 2010; Johnston et al. 2011, 2010; McBride et al., 2013; Nguyen, 2011; Petal & Green, 2008; Petal, Green, Wood, Reuss, & Coomer et al., 2009). One of the first attempts to scientifically evaluate a school drill was the Ramirez et al. (2009) study of a Los Angeles County school district in California. The authors used a mixed method design to assess the drill process and children's behaviors during the school drills. The authors' conclusions were mostly negative, because they observed both the children and staff treating the drills as a "compulsory exercise with little meaning" (p. 110). A main concern was that children were not provided feedback on uncertain or incorrect actions: for example, children who did not fit under desks during a "drop, cover, and hold" drill for earthquakes were not instructed on safe alternatives. Another seminal study by Soffer et al. (2009) evaluated the outcomes of three different earthquake education interventions

for 5th and 6th graders: a lecture, an earthquake drill, and a combination of both. The author found that each individual method increased children's earthquake knowledge, but the combination of a lecture and drill garnered the best results, suggesting education on earthquake safety should include instruction on both the theoretical and practical aspects of safety procedures.

Although some children may be skilled in disaster response, some scholars argue that not all children will understand the purpose and goals of practicing self-protective actions during drills, especially if they are not explicitly taught (Lund, 2013; Petal & Green, 2008). School drills tend to emphasize repetition and memorization of correct actions for the mastery of basic response skills, but often do not provide the reasoning for the skills, which are needed to help the children apply knowledge and make decisions in unfamiliar scenarios (Carboni, 1962; Mayer, 2002). Observational evaluations of school drills have also revealed that many drills are not used as opportunities to address problematic safety procedures or test different scenarios (Green & Petal, 2010; Johnston et al., 2011; Petal & Green, 2008). In an observation of a school earthquake drill, Petal and Green (2008, p. 43) concluded, "while the rote 'drop and cover' rule is well-practiced under school desks, neither students nor general public have been able to generalize from this to many other situations away from a school desk." Similarly, Green and Petal (2010, p. 19) concluded, "students may be unprepared to think through and apply a range of behaviors for safety in different situations." There are very few accounts of school drills incorporating lessons or discussions on problem-solving in emergencies and unsafe actions to avoid, such as running outside during ground shaking from an earthquake (Ramirez et al., 2009). Citing research by Gebbie, Valas, Merrill, and Morse

(2006), Soffer et al. (2010, pp. 205-206) notes ,"a poorly designed or executed exercise or one that does not include a well planned evaluation of the intended outcomes may do more harm than good, in that it may lead to a false sense of security, which could result in poor performance during an actual emergency." Thus, a common policy recommendation is for school drills to incorporate curricular lessons on disaster preparedness and practice of different scenarios.

In sum, first-hand stories of children using specific self-protective actions during disasters provide evidence that some children can learn skills and successfully apply them during an emergency. However, there is little to no systematic evidence that school drills as they are normally practiced provide children adequate context for learning and comprehending response skills that will prevent injuries and deaths in real emergencies.

2.2.3   Children can lead and contribute to disaster preparedness and response

Many international child advocacy organizations support the theory that children can constructively contribute to and lead disaster preparedness and response in their households and schools, and provide added capacity to community efforts. Child-Led Disaster Risk Reduction (CLDRR), also known as child-centered or child-focused disaster risk reduction, stems from a child protection framework to address children's vulnerability to disasters. Save the Children defines CLDRR as "a child-centered community based framework where children play leading roles in their communities to minimize the negative impacts of disasters" (Benson & Bugge, 2007, p. 2). Similarly, Plan International (2010, p. 3) defines child-centered disaster risk reduction as "a flexible rights-based approach combining child-focused (for children) and child-led (by children)

activities with interventions geared towards bringing about change in community, local and national duty bearers. It applies strategies such as awareness raising, capacity building, group formation, institutional development, research and influencing, and advocacy across a range of arenas." According to Plan International (2010, p. 4), child-centered disaster risk reduction embraces the four principles of the *UN Convention on the Rights of the Child*: 1) non-discrimination, 2) the best interests of the child, 3) the right to life, survival and development, and 4) the view of the child.

Save the Children supports CLDRR because they believe "children who participate in CLDRR have a greater capacity to cope with disasters; their sense of security is increased; their knowledge of the risks is developed; and their sense of control and survival potential is enhanced by knowing how to respond to disasters" (Benson & Bugge, 2007, p. 2). Plan International (2010, p. 9) argues that CLDRR initiatives are valuable because children "have a unique and holistic perception of risk." For example, they posit that children "often have a longer term perspective of risks than adults, who are primarily concerned with meeting day-to-day needs, in particular with regard to the environment. They have regularly identified immediate risks in their communities (such as road security, unsecured electric cables or child abuse), and social risks such as teenage pregnancy and domestic violence – which may be overlooked by adults" (p. 9). Also, "children often have creative means and ambitious strategies to bring about change. They tend to be less constrained by social norms and fatalistic attitudes common among their parents" (p. 10).

The positive outcomes of CLDRR initiatives are mainly interpreted from descriptive case studies. Save the Children (Benson & Bugge, 2007), UNICEF (2012)

and Plan International (2010) provide many examples of child-led projects in developing countries where children are contributing to disaster governance, risk assessment, education, risk management, preparedness, and response. For example, in the Philippines, children in one community successfully lobbied their parents and politicians to relocate their school from a landslide-prone area, despite opposition from some community factions (Plan International, 2010, p. 41). In El Salvador, children reduced flood risks by convincing adults to improve waste management and establish weekly garbage collection services (Plan International, 2010, p. 10). Gaillard and Pangilinan (2010) provide a detailed description of a participatory mapping project in the Philippines where young children helped city planners identify community hazards, at-risk populations, and evacuation routes. There are also many accounts of child-led disaster response efforts in developed countries. Kirshke and van Vliet (2005) documented stories of American children who helped evacuate family members during Hurricane Katrina. Also, students at the University of Canterbury in New Zealand mobilized a grassroots "Student Army" by using social media to recruit and organize large groups of students to help check on neighbors, clear debris, and provide social support in the aftermath of the 2011 Christchurch earthquake (Giovinazzi et al., 2011).

Field studies in El Salvador and the Philippines by Mitchell et al. (2009) represent one of the first attempts to analytically examine the capacities of children to contribute to community-level disaster risk reduction efforts. Based on the results of interviews, focus groups, and visioning exercises with children and youth, their parents, and local policy makers, the authors identified a number of official and unofficial pathways for children and youth to communicate their ideas for reducing risks. These

include household and classroom discussion, formal youth councils, news media, and theatre and art exhibitions. Among the positive findings, parents reported being influenced by the passion and action of their children. Also, based on the authors' observations of risk mapping, ranking, and guided walk exercises with children, the authors reported that children demonstrated a clear ability to identify and communicate risks and actions necessary to reduce the risks. However, many of the children and youth felt that the formal mechanisms for disaster risk reduction participation in the community, such as the youth councils, were ineffectual and were being used as a campaign tool for politicians. Also, policy makers reported resource constraints and limited community awareness of disaster risks as barriers to proactively including children within their work.

Some scholars argue children's opinions and contributions to jurisdictional policy are often misunderstood, misdirected, or controlled for purposes that are at odds with the interests of children and youth (Chawla, 2002; Hart, 2013; Mitchell et al., 2009). Policy makers sometimes treat children simply as bystanders or recipients of programs that are already developed, rather than active partners and contributors, which can limit the effectiveness of the tools. For example, Bastiani (2012) suggests that resource-based models of preparedness that are often central to disaster education programs for children, such as those focused on teaching children to create home preparedness kits, have a negative impact on the self-efficacy of low-income children who have limited access to resources. Also, the process and methods used in child and youth participation and consultation can even create negative effects, such as the alienation of children from civic participation (Mitchell et al. 2009). For example, Mitchell et al. (2009, p. 14) found that

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children's poor quality experience in the youth councils fostered a mistrust of the involved adult authorities. Also, the authors posit that some children may choose not to participate due to other priorities, skepticism, isolation, lack of self confidence, and lack of interest, which can lead to a skewed representation of youth opinions. The authors conclude child-led disaster risk reduction initiatives require a network of supportive adults that can provide an enabling environment, equity, and access to the decision-making process.

In sum, the observational and anecdotal evidence of children's participation in disaster risk reduction leaves little doubt that children have the capacity to contribute to efforts to reduce their own vulnerability and increase the resilience of their households and communities. However, their contributions tend to depend on adults to provide facilitation and meaningful access to decision-making processes. Therefore, systematic evaluation of programs that encourage child-led disaster risk reduction is needed to assess the quality of children's engagement and identify both the positive and potentially negative impacts.

2.2.4   *Children can transfer knowledge to adults and influence them to prepare*

A major assumption of disaster education programs for children is that they create a ripple effect of information dissemination in the community since children often discuss what they have learned with their parents and can influence adults' risk awareness and behaviors (Izadkhah & Hosseini, 2005). According to Ronan, Johnston, Daly, and Fairley (2001, para. 7), "the more a child is aware of hazards and realistic risks, the more potential there is for the adults (particularly parents) to be educated through the child

sharing the knowledge at home." This theory stems from an established knowledge base that children influence their parents in a number of ways. For example, children have been found to influence consumer choices made by parents (Berey & Pollay, 1968; Flurry & Burns, 2005), parental attitudes such as gender roles (Axinn & Thorton, 1993; Glass, Bengtson, & Dunham, 1986), parents' use of technology (Liikanen, Stoneman, & Toivanen, 2004), and their knowledge of health risks (Crawford et al., 1990).

Although there is a substantial amount of literature on the roles of children and youth as communicators, there are only a few studies on the role of children as either sources or recipients of disaster risk reduction knowledge (Kasperson & Kasperson, 2005; Mitchell et al., 2009). Beyond field evidence of children conveying risk information to household members as a result of participating in disaster education (e.g., Back, Cameron, & Tanner, 2009; Plan International, 2010), a small number of empirical studies have identified cases in which children shared information with their guardians and had a positive impact on adults' risk awareness and home hazards adjustments. Two studies by Ronan and Johnston (2001a, 2003), discussed previously, found hazards education prompted hazard-related discussions between children and their parents and predicted an increased number of household preparedness actions. Also, Ronan et al. (2010) found that children's participation in disaster education programs that encouraged discussion of emergency preparedness with parents, together with parents' willingness to discuss what was learned, was associated with higher levels of home preparedness activities. In case studies of children in El Salvador, the Philippines and the U.S., Mitchell et al. (2008) found that children were effective communicators of disaster risk information when parents were constrained by language barriers, an outside agent

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facilitated the organization of youth groups, the community had strong social cohesion, and there was a level of distrust of political authorities.

Other research related to this theory is the literature on the effectiveness of environmental education programs in promoting intergenerational influence and intercommunity learning (Ballantyne et al., 2001; Duvall & Zint, 2007; Vaughan et al. 2003). In a study including parents of 60 third and fourth graders who participated in school-based education on conservation principles, Vaughan, Gack, Solorazano, and Ray (2003) detected a high level of information transfer from children to their parents. Also, studies by Ballantyne, Connell, and Fien (1998) and Ballantyne et al. (2001) indicated that students shared their environmental knowledge with their parents, and in some cases, facilitated positive change in households. On the other hand, some studies of intergenerational learning were less convincing. Sutherland and Ham (1992) found that discussion about environmental conservation among children and parents in Costa Rica was not a consistent or reliable method of knowledge attainment, particularly when children deliberately provided information to parents, or when parents solicited the information. Further, Duvall and Zint (2007) reviewed seven studies on intergenerational learning and concluded school-based environmental educations programs had only a modest potential to influence parental knowledge, attitudes, and behavior.

Although there is limited evidence of how intergenerational learning changes social norms, developers of disaster education are also motivated to facilitate child and parent interactions because these interactions can have a positive effect on children's learning. There is an evidence base on the positive effect of parent involvement in young children's education for wide variety of knowledge, skills, and social competencies

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(Campbell & Verna, 2007; Dunst, 2002; El Nokali, Bachman, & Votruba- Drzal, 2010). The United States Fire Service, which strongly advocates for parent involvement in fire and life safety education for children, found that both children's comprehension of fire safety messages and children's sense of self-efficacy increased when parents talked with their children about the safety messages they received (Gielen, Borzekowski, Rimal, & Kumae, 2010; Sturtevant & Myer, 2013). Similarly, Gulay's (2010) experimental study of an earthquake education program for children, introduced previously, found that parent participation was significantly more effective in achieving learning outcomes than program delivery that had no parent participation. A review of studies of environmental education programs also found parental involvement in student activities to be a critical factor in successful learning outcomes (Duvall & Zint, 2007).

Despite these findings, Ronan and Johnston (2003, p. 1011) note that child-to-parent knowledge transfer and a wider community impact do not inevitably occur, particularly when adults' learning intelligences are different from those of the children who are communicating new knowledge. There are also age-specific limitations to children's capacities to interpret, reason, communicate, and take action on specific issues (Mitchell et al., 2008). Based on Piaget's "Stages of Cognitive Development," at age of seven, most children have not yet learned cause and effect relationships, and comprehension of complex issues can vary widely among children of the same age (as cited in Wood, Smith, & Grossniklaus, 2001). Further, disaster education programs for children do not always explicitly encourage children to discuss emergency preparedness with their parents or include activities that involve children's households. School emergency drills are an example of this. Also, a study with 852 intermediate school

children in New Zealand found only a minority of children discussed with their parents what they learned about hazards at school (Tarrant & Johnston, 2010). On the other extreme, programs that do encourage children to communicate risks to their households may be exploiting children for the purpose of political goals that are not in the best interests of children (Mitchell et al., 2008).

In sum, there is evidence that children can effectively communicate what they have learned about disaster risks and risk reduction strategies and in some cases, they have been found to influence parents to take action. However, simple logic, combined with findings to date, dictate that disaster education for children will not inevitably lead to intergenerational learning and social change. Mechanisms to encourage and support knowledge transfer should be incorporated and evaluated in education programs. The quality of knowledge transfer should also be examined, including the accuracy of the information children share with adults, and the factors of that communication that either motivate or have no effect on adults' preparedness actions. Also, investigation is needed to determine the ethical implications of using children as a vehicle to communicate risks to adults.

2.2.5 *Disaster education that aims to increase realistic risk perceptions can reduce, rather than increase, anxiety and fear in children*

A key theory underpinned with the least amount of consensus is the premise that disaster education for children can reduce, rather than increase, anxiety and fear of disasters in children. It is well known that children can feel overwhelmed with concerns of safety, security, and trust both before and after disasters, and disasters have been found

to be one of children's most common worries (Ollendick, King, & Frary, 1989; Silverman, Greca, & Wasserstein, 1995). When children hear about or discuss traumatic events like fires, disasters, schools shootings, or terrorism, it is natural for children to be anxious about their own safety and the safety of the important people in their lives. Likewise, children who experience disasters can have great difficulty expressing or coping with feelings of fear, anxiety, confusion, sadness, anger, grief, and isolation (Peek, 2008; Pfefferbaum et al., 2008). Consequently, the impact of disaster education on children's emotional well-being is a concern that has been voiced by parents, teachers, and policy makers for several decades (Gustafson, 2009).

Several studies, introduced previously, have demonstrated that disaster education does not necessarily increase fear and anxiety in children. In a correlational study of 409 school children, Ronan et al. (2001) found that children who had been exposed hazards education in school had more correct knowledge of risks and less hazard-related fear, despite increased perceptions of being injured. In a similar correlational survey of 560 schoolchildren, Ronan and Johnston (2001a) found children who participated in hazards education had the same fear levels and perceived coping levels compared with children who were not involved in hazards education. The latter study was replicated with 407 children in 2010 (Ronan et al., 2010) with added measures including perceptions of parents' hazard-related distress. The authors found there were no significant differences between those children who had and had not participated in a hazards education program for their own level of fear or perceived emotional coping ability. However, children who had not been exposed to hazards education were significantly more likely to perceive their parents as being upset or fearful when talking about hazards, which was viewed as a

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disadvantage since children's coping after disasters often reflects that of their parents. Interestingly, they identified an association between hazard-related anxiety and an increased number of home hazard adjustments.

Ronan and Johnston's (2003) first quasi-experimental study, introduced previously, also examined children's hazard-related fear levels, perceptions of parent's hazard-related distress, and perceptions of their own ability to cope emotionally with a future hazard. Students aged 11 to 13 were randomized by class to two different treatments: a "usual condition" that consisted of a reading and discussion, and an "emergency management" condition that consisted of the usual condition combined with emergency management focused teaching and home activities. Children rated the measures on a 3-point scale (1 = not at all, 2 = sometimes, 3 = often). The authors found that neither condition produced significant effects for perceived emotional coping ability, but both conditions reduced pre-test levels of hazard-related fears and significantly reduced perceptions of parents' hazard-related distress. The same emotion-related measures were used in a second quasi-experimental study by Ronan et al. (2012), which evaluated the impacts of a school education component on a new tsunami warning system in Napier, New Zealand. Following the education program, children aged 8 to 17 reported a significantly reduced level of fear, a significant decrease in the fear associated with a number of specific hazards, and a decrease in perceived parental fear, which trended toward significance. However, the program did not have a significant effect on children's perception of their emotional coping ability in the event of a hazard. Tarrant and Johnston (2010) also used the 3-point scale and similar emotion-related measures in a survey of 852 intermediate school students. Unexpectedly, more than 20% of students reported they

were "often" scared of variety of hazards, including house fires, tsunamis, tornados, volcanic eruptions, and earthquakes, even though 76% of students had been involved in some type of hazard education program. The authors theorized that some children may be influenced by media coverage and related incidental discussions, and these factors should be considered in the evaluation of disaster education programs.

Some parents, teachers, and policy makers feel that it is unnecessary or unethical to prompt children's concerns about disasters, an opinion that aligns with the paternalistic view that disaster preparedness and response is largely the concern of adults. For example, primary school teachers who participated in focus group research on the use of disaster education resources discussed how some parents are resistant to disaster education for children because they believe it is scaremongering (Johnson, 2011, p. 31). Also, some teachers did not deliver disaster education because they believe it is up to parents to decide how much children should be exposed to sensitive topics (Johnson, 2011, p. 21).

On the other hand, several scholars argue that anxiety about the consequences of disasters is a normal outcome of disaster learning, and even a desired outcome if it constructively motivates people to take actions that reduce their vulnerability (Mishra & Suar, 2012; Ronan et al., 2001). Public education on disasters is generally intended to give people an increased sense of personal control and self-efficacy through provision of information on risks and disaster preparedness and prevention strategies. Ronan and Johnston (2003, p. 1018) suggest that the education effect of reducing children's hazard-related fears "bodes well for these children being able to manage a future event more effectively." However, there is not clear evidence that a low level of disaster-related fear

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before a disaster translates to better disaster outcomes and emotional coping. Most of what is known about factors of children's resilience and emotional coping after disasters is based on post-disaster research. For example, several studies support the theory that proactive interventions with children that provide them the opportunity to openly discuss and cope with the traumatic events helps reduce children's posttraumatic symptoms after disasters (Cohen & Mannarino, 2011; Ronan & Johnston, 2005; Wolmer, Laor, & Yazgan, 2003). Also, acknowledging people's emotions and providing accurate information about a traumatic event has been found to reduce anxiety and distress in both children and adults (Brodkin & Coleman, 1994; Damiani, 2011; Fothergill & Peek, 2006; Kenardy, Thompson, Le Brocque, & Olsson, 2008).

There is also no clear consensus yet on whether disaster-related fear and anxiety is primarily a motivating or demotivating factor of disaster preparedness. Mishra and Suar (2009) provide an overview of the mixed findings in the literature, including research where trait anxiety was found to decrease a protective response (DeMan & Simpson-Housley, 1988; Weinstein, Lyon, Rothman, & Cuite, 2000), increase disaster preparedness (Rustemli & Karanci, 1999), and both decrease and increase protective strategies (Kiecolt & Nigg, 1982). Most of the research on the relationship between hazard-related fear and self-led preparedness actions has been conducted with adults. It is questionable that "motivational anxiety" in children is valuable when many preparedness activities, such as stockpiling of supplies and acquisition of disaster insurance, remain largely in the purview of adults and require resources that children cannot access.

One major weakness of educational initiatives for children is that many, if not most, disaster education methods exclude activities to address uncomfortable feelings and

emotions elicited by disasters, and in some cases, focus inappropriately on making learning activities enjoyable for the purpose of quelling children's fears (Selby & Kagawa, 2012). For example, in a case study of teachers using methods to teach earthquake preparedness to preschool children, Izadkhah and Heshmati (2007, p. 6) reported, "there was no sign of fear in children on the earthquake issue if they were taught with amusing methods." Because the topic of disasters inherently touches on the aspects of injury, loss, and death, several scholars emphasize the critical need to incorporate affective learning activities into disaster education in order to provide children a supportive environment to consider and express their feelings and emotions about disasters (Pfefferbaum et al., 2008; Tarrant & Johnston, 2010). A key objective of discussing unpleasant feelings and emotions is self-esteem building, which is vital for developing children's sense of personal responsibility. Self-esteem building activities may be valuable for disaster risk reduction goals because, as Selby (1995, pp. 36-40) found, there is a high correlation between people's sense of personal self worth and their level of altruism and willingness to take action for the good of the community (as cited in Selby & Kagawa, 2012, p. 30).

In sum, the limited empirical research on disaster education's influence on children's hazard-related fears indicates that education may reduce or have no effect on children's fear of hazards and may reduce children's perceptions of their parents' fears. However, no studies found that education increased children's perceived emotional coping abilities for a future disaster event, and it is unclear if hazard anxiety increases or decreases children's preparedness actions. Thus, there remains a significant gap of research on whether the reduction of children's fears and concerns about disasters is a

worthy goal of disaster education programs, or if it hinders children's realistic perceptions of hazard impacts and their self-efficacy.

2.3   Limitations of previous research

There is international consensus that disaster education for children is valuable and increases disaster resilience in children and their sphere of influence. Yet, the review of the literature revealed significant gaps in our understanding of the impacts of children's disaster education and if the educational outcomes will change social norms of disaster preparedness and mitigation, and substantially reduce disasters. There are several major assumptions about disaster education for children that remain unchallenged, including: 1) knowledge gained in children's disaster education programs translates to instrumental action and reduced disaster vulnerability, 2) disaster education programs have few negative impacts, 3) schools drills as they are normally practiced yield skills that prevent injuries and deaths during disasters, 4) children who participate in disaster education transfer knowledge to the adults in their households and influence adults to take preparedness action, and 5) the reduction of children's hazard-related fears through education improves children's resilience.

Also, the evidence base specific to the impact and implementation of disaster education programs for children that does exist may be unreliable due to weaknesses in the studies' data collection methods. One major weakness of several of the empirical studies is the use of child reports to measure children's exposure to previous disaster education and home hazard adjustments. These measures are prone to response bias (where the child reports what he or she thinks the evaluator would like hear) and memory

bias (where children have difficulty accurately remembering past events and experiences). Children do not have the same level of recall as adults, and provide less valid data about mundane or everyday occurrences (Tourangeau, Rips, & Rasinski, 2000, as cited in Bell, 2007). Further, quantitative questionnaires, a common method in the empirical studies reviewed, have to be carefully conceived to ensure that their operationalization is developmentally-appropriate. Throughout childhood and adolescent, young people continue to develop functions related to language, literacy, and memory, which can affect their ability to answer a survey question as expected (Borgers, Hox, & Sikkel, 2003). When developing questionnaires administered to children, reading level, the use of scales, number and ordering of response options, question length and wording, and suggestions and connotations in questions all require specific consideration to maximize the validity and reliability of the tool (Bell, 2007). These challenges, as well as time, expertise, and human resource constraints, may be part of the reason observations and descriptive case studies are more commonly used than empirical methods to ascertain the outcomes of children's disaster education.

2.4   Summary of research gaps and future directions

First, there is a need to define the state of the art in evaluation of disaster education programs for children. In recent years, several literature reviews concluded that there is little research and evaluation of program impacts, learning outcomes, and implementation processes (FEMA, 2010a; Ronan et al., 2010; Selby & Kagawa, 2012). However, more evaluation research may be available in the grey literature in the form of internal reports and other uncataloged documents. Because most disaster education programs are in the purview of non-governmental organizations, government agencies,

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and other non-formal educators, it was theorized that evaluation and research on program

impacts may exist outside the sphere of academic publishing and this research should be

reviewed since it may be highly influential in policy and program decisions.

Second, there is a need to understand in what aspects of evaluation practice in this

discipline could be improved to achieve more meaningful indicators of programs'

societal impact. This requires an understanding of common limitations to research with

children in contexts where disaster education programs are being delivered.

Third, evaluative outcomes indicators need to be developed and tested against

large-scale programs in order to identify evaluation methods that are both effective and

practical for measuring the societal impacts of programs.

Consequently, this case study aims to investigate the current state of disaster

education programs for children and build on previous research to develop and test

evaluative outcome indicators that measure programs' outcomes and societal impacts.

Chapter 3 (Research Methods) discusses how the research was designed and carried out.

Chapter 3: Research Methods

3.1   Overview

Chapter 2 provided a review of the literature supporting key theories and underlying assumptions of disaster education for children. This chapter discusses the design, methods, and conceptual frameworks of the research.

Sections 3.2 and 3.3 describe the overarching objective of the case study research, and the key research questions that are addressed by the entirety of the study. Section 3.4 discusses the research design, including the case study's conceptual framework, details of the case study method, and the rationale for the case selection. Section 3.5 provides an overview of theoretical constructs of the case study research.

Following the description of the full body of research, Section 3.6 describes the four distinct and sequential components of the research, which comprise the four papers presented in the thesis (Chapters 4 to 7). The four components are: 1) a methodological literature review of program evaluations; 2) the development of program theory models and outcome indicators; 3) a case study evaluation of ShakeOut, an earthquake and tsunami exercise in two Washington State school districts, and; 4) a case study evaluation of *What's the Plan, Stan?*, a voluntary teaching resource on disasters distributed to all New Zealand primary schools. Section 3.6 describes each component's conceptual framework, research questions, theoretical paradigm, research methods, and analysis method. Finally, Section 3.7 describes how the findings of the four components of

research are analyzed to produce new knowledge on evaluating disaster education programs for children.

3.2   Objective

The objective of the research was to build and test evaluative outcome indicators to measure the effectiveness and implementation of disaster education programs for children. The goal was not to identify a single theory or approach to evaluation, but to identify gaps in the current evidence base and propose new approaches to measuring outcomes that build on findings and lessons from previous research. The findings from this research are intended to contribute to theory development and evaluation practice, and help program developers articulate goals and meaningful measures of programs' societal impacts. The secondary purpose was to contribute original, published studies of large-scale disaster education programs to add new knowledge to the limited evidence base on the impacts of disaster education for children.

3.3   Research Questions

The primary research question was:

How can we measure the outcomes and societal impacts of disaster education programs for children?

Other research questions include:

1. *What are the existing method traditions in evaluations of disaster education programs for children?*

2. *What models of evaluation could be used to measure the outcomes and societal impacts of disaster education programs for children?*

3. *What outcome indicators could be used to measure learning and behavioral outcomes from programs?*

4. *What outcome indicators could be used to measure the efficacy of program implementation?*

5. *Did the case study evaluations garner new knowledge about the outcomes and societal impacts of the programs?*

6. *How do the evaluation findings compare to findings in previous research?*

   a. *What was the quality and feasibility of the proposed outcome indicators and research methods for measuring societal impacts?*

   b. *How could the proposed outcome indicators and research methods be improved?*

   c. *What is the contribution of these findings to the cumulative body of knowledge?*

   d. *What research opportunities and challenges remain?*

3.4   Research design

A research design may be defined as the blueprint for reaching the conclusions to a research question (Tan, 2004). This section provides additional detail about the research design used in this dissertation, including the conceptual framework, case study method, and case selection.

3.4.1   Conceptual framework

To address the primary research question, a qualitative case study design was used to identify methods, build evaluative outcome indicators, and test the approaches in a real world context (Stake, 2005). The approach to the research was guided by the ideas of Abraham Kaplan (1964) and John Dewey (1938) who described how to use theory as a tool to structure empirical inquiry while considering the practical aspects of research. According to Kaplan (1964, p. 296), a conceptual framework is a systematic means, based on theory, to organize research to find answers. To describe the operationalization of this research, the conceptual framework and four main methods are displayed in Table 3.1. The table illustrates an adaptation of conceptual and microconceptual tables and categories developed by Shields and Tajalli (2006). The purpose of the research was *gauging*, which Shields and Tajalli (2006, p. 318) describe as a research inquiry, *How can x be improved?* In this study, the overarching research question was, *How can we measure the outcomes and societal impacts of disaster education programs for children?*, and the purpose of the research was to identify and gauge ways to improve evaluation practice in this area. The conceptual framework is described as *practical ideal type*, which corresponds to the research process of developing criteria for the judgement of a program or policy and collecting empirical evidence to contrast the reality of the program or policy against the criteria (Shields and Tajalli, 2006, p. 324). In this case, program theories and outcome indicators were proposed and tested in case studies, and their performance was judged against criteria of quality and feasibility adapted from those developed by Wall et al. (2010).

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The research design includes four sequential methods displayed in the Methods column of Table 3.1: 1) a methodological literature review to empirically characterize the tradition of evaluation theories, methods, and outcome indicators, and identify gaps in the existing knowledge base; 2) visual modeling of program theories, which were used to generate evaluative outcome indicators using applied theory from education and psychology; 3) a quantitative quasi-experimental evaluation of program impact, which served the dual purpose of evaluating a large scale program and testing the quality and feasibility of the program theory and evaluative outcome indicators developed for the case; and 4) a qualitative, mixed methods evaluation of program implementation, which served the same dual purpose. The programs featured in the case study evaluations include ShakeOut, an earthquake and tsunami drill in two Washington State school districts, and *What's the Plan, Stan?*, a disaster teaching resource distributed for voluntary use to New Zealand primary schools.

Table 3.1

Conceptual framework and operationalization of the case study research

Purpose	Research Questions	Conceptual Framework	Methods	Analysis
Gauging	*How can we measure the outcomes and societal impacts of disaster education programs for children?* • *What models of evaluation could be used to measure the outcomes and societal impacts of disaster education programs for children?* • *What outcome indicators could be used to measure learning and behavioral outcomes from programs?* • *What outcome indicators could be used to measure the efficacy of program implementation?* • *Did the case study evaluations garner new knowledge about the outcomes and societal impacts of the programs?* • *What was the quality and feasibility of the proposed outcome indicators and research methods?*	Practical ideal type	Mixed methods (in sequence): (1) Methodological literature review: categorizing methods and theories from evaluations (2) Visual modeling of program theories and development of outcome indicators (3) Case study 1: quantitative quasi-experimental evaluation of program impact (4) Case study 2: qualitative mixed methods evaluation of program implementation	Judge program theory models and outcome indicators against criteria of quality and feasibility

Note. Adapted from microconceptual framework tables and research method categories in "Intermediate Theory: The Missing Link in Successful Student Scholarship," by P. M. Shields and H. Tajalli, 2006, *Journal of Public Affairs Education*, 12(3), pp. 313-334.

3.4.2 Case study method

Eisenhardt and Graebner (2007, p. 25) argue that one of the strengths of theory building through case studies is "it is one of the best (if not the best) of the bridges from rich qualitative evidence to mainstream deductive research. Its emphasis on developing constructs, measures, and testable theoretical propositions makes inductive case research consistent with the emphasis on testable theory within mainstream deductive research." Further, Eckstein (2000, p. 119) argues that case studies "are valuable at all stages of the theory-building process, but most valuable at the stage of theory building where the least value is generally attached to them: the stage at which candidate theories are 'tested.'" Although some scholars argue that case studies cannot provide reliable information about the broader context of a phenomenon (Abercrombie, Hill, & Turner, 1984; Campbell & Stanley, 1966; Dogan & Pelassey, 1990), this research follows the stance of authors such as Flyvbjerg (2006) and Meyer (2001) that case study methods can produce rich insights to the discovery dimension of inquiry, and can contribute to the cumulative development of knowledge.

The case study approach was identified as the best method to test new outcome indicators because it allowed the proposed measures to be tested in a real-world context, rather than a theoretical context. One weakness of this approach is that there can be biases introduced by the author's role as lead evaluator and analyst in both cases. A particular bias relevant here is experimenter-expectancy bias, which is a cognitive bias towards a result created by the human experimenter (Sackett, 1979). However, the benefits of testing the indicators in evaluations of existing programs outweighs some of this potential bias. Also, the methods and data collection, analyses, and interpretation

processes were mediated by guidance and review of the author's doctoral supervisors, local stakeholders, and other experts. Other potential methods for the research that were considered included the development of a mixed methods survey for a panel of experts with expertise in evaluation and education. The survey would allow the experts to rate the proposed outcome indicators based on a set of criteria of quality and feasibility. The main disadvantage of this approach was the lack of a specific context against which the outcome indicators would need to be judged, which would have likely resulted in inconsistent and unreliable results.

3.4.3 Case selection

At the outset of the research, it was determined that the timeline and resources available would allow for the inclusion of two case studies, each of which would be a distinct evaluation of an existing disaster education program for children. To add breadth to the inquiry, one case study would be an in-depth study of program impact and the other an in-depth study of program implementation. To contribute new knowledge that would be generalizable to a variety of organizations, government agencies, and stakeholders, and to develop outcome indicators that would have potential for iterative testing in the future, it was determined that the programs evaluated should ideally be on-going disaster education programs of large scale, with the potential for delivery to a large number of children. Feasibility, funding, location, and accessibility to research participants were also major determinants of the case study selection.

ShakeOut, an event held in Washington State in 2012 with the participation of several school districts, was chosen for the case study evaluation of program impact.

ShakeOut is an annual, one-day event promoted on a central website (http://www.shakeout.org/) that encourages residents to collectively practice an earthquake drill, and in some cases a tsunami drill, at a designated date and time. In addition to instructions about correct protective actions, the ShakeOut website also provides information on the reasoning behind the recommended practice and other disaster preparedness strategies. Initiated in California in 2008, ShakeOut is now organized in many other seismically-active areas, including several U.S. states and regions, New Zealand, Guam, southern Italy, and Japan. Two coastal school districts in Grays Harbor County, Washington that have a seismic and tsunami risk served as the population for the study. Although schools in Grays Harbor County annually conduct earthquake and tsunami drills, schools' participation in the 2012 ShakeOut event provided a unique opportunity to evaluate the outcomes of an identical earthquake and tsunami drill practiced in two school districts at the same date and time, garnering a large population for the study. The participation of schools in ShakeOut was ideal for study because school-based emergency drills are one of the most prevalent forms of disaster education for children worldwide. Therefore, the findings of this evaluation have potential value to schools internationally that use earthquake and tsunami drills to teach children self-protective actions for the purpose of preventing injuries and deaths during disasters.

The case study evaluation of program implementation featured *What's the Plan, Stan?*, a free, curriculum-based resource for teaching disaster science and preparedness to students in Years 1 to 8 in New Zealand primary schools. In 2011, the author undertook a process evaluation of *What's the Plan, Stan?* as an Ian Axford Fellow in Public Policy

based in the Ministry of Civil Defence and Emergency Management. The 7-month

project resulted in a public report of results garnered from basic thematic analysis of

focus group discussions with teachers and interviews with local civil defence staff

(Johnson, 2011). The case study evaluation presented in the thesis used the original focus

group and interview transcripts in addition to findings of a national survey research on

What's the Plan, Stan? conducted by the Department of Internal Affairs in 2012

(Renwick, 2012) for an original analysis. Two raters coding the two data sets in NVivo

software led to a more rigorous thematic analysis (Peace & van Hoven, 2005). *What's the*

Plan, Stan? was ideal for study because it is an example of a large-scale initiative to

nationally integrate disaster education in school curricula using voluntary teaching

resources. Further, when disaster education programs are used nationally, larger scale

reviews[2] appear to indicate that most countries that desire, or are tracking towards, large-

scale implementation continue to disseminate resources for voluntary inclusion in the

curriculum. Thus, the findings are applicable to other national governments and local

emergency management agencies attempting curricular integration as part of efforts to

achieve the Core Indicators of progress established in the United Nations *2005-2015*

Hyogo Framework for Action (UNISDR, 2005).

3.5   Theory

The research was mixed methods but rested primarily on qualitative determinants.

Thus, the research aligned with the related theories of interpretivism and constructivism.

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[2] This includes a progress report on Priority for Action (PFA) 3 - Core Indicator (CI) 2 ("School curricula, education material and relevant training include disaster risk reduction and recovery currently in preparation") for the United Nations International Strategy for Disaster Risk Reduction *2005-2015 Hyogo Framework For Action* HFA (Ronan, Petal, Johnson, et al., 2014).

Oliver states that from the interpretivist perspective, there are no predetermined social facts that can be collected and analyzed, but rather, "the social world exists in a state of fluid interaction, that has to be interpreted to be at least partially understood" (Oliver, 2008, p. 23). The research was based on the premise that to understand and identify better methods of evaluating disaster education programs, data and observations of evaluation practice must be interpreted, and these interpretations are framed by the belief that the state of evaluation practice, including the knowledge, beliefs and actions of its actors, is dynamic. Using the case study approach, the research also aligned with constructivism, in that the case studies were used as a mechanism for constructing knowledge and hidden meanings from observations of an object or process as it operates (Mertens & Wilson, 2012, p. 143). Constructivism is the premise that "humans construct meaning of their experiences and situation," and while each individual has a different concept of external reality, there are some commonalities in these experiences that create socially constructed knowledge (Mathison, 2005, p. 81). Together, these theoretical paradigms supported the conceptual framework for the research, including the basis for how the data was collected and analyzed, and how the findings can be understood.

The research also dealt extensively with evaluation theory. Evaluation is "an applied inquiry process for collecting and synthesizing evidence that culminates in conclusions about the state of affairs, value, merit, worth, significance, or quality of a program, product, person, policy or plan" (Fournier, 2005, p. 139). According to Fournier (2005, p. 139), evaluation research includes both an empirical aspect of inquiry and a normative aspect of judging the value of something, and the value feature is what distinguishes evaluation from other forms of empirical research. Evaluation theory forms

the basis and guiding principles for evaluation practice, which is concerned with the formal process of evaluation in a discipline or organization (Mathison, 2005, p. 142). Evaluation theory also defines what is considered to be acceptable evidence for making decisions about the object of an evaluation (Smith & Brandon, 2008). Evaluation practice includes the study of many different types of evaluands, including programs, projects, policies, products, processes, and personnel. This research focuses on program theory and evaluation. Theory-driven evaluation served as the framework for the two case study evaluations, and is described in more detail in Chapter 5. Theory-driven evaluation includes the use of logic models and other program theory models to develop outcome indicators that measure how the program works and how program outcomes are understood to contribute to potential or actual impacts, which may be beneficial or detrimental (Mertens & Wilson, 2012). Outcomes are also distinguished as outcomes of impact, such as learning, behavior change, and community action, and outcomes of process or implementation, such as the program feasibility, uptake, and client satisfaction.

Evaluation theories, also known as evaluation "models" and "approaches" (Alkin, 2004), embody several different paradigms that guide the process of investigation and choice of research and analysis methods. Three main theoretical branches of program evaluation that relate to this research include the empiricist, pragmatic, and constructivist paradigms. The *empiricist paradigm* of evaluation primarily focuses on the use of quantitative data collection and experimental and quasi-experimental designs, which feature characteristics of scientific experimentation such as random sampling and random assignment, control groups, and statistical analysis techniques to determine cause-and-

effect relationships (Mertens, 2009). From an epistemological standpoint, empiricists rely on sensory knowledge in evaluation and consider experiments and observation superior to opinion, beliefs, and reasoning (Mathison, 2005, p. 124). Evaluators of the *pragmatic paradigm* primarily focus on collecting data that is useful to policy makers and stakeholders (Mertens & Wilson, 2012, p. 41). Morgan (2007) suggests that pragmatists adhere to the principle that an evaluation is not about discovering "truth," but about revealing information that is useful to the intended audience for the purposes of decision-making. The *constructivist paradigm*, also referred to as the *interpretivist* paradigm (Greene & Caracelli, 1997) emphasizes the use of qualitative methods to identify multiple perspectives and construct theories of outcomes. According to Creswell and Miller (2000, pp. 125-126) constructivists believe in "pluralistic, interpretive, open-ended and contextualized (e.g., sensitive to place and situation) perspectives toward reality." Constructivists generally use qualitative, participatory methods such as observations, interviews, focus groups, and document analysis (Mertens & Wilson 2012, p. 136).

Purist scholars believe it is inappropriate to "mix and match" paradigms in conducting an evaluation, because the paradigms are different, incompatible stances about human nature and "may well result in nonsense approaches and conclusions" (Guba & Lincoln, 2001, p. 2). In contrast, some scholars argue that the boundaries between the paradigms and their approaches are not clear-cut and in many cases, can overlap (Mertens & Wilson, 2012, p. 37). *Pragmatic* scholars contend there are philosophical differences among paradigms, but the differences are not important; they believe mixed methods of inquiry are not only possible, but may be the most effective approach to the inquiry (Greene & Caracelli, 1997, p. 8). *Dialectical* scholars believe the

paradigm differences are important and should be deliberately used within and across studies to achieve understanding (Greene & Caracelli, 1997, p. 8).

As a case study approach for constructing, testing, and assessing the quality and feasibility of program theory models and outcomes indicators, the research is based on the pragmatic standpoint that mixed methods are the most effective approach to addressing the research question. The theoretical paradigms of the two case study evaluations presented in Chapters 6 and 7 also stem from a pragmatic stance that mixed methods are an ideal approach to evaluating the impact and implementation of disaster education programs for children. The choice of evaluation paradigms for the two case study evaluations is described in more detail in the following section.

3.6   Methods

The following section describes methodological details of the four main components of the case study research, including each components's conceptual framework, research questions, theoretical paradigm, research methods, and analysis methods.

3.6.1   Methodological literature review (Chapter 4 / Paper 1)

The objective of the methodological review was to create a categorization of the operational components of the existing body of evaluation research to characterize how scholars and practitioners have traditionally assessed the impact and implementation of disaster education programs for children. The studies' research methods were investigated to "identify key variables, measures, and methods of analysis and inform

outcomes-oriented research" (Randolph, 2009, p. 2). This approach is similar to the work

of constructivist scholars Shadish, Cook, and Leviton (1990) and Christie (2003), who

developed categorizations of evaluation models and theories of evaluation through

mining evaluations. The review examines the strengths and weaknesses of previous

studies and distinguishes the gaps in the evidence base that, at the outset of the research,

were not well-defined. Table 3.2 displays the operationalization of the methodological

literature review. The research purpose includes *description* and *exploration*, categories

Shields and Tajalli (2006) use to describe conceptual frameworks of research that include

descriptive categories, which are classifications of data developed through qualitative

analysis, and *working hypotheses*, which are a "provisional, working means of advancing

investigation" (Dewey, 1938, p. 142, as cited in Shields and Tajalli, 2006, p. 320).

Table 3.2

Operationalization of the methodological literature review

Research Purpose	Research Questions	Conceptual Framework	Method-ology	Analysis Technique
Description	*What are the method traditions?* *What are the theoretical constructs of the evaluation studies?* *What outcome indicators have been used to measure impact and implementation?* *What data collection tools have been used, particularly in research with children?* *What are the common research limitations?*	Descriptive categories	Categor-ization	Coding
Exploration	*What is the current state of evaluation practice for disaster education programs for children?* *What are the strengths and weaknesses of outcome indicators used to date?* *What themes emerge across the categorized data?* *What are the promising research methods and data collection tools?* *What are the gaps in the evidence base?*	Working hypotheses	Content analysis	Thematic analysis

Note. Adapted from microconceptual framework tables and research method categories in "Intermediate Theory: The Missing Link in Successful Student Scholarship," by P. M. Shields and H. Tajalli, 2006, *Journal of Public Affairs Education*, 12(3), pp. 313-334.

The methodological literature review represents an *exhaustive review with selective citations*, where the researchers "define the population in such a way that it is bounded and the number of articles to review is manageable" (Cooper, 1988, as cited in Randolph, 2009, p. 4). The search definition was "quantitative and qualitative evaluations

of disaster education programs for children," using the dissertation's operational definition of a disaster education program for children.[3] This review includes English language evaluations of the impacts and implementation of disaster education programs for children age 18 and younger. *Evaluation* is liberally defined as "an implied inquiry process for collecting and synthesizing evidence that culminates in conclusions about the state of affairs, value, merit, worth, significance, or quality of a program" (Fournier, 2005, p. 139-40). For inclusion, studies had to involve children (age 18 and younger), or children's teachers or parents. Because many children's programs are developed by non-formal educators such as emergency management agencies, this literature review also included unpublished evaluations from the grey literature found through Internet searches and email inquiries to program coordinators.

Articles and reports were identified through a broad, multi-faceted search strategy. First, academic databases were searched including Scopus, Web of Knowledge, and Academic Search Premier. Each search was refined to articles written in English using a combination of the words evaluat* or assess*; child*, youth, or teen*; interview*, focus groups, survey*, observation*, or questionn*; curricul*, educat*, or teach*; and hazard*, safety, or disaster*. These searches yielded more than 40,000 results, and the results were further refined using the individual search terms earthquake*, volcan*, fire*, tsunami*, hurricane*, storm*, flood*, and tornado*. The U.S. Department of Education's Educational Resources Information Center (ERIC) was also searched using the terms

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[3] For the purpose of this research, "disaster education," also referred to by some scholars as "hazards education," is used as short hand for a public or curricular education initiative that includes the theory and practice of teaching two incorporated subjects: 1) disaster and hazard risks and 2) disaster risk reduction, preparedness, and/or protective actions. In practice, it is common for programs described as disaster or hazards education to teach only the causes of disasters; however, these programs do not meet the definition of disaster education for the purpose of this research.

children, disaster, hazard, and evaluation. The detailed numerical results of the search strategy are provided in Chapter 4, Table 4.1.

Once duplicates were removed, the titles of 2,838 articles were reviewed. Originally, it was expected that the review would include studies evaluating a wide range of hazards and safety-oriented educational programs for children. However, the search generated more articles about disaster education programs than expected. Therefore, studies of educational programs on other safety and hazards-related topics, such as household fire safety, gun safety, and prevention of unintentional injuries, were excluded. Consequently, the titles were refined to 354 abstracts for potential inclusion. Studies were then excluded if they did not assess the effectiveness or implementation of an education intervention. Also, the reference lists of other literature reviews and case study reports were reviewed, which yielded two additional evaluations. During this process, 33 papers met the inclusion criteria.

In addition, a Google search was performed using the titles of 50 disaster education programs for children listed in the 2011 version of FEMA's *Catalogue of Youth Disaster Preparedness Education Resources* (FEMA, 2013a), which yielded four additional reports for potential inclusion. Also, 42 program coordinators were emailed in May 2012 and invited to provide program evaluations, including informal studies and unpublished reports. Twenty-three program coordinators responded, including 12 who reported an evaluation had been done, although five could not share the results because the data were for internal use only or a report was not prepared. The other 11 coordinators indicated that an evaluation had not been done due to time, staff, and funding constraints. In total, seven papers were provided by email, including six reports

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that had already been identified and one new report. Lastly, the catalogue of the University of Delaware's Disaster Research Center library was searched, which yielded two additional studies from book chapters.

In total, 38 papers and reports, representing 35 distinct evaluation studies, met the inclusion criteria. Using a grounded theory approach (Strauss & Corbin, 1997), each paper was coded by two raters using more than 100 codes (see codes, Appendix 3) under variables comprising four main concepts of interest: 1) *program description*: developer type, content type, format, geographic location, and duration; 2) *evaluation context*: object, evaluator type, publisher type, evaluation type, and location; 3) *research design*: design type, data collection tools, research participants (including type, number, and demographics), sample response rate, outcome indicators, and analysis methods; and 4) *research outcomes*: study limitations and research conclusions. Two raters coded the articles independently and compared results to resolve inconsistencies. The results are presented in Chapter 4, a paper published in the *International Journal of Disaster Risk Reduction* (Johnson, Ronan, Johnston, & Peace, 2014c)

3.6.2   Development of program theory models (Chapter 5 / Paper 2)

The findings from the methodological review were used to guide the identification of evaluation models that could help address significant gaps in the evidence base and serve as the theoretical basis for the subsequent case studies. The methodological review of 35 evaluation studies identified a tradition of evaluation methods focused on measuring children's knowledge attainment, and a lack of attention to testing programs' major underlying assumptions. Chapter 5 (Johnson, Peace, Ronan, &

Johnston, 2014b) explores the key challenges to evaluating disaster education programs

for children and the potential benefits of applying theory-based evaluation techniques to

test underlying assumptions of program outcomes and impacts. Following a review of

some visual models for program theory development, including the logic model (Cooksy,

Gill, & Kelly, 2001), the program theory matrix (Funnell, 2000), and the stage step model

(Lipsey & Pollard, 1989), the paper provides detailed descriptions and worked examples

of two program theory models, which served as the basis for the two case study

evaluations respectively. The program theory modeling was used to illustrate the

advantages of building a visual program theory model to develop meaningful outcome

indicators of program impact and implementation. Table 3.3 displays the

operationalization of the program theory modeling, which explored a working hypothesis

for the purpose of research planning for the two case study evaluations.

Table 3.3

Operationalization of program theory modeling

Purpose	Research Questions	Conceptual Framework	Research Technique
Research planning: case study evaluations	*What models of evaluation could be used to test underlying assumptions and theoretical constructs of disaster education programs for children?* *What outcome indicators could be used to measure learning and behavioral outcomes of ShakeOut?* *What outcome indicators could be used to measure process outcomes of What's the Plan, Stan?*	Working hypothesis	Program theory modeling

Note. Adapted from microconceptual framework tables and research method categories in "Intermediate Theory: The Missing Link in Successful Student Scholarship," by P. M. Shields and H. Tajalli, 2006, *Journal of Public Affairs Education*, 12(3), pp. 313-334.

The interpretivist paradigm guided the modeling process, and followed the constructivist stance, described by Astbury and Leeuw (2010, p. 375), that "theorizing with mechanisms strengthens our understanding of how and why programs work, with whom and under what circumstances." The first model, a program theory matrix, was used to construct a program theory of Shakeout, a school-based earthquake and tsunami drill. A program theory matrix includes a visual graph of a hierarchy of intended program outcomes and a complementary table that includes a series of questions related to program theories and methodological variables such as potential data sources, evaluative success criteria, and external factors that may influence the outcomes (Funnell, 2000, pp. 92-93). Some of these questions include *What would success look like?* and *What are the factors that influence the achievement of each outcome?*, which are used to consider measurements of success at all levels of the hierarchy of intended outcomes (Funnell, 2000, p. 92). In this case, the questions and variables in the matrix were used to consider and produce the outcome indicators for the ShakeOut evaluation.

The second model, a stage step model, was used to construct an implementation theory of a national voluntary teaching resource, *What's the Plan, Stan?* The stage step model is a visual depiction of the major stages and statuses through which people progress in the context of interest, such as participation in a program (Lipsey & Pollard, 1989, p. 321). The model links the activities and outcomes of the program's implementation to the desired goals of resource awareness and use. The stage step model depicting the implementation theory of *What's the Plan, Stan?* was reconstructed from Ministry of Civil Defence and Emergency Management's *What's the Plan, Stan? Communications Strategy for 2009 Launch* (MCDEM, 2009a). The *Strategy* focuses

heavily on the notion that promotion of the resource through seminars, print advertising, media, and student competitions would maximize awareness of the resource, which would in turn increase uptake and use of the resource. The model illustrates this theory and highlights the other unknown intervening factors between resource promotion and resource use. The unknown factors were represented as intervening, facilitating, and deterrent factors to resource awareness and use and served as the focus of the evaluation and the framework for the qualitative analysis.

3.6.3 Case study 1: Quantitative quasi-experimental evaluation of program impact (Chapter 5 / Paper 3)

A quantitative quasi-experimental research design was used to assess the role of the disaster education program, ShakeOut, in improving or maintaining children's accurate risk perceptions and self-protective skills for disaster response. The case study evaluation also had two other objectives: first, to test a new set of outcome indicators intended to measure children's application of their knowledge of self-protective actions, and second, to test the quality and feasibility of a quantitative survey with children age 10 and older for use in drill evaluations (which are typically evaluated through observation). Table 3.4 displays the operationalization of the study, which addressed two conceptual frameworks described by Shields and Tajalli (2006): *working hypotheses*, which matches the research process of addressing exploratory questions about children's adaptive response capacities learned from school drills, and *practical ideal type*, which corresponds to the research process of comparing the outcome indicators to criteria of quality and feasibility. The criteria are adapted from a set of criteria developed by Wall et al. (2010) and are discussed further in the Analysis section (3.7).

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Table 3.4

Operationalization of the first case study evaluation: a quasi-experimental evaluation of ShakeOut, an earthquake and tsunami drill in two Washington State school districts

Research Purpose	Evaluation Research Questions	Conceptual Framework	Methodology	Analysis Technique
Exploration	*Do school-based drills improve children's self-protective skills for earthquakes and tsunamis?* *Based on what they learn in drills, can children apply their knowledge of self-protective actions to identify correct and incorrect response behaviors in different earthquake scenarios?* *Do drills help children understand the causes of injury?* *Do drills change children's levels of upset when thinking or talking about disasters?* *How can learning outcomes from earthquake drills be improved?* *Can adaptive response capacities in children be measured using a quantitative survey method?* *How can evaluation methods for drills be improved?*	Working hypotheses	Quantitative one group pretest/posttest quantitative questionnaire Teacher posttest	Statistical analysis
Gauging	*Can adaptive response capacities in children be measured using a quantitative survey method?* *What are the quality and feasibility of the outcome indicators?*	Practical ideal type	Case study	Comparison against criteria of quality and feasibility

Note. Adapted from microconceptual framework tables and research method categories in "Intermediate Theory: The Missing Link in Successful Student Scholarship," by P. M. Shields and H. Tajalli, 2006, *Journal of Public Affairs Education*, 12(3), pp. 313-334.

The evaluation embodied principles of both the empiricist and pragmatic paradigms. A one group quasi-experimental study using a quantitative questionnaire was designed to evaluate the program's impact on children's adaptive response capacities learned before and during the ShakeOut drill. The evaluation was based in an empiricist paradigm by using quantitative methods, measurement, and statistical analysis to test working hypotheses about human behavior. However, the study was also pragmatic in that it purposely used a one group pretest-posttest design to carry out the research, which was determined to be sufficient and more feasible than a randomized experimental design to gather data on the outcome indicators. A randomized experimental study would not have been possible to carry out since the schools expected all children to participate in ShakeOut.

The evaluation used matched pretest and posttest questionnaires in order to assess population level and individual differences in knowledge and scenario-based knowledge application as a result of the ShakeOut drill. The population was 624 students, age 10 and older, from North Beach and Ocosta School Districts in Washington. Both campuses have a seismic and tsunami risk and practice vertical evacuation for tsunamis by moving to the highest building floor on the school campus. Both school districts conduct school-wide earthquake and tsunami drills biannually and students and staff were informed of the drills in advance. Although teachers are encouraged by their school principals to teach earthquake and tsunami science and preparedness to their students, there was no requirement to do this as part of the schools' participation in ShakeOut, which was a one-day, annual event.

As part of adherence to the high-risk human ethics procedures for this research, students, teachers, and parents received information sheets about the evaluation (Appendix 2) in advance and were provided an in-person opportunity at the schools to learn more about the evaluation. Following human ethics approval, parent consent for children's participation was obtained through passive consent, where parent consent was assumed unless a parent returned a non-consent form (Appendix 2) indicating their child's abstention from the evaluation. The children were provided the opportunity to decline participation in the evaluation at any time before or during administration of both the pretest and posttest questionnaires. When the questionnaires were administered during the evaluation, a set of directions was read aloud to children clarifying that their answers would not be graded and the results would be anonymous.

Because a quantitative, written questionnaire was chosen as the most feasible data collection tool, the study participants were limited to students age ten and older. Bell (2007) provides evidence that survey research can be effectively conducted with children age seven and older, and if adapted and age-appropriate, quantitative questionnaires can yield results that are valid (i.e., accurately reflecting the intention of the question) and reliable (i.e., replicable using a similar survey). To increase the validity and reliability of the tools, the questionnaires (see Appendix 4) followed guidelines for designing questionnaires for children (Bell, 2007; Borgers & Hox, 2001; Borgers, Hox, & Sikkel, 2003) For example, they were prepared at a 6th grade reading level; the question length and wording was kept as short and simple as possible, using unambiguous language; 'I don't know' and 'Not sure' were added to answer selections where appropriate to reduce the demand on children's cognition or memory; ambiguous suggestions and connotations

were avoided; the number of answer selections and scales were limited to no more than six, and each scale was labeled; and the order of response options was mixed so correct answers were not always at the top. The questionnaire was piloted with a small classroom of children aged 10 to 12 in Washington State following guidelines for pretesting questionnaires with children (Bell, 2007; De Leeuw, Borgers, & Smits, 2004). The pilot test checked for item non-response, unexpected findings, and inconsistency in individuals' responses.

The student questionnaires were designed to assess children's knowledge, risk perceptions, and application of their knowledge and risk perceptions in theoretical situations. The questions examined students' knowledge and perceptions of: 1) protective actions for earthquakes and tsunami, 2) actions they should take and actions to avoid during earthquakes and tsunami when inside and outside buildings, 3) the causes of injury during earthquakes, and 4) what "drop, cover, and hold on" means and why this action is practiced. They were also asked questions about their exposure to education on disaster preparedness, their individual actions during the ShakeOut drill, their degree of upset feelings when thinking or talking about disasters, what they intend to do if an earthquake happens while they are at home, and their perception of how much they knew about earthquake and tsunami preparedness before and after ShakeOut.

Considering children's potential sensitivity to the topics in the questionnaires, access limitations of the evaluator, and the goal to achieve a high response rate, it was ideal for the students' teachers to administer the questionnaires. After permission was obtained from the school districts' Superintendents, 29 school teachers (representing all

full-time teachers excluding special education teachers), were recruited to serve as volunteer questionnaire administrators for the evaluation.

The teachers were also provided an eight question post-ShakeOut questionnaire that gathered information about their experience and classroom activities. The results of this questionnaire provided additional information on how much exposure students had to earthquake and tsunami-related classroom lessons just before, during, and after ShakeOut. It also documented students' exposure to a review of the correct answer key for the student questionnaire, which were provided to teachers before the evaluation began. Teachers were also asked their feelings when discussing or thinking about earthquakes and tsunami, and their opinion on the frequency of school disaster drills.

Teachers collected completed questionnaires from 574 students, a 92% response rate from the total population of 624 students. Of the 574 participants, 74% completed both a pretest and posttest (n=428), 12% completed a pretest only (n=67) and 14% completed a posttest only (n=79). In total, 495 students completed pretests and 507 completed posttests.

The data were analyzed in two ways. Chapter 6 (Johnson, Johnston, Ronan, & Peace, 2014a) describes the statistical analysis and comparison of both population-level and individual-level changes in children's responses to the questionnaires, an approach used to examine children's maintenance and improvements in correct knowledge, as well as maintenance of incorrect knowledge and changes from correct to incorrect answers after ShakeOut. Also, a GNS Science Report, which is not part of the thesis, describes an analysis of the differences in children's responses based on children's exposure or lack of

exposure to the questionnaire answers before the posttest (Johnson, 2013); the relevant results of this analysis are included in Chapter 6 (Johnson et al., 2014a). More advanced statistical techniques such as analyses of statistical significance were considered; however, basic statistical analyses were seen as more fundamental to the overall purpose of the dissertation and the pragmatic approach of the evaluation.

3.6.4   Case study 2: Mixed methods evaluation with qualitative analysis of program implementation (Chapter 7 / Paper 4)

An evaluation using mixed method data and qualitative analysis was designed to assess the process of national implementation of *What's the Plan, Stan?,* a voluntary teaching resource distributed to New Zealand primary schools for the purpose of integrating disaster education into school curricula. Table 3.5 displays the operationalization of the study, which includes two conceptual frameworks, described by Shields and Tajalli (2006): *descriptive categories*, which corresponds with the qualitative categorization of the data to identify influencing factors to the program's uptake and use, and *practical ideal type*, which corresponds to the research process of comparing the outcome indicators to criteria of quality and feasibility. The criteria are adapted from a set of criteria developed by Wall et al. (2010) and are discussed further in the Analysis section (3.7).

The evaluation analyzes data and findings from two distinct sets of data on uptake and use of *What's the Plan, Stan?* in primary schools. The first set of data is from a study conducted by the author in 2011 using focus group and interview methods to gather in-depth perspectives from primary school teachers and local civil defence and emergency

management staff to identify motivators and challenges to use of the resource (Johnson, 2011). The other set of data is findings from a national cross-sectional survey of schools conducted by the Research and Evaluation Services, Strategy and Governance Branch of the Department of Internal Affairs in 2012 (Renwick, 2012). The intention of this study was to gather nationally representative data on use of the resource in schools.

Table 3.5

Operationalization of the second case study evaluation: a qualitative, mixed methods evaluation of What's the Plan, Stan?, a national voluntary teaching resource

Research Purpose	Evaluation Research Questions	Conceptual Framework	Methodology	Analysis Technique
Description	*What are the intervening, facilitating and deterrent factors of school teachers' awareness and use of the resource?* *How can the integration of disaster education in school curricula be improved?* *How can evaluation of program implementation be improved?*	Descriptive categories	Raw data from a study by Johnson (2011): • Focus groups with teachers • Follow-up survey with teachers • Individual interviews with civil defence staff Findings from a cross-sectional national survey by the Department of Internal Affairs (Renwick 2012)	Coding and thematic analysis
Gauging	*What are the quality and feasibility of the outcome indicators?*	Practical ideal type	Case study	Comparison against criteria of quality and feasibility

Note. Adapted from microconceptual framework tables and research method categories in "Intermediate Theory: The Missing Link in Successful Student Scholarship," by P. M. Shields and H. Tajalli, 2006, *Journal of Public Affairs Education*, 12(3), pp. 313-334.

Based on the stage step model developed for the evaluation, discussed previously, data and findings from the two studies were analyzed to develop a typology of intervening, facilitating, and deterrent factors to primary school teachers' awareness and use of the resource. The original focus group and interview transcripts and the findings of the national survey were coded and analyzed in NVivo software (see codes, Appendix 5). Following a constructivist paradigm, the study aimed to identify underlying ideas, conceptualizations, and theories through a process Braun and Clarke (2006, p. 84) define as "thematic analysis at the latent level." Before analysis began, the lead author developed 12 main codes under the three main categories of intervening, facilitating, and deterrent factors of use, which served as the study's conceptual framework. The prevalence of particular concepts, words, and phrases for each code were interpreted to create 77 sub-codes. Working separately, two raters used NVivo software for coding to increase the dependability and credibility of the coding process and thematic analysis (Lincoln & Guba, 1985; Peace & van Hoven, 2005). During the coding process, each document was reviewed three times. The analysis resulted in the identification of three main intervening factors between resource promotion and awareness, and eight main facilitating and deterrent factors, respectively, that exist between teachers' awareness and use of the resource. The factors serve as the basis for several policy recommendations on ways to increase the awareness, uptake, and ongoing use of the *What's the Plan, Stan?* resource.

3.7   Analysis

The overarching research question of the research is: *How can we measure the outcomes and societal impacts of disaster education programs for children?* In this research, original program theory models and outcome indicators were developed, modeled, and tested in two case studies of evaluations to determine their effectiveness and feasibility in measuring learning and implementation outcomes that could lead to the programs' intended societal impacts.

In the respective case study evaluation chapters (Chapters 6 and 7), the strengths and weaknesses of the program theory models and outcome indicators are described using a set of criteria adapted from a model developed by Wall et al. (2010, pp. 6-7). Wall's criteria were originally used by a group of scholars and practitioners to judge the quality and feasibility of proposed outcome indicators that would be used in evaluations of state and local emergency response systems. The adapted criteria include:

- *Strength of the scientific evidence:* reflecting the extent to which the literature supports the use of the indicator;
- *Conformity with accepted practice:* reflecting the degree to which use of the indicator is consistent with current evaluation practice;
- *Reliability*: reflecting the evaluator's estimation of the extent to which the indicator would garner consistent results;
- *Face validity:* reflecting the evaluator's estimation of the extent to which judgments about and measurement of the indicator would appear valid and

relevant to policy makers and other stakeholders who use the results of an

evaluation to justify continued support of policy and program approaches;

- *Affectivity:* reflecting the potential for the indicator to affect a negative or
  unpleasant emotional reaction among research participants, namely children;

- *Resources needed:* reflecting the amount of money, time, and effort needed to
  collect reliable and precise data on the indicator and to analyze primary or
  secondary data;

- *Utility:* reflecting the extent to which the evaluator believes that the indicator
  would help to answer key evaluation questions;

- *User-friendliness*: reflecting the evaluator's opinion of the level of technical
  knowledge needed to understand and analyze results from the indicator; and

- *Overall quality:* reflecting the evaluator's opinion.

Chapters 6 and 7 respectively provide a discussion, following the body of the

evaluation paper, on the evaluative outcome indicator's strengths and weaknesses against

each of the criterion. Recommendations are then provided on how the outcome

indicators and research methods could be refined and improved. In the Conclusion

chapter (Chapter 8), the findings from the case study evaluations are compared and

contrasted to findings in previous research to illuminate the contribution of this research

to the cumulative body of knowledge on evaluating disaster education programs for

children. The Conclusion chapter closes with a discussion of opportunities for future

research.

3.8   Link to Chapter 4: Paper 1

Chapters 1 and 2 provided an overview of major underlying theories of disaster education for children and the gaps in the literature, and Chapter 3 provided details on the theories, design, methods, and conceptual framework of the research. Chapter 4 is the first paper, a methodological literature review of 35 evaluations identified in the published and grey literature (Johnson et al., 2014c). This paper analyzes the methodological components of the evaluation in order to characterize the state of the art in evaluation of disaster education programs for children and identify the strengths and weaknesses of current approaches.

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Chapter 4: Paper 1 Evaluations of Disaster Education Programs for Children: A Methodological Review

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Abstract

The purpose of this methodological literature review was to investigate how scholars and practitioners currently measure and judge the effectiveness of disaster education programs for children through evaluation. From a systematic search of the published and grey literature, 35 studies were identified and analyzed to develop a categorization of the operational components of the existing body of research, including the types and sources of evaluations, research methods and designs, research participants, outcome indicators, approaches to analysis, and research limitations. A significant finding is that most of what is known about the effectiveness of disaster education programs for children is based on the results of quantitative studies with children that generally focused on measuring children's knowledge of disaster risks and protective actions and child reports of preparedness actions. The majority of descriptive and quasi-

experimental studies concluded that programs were effective based on the portion or positive change in children's correct answers on surveys, and most correlational studies concluded positive outcomes such as household preparedness were associated with children's participation in disaster education programs. However, many of the studies had significant methodological limitations. While there is evidence of valuable knowledge change, there is still very limited empirical evidence of how disaster education programs facilitate children's roles in household preparedness, their self-protective capacities, or their likelihood of preparing for disasters as adults. In addition to the need to identify and refine program theory and meaningful outcome indicators, the authors suggest several other opportunities for future research.

4.1   Introduction

Research has found that advanced preparations for disasters can save lives, reduce injuries, and prevent damage to property and critical infrastructure, enabling communities to recover more quickly (Peek & Mileti, 2002; Ronan & Johnston, 2005; Tierney et al. 2001). Disaster education, which includes education on disaster risks, mitigation, and preparedness strategies, is one approach to reducing the negative consequences of disasters (Mulyasari et al., 2011; Smith 1993). According the United Nations' *2005-2015 Hyogo Framework for Action*, the objective of disaster education is "to build a culture of safety and resilience at all levels," in order to reduce the adverse social and economic impacts of hazards (UNISDR, 2005, p. 6). Disaster education programs and media have historically targeted adults with information on disaster risks and ways to prepare their families, such as creating family emergency plans, purchasing home and rental insurance, and stockpiling food, water and supplies (Faupel et al., 1992; Mileti et al., 2004). Despite

these longstanding education efforts, household preparedness levels have remained low

and generally unchanged, even while the costs and dangers of catastrophic disasters have

increased (Paton et al., 2010), indicating public education is failing to motivate adults to

take preparedness measures.

Over the last decade, emergency management agencies, schools and non-

governmental organizations have increasingly targeted children as an audience for

disaster education (Lintner, 2006; Mitchell et al., 2008; National Commission, 2010;

Sharpe & Kellman, 2011; Shiwaku & Fernandez, 2011; UNESCO, 2013; UNISDR,

2007b). According to the UNICEF and UNISDR (2011, p. 19), disaster education

programs for children intend to "contribute to a drastic shift in mentalities and

perceptions as well as behavioral change towards a more proactive preventative approach

to disasters." Recently, the United States Federal Emergency Management Agency

(2013a) and UNICEF (Selby & Kagawa, 2012) have documented a wide range of disaster

education programs for children globally, including formal and informal community,

school-based, and extracurricular programs supported by government or private sector

funding. The increasing development and investment in disaster education programs for

children reflect an international consensus that these educational initiatives produce some

gain in individual and community resilience to disasters (Wisner, 2006). However,

several authors conclude there is very little formal evaluation of these programs and their

effectiveness achieving desired learning and behavioral outcomes (FEMA, 2010a; Ronan

& Johnston, 2005; Ronan & Towers, 2014; Selby & Kagawa, 2012).

Although research in this area is growing, there is currently no scholarly

consensus on what counts as credible evidence of effectiveness of disaster education

programs for children (for a related discussion, see Donaldson, Christie, & Mark, 2009). In a case study of school-based disaster education in 30 countries, Selby and Kagawa (2012, p. 35) concluded, "assessment of student learning is the least considered and least developed element of disaster risk reduction education." One area requiring further examination is the development of measurable program outcomes that explicitly link children's learning to improvements in disaster preparedness, and outcomes during and after disasters. Another is the identification of practical and effective evaluation methodologies, particularly age-appropriate data collection methods to assess indicators of children's disaster resilience.

The purpose of this methodological literature review is to investigate how scholars and practitioners currently measure and judge the effectiveness of disaster education programs for children through evaluation. The extent of the existing body of research on disaster education for children is not well defined. The few commonly cited studies of disaster education for children, particularly those by Ronan, Johnston and colleagues, have reported preliminary findings based on both correlational (Ronan et al., 2001, 2010; Ronan & Johnston, 2001a) and quasi-experimental studies (Ronan et al., 2012; Ronan & Johnston, 2003). However, as these authors themselves conclude, more research is necessary to identify casual relationships between children's education and improvements in individual and community disaster resilience. Since many disaster education programs have been developed by non-formal educators, such as emergency management agencies and child protection organizations, program evaluations may exist in the grey literature in the form of government reports, internal studies, and white papers (Rogers, Petrosino, Huebner, & Hacsi, 2000, p. 10). Therefore, the review presented here

results from a broad and systematic search for both published and unpublished studies that evaluate the impacts and implementation of disaster education programs for children.

To characterize the current state of evaluation of disaster education programs for children, the studies were analyzed to develop a categorization of the operational components of the existing body of research, including the types and sources of evaluations, research methods and designs, research participants, outcome indicators, approaches to analysis, and research limitations. In particular, this study examines the types of outcome indicators used to measure program impacts. It also examines the data collection methods used in studies involving children to identify promising practices. In addition, the categorization of research limitations reported in the studies is used to identify common research constraints and possible solutions. On the basis of these findings, the authors suggest ways to improve the quality and breadth of evaluation of disaster education programs for children and opportunities for further research.

4.2   Method

For the purpose of this review, *disaster* is defined as a natural or human-caused hazard that causes "a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources" (UNISDR Terminology, 2007). By this definition, disasters include destructive events such as earthquakes, tsunamis, storms, hurricanes, tornados, wildfires, floods, pandemics, nuclear emergencies, chemical spills and terrorism, among others. *Disaster risk* is defined as the potential for negative impacts from disasters including loss

of life, injuries and damage to assets, functions and services (UNISDR Terminology, 2009).

This review includes evaluations of the impacts and implementation of disaster education programs for children age 18 and younger. *Evaluation* is liberally defined as "an implied inquiry process for collecting and synthesizing evidence that culminates in conclusions about the state of affairs, value, merit, worth, significance, or quality of a program" (Fournier, 2005, pp. 139-140). Studies were included in the review if they described a research design using surveys, questionnaires, interviews, focus groups, observations or content analysis, and research participants including children, or the teachers or parents of children, who participated in a disaster education program. *Disaster education program* is shorthand for an educational initiative that includes the practice of teaching two incorporated subjects: 1) disaster risks and 2) actions to mitigate or reduce injuries and damage from disasters. Education programs that teach only the science of natural hazards did not meet the definition of disaster education for the purpose of this review.

Articles and reports were identified through a broad, multi-faceted search strategy. First, academic databases were searched including Scopus, Web of Knowledge and Academic Search Premier. Each search was refined to articles written in English using a combination of the words *evaluat** or *assess**; *child**, *youth* or *teen**; *interview**, *focus groups*, *survey**, *observation**, or *questionn**; *curricul**, *educat** or *teach**; and *hazard**, *safety* or *disaster**. These searches yielded more than 40,000 results, and the results were further refined using the individual search terms *earthquake**, *volcan**, *fire**, *tsunami**, *hurricane**, *storm**, *flood** and *tornado**. The U.S. Department of Education's

Educational Resources Information Center (ERIC) was also searched using the terms
children, *disaster*, *hazard* and *evaluation*.

Once duplicates were removed, the titles of 2,838 articles were reviewed (see
Table 4.1). Originally it was expected that the review would include studies evaluating a
wide range of hazards and safety-oriented educational programs for children. However,
the search generated more articles about disaster education programs than expected.
Therefore, studies of educational programs on other safety and hazards-related topics,
such as household fire safety, gun safety, and prevention of unintentional injuries, were
excluded. Consequently, the titles were refined to 354 abstracts for potential inclusion.
Studies were then excluded if they did not assess the effectiveness or implementation of
an education intervention. Also, the reference lists of other literature reviews and case
study reports were reviewed which yielded two additional evaluations. During this
process, 33 papers met the inclusion criteria.

In addition, a Google search was performed using the titles of 50 disaster
education programs for children listed in the 2011 version of FEMA's *Catalogue of
Youth Disaster Preparedness Education Resources* (FEMA, 2013a), which yielded four
additional reports for potential inclusion. Also, 42 program coordinators were emailed in
May 2012 and invited to provide program evaluations, including informal studies and
unpublished reports. Twenty-three program coordinators responded, including 12 who
reported an evaluation had been done, although five could not share the results because
the data was for internal use only or a report was not prepared. The other 11 coordinators
indicated that an evaluation had not been done due to time, staff and funding constraints.
In total, seven papers were provided by email, including six reports that were already

identified and one additional report. Lastly, the catalogue of the University of Delaware's Disaster Research Center library was searched, which yielded two additional studies from book chapters.

In total, 38 papers met the inclusion criteria. Using a grounded theory approach (Strauss & Corbin, 1997), each paper was coded by two raters using more than 100 codes under variables comprising four main concepts of interest: 1) *program description*: developer type, content type, format, geographic location, duration; 2) *evaluation context*: object, evaluator type, publisher type, evaluation type and location; 3) *research design*: design type, data collection tools, research participants (including type, number and demographics), sample response rate, outcome indicators and analysis methods; and 4) *research outcomes*: study limitations and research conclusions. Two raters coded the articles independently and compared results to resolve inconsistencies. Several of the articles had vague or missing information for a number of variables and where this occurred is noted in the results.

Table 4.1

Literature search results

Source	Search criteria	Results	Refined by	Results	Titles	Abst.	Incl.
Scopus, Web of Knowledge, Academic Search Premier – Education Research, Educational Resources Information Center (May 2012)	*evaluat** or *assess**; AND *child**, *youth* or *teen**; AND *interview**, *focus groups, survey**, *observation**, or *questionn**; AND *curricul**, *educat** or *teach**; AND *hazard**, *safety* or *disaster**	45,543	*fire** *earthquake** *hurricane** *volcan** *tsunami** *storm** *flood** *tornado**	2,412 725 610 105 239 1,105 803 69	2,838 after dups. removed	354	33
Catalogue of Youth Disaster Preparedness Education Resources (2011 version)	Google search of 50 titles of disaster education programs	4			4	4	2
Catalogue of Youth Disaster Preparedness Education Resources (2011 version)	42 program coordinators identified and emailed (23 responded)	7			7	1	1
University of Delaware's Disaster Research Center library (Oct. 2012)	Catalogue search of 'disasters and children'; 'disaster education and children'; 'disaster and education and children'	411			33 after dups removed	8	2
					Total papers included		**38**

4.3   Results

The review identified 38 papers that describe evaluations of 40 disaster education programs for children, including 30 specific education programs and 10 cases of non-specific disaster education delivered in schools and communities. The 38 papers were categorized as 35 studies for the review as some studies were discussed in more than one paper. Table 4.2 provides a summary of the 35 studies.

The following results present themes identified from the coding process under the categories: disaster education program descriptions, evaluation contexts, research locations and participants, research designs, outcome indicators, study conclusions and research limitations.

Table 4.2

Summary of evaluations of disaster education programs for children

Study	Object	Type	Participants	Design	Data tools	Analysis	
(1) Do hypermedia systems really enhance learning? A case study on earthquake education (Frau, Midoro, & Pedemonte, 1992)	Effectiveness of a hypermedia system, *Terremoti* (Earthquakes) in producing meaningful learning	Impact and process	Teens, age 14-19 (36)	Mixed methods: • Quasi-experimental one group pretest-posttest • Descriptive interviews • Descriptive naturalistic observations	Mixed methods questionnaire Individual interviews Observations	Quantitative analysis basic[iv] Qualitative analysis	
(2) Correlates of hazard education programs for youth (Ronan & Johnston, 2001)	Effectiveness of non-specific school-based hazard education programs for youth in increasing community resilience	Impact	Children, age 7-13 (56) Parents	Correlational - observational study	Quantitative questionnaire	Quantitative analysis advanced[v] - multiple regression analyses	
(3) School children's risk perceptions and preparedness: A hazards education survey (Ronan et al., 2001)	Effectiveness of non-specific hazard education programs	Impact	Children, age 5-13 (409)	Correlational - observational study	Quantitative questionnaire	Quantitative analysis advanced - correlation analysis	

[iv] *'Quantitative analysis basic' includes basic mathematical methods such as counting, percentages and averages to describe resul*

[v] *'Quantitative analysis advanced' includes advanced statistical methods such as paired t-Tests, regression, chi-squared tests, ANO*

(4) Hazards education for youth: A quasi-experimental investigation (Ronan & Johnston, 2003)	Comparing the effectiveness of readings and classroom discussions on disasters vs. program supplemented with an explicit emergency management focus	Impact	Children, age 11-13 (219) Parents	Quasi-experimental -Treatment and control (intact groups) pretest/posttest design	Quantitative questionnaire	Quantitative analysis advanced - ANOVA frequency, t-tests
(5) Impact analysis of the Canadian Red Cross Expect the Unexpected program (Falkiner, 2003)	Effectiveness and implementation of the of the *Expect the Unexpected* program in Canada	Impact and process	Children, age 7-13 and parents (429 pairs) School teachers (14)	Correlational - observational study	Quantitative questionnaire	Quantitative analysis basic
(6) Linking experience, education, perception and earthquake preparedness (Shaw, Kobayashi, & Kobayashi, 2004)	Effectiveness of non-specific school-based disaster education in Japan	Impact	Teens, age 15-16 (1,065)	Correlational - observational study	Quantitative questionnaire	Quantitative analysis advanced - cross tabulation

(7) Basic Disaster Awareness In Turkish Schools Program 2003 - 2005 (TR Ministry of Education et al., 2005)	Effectiveness of the *Basic Disaster Awareness Curriculum* (Instructor's Handbook and CD) and implementation of cascading train-the-trainer program to train school teachers	Impact and process	Instructor trainees (9,000+) Instructors (114) School teachers (99) Children, age 10-14 (101) Teens, age 14-19 (400)	Mixed methods: • Quasi-experimental - One group pretest/posttest • Descriptive - surveys	Quantitative questionnaire Questionnaire – not specified	Quantitative analysis basic
(8) Children's risk perceptions and preparedness: Mt Rainier 2005 hazard education assessment, tabulated results (Johnston et al., 2005)	Effectiveness of non-specific school-based teaching on the lahar hazard	Impact	Children and Teens, ~ age 11-19 (84)	Descriptive - longitudinal time-lag	Quantitative questionnaire	Quantitative analysis basic
(9) Children's risk perceptions and preparedness: Mt Rainier 2006 hazard education assessment tabulated result (Johnston et al., 2006)	Effectiveness of non-specific teaching on disasters/hazards by parents and teachers	Impact	Children and Teens, ~ age 11-19 (356)	Descriptive - longitudinal time-lag	Quantitative questionnaire	Quantitative analysis basic

(10) Tsunami public awareness and the disaster management system of Sri Lanka (Kurita, Nakamura, Kodama, & Colombage, 2006)	Effectiveness of school-based disaster education in Sri Lanka (and other public education)	Impact and process	Children, ~ age 10 (1,112) School teachers (36)	Descriptive - survey	Quantitative questionnaire	Quantitative analysis advanced - chi-square
(11) Applicable methods in teaching earthquakes to preschool children (Izadkhah & Heshmati, 2007)	Impact of six different educational methods for teaching preschoolers about earthquakes	Impact and process	Children, age 5-6 (257) Instructors Parents	Mixed methods: • Descriptive - naturalistic observation • Descriptive - survey Descriptive - interviews	Observations Individual interviews Questionnaire -not specified (with parents)	Not specified
(12) Future perspective of school disaster education in Nepal (Shiwaku et al., 2007)	Effectiveness and implementation of the School Earthquake Safety Program (SESP) in Nepal	Impact	Teens, age 15-16 (452) Teachers	Mixed methods: • Correlational - observational study • Descriptive - interviews	Quantitative questionnaire Individual interviews	Quantitative analysis advanced - cross tabulation, chi-square
(13) How intercultural disaster reduction education change students: A case study of an evening course senior high school in Hyogo, Japan (Naya, 2007)	Effectiveness of a model of online international collaborative learning on disasters	Impact	Teens, ~age 17-18 (32)	Descriptive - case study	Observations	Case study

(14) Proactive co-learning: A new paradigm in disaster education (Shiwaku & Shaw, 2008)	Effectiveness of the Environment and Disaster Mitigation course at Maiko High School compared to courses in other high schools in Japan	Impact	Teens, age 15-16 (1,065)	Correlational - observational study	Quantitative questionnaire	Quantitative analysis advanced - cross tabulation
(15) Big Bird, Disaster Masters, and high school students taking charge: The social capacities of children in disasters education (Wachtendorf et al., 2008)	Effectiveness of the *Friends to the Rescue* Sesame Workshop video, *Masters of Disaster*, and *I Don't Fit Under the Desk: Advanced Earthquake Safety* video	Impact	n/a (case studies)	Descriptive - case study	Content review	Content analysis
(16) Emergency management in schools – Wellington survey (Coomer et al., 2008)	Implementation of non-specific hazards education in schools in the Wellington region	Process	School representatives (101)	Descriptive - survey	Mixed methods questionnaire	Quantitative analysis basic / Qualitative analysis - categorization
(17) READY Evaluation Report 2008 (Oganowski & Wycoff-Horn, 2008)	Impact of *READY Camp* and *READY Classes*	Impact and process	Children and Teens, age 11-18 (767) Instructors	Mixed methods: • Quasi-experimental one group pretest-posttest • Descriptive - observations	Quantitative questionnaire Observations	Quantitative analysis advanced – correlation analysis

(18) Involving youth in community emergency preparedness: Impacts of a multistate initiative (Powell, Black, & Smith, 2009a)	Impact of the *Alert, Evacuation and Shelter* program on knowledge of emergency management and geospatial technology	Impact	Teens (no age given) and Adults (146)	Mixed methods: • Quasi-experimental - One group retrospective pretest/posttest • Descriptive - interviews	Quantitative questionnaire Individual interviews	Quantitative analysis advanced - Wilcoxon non-parametric statistical query Qualitative analysis
(19) The communication of disaster information and knowledge to children using game technique (Clerveaux & Spence, 2009)	Effectiveness of the Disaster Awareness Game (DAG)	Impact	Children, age 9-12 (75)	Quasi-experimental - One group pretest/posttest	Quantitative questionnaire	Quantitative analysis basic
(20) The effect of different educational interventions on schoolchildren's knowledge of earthquake protective behavior in Israel (Soffer et al., 2009)	Effectiveness of attending an earthquake lecture, participation in an earthquake drill, and a combination of a lecture and drill	Impact	Children, ~age 10-12 (2,648)	Correlational – observational study	Quantitative questionnaire	Quantitative analysis advanced - ANOVA and the Kruskal-Wallis test
(21) Training youth to prepare communities for disasters (Powell, Black, & Smith, 2009b)	Effectiveness of 4-H Teen Cert in Oregon	Impact	Teens, age 14+ (14) Adults (7)	Quasi-experimental - One group retrospective pretest/posttest	Quantitative questionnaire	Quantitative analysis advanced - paired t-test

(22) An earthquake education program with parent participation for preschool children (Gulay, 2010)	Impact of the *Earthquake Education Program* for preschool children and influence of parent participation	Impact	Children, age 5-6 (93)	Experimental – randomized treatment and control pretest-pottest	Mixed methods questionnaire	Quantitative analysis advanced - ANOVA frequency group comparison
(23) Young children's demonstrated understanding of hurricanes (Buchanan et al., 2009) **AND** Consequences for classroom environments and school personnel (Buchanan et al., 2010)	Indicators of non-specific classroom teaching and discussion about hurricanes	Impact and process	Children, ~age 5-9 (84) School teachers (592)	Correlational - observational study	Individual interviews (children) Mixed methods questionnaire (school teachers)	Quantitative analysis advanced - chi-squared Qualitative analysis - constant comparative method Qualitative analysis – video coding
(24) Correlates of hazards education for youth: a replication study (Ronan et al., 2010)	Effectiveness of hazard education programs for youth (non-specific) in increasing community resilience	Impact	Children and teens, age 7-18 (407)	Correlational - observational study	Quantitative questionnaire	Quantitative analysis advanced - chi squared, t-tests, ANOVA

(25) Hazard perceptions and preparedness of Taranaki youth (Finnis et al., 2010)	Effectiveness of hazard education for children (non-specific)	Impact	Teens, age 13-18 (282)	Correlational - observational study	Quantitative questionnaire	Quantitative analysis advanced-chi-squared
(26) Preparing children for disasters: Evaluation of the Ready and Resilient program (Blanchet-Cohen & Nelems, 2010)	Effectiveness of the *Ready & Resilient* program by Save the Children	Impact and process	Children and Teens age 8-17 (305) Observers	Descriptive - survey	Mixed methods questionnaire Individual interviews	Qualitative analysis Quantitative analysis basic
(27) Promoting disaster awareness in multicultural societies: the DAG approach (Clerveaux et al., 2010)	Effectiveness of the *Disaster Awareness Game (DAG)* for non-English speakers; Equity of access to the information content	Impact	Children, ~age 10 (~55)	Quasi-experimental - One group pretest/posttest	Questionnaire – not specified	Quantitative analysis basic
(28) Student Tools for Emergency Preparedness (STEP) Draft Evaluation Report (FEMA, 2010b)	Implementation and effectiveness of *Student Tools for Emergency Preparedness (STEP)*	Impact and process	Children, ~age 9-11 (244) School teachers (11) School representatives (7)	Mixed methods: • Descriptive – diary • Descriptive – interviews • Quasi-experimental - One group pretest/posttest	Mixed methods questionnaire Individual interviews Group interviews Diary	Qualitative analysis Quantitative analysis basic

(29) 4-H Teen CERT: An evaluation of a two-day Nevada training (Powell, Smith, & Black, 2011)	Effectiveness of the *4-H Teen CERT* training program in Nevada	Impact	Teens, age 14+ (17)	Quasi-experimental - One group retrospective pretest/posttest	Quantitative questionnaire	Quantitative analysis advanced - paired T-test
(30) Disaster on the web? A qualitative analysis of disaster preparedness websites for children (Hilyard, Hocke, & Ryan, 2011) **AND** Ready or not, here it comes: Disaster preparedness messages on children's websites in the USA (Ryan et al., 2011)	Effectiveness of three federal children's websites on disaster preparedness	Impact	n/a (case studies)	Descriptive - case study	Content review	Content analysis Quantitative analysis basic
(31) Disaster preparedness education in schools: Recommendations for New Zealand and the United States (Johnson, 2011)	Success of national implementation of *What's the Plan, Stan?* in New Zealand primary schools	Process	School teachers and school representatives (49) Emergency managers	Descriptive - focus groups	Focus groups Mixed methods questionnaire Group interviews	Qualitative analysis Quantitative analysis basic
(32) Eagle Scouts Merit Beyond the Badge (Jang et al., 2011)	Effectiveness of the *Eagle Scout* program	Impact	Adults (2,512)	Correlational - observational study	Quantitative questionnaire	Quantitative analysis advanced - correlation analysis

(33) 4-H Teen Community Emergency Response Team (CERT) (Black & Powell, 2012)	Effectiveness of 4-H Teen CERT program	Impact	Teens, age 15+ (33)	Quasi-experimental - One group pretest/posttest	Quantitative questionnaire	Quantitative analysis advanced - paired T-test
(34) Community readiness for a new tsunami warning system: quasi-experimental and benchmarking evaluation of a school education component (Ronan et al., 2012)	Effectiveness of the education program corresponding to the rollout of a new tsunami warning system	Impact	Children and teens, age 8-17 (213)	Quasi-experimental - One group pretest/posttest with benchmarking	Quantitative questionnaire	Quantitative analysis advanced - paired T-test
(35) Participatory mapping for raising disaster risk awareness among the youth (Gaillard & Pangilinan, 2010) **AND** Integrating knowledge and actions in disaster risk reduction (Cadag & Gaillard, 2012)	Effectiveness of Participatory 3-Dimensional Mapping (P3DM) to raise disaster risk awareness among the youth	Impact and process	Teens, age 16 (70)	Descriptive - case study	Observations	Case Study

4.3.1 Disaster education program descriptions

Evaluation of the impact and implementation of disaster education programs for children is occurring internationally, and the studies included in this review illustrate the varying types and geographic spread of these programs (Table 4.2). Eighteen of the 40 education programs evaluated were delivered in the United States and 22 programs were delivered in other countries. Seven of the programs were nationally implemented, including school-based programs in Turkey (TR Ministry of Education et al., 2005), Nepal (Shiwaku et al., 2007), Israel (Soffer et al., 2009), New Zealand (Johnson, 2011) and three public, self-study websites for children developed by the United States Federal Emergency Management Agency (Ryan et al., 2011).

The studies include evaluations of 30 specific disaster education programs and 10 cases of non-specific disaster education delivered in schools and communities. Of the 30 specific educational interventions evaluated, most were reported as being developed by people or organizations from an academic or emergency management discipline; specifically, nine programs (30%) were developed by academic researchers, most of whom worked at universities or research organizations; six (20%) were developed by national level government agencies; five (17%) by non-governmental organizations (NGOs); three (10%) by local or state emergency management agencies; and three (10%) by schools. One program was developed by a collaboration of a national agency, NGO and academic researchers. For 13 programs, including the 10 non-specific cases, the developer was not specified.

4.3.2 Evaluation contexts

The earliest evaluation identified in the search was published in 1992, and the remaining evaluations were prepared between 2001 and 2012. While older papers and reports are more difficult to find, the increasing number of evaluations, particularly from 2008 onwards, mirrors the increasing international policy interest in disaster education programs for children (Table 4.2).

Although the majority of the 38 papers were published in journals or books, 40% are unpublished or un-catalogued reports, confirming that a significant portion of program evaluations exists in the grey literature. Specifically, of the 38 papers, 22 (58%) were published in peer-reviewed academic journals and two (5%) were published in books. Among the articles that were not catalogued in scholarly databases, eleven (29%) were prepared by an academic research organization, meaning these studies were prepared by PhD-level researchers but were not necessarily subject to external peer review. The three remaining studies (8%) constitute internal reports, one distributed by a government agency, one by a NGO and one by a regional emergency management organization. The studies identified were designed exclusively by academic researchers (91%) or professional evaluators (9%).

4.3.3 Research locations and participants

Most evaluations took place where children and other study participants could be feasibly accessed by researchers. Twenty-five studies (71%), took place in a school setting, seven (20%) took place in an extracurricular or summer camp setting and one

study (3%) was conducted online. Two evaluations (6%) were content analyses of websites.

There was a wide range of numbers of research participants but a skew toward small sample sizes (Table 4.3). Eleven studies (31%) had 17-93 participants, seven (20%) had 101-282 participants, six (17%) had 356-452 participants, three (9%) had 560-767 participants, five (14%) had 1,065 – 2,648 participants, and one (3%), a national evaluation in Turkey, included more than 9,000 participants, primarily adults training for positions as school-based program instructors.

Table 4.3

Numbers of study participants

Bucket	No. of participants	No. of studies	(%) of studies
0	0	2	(6)
1-100	17-93	11	(31)
101-300	101-282	7	(20)
301-500	356-452	6	(17)
501-1,000	560-767	3	(9)
1,001-3,000	1,065–2,648	5	(14)
3,001+	9,000+	1	(3)
Total		*35*	

The majority, 31 studies (89%), used an opportunity sample of respondents who were purposely selected for the study. The use of classrooms of school children was common and was often justified by the need to access groups of children, gain parent

consent and more easily collect data. Only three studies used random sampling techniques for the study design: Gulay's (2010) evaluation of an earthquake education program for preschool children, which selected schools randomly for participation and also assigned children randomly to experimental and control groups; the evaluation of the Eagle Scouts program (Jang et al., 2011), which used a nationwide random-digit telephone dialing sampling design for a survey of adults, and; the evaluation of the national disaster education program in Turkey (TR Ministry of Education et al., 2005), which used randomly selected provinces and random samples and clustered samples of teachers and participating children for the multi-method study design.

It was common to incorporate children as research participants, but much less common to involve children's parents and teachers (Table 4.4). Thirty studies (86%) incorporated children and teens age 18 and younger as research participants, including four (11%) with children age six and younger, 14 (40%) with children between the ages of seven and 13, and 16 (46%) with teens age 14 to 19. The two most frequent age ranges of child research participants were ages 11-12 and 15-16. The next most common research participants were school teachers, featured in seven studies (20%), and program instructors who are not school teachers, featured in four studies (11%). Three evaluations (9%) included parents and three (9%) included school representatives like principals. Program instructor trainers, adult observers and members of the general adult public were featured in one evaluation respectively (3% each). Two studies (6%) were content reviews with no research participants.

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Table 4.4

Types of study participants

Type	No. of studies	(%) of studies
Children and/or teens	30	(86)
- Young children (*age 6 and younger*)	4	(11)
- Children (*age 7-13*)	14	(40)
- Teens (*age 14 and older*)	16	(46)
School teachers	7	(20)
Program instructors (*who are not school teachers*)	4	(11)
Parents	3	(9)
School representatives (*e.g., principal or emergency management lead*)	3	(9)
Program instructor trainers	1	(3)
Emergency managers	1	(3)
Observers	1	(3)
Adults (*general public*)	1	(3)

Twenty-seven studies (77%) provided some demographic information about research participants. The most common demographic information provided was gender, in 18 studies (51%) and age, in 17 studies (49%). Eight studies (23%) described participants' ethnicities. Family socioeconomic status was reported in only two studies: an impact analysis of the Canadian Red Cross *Expect the Unexpected* program (Falkiner, 2003) and an evaluation of a participatory mapping project in the Philippines (Cadag &

Gaillard, 2012; Gaillard & Pangilinan, 2010). Two unique participant demographics that were gathered in some of the studies were personal experience with disasters, asked in seven studies (20%) and previous exposure to disaster education, asked in six studies (17%).

Thirteen studies (37%) measured the effects of demographic variables, although these primarily represent studies that measured the effects of previous exposure to disaster education, analyzed in six studies (17%) and personal experience with disasters, analyzed in four studies (11%). For the former, all six of these studies found a higher frequency of positive outcomes among children who participated in disaster education compared to those who had participated in less or no programs, including higher frequencies of correct knowledge and awareness of appropriate disaster responses (Ronan et al., 2010; Soffer et al., 2009; Shaw et al., 2004; Ronan & Johnston, 2001), more reported household preparedness activities (Finnis et al., 2010; Ronan et al., 2010; Ronan & Johnston, 2001) and fewer hazards-related fears (Ronan et al., 2010; Ronan et al., 2001). Findings regarding the differential effect of personal experience with disasters were mixed. One evaluation found that children who reported personal experiences with disasters had more accurate risk perceptions (FEMA, 2010b), and one study (Falkiner, 2003) concluded, based on a cross tabulation analysis, that the hazard perceptions of respondents is likely shaped by their experience with disasters. In contrast, two studies found no significant effect of disaster experience on respondents' disaster knowledge (Buchanan et al., 2010; TR Ministry of Education et al., 2005).

Among the few studies that analyzed age and ethnicity effects, the conclusions were mixed. In some studies, older children were found to have more correct knowledge,

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which could be a result of maturation (Mitchell et al., 2009; Ronan & Johnston, 2001; Soffer et al., 2009), while in another, younger age was found to correlate significantly with a more instances of home preparedness measures, interaction with parents and family planning (Ronan et al., 2010). In two studies, girls were found to be more knowledgeable than boys (Ronan et al., 2010; Ronan & Johnston, 2001), while a large-scale evaluation of Turkey's *Basic Disaster Awareness Curriculum* (TR Ministry of Education et al., 2005) and an evaluation of a disaster education program in Israel (Soffer et al., 2009) found no significant differences in disaster knowledge by gender. The only study that assessed the differential effect of ethnicity (Clerveaux et al., 2010) found no differences in correct risk perceptions or household preparedness levels but identified differences in hazard awareness, although the statistical significance of these differences were not reported.

4.3.4   *Research designs*

The analysis identified a strong preference for measuring learning outcomes and less attention to process outcomes. Twenty-three studies (66%) were exclusively impact evaluations that measured learning and behavioral outcomes, and two studies (6%) were exclusively process evaluations that studied the execution and implementation of the program. Ten studies (29%) measured both impact and process outcomes, although in most cases, the process outcomes represented only a small portion of the studies' outcome indicators.

The most common research designs were descriptive, quasi-experimental and correlational study designs (Table 4.5). Only one of the 35 studies, an evaluation of an

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earthquake education program for preschoolers in Turkey (Gulay 2010), used an experimental design including the randomization of children to treatment and control groups. The majority, 28 studies (80%), used a single research method, most commonly a descriptive method such as a cross-sectional survey or interviews, used in 10 studies respectively (29% each), a correlational design comparing the outcomes of existing groups, used in 10 studies (29%), or a quasi-experimental design, such as a one group pretest-posttest, used in seven studies (20%). Seven studies (20%) used mixed methods. Other findings include: 10 studies (29%) used a pretest to gather baseline data and four studies (11%) included control groups. Table 4.5 presents the frequencies of designs and data collection methods.

Table 4.5

Evaluation designs

Evaluation Designs	No.	(%)
One method studies	28	(80)
• Descriptive	10	(29)
• Correlational	10	(29)
• Quasi-experimental	7	(20)
• Experimental	1	(3)
Mixed methods studies	7	(20)
Total no. of studies including:		
Descriptive methods	17	(49)
• Cross-sectional survey	5	(14)
• Interviews	5	(14)
• Case study	2	(6)
• Longitudinal time lag*	2	(6)
• Naturalistic observation	2	(6)
• Content review	2	(6)
• Focus groups	1	(3)
• Diary	1	(3)
Correlational observational methods**	11	(31)
Quasi-experimental methods	12	(34)
• One group pretest-posttest	7	(20)
• One group posttest with retrospective pretest questions	3	(9)
• One group pretest-posttest with benchmarking^	1	(3)
• Treatment and control group pretest-posttest	1	(3)
Experimental designs^^	1	(3)

* *Multiple surveys over time, using the same tool with different groups of people in the same location*
** *Outcome comparison of two or more existing groups based on tests for statistical relationships between variables*
^ *Benchmarking from a previous quasi-experimental study to compare intervention-produced results*
^^ *Random assignment to treatment and control groups with matched participants*

The analysis revealed that quantitative questionnaires were the most common data collection method (Table 4.6). Quantitative questionnaires using multiple choice questions or Likert-type scales were used in 22 studies (63%), including 21 studies (60%) that used a quantitative questionnaire as the sole data collection method. Tools less commonly used were mixed methods questionnaires that included both quantitative and open-ended questions, used in seven studies (20%), qualitative individual interviews, used in five studies (14%), and evaluator observations, used in five studies (14%). Qualitative focus groups, group interviews and content reviews were featured in only two studies respectively (6% each), and only one study used a qualitative diary method (3%).

Table 4.6

Data collection methods

Types	No.	(%) of studies
Quantitative questionnaire	22	(63)
Mixed methods questionnaire	7	(20)
Individual interviews	5	(14)
Evaluator observations	5	(14)
Focus groups	2	(6)
Group interviews	2	(6)
Content review	2	(6)
Diary	1	(3)

The approaches to data analysis varied but less than a quarter of studies incorporated qualitative analysis, illustrating a preference for numerical measurements of program outcomes. Nineteen studies (54%) analyzed quantitative data using advanced statistical methods such as paired t-Tests, regression, chi-squared tests, ANOVA and cross-tabulation, including 16 studies (46%) that reported statistical significance. Twelve studies (34%) with quantitative methods used basic mathematical methods such as counting, percentages and averages to describe results. Seven studies (20%) included qualitative data analysis, such a categorization or thematic coding of interview transcripts and open-ended responses on written surveys. Two evaluations (6%) were descriptive case studies of programs, two (6%) analyzed website content, and one (3%) did not describe the analysis method.

One variable of interest was the methods used to measure learning outcomes of children age six and younger. Four studies (11%) had research participants age six and younger, and of these, two used a written quantitative questionnaire as the sole data collection method (Gulay, 2010; Ronan et al., 2001). One study used qualitative individual interviews (Buchanan et al., 2010) and one study used mixed methods of observations and qualitative individual interviews (Izadkhah & Heshmati, 2007). Some of the difficulties in doing research with children of this age were noted in the papers. In a cross-sectional survey of children, Ronan et al. (2001) noted that children age five and six had difficulty filling out the written surveys and consequently 31 surveys (7% of the sample) were discarded because the responses were unintelligible. Gulay (2010) used a mixed methods questionnaire with children age five and six, which included one open-ended question ("What are the three most important things that should be available in the

earthquake bag?") and three or four-point Likert-type scale questions. While Gulay found a statistically significant intervention effect, he also reported a high degree of non-responses, particularly for the open-ended question.

Citing the unsuitability of formal testing, Buchanan et al. (2010) chose a qualitative interview method and assessed the impact of post-disaster classroom activities on children's knowledge of hurricanes using an adapted Narrative Story Stem Technique (NSST), which examines children's oral narrative structures to characterize children's knowledge and risk perceptions. The authors pursued a high degree of rigor in their analysis method. With the guidance of NSST experts, they piloted the technique with a small group of children before research began. For the coding of the videotaped interviews, they used five trained coders with an interrater reliability of .81, as well as an additional reliability judge. In their analysis, they found many children understood the destructive nature of hurricanes and some of the consequences such as power outages and evacuations, but this knowledge was not significantly correlated to participation in teacher-planned activities on hurricanes or personal experience in a disaster. This method may be a promising practice for future research with young children.

4.3.5   Outcome indicators

Several patterns were identified in the outcome indicators used across the 35 studies. Table 4.7 provides the outcome indicator codes and their frequencies.

Table 4.7

Frequencies of impact outcome indicators

Outcome Indicators	No.	% of studies
Knowledge of hazard science	3	(9)
Knowledge of hazard risks	**23**	**(66)**
Knowledge of causes of injury	2	(6)
Knowledge of protective actions during an emergency	**19**	**(54)**
Demonstration of protective actions	2	(6)
Knowledge of preparedness actions and resources	**12**	**(34)**
Knowledge of mitigation actions	4	(11)
Knowledge of recovery actions	1	(3)
Discussion with household members – indicated as done	**14**	**(40)**
Discussion with household members – intended	4	(11)
Discussion with peers	4	(11)
Discussion with teachers	3	(9)
Home hazards adjustments – indicated as done	**16**	**(46)**
Home hazards adjustments – intended	4	(11)
Home-based practice –indicated as done	5	(14)
Family emergency plan – indicated as done	**11**	**(31)**
Family emergency plan – intended	0	(0)
School hazards adjustments – indicated as done	2	(6)
School drills – indicated as done	2	(6)
School drills – desired	2	(6)
Anxiety level – personal	**12**	**(34)**
Anxiety level perceived in parents	**8**	**(23)**
Perceived coping ability – personal	5	(14)
Confidence level – stated	**7**	**(20)**
Confidence level – observed by the evaluator	2	(6)
Actions during an emergency in the past*	2	(6)
Identification of helpful people or networks	3	(9)
Information seeking about disasters	4	(11)
Preparedness attitudes	**12**	**(34)**
Perceived knowledge and learning**	**8**	**(23)**
CPR and other responder certifications	2	(6)
Interest in the subject matter	**7**	**(20)**
Usability criteria	1	(3)
Adaptive capacities***	3	(9)
Other	2	(6)
• *Public service career intentions*	*1*	
• *Drug related risk behaviors*	*1*	

* e.g., 'Did you 'drop, cover and hold' during the 2011 earthquake?'
** e.g., The survey asked 'Did you learn something new?'
*** Ability to solve a new problem/decision-making skills

Across the 35 studies, there was a predominance of knowledge-based outcome indicators, which demonstrates a propensity to define program effectiveness by children's correct answers to knowledge-based questions. The most frequent outcome indicators were children's knowledge of hazards risks, measured in 22 evaluations (63%) and children's knowledge of protective actions during disasters, such as "drop, cover and hold" during earthquakes, measured in 18 evaluations (51%). The latter is distinct from demonstration of protective actions, an indicator used in only two studies that incorporated a disaster drill observed by the evaluators (6%).

Another common indicator used in 16 evaluations (46%) was reported home hazards adjustments, including household disaster preparedness kits, family communication plans and bolted furniture in preparation for earthquakes. While this outcome indicator is a direct measurement of participants' household disaster preparedness, 11 of the studies only measured the correlational relationship between home hazards adjustments and self-reported participation in a disaster education program. Also, due to the limitations of the research designs, these studies did not systematically rule out other explanations for differences in children's household hazards adjustments. In most cases, records of these adjustments were based on child reports. Only two of the studies measuring home hazards adjustments incorporated children's parents as research participants. One study, which was a correlational observational study with parents and children age seven to 13, found a significant correlation between child- and parent-reported hazards adjustments (Ronan & Johnston, 2001). The other study, a quasi-experimental pretest-posttest design with parents and children age 11 to 13, also found a significant correlation and large intervention effect on the reported hazards adjustments,

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but noted that the parent pretest may have artificially initiated increased communication and activity at home and school (Ronan & Johnston, 2003).

Other common outcome indicators relating to household preparedness include child reports of discussion with household members, used in 14 studies (40%), which reflects the value placed on knowledge transfer from children to parents. Knowledge of preparedness actions and resources, such as what to put in a disaster preparedness kit, was measured in 12 studies (34%), and child reports of family communication plans were gathered in 11 studies (31%). A less common indicator was reported practice of family plans, gathered in five studies (14%).

Attitudes towards disaster preparedness were measured in 12 studies (34%). For example, in an evaluation of the 4-H Teen Community Emergency Report Team (CERT) program in Oregon, Black and Powell (2012) used identical five-point Likert-type scale questions in a pretest and posttest to measure program-induced changes to participants' rating of statements such as "It is important to review my family's emergency plan yearly" and "I have a lot to offer my community as a volunteer." The authors found statistically significant changes to the participants' attitudes towards preparedness, which they attributed to the program.

Several studies aimed to measure the emotional impacts of a program or the subject of disasters on children, since disaster education inherently touch on topics dealing with injury, death and loss. Ten studies (29%) measured children's personal anxiety level when thinking about or discussing disasters. Seven studies (20%) also measured children's rating of their parents' anxiety levels, since children's perception of

their parents' level of distress has been found to influence and predict their own anxiety levels (see Proctor et al., 2007; Ronan & Johnston, 2003). Five studies (14%) also asked children questions regarding their perceived ability to emotionally cope in a future emergency. Overall, most studies concluded that the programs had no significant impact on children's reported levels of fear, and in some cases, education appeared to reduce disaster-related fears (Ronan et al., 2001, 2012). An evaluation of Save the Children's *Ready and Resilient* program (Blanchet-Cohen & Nelems, 2010) reported that about half of participants indicated increased worry about disasters after the program, but the authors concluded this result could be interpreted as either a positive or negative outcome since anxiety has been associated with higher levels of coping potential and household preparedness (see Mishra & Suar, 2012).

In seven studies (20%), evaluators assessed children's reported sense of self-efficacy, or self-confidence, in carrying out preparedness activities or improving their own outcomes in a disaster. For example, in a correlational study of the relationship between disaster education and children's risk perceptions, Johnston et al. (2005, p. 8) measured children's self-confidence in their ability to cope psychologically by using a multi-choice question: "If an emergency happened, some kids and adults get upset. That is normal. If you got upset, do you feel you, your family, or school would be able to help you feel less upset?" Also, in two studies (6%), evaluators reported their personal observations of children's improved self-efficacy during their participation in program activities (Naya, 2007; Izadkhah & Heshmati, 2007). Although some of the studies concluded that a program improved children's self-efficacy, the effects of those outcomes on children's actions or intentions to prepare for disasters were unclear. For example, in

the evaluation of the 4-H Teen CERT program, which reported statistically significant changes in reported self-confidence, Black and Powell (2012, p. 7) concluded, "Despite the training and personal actions taken to prepare for a disaster, youth indicated they still do not believe there is any cause for concern regarding [disasters], nor do they believe a disaster will occur in their community in the next 10 years."

Children's interest in the subject matter and children's perceived knowledge and learning using questions regarding whether they learned something new were measured in seven studies respectively (20% each). These outcome indicators can reflect the quality of children's engagement with the information. All of the studies that measured student interest concluded that students expressed a strong interest in disaster education and perceived that they learned something new.

The analysis also identified less commonly used indicators. Adaptive capacities, defined as measurements of children's abilities to solve problems using newly learned or existing knowledge, were measured in four studies (11%). For example, in a descriptive case study of a participatory mapping project, the authors observed children identifying their flood risks and evacuation routes on a map of their community using their own local knowledge (Gaillard & Pangilinan, 2010). Also, individual information seeking about disasters and knowledge of mitigation actions (e.g., avoiding residence in high-risk zones) were measured in four studies respectively (11% each). Outcomes such as knowledge of hazard science, identification of helpful people and networks, responder skills and certifications such as Cardiopulmonary Resuscitation (CPR), knowledge of the causes of injury during disasters, and school-based hazards adjustments were measured in

three studies respectively (9% each). Discussion with peers, an indicator of peer-to-peer learning, was also measured in three studies (9%).

Indicators that measured achievements or challenges to a program's delivery and implementation were less common. Twelve studies (34%) included questions about the program's implementation. The most common indicators include program instructors' satisfaction with the learning tools provided, used in six studies (17%), and motivators to use of the program, used in five studies (14%). Deterrents to use, frequency of use, and satisfaction with the overall education program were measured in four studies respectively (11% each). Four studies (11%) also gathered suggestions for improvements from instructors, and three studies (9%) assessed uptake of voluntary teaching and self-study resources. Children's preference for different types of learning tools, content used or not used, and the level of instructor preparation needed to deliver the program were measured in only two studies respectively (6% each). While seven studies assessed the impacts of national disaster education programs for children, only two assessed the success of the program's implementation. The evaluation of an ambitious national initiative in Turkey that trained 13,500 volunteer instructors reported successfully delivering disaster education to 2.4 million school children (TR Ministry of Education et al., 2005). In contrast, the evaluation of a nationally-distributed teaching resource on disaster preparedness for New Zealand school teachers found that teachers rated the resource highly, but use of the resource was low and infrequent (Johnson, 2011).

A significant finding was that most authors did not articulate an explicit theory or model of how the program would enable specific learning outcomes, or how program outcomes would achieve wider impacts such as improved disaster resilience. The

majority of studies, particularly those using an experimental, quasi-experimental or correlational paradigm, were simple hypothesis testing frameworks of limited scope. While immediate and easily measured program outcomes were identified, such as improvements in children's knowledge and attitudes, intended program impacts related to instrumental action or changes in social norms were not well defined in the studies.

4.3.6 Evaluation conclusions and research limitations

Despite the exploratory nature of many of the studies and limitations to the research designs and data collection tools, the majority of the studies concluded that a specific intervention, or disaster education for children in general, produces benefits to children and the wider community (see Table 4.2). Twenty-three studies (66%) drew mostly positive conclusions affirming that a program caused or was related to outcomes such as children's increased knowledge and awareness of disaster risks, improved attitudes towards disaster preparedness or increased household preparedness. Twelve of these studies (34%) came to a positive conclusion based on statistically significant increases in correct knowledge and risk perceptions among children. In contrast, seven studies (20%) drew a mixed conclusion that the program had both positive effects and no effects for different outcomes of interest, including two that tested for statistical significance (Oganowski & Wycoff-Horn, 2008; Ronan et al., 2001). Four studies (11%) concluded that education did not improve children's correct knowledge, including two that tested for statistical significance (Buchanan et al., 2010; Kurita et al., 2006). Two studies (6%) were inconclusive, one due to a lack of conclusive data (Falkiner, 2003) and the other due to the limitations of the research method (Wachtendorf et al., 2008).

Twenty-one studies (60%) provided recommendations on ways to improve the content or delivery of the program.

Although 14 studies (40%) did not report research limitations, several types of reported limitations were common to multiple studies. The most frequent limitation was a weakness of the data collection tool, reported in seven studies (20%). For example, some studies reported children had difficulties responding to written questionnaires (Clerveaux & Spence, 2009; Ronan et al., 2001) and one analysis was limited by a questionnaire that was changed between assessments (Oganowski & Wycoff-Horn, 2008). Six studies (17%) discussed weaknesses in their data collection method, such as the limitations of a longitudinal time-lag analysis that did not survey the same exact group (Johnston et al., 2005). Six (17%) stated that the study only measured short-term outcomes and could not gauge long-term impacts, although this was a limitation in almost all of the studies. Five studies (14%) acknowledged the limitations of a study's small sample, and four studies (11%) stated the research was exploratory in nature and more research is needed to draw conclusions. Other findings include: four studies (11%) noted the potential confounding factors to the intervention effect such as media about a recent disaster or other community-wide disaster education initiatives; three studies (9%) acknowledged the lack of randomly selected or randomly assigned research participants, and; two studies (6%) acknowledged the potential bias caused by a low response rate.

4.4   Summary and discussion

The purpose of this methodological review was to characterize the current state of evaluation of disaster education programs for children and identify opportunities for improvements in evaluation practice. The search found there are more evaluations available than presumed in previous literature reviews. Thirty-eight papers representing 35 studies were identified as a result of an extension search of evaluations of disaster education programs for children. Of the papers, 40% were found in the grey literature. However, there is still a large number of disaster education programs for children internationally that have not been evaluated. Of the portion of program coordinators who responded to an email inquiry for evaluations, half replied that they had not done an evaluation of their program, reporting time, staff and funding constraints. Although most disaster education programs for children are developed by non-formal educators like emergency management agencies, evaluation remains almost entirely in the purview of academic researchers, many of whom do not appear to be directly involved in the development and execution of programs at the school and community level. It remains unclear if and how well evaluation research is being applied to improve programs, particularly since most authors concluded that the programs were effective despite limited measures of impacts.

The contexts of the evaluation studies allude to some of the logistical challenges faced by program evaluators (Bamberger, Rugh, & Mabry, 2011). Most of the studies took place in school settings and included children as research participants, normally as an opportunity sample. The ability to access children in a school setting, where researchers can more easily obtain parent consent and involve stakeholders, may

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outweigh some of the research limitations authors reported, such as the inability to randomize children to treatment and control groups. Several authors mentioned challenges to their research with children, including poor quality responses to questionnaires, particularly those administered to very young children. For example, voluntary take home surveys often have a low response rate, and some evaluators may not have had the time or human resources to add other data collection methods to their research design. Also, most studies used a single method of data collection with children and did not include teachers or parents as research participants, which may be due to other logistical or resource challenges. Future studies would benefit from the inclusion of parents and teachers who can provide validation of child reports and useful perspectives on program impacts.

A significant finding is that most of what is known about the effectiveness of disaster education programs for children is based on results of quantitative studies with children that generally focused on measuring children's knowledge of disaster risks and protective actions and child reports of preparedness actions. Most studies used descriptive, correlational and quasi-experimental designs and most collected data through written questionnaires with multiple-choice or Likert-type scale questions. The majority of descriptive and quasi-experimental studies concluded that programs were effective based on a result of or positive change in children's correct answers on surveys, and most correlational studies concluded positive outcomes such as household preparedness were associated with children's participation in disaster education programs. However, many of the studies had significant methodological limitations such as small samples and lack of baseline data or a control group, and most correlational studies measured exposure and

outcomes through child reports, which are subject to memory and response biases. Mixed method designs, and qualitative methods in general, were uncommon. While many studies incorporated questions measuring children's knowledge of protective actions during disasters, such as "drop, cover, and hold" for earthquakes, only two studies included evaluator observations of children practicing protective actions or other measures of children's competency. In sum, while there is significant evidence of valuable knowledge change, there is still very limited empirical evidence of how disaster education programs facilitate children's roles in household preparedness, their self-protective capacities, or their likelihood of preparing for disasters as adults.

The concentration on changes in knowledge and attitudes in disaster education and program evaluation fails to acknowledge the psychology of social norms and norms adherence. Jacobs et al. (2011) describe how information-based education programs can effectively change the way people *speak* about program goals, like disaster preparedness, but in the absence of immediate consequences for failure to take action, people's reported change in their awareness and attitudes does not mean that instrumental action will occur. Contemporary research in risk communication has found that the relationship between knowledge of preparedness strategies and preparedness actions is tenuous, at best (Becker, Paton, Johnston, & Ronan, 2012; Paton et al. 2010). Three studies that measured both knowledge and home hazards adjustments found that school-based education increased children's knowledge but had no effect on preparedness actions (Ronan et al., 2001; Shaw et al., 2004; Shiwaku et al., 2007). Findings from Shiwaku et al. (2007) and Jang et al. (2011) suggest that experiential, community-based activities are more effective than information-based education at instigating preparedness activities.

The quantitative questionnaire was identified as the most common data collection tool and in the majority of studies, was the sole data collection method, which raises several concerns. Written questionnaires are problematic for assessing young children's learning; to increase reliability and validity, questionnaires need to have an age-appropriate reading level, font size, length, syntax, and number of answer selections (Bell 2007). Also, quantitative quantitative studies often do not gather results that explain why an outcome has or has not occurred, which can limit the evaluators' ability to make meaningful recommendations for program improvement. On the other hand, evaluators face the real world challenges of conducting research with children such as limited access, time, resources, and in some cases, evaluation expertise (Bamberger et al., 2011). The benefits of quantitative questionnaires are that they can be administered to large groups, particularly children in a school setting, and numerical data is relatively simple to analyze compared to qualitative data. The incorporation of qualitative methods to gather in-depth data on the mechanisms of change would add significantly to the evidence base (Mertens & Hesse-Biber, 2013). If evaluators continue to use quantitative questionnaires for research with children, which is likely, more meaningful outcome indicators of change beyond knowledge acquisition must be identified, tested and refined.

The practice of evaluating disaster education programs for children could be improved by the incorporation of program theory. Most studies did not discuss how program outcomes would contribute to a "drastic shift" in risk perceptions, attitudes and the proactive prevention of disasters, as urged by UNICEF and UNISDR (2011, p.19). Most outcome indicators used in evaluations to date measured limited intermediate outcomes rather than mechanisms of change or instrumental actions that improve

individual and community resilience. The creation of a program model that describes the relationships between educational activities, desired outcomes and intended impacts can help clarify what evaluators should measure to determine effectiveness (Astbury & Leeuw, 2010). To develop or reconstruct program theories, evaluators often apply concepts from existing theories that are relevant, such as behavioral theory, learning theory, social-cognitive theory, or behavior-modification principles (Lipsey & Pollard, 1989). In this case, learning theory and behavioral theories of disaster preparedness should be applied to improve program theories. For example, several scholars have argued that factors such as self-efficacy, adaptive capacities, sense of personal responsibility, sense of community, trust in authorities, and discussion with peers are critical to people's motivations and intentions to prepare, and likewise, should be cultivated through public education programs (Becker et al., 2012; Mishra & Suar, 2012; Paton, 2003; Peek, 2008; Shiwaku et al., 2007; Wood et al. 2011; see also Cameron, 2002; Pajares, 1996; Vosniadou, 2003).

This review identified several promising examples of tools to measure children's self-efficacy, adaptive capacities, subject comprehension and knowledge transfer. These examples include: measuring children's self-efficacy using Likert-type scale questions to rank statements related to personal self-confidence in achieving specific preparedness and response tasks (Black & Powell, 2012); documenting children's adaptive capacities by observing children's application of existing knowledge and problem-solving in a participatory mapping project of local risks (Gaillard & Pangilinan, 2010); and measuring young children's subject comprehension using a Narrative Story Stem Technique, which examines children's oral narrative structures to characterize children's knowledge and

risk perceptions (Buchanan et al., 2010). Also, children's discussion with household members was an indicator in almost half of all studies. Children's engagement with parents not only facilitates knowledge transfer from children to parents, but can also improve the quality of children's learning (Ballantyne et al., 2001; Campbell & Verna, 2007; Dunst, 2002; El Nokali et al., 2010).

In addition to the need to identify and refine program theory and more meaningful outcome indicators, there are several other gaps in the literature and opportunities for future research. Very few studies assessed the differential effects of age, gender, ethnicity and socioeconomic status on program outcomes. Also, except for a retrospective survey of adults who participated in Boys Scouts as children (Jang et al., 2011), no studies measured long-term outcomes of disaster education, including improvements in response to and recovery from an actual disaster. To achieve this, time series designs that are extended to cover the timeframes of disaster events are needed. Finally, few studies assessed process outcomes, such as uptake and instructor satisfaction with the learning tools. The studies that did assess process outcomes were able to provide more comprehensive recommendations of ways to overcome implementation challenges that hinder the delivery of disaster education to children.

To meet aspirational goals of changing the culture of safety and resilience, disaster education programs for children must be both effective and scalable. Most of the studies reviewed here measured outcomes of ad hoc disaster education programs delivered to very small numbers of children. Considering the priority goal of the *2005-2015 Hyogo Framework for Action* to embed disaster education in school curricula, the international community would benefit from research on national curriculum integration

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processes to help identify replicable, large-scale models, particularly ones that facilitate

children's comprehension of science, geography, societal and other academic elements.

4.5   Link to Chapter 5: Paper 2

Chapter 4 (Johnson et al., 2014c) described the findings of a methodological literature review of evaluations of disaster education programs for children. Knowledge-based outcome indicators were common, but few evaluations measured program impacts on behavior change and instrumental action towards disaster risk reduction. Because most studies did not explicitly address underlying assumptions of children's programs, it was suggested that theory-driven evaluation approaches could help uncover the relationships between educational activities, desired outcomes, and intended impacts, and help identify meaningful outcome indicators. Chapter 5 (Johnson et al., 2014b) explores the key challenges to evaluation of disaster education programs for children and provides working examples of constructing program theory models for the purpose of evaluation planning.

Chapter 5: Paper 2 Improving the Impact and Implementation of Disaster Education Programs for Children Through Theory-Based Evaluation

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Abstract

A main weakness in the evaluation of disaster education programs for children is evaluators' propensity to judge program effectiveness based on changes in children's knowledge. Few studies have articulated an explicit program theory of how children's education would achieve desired outcomes and impacts related to disaster risk reduction in households and communities. This paper describes the advantages of constructing program theory models for the purpose of theory-based evaluation of disaster education programs for children. Following a review of some potential frameworks for program theory development, including the logic model, the program theory matrix, and the stage step model, the paper provides working examples of these frameworks. The first example is the development of a program theory matrix used in an evaluation of ShakeOut, an

earthquake and tsunami drill practiced in two Washington State school districts. The model illustrates a theory of action; specifically the effectiveness of school earthquake drills in preventing injuries and deaths during disasters. The second example is the development of stage step model used for a process evaluation of *What's the Plan Stan?*, a voluntary teaching resource distributed to all New Zealand primary schools for curricular integration of disaster education. The model illustrates a theory of implementation, specifically expanding the reach of disaster education for children through increased promotion of the resource. The process of developing the program theory models for the purpose of evaluation planning is discussed, as well as the advantages of the theory-based approaches.

5.1   Introduction

In response to growing costs and consequences of disasters, and predictions of communities' increased vulnerability to hazards due to the effects of climate change and population settlement patterns, there is an increasing need for communities to prepare for and proactively mitigate disaster risks to prevent catastrophic damages, injuries, and deaths. Education continues to be a cornerstone of disaster risk reduction efforts, as many policy makers and practitioners view education as a vehicle to instigate individual and community-initiated actions that reduce their own vulnerability. In 2005, 168 Member States of the United Nations endorsed the *2005-2015 Hyogo Framework For Action* (HFA), agreeing to five priority actions to reduce disaster risks globally, including Priority for Action #3: *Use knowledge, innovation and education to build a culture of safety and resilience at all levels* (UNISDR, 2005, p. 18). The HFA states the intended outcomes and impact of this priority action: "Disasters can be substantially reduced if

people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities" (UNISDR, 2005, p. 9).

The dissemination of knowledge and information that the HFA refers to includes a wide variety of educational activities internationally that are focused on teaching people about disaster risks and actions to reduce their vulnerability. These include practicing self-protective actions to prevent injuries, creating family communication plans, securing disaster insurance, stockpiling food, water and supplies at home, and preventing hazards through efforts such as updating building codes to improve the safety of buildings. Although adults have always been a primary audience for these initiatives, the HFA is the sponsor of more recent efforts to focus on children as an audience for disaster education. At the heart of the United Nations campaign promoting children's disaster education, particularly school-based education, is the idea that children represent the future generation of adults who will embody the collective values and culture of disaster prevention (UNISDR, 2007b). UNICEF and UNISDR (2011, p. 19) state that disaster education programs for children aim to "contribute to a drastic shift in mentalities and perceptions as well as behavioral change towards a more proactive preventative approach to disasters." Children are viewed as vehicles of disaster preparedness and prevention in the future as well as in the present; this optimism is reflected in many United Nations reports that discuss the active role of children in "child-centered" disaster preparedness activities and their role in influencing adults to take action (Selby & Kagawa, 2012; UNISDR, 2007b; Wisner, 2006).

Internationally, a wide range of disaster education programs for children has been documented, including formal and informal community, school-based, and extracurricular programs, and school emergency drills (Selby & Kagawa, 2012; Wisner, 2006). One of the oldest forms of disaster education for children is school emergency drills for fires and sudden-onset disasters, although scholars and practitioners emphasize that even today, most school drills serve only as basic, perfunctory practice of school safety procedures (Lund, 2013; Ramirez, Kubicek, Peek-Asa, & Wong, 2009). To meet HFA goals, some countries, including France, Georgia, Russia, and Turkey, have taken steps to integrate curriculum-based disaster education into schools through efforts that include content reorganization, curriculum requirements, and large-scale teacher training schemes (Selby & Kagawa, 2012). In other countries such as United States and New Zealand, where curriculum content choices are the province of individual school districts or schools, children receive disaster education primarily through voluntary school teaching and ad hoc activities. These include afterschool programs, summer camps, and classes developed by non-formal educators, such as emergency management agencies and child advocacy organizations (Federal Emergency Management Agency, 2013; Johnson, 2011).

The significant investment in disaster education for children is based on a consensus that these efforts produce some gain in individual and community resilience to disasters (Wisner, 2006). However, a review of evaluations of disaster education programs for children identified major gaps in the evidence base on the effectiveness of these programs (Johnson, Ronan, Johnston & Peace, 2014c). Johnson and colleagues (2014c) concluded that most of what is known about the effectiveness of disaster

education programs for children is based on the results of a body of quasi-experimental and correlational studies that primarily measured children's correct answers to knowledge-based questions about disaster risks and protective actions. Although the authors found some studies measured the achievement of goals such as improved attitudes towards preparedness and children's household preparedness activities, few studies gathered evidence of a causal relationship between children's exposure to disaster education and instrumental action toward disaster preparedness (p. 15). Little attention has been paid to the theoretical models of these education interventions and the mechanisms that facilitate changes in attitudes and behaviors. The authors found that the gaps in the literature are not due to a lack of research, but a lack of conceptually framed program theories and meaningful outcome indicators that explicitly seek to validate if and how programs result in the intended outcomes and desired long-term impacts (p. 15). Donaldson (2012, p. 8) suggests that "program theory-driven evaluation science" comprises a three step model that includes: "developing program impact theory; formulating and prioritizing evaluation questions; [and] answering evaluation questions." It is these three elements, systematically applied, that are missing from the extant explorations into causality in disaster education studies.

The use of theory-based evaluation has the potential to improve the quality of evaluations of disaster education programs for children by providing a framework to help identify, test, and refine more meaningful outcome indicators and success criteria. If a culture of more systematic evaluation of programs is encouraged, long-term, the application of theory-based evaluation tools to children's disaster education may help generate a cumulative body of knowledge that demonstrates how disaster risk reduction

can be achieved through curricular integration and children's programming (Turnbull, 2002).

The following sections explores the key challenges to evaluation of disaster education programs for children and ways theory-based evaluation could enhance evaluation practice in this particular field. After a review of some potential frameworks for program theory development, including the logic model (Cooksy, Gill, & Kelly, 2001), the program theory matrix (Funnell, 2000), and the stage step model (Lipsey & Pollard, 1989), the authors provide examples of these frameworks in practice. The first example illustrates a theory of action; specifically, the effectiveness of school emergency drills in preventing injuries and deaths during disasters. The second example illustrates a theory of use; specifically, expanding the reach of disaster education for children through the national distribution of a voluntary teaching resource, an approach used by several countries to integrate disaster education in school curricula (Selby & Kagawa, 2012). The examples illustrate ways to construct program theories from central assumptions underlying disaster education programs for children for the purpose of evaluation planning.

5.2   The role of theory-based evaluation

Theory-based evaluation goes under a number of different names and descriptions ranging from "theory-oriented evaluation" through to "logic modeling" (Donaldson, 2012). It is most commonly referred to as program theory, theory-based, or theory-driven evaluation. A broad definition of theory-based program evaluation suggested by Fitz-Gibbon and Morris (1996, p. 177) is "one in which the selection of program features to

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evaluate is determined by an explicit conceptualization of the program in terms of a

theory, a theory which attempts to explain how the program produces the desired

effects." More succinctly, Rogers and colleagues define it as "an explicit theory or model

of how the program causes the intended or observed outcomes and an evaluation that is at

least partly guided by this model" (Rogers, Petrosino, Huebner, & Hacsi 2000, p. 6).

Roots of program theory began as early as the 1930s in the work of Ralph Tyler

(Donaldson, 2012, p. 9), and is associated with scholars such as Edward Suchman (1967)

who articulated two distinct reasons for a program's failure: *theory failure*, when the

intended outcomes and effects of a program do not occur, and *implementation failure*,

when the operation of the program does not work as intended (as cited in Rogers et al.,

2000, p. 6). In the 1980s, Huey-Tsyh Chen and Peter Rossi (1980, 1983, 1987) discussed

the advantages of theory-based evaluation by arguing that the explicit theorizing of a

program's central cause-and-effect mechanisms provides useful guidance for an

evaluation's planning, execution, and interpretation.

As theory-based program development and evaluation became more common in

the 1990s, particularly in the fields of health promotion and risk prevention, Carol Weiss

(1998, p. 57) further defined program theory, stating that it "refers to the mechanisms that

mediate the delivery (and receipt) of the program and the emergence of the outcomes of

interest." Scholars clarified that the mechanism of change, also known as change theory,

is the process of change that leads to the attainment of the program's goals, which are

intended to facilitate significant social impacts (Chen, 2005; Donaldson, Christie, &

Mark, 2009; Funnell, 2000; Weiss, 1997). In plain language, theory-based evaluation is

different from other models of evaluation in that it is mainly concerned with discerning

the explicit theory or model of *how* the program causes the observed outcomes (Rogers et al., 2000, p. 5).

Some evaluation scholars argue that the articulation and testing of a program theory are not necessary for an effective evaluation, particularly if evaluation resources are in short supply and the goal is simply to judge a program's worth, merit, or significance (Scriven, 1998, p. 59). Yet, there is some consensus that theory-based evaluation methods are beneficial for uncovering faulty assumptions about a program, improving the collaboration of program developers and external evaluators, identifying appropriate data collection and analysis methods, and developing better quality outcome indicators to measure program impacts and processes (Bickman, 1987; Birckmayer, & Weiss, 2000; Chen & Rossi, 1983; Lipsey & Pollard, 1989; Riemer & Bickman, 2011; Weiss, 1997).

Theory-based evaluation was developed to address the lack of emphasis on testing program's underlying assumptions. Such assumption testing is necessary if program stakeholders are to understand *how* a social intervention works or fails. Lipsey (1993, p. 33) proposed that we learn the most from program evaluations that test specific causal theories of process mediation, rather than evaluations that treat programs as idiosyncratic "black boxes." However, the predominance of quantitative comparison models among evaluations of disaster education programs for children (Johnson et al., 2014c) indicates a preference for empiricist paradigms that measure program effects through the statistical analysis of differences within and between groups, which may be impeding the development of program theory and conceptualization in this particular field (Lipsey & Pollard, 1989, p. 318).

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Often program managers do not articulate a program theory at the outset of program development. Therefore, when theory-based evaluation is applied, central assumptions need to be unpacked retrospectively (Astbury & Leeuw, 2010). There are a number of frameworks for developing or reconstructing the underlying theories of how a program is intended to work and what it is intended to achieve (Leeuw, 2003). The most common framework used by many government and non-governmental organizations is the logic model, which is a visual chart that depicts the sequential process of a program's inputs, activities, outputs, and outcomes (Cooksy et al., 2001). The last step in the logic model may be program impacts, which are the longer-term outcomes expected to be achieved through the immediate and intermediate program outcomes. The simplest form of a logic model depicts a single, linear chain that illustrates a sequential series of variables from inputs to impacts. In more complex logic models, variables like program activities may be differentiated and depicted in several different boxes, or the models may depict linkages across and between variables to illustrate the ways in which variables influence each other (see models in Cooksy et al., 2001). Figure 5.1 depicts a basic, linear logic model of the HFA Priority For Action #3 (UNISDR, 2005, p. 9) stated in the article's opening paragraph.

Figure 5.1 Basic logic model of the HFA Priority For Action #3

Inputs	• Collected and compiled knowledge and information
Activities	• Dissemination of relevant knowledge and information
Outputs	• People are well informed and motivated
Outcomes	• Improved culture of disaster prevention and resilience
Impacts	• Disasters substantially reduced
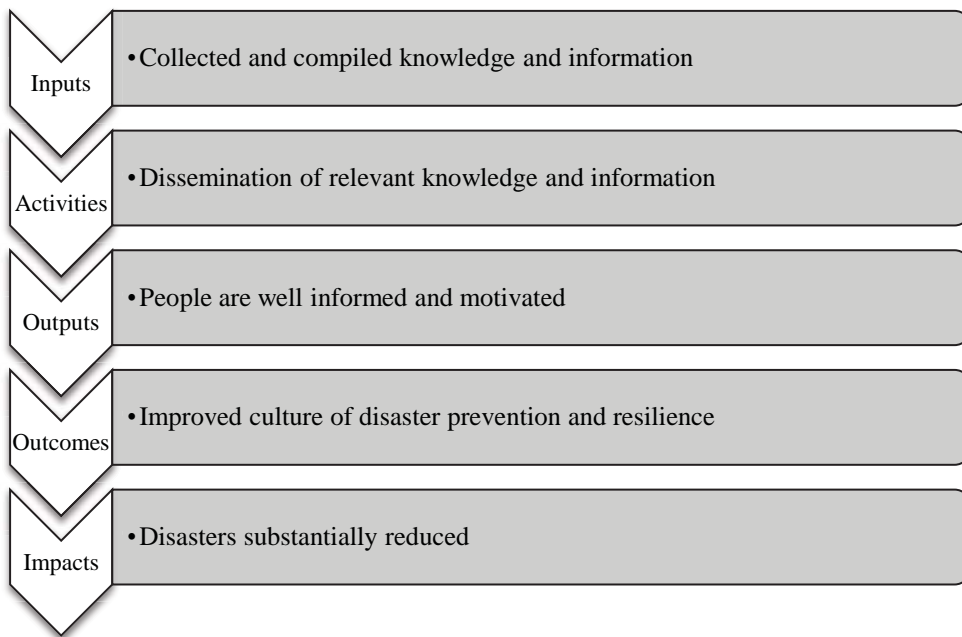
Note. Text adapted from "Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters: Priority for Action #3," by UNISDR, 2005, p. 9. Model adapted from "The program logic model as an integrative framework for a multimethod evaluation" by L. J. Cooksy, P. Gill, and P. A. Kelly, 2001, *Evaluation and program planning*, *24*, p. 120.

The primary criticism of logic models is that they do not illustrate causal links among components; the simplistic, linear trajectory for social change is incapable of showing where, how, and at what scale outcomes are achieved (Rogers & Weiss, 2007). An examination of Figure 5.1 reveals a significant gap in detail of the relationship between the outputs and outcomes, as well as the outcomes and impacts. Also, as Funnell (2000, p. 91) notes, evaluations based on simplistic logic models often concentrate on components that relate to the lowest levels of outcomes that are easy to measure, such as knowledge attainment, and may overlook components that achieve the more important higher-level outcomes and impacts. Consequently, program theory evaluators have

developed and refined more complex models, such as the program theory matrix (Funnell, 2000), the stage step model (Lipsey & Pollard, 1989), outcome pattern matching (Trochim, 1989), and systems evaluation (Bellamy, Walker, McDonald, & Syme, 2001), among many others.

Theory-based evaluation and related frameworks offer a pathway toward more systematic approaches to identifying if and how disaster education programs for children are facilitating the goal of positively changing the culture of disaster preparedness and prevention. The most pressing need is a more critical examination of underlying assumptions and alternative casual explanations for program outcomes. Johnson et al. (2014c) found that one of the most common goals of disaster education programs for children was to increase children's household preparedness activities. Sixteen evaluation studies, almost half the evaluations identified for the review, measured household preparedness as a program outcome; however, 11 of the studies only measured the correlational relationship between home hazards adjustments and children's previous participation in a disaster education program, meaning there may be other causal factors of household preparedness not related to the education program (Johnston et al., 2014a, p. 12). Also, many of the correlational studies measured household preparedness through child reports, which the authors note may be prone to memory bias (p. 15), particularly since children do not have the same level of recall as adults (see Bell, 2007). Further, program incentives for reporting preparedness activities, such as take-home activities that encourage or require children to return a checklist of completed household preparedness tasks, may instigate short-term gains in household preparedness, but may have no long-

term effect on levels of household preparedness in communities, nor change social norms that would create a culture of preparedness.

A further contribution of a theory-based evaluation approach is in helping evaluators identify the mechanisms of change facilitated by education programs, if they exist at all. Jacobs et al. (2012, p. 356) note that many, if not most, information-based public education programs change social norms of the way people *speak* of program goals, such as the need to prepare for disasters, but they do not necessarily cause changes in social behaviors, particularly when there are no social consequences for failure to act (p. 362). Likewise, information-based disaster education programs for children may be ineffective in instigating behavior changes like household preparedness. Most of the evaluations reviewed by Johnson et al. (2014c) identified positive changes in children's knowledge and attitudes towards preparedness immediately following a program, but few examined instrumental actions that would change disaster outcomes or prevent disaster risks.

A theory-based evaluation approach also offers evaluators the opportunity to refine and iterate outcome indicators that could better validate if and how programs result in the intended outcomes and longer-term impacts. With the exception of the small number of countries executing national curriculum integration of disaster risk reduction education (e.g., Turkey and Russia), disaster education programs for children are being disseminated in an inconsistent, ad hoc manner to relatively small pockets of people (Selby & Kagawa, 2012). The geographically inconsistent spread of disaster education programs globally reinforces a tendency toward individualistic program evaluations that do little to produce knowledge that is generalizable and meaningful for theory iteration.

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Because evaluation of disaster education programs has remained limited to few empirical studies, a substantial gap has emerged between program theory and program development. A concerted effort to systematically test program theory across programs may help generate more meaningful outcome indicators of program effectiveness (Turnbull, 2002).

One way to expand the scope of evaluation research to include more critical appraisal of program theories and causal factors is to look at some worked examples of program theory construction and modeling. Astbury and Leeuw (2010, p. 365) identified three purposes for program theory modeling. First, if used as part of an initial evaluability assessment, the theoretical framing can help determine the feasibility of a study. Second, it can be used to facilitate collaborative program planning with stakeholders and third, help clarify the design of a program. Finally, a theoretical approach can be used for evaluation planning to identify appropriate research questions, data collection tools, and analysis techniques.

In order to explore the applicability and relevance of theory-based evaluation approaches for the purpose of evaluation planning, the authors investigated Suchman's (1967) idea of evaluating "theory failure" and "implementation failure" using two real-life examples of disaster education programs for children. The first example is in relation to the role of school-based emergency drills in teaching children self-protective actions for disasters. In this instance, the authors applied a *program theory matrix* to model the generally unexamined assumptions in the drill activities that related to the drill's theory of effectiveness. The program theory matrix was used in the planning of an evaluation of ShakeOut, an earthquake and tsunami drill in two Washington State school districts

(Johnson, 2013; Johnson, Johnston, Ronan, & Peace, 2014a). The second example was used for planning a process evaluation of *What's the Plan, Stan?*, a national teaching resource first disseminated to New Zealand primary schools in 2006 (Johnson, Ronan, Johnston, & Peace, 2014d). In this instance, the authors applied a *stage step model* to examine the factors that influence awareness, use, and non-use of the resource that were relevant to the program's implementation theory. Both of these cases are discussed in more detail below, including the value of the theory-based approaches.

5.3   A program theory matrix for school earthquake drills

The program theory matrix, which originated in 1985 in the state of New South Wales, Australia (Lenne & Cleland, 1987), is a visual representation of a hierarchy of intended program outcomes, each of which includes a series of questions and answers embodied in a complementary matrix that help identify potential data sources, evaluative criteria, and external factors that may influence the outcomes (Funnell, 2000, pp. 92-93). Funnell argues that the program theory matrix helps illustrate that the immediate and intermediate outcomes do not always explicitly link with the desired long-term impacts. By answering questions in the matrix such as *What would success look like?* and *What are the factors that influence the achievement of each outcome?*, evaluators can produce better quality measurements of success at all levels of the hierarchy of outcomes (Funnell, 2000, p. 92).

To illustrate an example of program theory matrix, the authors used one of the most common forms of disaster education for children, the school emergency drill. School emergency drills normally entail students and staff practicing the school's

emergency response procedures such as evacuation for fires, "drop, cover, and hold" for earthquakes, "shelter-in-place" for tornados, and high ground evacuation for tsunamis, among other scenarios (Ramirez et al., 2009). A central assumption of emergency drills is that children can be effectively taught safety procedures and self-protective actions for disasters, and when children practice these procedures often, disaster-related injuries and deaths will be prevented (Jones, Kadzin, & Haney, 1981; Ramirez et al., 2009; Ronan & Johnston, 2005). Over the past fifty years there has been a dramatic decrease in fire-related injuries and deaths in school buildings in the United States, which has been primarily credited to schools' execution of routine fire drills (Hull, 2011). However, school drills tend to be brief and perfunctory in nature, and some scholars and practitioners argue that this may inhibit learning outcomes (Lund, 2013; Ramirez et al., 2009). To minimize time and disruption to school routines, schools often conduct the same drill at expected times and locations, typically during class when students are at their desks (e.g., Central U.S. Earthquake Consortium, 2011; Green & Petal, 2010; Johnston et al., 2011; Ramirez et al., 2009). Often drills do not incorporate lessons on the reasons why the procedures are practiced and how they protect against injury (Lund, 2013; Ramirez et al., 2009). There has been very little study of school drills beyond visual observations. Therefore, it is an assumption that rote practice of protective actions provides children with the knowledge and skills needed to successfully protect themselves in an emergency that happens whether they are inside or outside the classroom.

Figure 5.2 provides a basic, linear logic model that illustrates the central underlying theory of school earthquake drills. The figure illustrates the difference

between the input (information) and the activity, namely when children are prompted in the classroom, they practice "drop, cover, and hold" under a desk. "Drop, cover, and hold" is a protective action that is used to protect against injuries from falling and flying objects during ground shaking. Basic logic models typically do not express the links between activities, outputs, outcomes, and impacts that describe how the output (here, the correct demonstration of "drop, cover, and hold") enacts the impact (fewer earthquake-related injuries and deaths). It seems logical that children's knowledge of "drop, cover, and hold" would achieve the goal of children successfully protecting themselves from preventable injuries in an earthquake. The challenge with evaluating the achievement of this goal is the fact that real earthquakes are extremely rare. Therefore, in drill evaluations, an intermediate outcome, such as a visual observation of children correctly demonstrating the protective actions, typically serves as the evidence that injuries and deaths will be prevented during a real emergency (Central U.S. Earthquake Consortium, 2011; Green & Petal, 2010; Hull, 2011; Johnston et al., 2011).

Figure 5.2 Basic logic model of school earthquake drills

Inputs	• Information on correct protective actions, such as "drop, cover, and hold", that prevent injury during earthquakes
Activities	• Practice of "drop, cover and hold" during an earthquake drill
Outputs	• Children correctly demonstrate "drop, cover, and hold"
Outcomes	• Children successfully protect themselves from injury during an earthquake
Impacts	• Fewer disaster-related injuries and deaths

Note. Model adapted from "The program logic model as an integrative framework for a multimethod evaluation" by L. J. Cooksy, P. Gill, and P. A. Kelly, 2001, *Evaluation and program planning*, *24*, p. 120.

Unlike the basic logic model, a program theory matrix provides a framework for testing an underlying program assumption through the introduction of questions that probe a more detailed hierarchy of intended outcomes. Funnel (2000, pp. 92-95) describes the components of a program theory matrix, which includes a sequenced hierarchy of intended outcomes (immediate, intermediate, and ultimate), a series of questions for each outcome, and a table where variables are listed for each outcome. The matrix includes variable categories such as success criteria, program factors affecting success, non-program factors affecting success, activities and resources of the program, performance information, and sources of data. The variables in the matrix help evaluators consider appropriate outcome indicators for evaluations assessing program impacts, processes, or both.

The biggest missing piece in the basic logic model in Figure 5.2 is the expression

of the casual link between the output (children correctly demonstrate "drop, cover, and

hold") and the outcome (children successfully protect themselves from injury during an

earthquake). If children's demonstration of "drop, cover, and hold" is the success criteria

of a drill, one must consider: Does correct demonstration of "drop, cover, and hold" mean

that children understand what this protective action is for? Do children understand what

types of injuries "drop, cover, and hold" protects against? Will children be able perform

an action they have practiced in a drill during a real earthquake? Will children perform

"drop, cover, and hold" in settings where it has not been practiced, such as outside? Can

children apply their knowledge of earthquake risks and protective actions to protect

themselves in unfamiliar settings? Do they have adequate knowledge to make good

response decisions?

With these questions in mind, the authors proposed a hierarchy of intended

outcomes for school earthquake drills displayed in Figure 5.3. If the ultimate outcome is

fewer injuries and deaths during earthquakes, even for the specific circumstance of

earthquakes that occur during school hours, the intermediate outcomes must be the

criteria for children's ability to successfully protect themselves from preventable injuries

in a variety of scenarios, including indoors when they are not near a desk or other cover,

and outdoors. The proposed intermediate outcomes in Figure 5.3 are based on principles

of learning theory described in *How Children Learn* (Vosniadou, 2003), namely: active

involvement, social participation, meaningful activities, engaging in self-regulation and

self-reflection, and knowledge transfer to real-life situations. A strong theme across all

the principles of learning theory described by Vosniadou is the need for children to

participate in active problem solving: "People learn by employing effective and flexible strategies that help them to understand, reason, memorize, and solve problems" (2003, p. 14).

Figure 5.3 Hierarchy of intended outcomes for school earthquake drills

Ultimate outcomes

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┌─────────────────────────────────────────────────┐
│     8. Fewer injuries and deaths during earthquakes │
└─────────────────────────────────────────────────┘
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┌─────────────────────────────────────────────────────┐
│  7. "Drop, cover, and hold" becomes a social norm of │
│          protective behavior during earthquakes      │
└─────────────────────────────────────────────────────┘
```

Intermediate outcomes   ⬆

```
┌──────────────────────┐    ┌──────────────────────┐    ┌──────────────────────┐
│ 4. Comprehension of  │    │ 6. Ability to identify│    │ 5. Comprehensin of   │
│ the causes of injury │ ⇨ │ correct and incorrect │ ⇦ │ the purpose of       │
│ during earthquakes   │    │ protective behaviors  │    │ practicing "drop,    │
│                      │    │ in different          │    │ cover, and hold"     │
│                      │    │ earthquake scenarios  │    │                      │
└──────────────────────┘    └──────────────────────┘    └──────────────────────┘
```

Immediate outcomes   ⬆

```
┌──────────────────────┐    ┌──────────────────────┐    ┌──────────────────────┐
│ 1. Awareness of the  │    │ 2. Knowledge of       │    │ 3. Knowledge of      │
│ earthquake risk in   │    │ protective actions    │    │ how to perform       │
│ the locality         │    │ for earthquakes       │    │ "drop, cover, and    │
│                      │    │                       │    │ hold"                │
└──────────────────────┘    └──────────────────────┘    └──────────────────────┘
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Note. Adapted from "Developing and Using a Program Theory Matrix for Program Evaluation and Performance Monitoring," by S. C. Funnell, 2000, *New Directions for Evaluation, 87*, p. 93.

While children's participation in "drop, cover, and hold" with their peers and teachers provides elements of active involvement and social participation, it is questionable whether drills are an effective learning technique because they usually lack opportunities for problem-solving, self-reflection, and knowledge transfer. Therefore, an

evaluation was planned for ShakeOut, an earthquake and tsunami drill that took place in two Washington State school districts in October 2012 (Johnson et al., 2014a). Based on the hierarchy of intended outcomes displayed in Figure 5.3, the authors theorized other intermediate outcomes of the evaluation could include: 1) children's comprehension of the most common causes of injury during earthquakes, a prerequisite for children's ability to strategically choose an appropriate protective action in an unfamiliar scenario; 2) children's comprehension of the purpose of practicing "drop, cover, and hold"; and 3) children's ability to identify correct and incorrect protective actions in different earthquake scenarios, an indicator of their comprehension of how and why protective actions are used. It was also theorized that children's levels of anxiety when thinking or talking about earthquakes and tsunamis could indicate whether the drills impacted children's self-confidence in their ability to self-protect during an earthquake.

In the top row of program theory matrix provided in Table 5.1 are the questions proposed by Funnell (2000, p. 92) to develop the variables that fill the matrix. The central question for developing the outcome indicators is: *What would success look like?* (Table 5.1, column 2). The authors' theories, stated previously, are listed here. Column 3 includes the program factors affecting success, including teacher leadership and comprehension of the response actions, peer and teacher participation in the drill, and annual repetition. Some non-program factors that may affect the learning outcomes of the drills (column 4) include anxiety produced by the topic or activities, children's self-confidence in their ability to self-protect, past experiences with earthquakes, and a lack of earthquake conditions that cannot be simulated (e.g., ground shaking, anxiety, dangers), among other factors.

Table 5.1 *Example of an application of a program theory matrix to school earthquake drills*

Questions:	*What would success look like?*	*What are the factors that influence the achievement of each outcome?*	*Which factors are outside the direct influence of the program?*	*How does the program address these factors in order to bring about the outcome?*	*What performance informat... collect (quantitative and qu... indicators and comparisons...*
1. Intended Outcome	*2. Success Criteria*	*3. Program Factors Affecting Success*	*4. Nonprogram Factors Affecting Success*	*5. Activities and Resources of the Program*	*6. Performance Information for Columns 2 to 5*
Comprehension of correct and incorrect protective actions in different earthquake scenarios	In a disaster, no preventable injuries among children In absence of a disaster, children can identify how and when they should respond to prevent injury in different scenarios In absence of a disaster, children can identify how *not* to respond in different scenarios	Teacher leadership during the drill Teacher comprehension of the rationale for school safety procedures and protective actions Participation of peers and teachers Annual repetition of the drill	Anxiety produced by the topic or activities Self-confidence in ability to protect oneself Trust in authorities Beliefs and past experiences with earthquakes Lack of earthquake conditions that cannot be simulated: e.g., ground shaking, anxiety, dangers Parent support for drills	Pre-drill notice to teachers and children Drill Repeat drill annually ***Not always included in drills:*** "Drop, cover and hold" clearly explained by teachers in age-appropriate manner to children Risks and causes of injuries clearly explained Simulation of different scenarios: inside with cover, inside with no cover, outside, etc. Review of alternative response actions – protective and not protective	***Typically:*** All children can demonstrat... cover, and hold" during a cl... based simulation ***Proposed for the evaluation...*** Percentage of children that i... causes of earthquake injurie... Percentage of children that i... correct and incorrect protec... different scenarios, includin... a desk, indoors without a de... outdoors Levels of disaster-related an... ***Other possible indicators:*** Percentage of children with... confidence in ability to prot... during an earthquake Percentage of children who... trust in authorities

Column 5 lists the activities involved in the drill, which typically include a pre-drill notice to teachers and children, the classroom-based drill (led by teachers), and repetition of the drill annually. Drill activities that are not always included but are often recommended include teacher explanations of "drop, cover, and hold," explanation of the causes of injuries during earthquakes, and review of alternative response actions for different scenarios, among others. Column 6 includes the proposed pieces of performance information, or outcome indicators. Typically, classroom-based drills are evaluated using a visual observation of children demonstrating "drop, cover, and hold." For the ShakeOut evaluation, the authors proposed measuring before and after the drill: 1) the percentage of children that know the causes of earthquake injuries; 2) the percentage of children that recognize correct and incorrect protective actions in different scenarios, including indoors with a desk, indoors without a desk, and outdoors; and 3) children's levels of disaster-related anxiety before and after the drill (Johnson et al., 2014a). Other potential outcome indicators that were outside the scope of the ShakeOut evaluation included the percentage of children with high self-confidence in ability to protect themselves during an earthquake, and the percentage of children who have high trust in authorities. Because a visual observation would not be able to capture children's knowledge of appropriate response actions in different scenarios, the authors chose to conduct the ShakeOut evaluation using a pretest-posttest questionnaire, specially designed for children age 10 and older (Johnson et al., 2014a).

The main challenge that the program theory matrix helps to overcome is the tendency to overlook the measurement of inputs, processes, and outputs needed to achieve the ultimate outcomes (Funnell, 2000, p. 96). The value of the program theory

matrix in this example was the provision of a practical framework in which to deeply examine and articulate the program theory of how school-based emergency drills are expected to achieve reduced injuries. Through this process, the authors discerned the need to test children's ability to apply knowledge in different scenarios. It became clear that a visual observation of the ShakeOut drill would not be adequate for collecting data on this outcome, and that another data collection method, such as a pretest-posttest questionnaire, would be needed.

The theory-based approach was also useful in identifying ways to answer key evaluation questions about the effectiveness of drills, and producing preliminary data for more in-depth examinations of learning outcomes in future evaluations. For example, the authors theorized if evaluation of a school earthquake drill incorporated a measurement of children's ability to choose or demonstrate both correct and incorrect actions in different earthquake scenarios, evaluators would have stronger evidence that children are successfully learning and applying knowledge that can prevent injuries, as opposed to rehearsing a memorized action when prompted. With this information, evaluators could determine whether drills are effective in enhancing children's ability to protect themselves during earthquakes, and delve deeper into questions of why or why not. The mechanism of learning (or lack of learning) could then be theorized and tested. For example, if evaluators find that drills are effective in enhancing children self-protective skills, the potential mechanisms of the learning that could be investigated include the active experience of practicing "drop, cover, and hold," the promotion of "drop, cover, and hold" by children's trusted authorities, the repetition of the drills that provides for ongoing reflection and practice, or other factors. As Astbury and Leeuw argue (2010, p.

375), the mechanisms may not be discerned or easily measured, and they are sensitive to variations in context; however, "theorizing with mechanisms strengthens our understanding of how and why programs work, with whom and under what circumstances," which allows opportunities to develop universal knowledge about social programs.

5.4   A stage step model of the implementation of a voluntary disaster teaching resource

Our second exploration of a theory-based evaluation approach aimed to test theories of use and implementation; specifically, theories that explain how a program is intended to occur in terms of process components such as uptake of the teaching resources, adherence to the program, barriers to use, and participants' experience with the program. Although there is a tendency among program evaluators to focus predominately on measuring program outcomes, it is also critical to assess the validity of a program's implementation theory, the success or failure of which will have a direct impact on a program's reach and long-term impact (Lipsey & Pollard, 1989). Lipsey and Pollard (1989, p. 321) describe a stage step model of program theory introduced by Runyan (1980), which is a visual depiction of the major stages and statuses through which people progress in the context of interest, such as participation in a program.

A stage step model was used by the authors in a process evaluation of *What's the Plan, Stan?*, a national, voluntary disaster teaching resource developed by New Zealand's Ministry of Civil Defence and Emergency Management (Johnson, Ronan, Johnston, & Peace, 2014d). *What's the Plan, Stan?* is a multi-modal resource for teaching disaster science and preparedness to students in Years 1 through 8 in New Zealand primary

schools (MCDEM, 2006). In 2006 and 2009 respectively, MCDEM distributed one hard

copy of the original and updated version of the teaching package, which includes unit

plans, fact sheets and classroom activities, to all primary schools in New Zealand. The

purpose of the resource is to help primary school teachers voluntarily incorporate

disaster-related topics into the English, Social Studies, Science, and Health and Physical

Education curricula. The development and distribution of the resource is a key

component of New Zealand's goal to integrate disaster risk reduction in school curricula,

a core indicator of achievement for the *Hyogo Framework for Action* Priority For Action

#3 (Hamilton, 2013). Use of the resource remains voluntary since disaster risk reduction

education is not a required school subject in New Zealand. Therefore, the program's

theory of use is the assumption that the availability of the resource facilitates the

incorporation of disaster-related topics into teachers' curricular activities.

The stage step model depicting the implementation theory of *What's the Plan,

Stan?* (Johnson et al., 2014d) was reconstructed from MCDEM's *What's the Plan, Stan?

Communications Strategy for 2009 Launch* (MCDEM, 2009a). When the

Communications Strategy was published, it was clear that uptake and use of the resource

had remained low since the resource was first released in 2006. The policy document

focused heavily on the notion that promotion of the resource through advertising would

maximize awareness of the resource, which will in turn increase uptake and use of the

resource. Since disaster education remains voluntary, few would argue that if all primary

school teachers in New Zealand were aware of the resource, all teachers would use the

resource. There are other unknown intervening factors within this implementation theory.

These unknown factors exist between resource promotion and teachers who continue to

lack awareness of the resource. There are also unknown factors that both facilitate and

deter teachers' uptake. The stage step model presented in Figure 5.4 was used as a

starting point for planning the evaluation, which aimed to understand how to increase

curriculum integration of disaster education in New Zealand through the distribution of a

voluntary teaching resource.

Figure 5.4 A stage step model of the implementation theory of What's the Plan, Stan?, a voluntary disaster teaching resource distributed to NZ primary schools
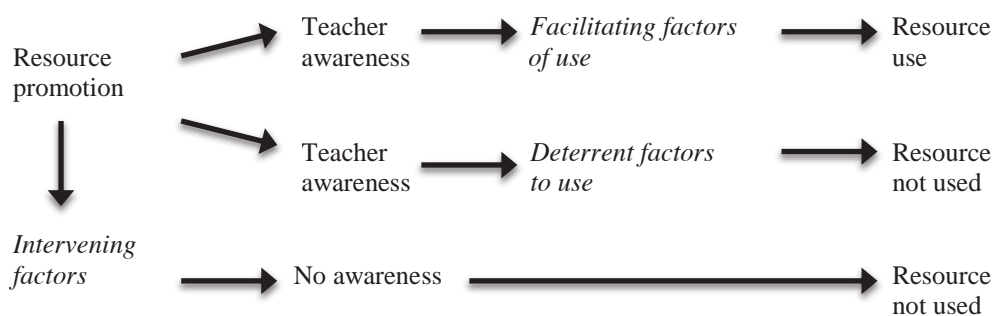
Note. Adapted from "Implementing disaster preparedness education in New Zealand primary schools," by V. A. Johnson, K. R. Ronan, D. M. Johnston, and R. Peace, 2014d, *Disaster Prevention and Management*. Model originally adapted from "Driving toward theory in program evaluation: More models to choose from," by M. W. Lipsey and J. A. Pollard, 1989, *Evaluation and Program Planning, 12*, p. 322.

The stage step model highlights the unknown intervening factors, which may not

be clear when starting from the assumption that an increase in resource promotion would

increase resource use. From an evaluation planning standpoint, the visualization prompts

the questions: *Why are teachers not aware of the resource when it is being promoted?*,

Why do teachers who are aware of the resource use it?, and *Why do teachers who are*

aware of the resource not use the resource? The resulting evaluation of *What's the Plan,*

Stan? aimed to determine the key intervening factors and their relative strength, in order

to postulate what facilitating factors could be influenced and what deterring factors could be removed, if possible, to increase the use of the resource (Johnson et al., 2014d).

The stage step model helps guide the choice of the evaluator's research methods, data collection tools, and analysis techniques. For example, because the influencing factors at different stages of the implementation process are unknown, an evaluator could develop theories of what those factors may be and test the existence and strength of those theorized factors through research designs such as surveys or interviews with teachers and other stakeholders. A major disadvantage to this approach is evaluators may not anticipate key factors that should be tested. The intervening factors may be unknown even to teachers, the key informants. Therefore, the authors felt a more promising approach to evaluating the implementation of *What's the Plan, Stan?* would be to interpret factors through a thematic analysis of qualitative and quantitative data available from other studies. For example, one source of data for the *What's the Plan, Stan?* evaluation was focus groups with teachers who discussed their use or non-use of the resource; another source was quantitative data from a national survey of schools (Johnson et al., 2014d). A qualitative, thematic analysis of the multiple sets of available data uncovered some of the more common factors and the strengths of those factors.

The value of the stage step model in this example was the framework it provided for organizing a theory-driven qualitative analysis of the data to answer key evaluation questions. With this framework, the analysis identified factors beyond the promotion of the resource that affected its use, such as teachers' perceived need for teacher training (Johnson et al., 2014d). Based on these findings, the authors concluded that increased promotion of the resource may not necessarily increase its uptake. The framework also

allowed the authors to identify some of the mechanisms of implementation; specifically, the factors that facilitated teachers' uptake beyond their awareness of the awareness, such as school-wide use of the resource, student interest in the topic, and recent disasters. Ultimately, the authors used the total findings to develop recommendations on how to the implementation of disaster education in New Zealand schools. In sum, the stage step model served as a practical tool for both evaluation planning and data analysis.

5.5   Conclusion

The *2005-2015 Hyogo Framework For Action* (HFA) urges member countries of the United Nations to use disaster education, including disaster education programs for children, to build a culture of safety and resilience at all levels. Currently, there is little empirical research to inform how children's education improves individual and community resilience to disasters, if at all. This article argues for the application of theory-based evaluation approaches to test underlying assumptions of educational initiatives and improve the theoretical and conceptual constructs of disaster education programs for children. The use of visual program theory models can help identify, test, and refine more meaningful outcome indicators during program and evaluation planning and iteration. Two examples of program theory models using existing programs were provided here to illustrate the practical application of theory-based evaluation and its benefits for executing program evaluations of disaster education programs for children. Long-term, a more comprehensive effort to test program theories could help generate a cumulative body of knowledge that demonstrates how disaster risk reduction can be achieved through children's education.

5.6   Link to Chapter 6: Paper 3

Chapter 5 (Johnson et al., 2014b) explored the key challenges to evaluation of disaster education programs for children and provided worked examples of constructing program theory models for the purpose of evaluation planning. The first example was the development of a program theory matrix of ShakeOut, an earthquake and tsunami drill practiced in two Washington State school districts. The model illustrates a theory of action; specifically the effectiveness of school earthquake drills in preventing injuries and deaths during disasters. The second example was the development of stage step model of the implementation of *What's the Plan Stan?*, a voluntary teaching research distributed to all New Zealand primary schools for curricular integration of disaster education. The model illustrates a theory of implementation, specifically expanding the reach of disaster education for children through increased promotion of the resource. These models are used in the two case study evaluations featured in the following chapters.

Chapter 6 (Johnson et al., 2014a) is the first case study: a theory-based, quasi-experimental impact evaluation of ShakeOut, an earthquake and tsunami drill that took place in two Washington State school districts in October 2012. Based on a program theory matrix of the program's theory of action, described in Chapter 5, unique outcome indicators were developed to measure the children's self-protective skills and adaptive response capacities for earthquakes and tsunamis.

Chapter 6: Paper 3 Evaluating Children's Learning of Adaptive Response Capacities from ShakeOut, an Earthquake and Tsunami Drill in Two Washington State School Districts

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Abstract

In 2012, Washington State participated in ShakeOut, an annual, one-day event that encourages residents, including school children, to practice "drop, cover, and hold on" drills for earthquakes and evacuation for tsunamis. To better understand the role of school drills in improving individual and community resilience to disasters, this evaluation examined the effectiveness of the ShakeOut drills in improving or maintaining children's accurate risk perceptions and adaptive response capacities for earthquakes and tsunamis. Using matched pretest and posttest questionnaires, the analysis examined both population level and individual differences in children's knowledge and scenario-based knowledge application before and after ShakeOut. Children demonstrated high levels of correct knowledge of protective actions for earthquakes and tsunamis both before and

after ShakeOut. However, the findings indicate that significant portions of children have varying levels of knowledge of the causes of injury and approximately a third of children chose an incorrect action or indicated uncertainty in scenarios not commonly practiced in school earthquake drills. Also, more than a quarter of children were not aware they practiced vertical evacuation procedures for a tsunami during ShakeOut. Children would benefit from practice for different scenarios, such as when they are outside or traveling between classes, and explicit lessons on the rationale for protective actions.

6.1   Introduction

In some disasters, children have an increased risk of injury and death because of children's physical vulnerabilities and their dependence on adults for protection and care (Zahran, Peek, & Brody, 2008). Reports on youth injury and mortality during earthquakes and tsunamis, including the 1999 Kocaeli earthquake in Turkey, the 2010 Haiti earthquake, and the 2011 earthquake and tsunami in Japan, indicate that children are at risk of physical trauma through being struck with building contents and structural elements (such as ceilings and beams), falls, heat and cold exposure, and drowning (Kolbe et al., 2010; Nakahara & Ichikawa, 2013; Ramirez, Kano, Bourque, & Shoaf, 2005). A shortage or lack of physicians skilled in pediatrics also increases risks to children's survival and recovery from injuries (Burnweit & Stylianos, 2011). Due to the wide range of risks to which children are exposed in disasters, and the significant amount of time they spend in school, many international organizations and national government administrations advocate for school emergency management planning, including school-based disaster drills to teach children disaster response skills (FEMA, 2010a; UNISDR, 2007b).

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There is some scholarly consensus that children can be effectively taught safety procedures and self-protective actions for disasters and these practices can help mitigate injuries and deaths (Jones, Kazdin, & Haney, 1981; Peek, 2008; Ronan & Johnston, 2003, 2005). Since the 1960s, most school districts in the United States perform routine fire drills, which have been credited with the significant reduction in fire-related injuries and deaths in school buildings (Hull, 2011). Some schools in hazardous areas of the United States and other countries also perform regular drills for staff and students to practice emergency response procedures for earthquakes, tsunamis, tornados and other sudden-onset disasters (USGAO, 2007; Wisner, 2006). Routine school drills are considered an important vehicle for sustaining awareness of community hazards and preparedness strategies, particularly since disaster preparedness is not commonly taught in schools as a classroom subject (Mitchell, 2009; Wisner, 2006).

To involve more people and institutions, particularly school children, in learning about earthquake preparedness and response, the California-based Earthquake Country Alliance designed ShakeOut, an annual, one-day event promoted on a central website (http://www.shakeout.org/) that encourages residents to practice "drop, cover and hold on" at a designated date and time. "Drop, cover and hold on" is shorthand for the recommendation to drop down onto your hands and knees, cover your head and neck under a sturdy table or desk, and hold on to your shelter (or to your head and neck when no shelter is available) until the shaking stops. The ShakeOut website also provides information on the reasoning behind recommended protective actions. Initiated in California in 2008, ShakeOut is now organized in many other seismically-active areas, including several U.S. states and regions, New Zealand, Guam, southern Italy and Japan.

ShakeOut has also been used in some coastal communities as an opportunity to learn about and practice protective actions for tsunamis (O'Sullivan, 2012).

According to the Earthquake Country Alliance website (2012), "drop, cover and hold on" can help protect against the most common causes of injury during earthquakes, including falling and flying objects, which can cause bruises, cuts, crushing and head injuries, and ground shaking, which can cause injuries resulting from falls. The advisement to "drop, cover and hold on" also opposes the common, but incorrect, perception that building collapse is the most common cause of earthquake injuries in developed countries such as the United States. Fear of building collapse may perpetuate the idea that it is protective to run outside to open areas during an earthquake. The Earthquake Country Alliance website advises not to run outside because the area near the exterior walls of a building, where windows, facades and architectural details break and fall, is the most dangerous place to be during an earthquake. Studies on earthquakes in California in the last two decades have found that building collapse is less of a risk than falling and flying objects, particularly during light and moderate-intensity earthquakes (Mahue-Giangreco, Mack, Seligson, & Bourque, 2001; Ramirez & Peek-Asa, 2005; Shoaf, Sareen, Nguyen, & Bourque, 1998).

The ShakeOut event also aims to address outdated or non-credible advice on protective actions. For example, it was once believed that door frames provided protection during earthquakes. The Earthquake Country Alliance website now advises that getting under a table is safer than getting in a doorway, based on observations that doorways do not protect against falling and flying objects and can be difficult to hold on to during strong shaking. The website also discredits the "triangle of life," an alternative

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theory of protection that is disseminated through emails (Haeck, 2011). "Triangle of life" proponents advocate for sheltering next to solid objects, suggesting there will be a void or "triangle" created there when a building collapses, and not under tables as recommended by national and international emergency management organizations (FEMA, 2013b). The Earthquake Country Alliance website (2012) states that the "triangle of life" theory is based on inaccurate assumptions that people can anticipate the locations of survivable void spaces and disregards the greater danger of falling and flying objects.

School-based disaster drills are believed to be a good approach for mitigating injuries and deaths and improving children's resilience to disasters (Heath, Ryan, Dean, & Bingham, 2007; Hull, 2011). Ronan and Johnston (2005) stressed that repeated practice of response skills helps improve children's self-confidence and resiliency to disasters, particularly when children have the opportunity to receive constructive feedback during practices. Finnis et al. (2004) argued that children's knowledge of protective behavior can reduce their vulnerability whether they are alone or unsupervised, and can reduce community vulnerability when they educate household members on the correct actions to take during an emergency. On the other hand, since the inception of routine school drills, scholars and practitioners have discussed the limitations of drills, which typically emphasize perfunctory repetition of protective actions rather than adaptive response skills (Carboni, 1962; Jones et al., 1981; Lund, 2013; Ramirez et al., 2009). Gebbie et al. (2006) note that poorly executed exercises that do not improve individuals' response skills can create a false sense of security, resulting in poor response during a real emergency. Ramirez et al. (2009, p. 110) reported from their observation of a school drill that many students did not take the drill seriously, and the drill was viewed

by both students and teachers as a "compulsory exercise with little meaning." Also, there is some concern that school drills increase children's anxiety and hazard fears in a non-constructive manner (Heath et al., 2007; Johnson, 2011). Although there is a growing body of research indicating that well- executed disaster drills and curricular activities do not increase anxiety in children (Ronan et al., 2010; Ronan & Johnston, 2001), concern alone can pose a challenge to gaining parent and teacher support for school drills.

Although school drills provide an opportunity to raise awareness of risks and emergency responses, few, if any, studies have evaluated the effectiveness of school drills in improving children's ability to successfully protect themselves during a real emergency (Ramirez et al., 2009). Most school drills go against a key principle of learning theory: children learn better through active problem solving than rote memorization (Mayer, 2002; Vosniadou, 2003). To make school drills efficient and less disruptive, schools often conduct drills in a relatively uniform manner at expected times and locations, typically in the middle of class periods when students are at their desks (e.g., Central U.S. Earthquake Consortium, 2011; Johnston et al., 2011; Lund, 2013; Ramirez et al., 2009). School drills tend to emphasize repetition and memorization of correct actions for the mastery of basic response skills, but often do not provide the reasoning or relationships involved in the skills, which are needed to help the children apply what is learned towards new challenges and scenarios (Carboni, 1962; Mayer, 2002). Two empirical studies on teaching children protective response actions have found that drills with children have better letter outcomes if they include a cognitive component, such as a lecture explaining the rationale for the procedures (Jones, Ollendick, & Shinske, 1989; Soffer et al., 2009). However, there are very few accounts of

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school-based drills incorporating lessons or discussions on adaptive response skills and actions to avoid, such as running outside during ground shaking (Ramirez et al., 2009).

In 2012, Washington state recognized the opportunity to link school-based drills with community-wide disaster preparedness education efforts, and widely promoted the participation of Washington schools in its first-time participation in ShakeOut. Washington state has experienced approximately 20 damaging earthquake events over the last 125 years (Washington EMD, 2010). Adjacent to the Cascadia subduction zone, the fault boundary between the North American plate and the Juan de Fuca plate, Washington's western coastline is particularly vulnerable to earthquakes and tsunamis caused by the sudden displacement of the sea floor (Clague & Orwin, 2005; Washington EMD, 2010). The only significant earthquake in Washington in the last 20 years was the 2001 Nisqually earthquake, a 6.8 magnitude earthquake with an epicenter ten miles northeast of Olympia, which resulted in some property damage and approximately 700 injuries and one death by heart attack (Washington EMD, 2010). Although Washington schools are required by state law to conduct regular fire evacuation drills in accordance with the state fire code (Wash. Rev. Code Ann., 2002), they are only encouraged to conduct drills for earthquakes, tsunamis, or other high-risk local events ("School Safety Planning Manual," 2008). Some free teaching resources on the topic of disaster preparedness are available (e.g., Crawford & Thurman, 2012), but there are no government or school district-level requirements to teach disaster preparedness in schools. Research has found that there are variable risk perceptions and generally low levels of preparedness for earthquakes and tsunamis among residents in Washington state (Johnston et al., 2005; Johnston, Orchiston, & Becker, 2012).

Although schools in Grays Harbor County, Washington annually conduct earthquake and tsunami drills, schools' participation in the 2012 ShakeOut event provided a unique opportunity to evaluate the outcomes of an identical earthquake and tsunami drill performed in two school districts at the same date and time, garnering a large population for the study. Evaluations of ShakeOut drills in schools in the U.S. and New Zealand to date have mainly documented observations of individual and institutional participation to identify lessons learned from the drill process (Central U.S. Earthquake Consortium, 2011; Coomer et al., 2009; Green & Petal, 2010; McBride et al., 2013; Petal et al., 2011; Petal & Green, 2008). To better understand the role of school drills in improving individual and community resilience to disasters, this research was designed to add new information to the literature on the effectiveness of drills in improving or maintaining children's accurate risk perceptions and self-protective skills for disaster response.

Quantitative questionnaires using multiple-choice and Likert-type scale questions are the most common data collection tools used in evaluations of disaster education programs for children (Johnson, Ronan, Johnston, & Peace, 2014c). Compared to qualitative methods such as interviews and observations, written questionnaires can be administered to large numbers of children and quantitative data is relatively easy to analyze. However, the authors found that quantitative questionnaires tend to be used to gather data on knowledge-based outcomes, such as children's knowledge of disaster risks and correct protective actions, which has limited utility as a predictive indicator of improved disaster outcomes. Observations of children practicing "drop, cover and hold on" also limits the ability to know if children are successfully learning and applying

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knowledge that can prevent injuries, as opposed to rehearsing a memorized action when prompted.

Therefore, this evaluation also served as a case study for how quantitative evaluation designs could be used more effectively to assess learning outcomes such as problem solving skills and adaptive response capacities. Children were administered a pretest and posttest questionnaire using a unique set of questions that measured children's ability to apply knowledge learned from practice during school drills, including: understanding of the causes of injury during earthquakes, understanding of both correct and incorrect actions during earthquakes and tsunamis, and application of response knowledge in earthquake and tsunami scenarios not typically practiced in school drills. Children's level of upset when speaking or thinking about disasters was also assessed to identify changes associated to participation in ShakeOut.

Through analyzing both population-level and individual-level changes in children's responses to the questionnaires, this study examined children's maintenance and improvements in correct knowledge, as well as maintenance of incorrect knowledge and changes from correct to incorrect answers after ShakeOut. Some results of this study challenge the theory that routine school drills help children develop adaptive response skills that will effectively mitigate injuries and deaths during an earthquake or tsunami. Following the results, the benefits of measuring specific learning outcomes from drills are discussed.

6.2   Methodology

The evaluation was designed using matched pretest and posttest questionnaires in order to assess individual differences in knowledge and scenario-based knowledge application as a result of the ShakeOut drill. The two coastal Washington state school districts that participated in the study, North Beach School District and Ocosta School District, bothlocated in Gray's Harbor County, volunteered to participate in the state-wide ShakeOut drill at 10:18am on October 18, 2012. Both school districts serve a rural, K-12 student population of approximately 600 students, and each school district has a single campus of school buildings located in a low-lying coastal area at risk of tsunamis. During ShakeOut, each school district facilitated a school-wide earthquake drill, when students and staff practiced "drop, cover and hold on" in their classrooms, followed by a tsunami drill, when students and staff practiced vertical evacuation by moving to the highest building floor on the school campus. These school districts practice vertical evacuation to prepare for a warning of a tsunami arriving in 30 minutes or less (Luvisi, 2013). Students and staff were informed of the drills in advance. Both school districts perform the same school-wide earthquake and tsunami drills annually. Although teachers are encouraged by their school principals to teach earthquake and tsunami science and preparedness to their students, there was no requirement to do this as part of the schools' participation in ShakeOut.

The study participants were limited to children age ten and older. Written pretest and posttest questionnaires for children were used to collect data because these tools were cost-effective, caused minimal classroom disruption and could be administered to a large number of classrooms simultaneously (Bell, 2007). The questionnaires included multiple-

choice questions and questions with Likert-type scale responses. The questionnaires were carefully conceived, following guidelines by Bell (2007) on designing and testing questionnaires for children. For example, they were prepared at a 6[th] grade reading level; the question length and wording was kept as short and simple as possible, using unambiguous language; 'I don't know' and 'Not sure' were added to answer selections where appropriate to reduce the demand on children's cognition or memory; ambiguous suggestions and connotations were avoided; the number of answer selections and scales were limited to no more than six, and each scale was labeled; and the order of response options was mixed so correct answers were not always at the top. The questionnaire was piloted with a small classroom of children aged 10 to 12 in Washington State.

After permission was obtained from the school districts' Superintendents, 29 6-12 grade teachers in Ocosta Junior/Senior High School and 7-12 grade teachers in North Beach Junior/Senior High School (representing all full time teachers in these schools excluding special education teachers) were recruited to serve as volunteer questionnaire administrators for the evaluation through a staff meeting led by the school principals. Teachers were also provided a brief, 12 question post-ShakeOut survey on their opinions, experience and classroom activities during and after ShakeOut, which provided some descriptive context of the execution of the ShakeOut drills and evaluation. All 29 teachers who administered student questionnaires completed the teacher post-ShakeOut survey.

Teachers collected completed questionnaires from 574 students, a 92% response rate from the total population of 624 students. Of the 574 participants, 74% completed both a pretest and posttest (n=428), 12% completed a pretest only (n=67) and 14%

completed a posttest only (n=79). In total, 495 students completed pretests and 507 completed posttests.

6.3   Results

The results below describe the population-level differences in student responses from the pretest to the posttest, and some individual-level changes that are informative. For each question, the number of non-responses and excluded responses (e.g., instances where more than one answer was selected for a question requiring a single response) is tallied in brackets in the results tables. The correct and incorrect responses in the pretest and posttest questionnaires were randomized, but for improved readability, the correct answers are displayed at the top of the tables in this section.

6.3.1   ShakeOut participation and teaching context

All 29 teachers who volunteered to administer the student questionnaires indicated in the teacher survey that their classroom participated in the ShakeOut drills, including the "drop, cover and hold on" drill and the subsequent vertical tsunami evacuation drill. This means that all students who completed the questionnaires and were at school on October 18, 2012 participated in the drills. In the student posttest, 89.3% of children indicated that they practiced "drop, cover and hold on" during the ShakeOut drill. However, as Table 6.1 illustrates, only 71.3% indicated they practiced evacuation for a tsunami. This suggests that 27% of children were not aware they were practicing a tsunami drill or did not perceive the second floor evacuation as the correct tsunami evacuation procedure. The proportion of children responding 'No' and 'Not sure' was slightly higher in North Beach School District compared to Ocosta School District.

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Table 6.1

*Question: During the ShakeOut earthquake drill in your school, did you practice
evacuation for a tsunami? (pick one)*

Responses	Posttest	North Beach only	Ocosta only
Yes	71.3% (360)	37% (187)	34.3% (173)
No	22% (111)	23.1% (61)	20.7% (50)
Not sure	5% (25)	5.7% (15)	4.1% (10)
I was not there	1.8% (9)	0.2% (1)	1.6% (8)
Total	505 [2]	76	60

Teachers were also asked if they reviewed the correct answers with students or voluntarily conducted any classroom or homework activities on earthquake and tsunami response or preparedness before ShakeOut in September and October 2012. Twelve of the 29 teachers (41%) reported that they reviewed the correct answers to the student questionnaire after the pretest and before the posttest. Also, 17 teachers (59%) indicated they conducted classroom or homework activities. Of these, 13 teachers (45%) reported spending less than 1 hour of time on these activities and four reported spending between two and five hours on them. Eight teachers (28%) indicated they did a classroom lesson or discussion on protective actions such as "drop, cover and hold on" or tsunami evacuation. Four teachers did a classroom lesson on tsunami science, and two did a classroom lesson on earthquake science. Also, three teachers indicated they did a homework lesson on earthquake or tsunami preparedness. The responses of children whose teachers reported doing classroom activities were not significantly different from those of children whose teachers did not do additional activities. This may be because most reported classroom activities were very brief and few teachers focused on teaching

about protective actions, which were the focus of this study. Although the content and breadth of some teachers' voluntary classroom activities were not determined in this study, a GNS Science Report provides more detailed comparisons of differences in children's responses based on teachers' review of the questionnaire answers before the posttest (Johnson, 2013). Review of the correct answers appeared to influence the small increases in correct posttest responses for some questions, but there were also several questions where the review did not improve the proportion of correct answers. Overall, the impact of reviewing the correct answers before the posttest was negligble.

Children were asked about their previous disaster education in relation to earthquake and tsunami events that can happen in Washington state. Before ShakeOut, 86.5% of children indicated that they had learned about earthquake preparedness, and 85.5% of children indicated they had learned what to do to prepare for tsunamis. These proportions remained relatively unchanged after ShakeOut. Although a small portion indicated they had not learned about earthquake or tsunami preparedness after ShakeOut, children's understanding of earthquake and tsunami preparedness varies and some children may not have viewed the ShakeOut drill as a lesson in earthquake or tsunami preparedness.

Of the children who had learned about earthquake and tsunami preparedness previously, 95% or more indicated they had learned this subject at school. Only a third of respondents (32.9%) indicated that they learned about earthquake preparedness at home before ShakeOut, and this percentage was slightly higher after ShakeOut (37.5%). On the topic of tsunami preparedness, 46.9% of children indicated they had learned this at home before ShakeOut, and this proportion was slightly lower after ShakeOut (41.8%). A small

percentage of respondents indicated in the posttest that they learned about earthquake preparedness in other non-school related activities like Scouts (6.2%), summer camp (3.9%) or other activities such as TV and Internet (6.2%). Likewise, some children learned about tsunami preparedness in Scouts (7.3%), summer camp (4.1%) or other activities (6.6%).

6.3.2   Knowledge of protective actions

Table 6.2 illustrates that before ShakeOut, most children (96.9%) picked the correct answer when asked to select the meaning of "drop, cover, and hold on," indicating children were already familiar with this action.

Table 6.2

Question: If you hear the words "Drop, Cover, and Hold On," what would you do? (pick one)

Responses	Pretest	Posttest	%Change
Drop to the ground, take cover under a desk or table if nearby, hold on to the desk or table until the shaking stops (correct)	96.9% (476)	96% (485)	-0.9%
Drop what you are doing, cover your ears, hold on to your belongings	0.8% (4)	2% (10)	+1.2%
Drop what you are doing, run for cover, hold on to your belongings	0.6% (3)	0.6% (3)	0%
None of the above	0.8% (4)	0.8% (4)	0%
I don't know	0.8% (4)	0.6% (3)	-0.2%
Total	491 [4]	505 [2]	

Table 6.3 shows that the majority of children also correctly identified both before and after ShakeOut that "drop, cover, and hold on" helps protect them from flying objects. However, only a fifth of participants identified the action as preventing falling

during both the pretest and posttest. There were no significant changes in the results after ShakeOut, including among students whose teachers reviewed the correct answers to the questionnaire before the posttest (Johnson, 2013, p. 10).

Table 6.3

Question: Why do you "Drop, Cover, and Hold On" during an earthquake? (select all that apply)

Responses	Pretest	Posttest	%Change
To protect myself from flying objects (correct)	96.1% (471)	96.4% (479)	+0.3%
To prevent myself from falling (correct)	20.8% (102)	20.1% (100)	-0.7%
To prevent fainting and heart attacks	5.7% (28)	6.8% (34)	+1.1%
To protect my ears from loud noises	4.3% (21)	3% (15)	-1.3%
To stay warm	0.4% (2)	1.4% (7)	+1%
I don't know	2.2% (11)	1.6% (8)	-0.6%
Total	490 [5]	497 [10]	

Children were also asked: *If you are near the ocean and an earthquake occurs, what should you do once the shaking stops?* The correct answer was 'Go to higher ground or the top floor of a high building immediately.' Table 6.4 illustrates that in both the pretest and posttest, approximately 90% of children chose the correct answer, indicating many children were already familiar with this safety procedure.

Table 6.4

Question: If you are near the ocean and an earthquake occurs, what should you do once the shaking stops? (pick one)

Responses	Pretest	Posttest	%Change
Go to higher ground or the top floor of a high building immediately (correct)	90.6% (424)	90.5% (440)	-0.1%
Go to the beach to see if a tsunami is coming	2.6% (12)	2.7% (13)	+0.1%
Stay where you are and wait for tsunami warning signals	2.4% (11)	3.5% (17)	+1.1%
Call 911 to find out if there is a tsunami warning	1.7% (8)	1.6% (8)	-0.1%
I don't know	2.8% (13)	1.6% (8)	-1.2%
Total	468 [27]	486 [19]	

6.3.3 Knowledge of the causes of injury

The study investigated if ShakeOut helped children learn or maintain awareness of the most frequent cause of injury during an earthquake (flying objects and broken glass) since correct knowledge may help children better protect themselves in a scenario they have not practiced. The population level changes, presented in Table 6.5, show about half of children (51.7%) chose the correct answer before ShakeOut, and the proportion of children selecting the correct answer increased by 7.1% after ShakeOut. About a third of children selected 'building collapse' in the pretest and posttest. The total proportion of incorrect answers went down by 5.4% after ShakeOut. At the individual level, the results show 19.9% of children improved their knowledge after ShakeOut. However, 38% of children resulted in or maintained incorrect knowledge and uncertainty about the main cause of injury. One possible explanation is that some children were not

explicitly taught the causes of earthquake injuries during ShakeOut or previous school earthquake drills.

Table 6.5

Question: What do you think has caused the most injuries during earthquakes in the United States? (pick one)

Population level changes

Responses	Pretest	Posttest	%Change
Flying objects and broken glass (correct)	51.7%(237)	58.8% (283)	+7.1%
Building collapse	34.5% (158)	30.8%(148)	-3.7%
Car accidents	4.8% (22)	3.5% (17)	-0.5%
Being stuck outside in bad weather	2.2% (10)	0.6% (3)	-1.6%
Fainting	0.4% (2)	1.2% (6)	+0.8%
Total incorrect answers:	*41.5% (192)*	*36.1% (174)*	*-5.4%*
I don't know	6.3% (29)	5% (24)	-1.3%
Total	458 [37]	481 [26]	

Individual level totals
Incorrect changed to correct: 19.9% (79)
Continuation of correct: 42% (167)
Correct changed to incorrect: 8.8% (35)
Continuation of incorrect: 29.2% (116)

Children were also asked, *What is the most important part of your body to protect from injury during an earthquake?*, with a selection of responses including the correct answer 'Head.' Table 6.6 illustrates that most children chose the correct answer both before and after ShakeOut.

Table 6.6

Question: What is the most important part of your body to protect from injury during an earthquake? (pick one)

Responses	Pretest	Posttest	%Change
Head (correct)	97.1% (472)	96.8% (483)	-0.3%
Arms	0.8% (4)	0.8% (4)	0%
Legs	0.2% (1)	1.2% (6)	+1%
Feet	0.4% (2)	1.2% (6)	+0.8%
I don't know	1.4% (7)	0% (0)	-1.4%
Total	486 [9]	496 [11]	

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6.3.4   Scenario-based knowledge application

In the pretest and posttest, children were provided a series of actions they could take during an earthquake or tsunami that could happen when they are inside or outside a building. Children were asked if the action would help protect them from injury and could select 'Yes,' 'No' or 'Not sure' for each action. The results below are presented in tables showing both population-level changes and individual-level changes in children's responses from the pretest and posttest to illustrate the continuation of correct knowledge, improvements in correct knowledge, as well as the result or continuation of uncertainty or incorrect knowledge after ShakeOut.

Children were first asked about actions they could take if an earthquake happened while they were inside a building. The correct and incorrect actions were presented in a random order. Correct actions included: 'Drop to my knees and cover my neck and head' and 'Take cover under a desk or table if possible.' Incorrect actions included: 'Go outside to an open area,' 'Hold on to a desk and try to stay standing,' 'Go to a doorway' and 'Get next to a desk and create a triangle of life.'

For the correct action 'Drop to my knees and cover my neck and head,' presented in Table 7, the majority of children correctly answered 'Yes' to this question on both the pretests and posttests, and the results indicate a 10.9% increase in correct answers and a decrease in incorrect answers and uncertainty after ShakeOut. The individual-level responses reveal that most children (74%) maintained correct pretest knowledge, and only a small portion of children (9.8%) resulted in or maintained incorrect knowledge and uncertainty.

Table 6.7

Correct indoor action: Drop to my knees and cover my neck and head

Population level

Responses	Pretest	Posttest	%Change
Yes (correct)	77.7% (373)	88.6% (434)	+10.9%
No	12.9% (62)	4.9% (24)	-8%
Not sure	9.4% (45)	6.5% (32)	-2.9%
Total	480 [15]	490 [17]	

Individual level totals
Incorrect changed to correct: 16.1% (65)
Continuation of correct: 74% (296)
Correct changed to incorrect: 5% (20)
Continuation of incorrect: 4.8% (19)

For the correct action 'Take cover under a desk or table if possible,' the pretest results presented in Table 6.8 indicate that there was a very high level of correct knowledge before ShakeOut, with 97.3% of children selecting 'Yes.' The population and individual level changes indicate most children maintained correct knowledge after ShakeOut.

Table 6.8

Correct indoor action: Take cover under a desk or table if possible

Population level changes

Responses	Pretest	Posttest	%Change
Yes	97.3% (471)	97.4% (484)	+0.1%
No	0.8% (4)	1% (5)	+0.2%
Not sure	1.9% (9)	1.6% (8)	-0.3%
Total	484 [484]	497 [10]	

Individual level totals
Incorrect changed to correct: 2.5% (10)
Continuation of correct: 95.2% (393)
Correct changed to incorrect: 2% (4)
Continuation of incorrect: 0.4% (2)

For the incorrect action 'Go outside to an open area,' the population level changes presented in Table 9 indicate a 15.7% increase in the correct answer, 'No,' after ShakeOut, and a reduction in uncertainty and incorrect answers. The individual-level

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changes reveal that 32.2% maintained their correct knowledge after ShakeOut, and 26.8%

of children improved their knowledge. However, 10.3% of children changed from correct

to incorrect answers after ShakeOut and about 30.7% maintained incorrect knowledge or

uncertainty.

Table 6.9

Incorrect indoor action: Go outside to an open area

Population level changes

Responses	Pretest	Posttest	%Change
No (correct)	41.8% (201)	57.5% (281)	+15.7%
Yes	38.5% (185)	28.6% (140)	- 9.9%
Not sure	19.8% (95)	13.9% (68)	- 5.9%
Total	481 [14]	489 [18]	

Individual level totals
Incorrect changed to correct: 26.8% (109)
Continuation of correct: 32.2% (131)
Correct changed to incorrect: 10.3% (42)
Continuation of incorrect: 30.7% (125)

One possible explanation for the large portion of incorrect answers and

uncertainty is the likelihood that many children have not been explicitly taught to avoid

going outside to an open area during ground shaking, an action that may result in injuries

from falls or tumbling debris from building facades. Another possible explanation for

some of the changes in proportions of correct and incorrect answers may be confusion

about the question. During earthquake drills, some schools practice evacuating students

and staff outside to an open area after conducting a "drop, cover and hold on" drill in the

classroom. Therefore, some children may have understood this question to concern a

protective action taken after the shaking has ended, not an action during shaking as the

question intended. However, it is relevant to note that during the ShakeOut drills in both

school districts, the participating classrooms immediately evacuated to the top floor of

the highest building after they practiced "drop, cover and hold on" in classrooms, and therefore, none of the questionnaire respondents went outside during the drills.

For the incorrect action 'Hold on to a desk and try to stay standing,' presented in Table 6.10, the population level changes indicate most children (90.4%) recognized this as an incorrect action by responding 'No' during the pretest. There was a small 5% increase in those responding the incorrect answer, 'Yes,' after ShakeOut. The individual level changes demonstrate most children maintained or improved their correct knowledge, while a small portion (11.5%) resulted in or maintained incorrect knowledge or uncertainty. Classrooms that reviewed the correct answers before the posttest had a higher proportion of correct answers and lower proportion of incorrect answers (Johnson, 2013, p. 12).

Table 6.10

Incorrect indoor action: Hold on to a desk and try to stay standing

Population level changes			
Responses	**Pretest**	**Posttest**	**%Change**
No	90.4% (434)	87.6% (423)	-2.8%
Yes	5.4% (26)	10.4% (50)	+5%
Not sure	4.2% (20)	2.1% (10)	-2.1%
Total	480 [15]	483 [24]	

Individual level totals
Incorrect changed to correct: 6.5% (26)
Continuation of correct: 81.9% (329)
Correct changed to incorrect: 8.9% (36)
Continuation of incorrect: 2.6% (11)

For the incorrect action 'Go to a doorway,' approximately two-thirds of children chose the incorrect answer, 'Yes,' during both the pretest and posttest. The individual level results presented in Table 6.11 illustrate that 68.1% of children resulted in or

maintained incorrect knowledge after ShakeOut. There was only a very small change in proportions of both the correct and incorrect answers from the pretest to posttest, indicating that ShakeOut had little impact on children's understanding of current emergency management advice to not shelter in a doorway during an earthquake. It is likely that the change in the doorway advice has not been explicitly taught to children during ShakeOut or previous earthquake drills. Also, there were no significant changes in the results among students whose teachers reviewed the correct answers to the questionnaire before the posttest (Johnson, 2013, p. 13).

Table 6.11

Incorrect indoor action: Go to a doorway

Population level changes

Responses	Pretes	Posttest	%Change
No (correct)	24.7%(119)	23.4%(115)	-1.3%
Yes	67.2% (324)	65.8% (323)	-1.4%
Not sure	8.1% (39)	10.8% (53)	+2.7%
Total	482 [13]	491 [16]	

Individual level totals
Incorrect changed to correct: 8.6% (35)
Continuation of correct: 13.6% (55)
Correct changed to incorrect: 9.6% (39)
Continuation of incorrect: 68.1% (276)

For the incorrect action 'Get next to a desk to create a *triangle of life*,' Table 6.12 illustrates that a little less than half of children correctly answered 'No' in the pretest and posttest. Also, more than a third of children answered 'Not sure' on the pretests and posttests, indicating that a good portion of children were not familiar with the "triangle of life" phrase. However, the population-level changes show an 8.9% increase in the incorrect answer 'Yes' after ShakeOut. At the individual level, a higher proportion of children (54.9%) resulted in or maintained incorrect knowledge and uncertainty than

those who improved or maintained their correct knowledge (45.1%). Without additional information, it cannot be determined why the proportion of children selecting 'Yes' increased after ShakeOut, but one possible explanation is the likelihood that this alternative theory of self-protection was not discussed with students during the ShakeOut drill. Also, some children may have misunderstood the reference to 'life' in the term "triangle of life" as being suggestive of a life enhancing measure.

Table 6.12

Incorrect indoor action: Get next to a desk to create a "triangle of life"

Population level changes

Responses	Pretest	Posttest	%Change
No (correct)	47.7% (227)	46% (223)	-1.7%
Yes	10.1% (48)	19% (92)	+8.9%
Not sure	42.2% (201)	35.1% (170)	-7.1%
Total	476 [19]	485 [22]	

Individual level totals
Incorrect changed to correct: 13.1% (52)
Continuation of correct: 32% (127)
Correct changed to incorrect: 16.4% (65)
Continuation of incorrect: 38.5% (153)

Children were also asked about actions they could take if an earthquake happened while they were outside a building. Correct actions included: 'Cover my head and neck with my arms,' 'Move away from overhead hazards,' and 'Move away from electrical lines.' Incorrect actions included: 'Go inside to get under a table or desk' and 'Hold on to a tree and try to stay standing.'

For the correct action 'Cover my head and neck with my arms,' the population level data in Table 6.13 shows the majority of children (74.4%) chose 'Yes,' the correct answer, during the pretest and the proportion of children choosing 'Yes' increased by 10.5% after ShakeOut. The individual level reveals that most children (69.7%)

maintained correct knowledge and 16.9% improved their knowledge. Also, for the correct outdoor actions, 'Move away from overhead hazards' and 'Move away from electrical lines,' more than 95% children chose the correct answer, 'Yes,' both before and after ShakeOut.

Also, for the correct outdoor actions 'Move away from overhead hazards' and 'Move away from electrical lines,' more than 95% children chose the correct answer, 'Yes,' both before and after ShakeOut.

Table 6.13

Correct outdoor action: Cover my head and neck with my arms

Population level changes

Responses	Pretest	Posttest	%Change
Yes (correct)	74.4% (354)	84.9% (415)	+10.5%
No	13.2% (63)	7% (34)	-6.2%
Not sure	12.4% (59)	8.2% (40)	-4.2%
Total	476 [19]	489 [18]	

Individual level totals
Incorrect changed to correct: 16.9% (68)
Continuation of correct: 69.7% (280)
Correct changed to incorrect: 6% (24)
Continuation of incorrect: 7.5% (30)

For the incorrect action 'Go inside to get under a table or desk,' Table 6.14 shows the majority of children picked the correct answer, 'No,' during the pretest and posttest, and the proportion of children choosing 'No' did not change after ShakeOut. However, the individual level changes reveal that 55% of children maintained correct knowledge and 15.5% improved their knowledge. Meanwhile, 12.8% of students moved from correct to incorrect responses and in total, 29.6% of children resulted in or maintained incorrect knowledge during the posttest. Most of the individual changes from incorrect to correct

answers, as well as the decrease in the response 'Not sure,' were from students who

reviewed the correct answers before the posttest (Johnson, 2013, p. 16).

Table 6.14

Incorrect outdoor action: Go inside to get under a table or desk

Population level changes

Responses	Pretest	Posttest	%Change
No (correct)	67.4% (322)	67.6% (328)	+0.2%
Yes	18% (86)	21.6% (105)	+3.6%
Not sure	14.6% (70)	10.7% (52)	-3.9%
Total	478 [17]	485 [22]	

Individual level totals
Incorrect changed to correct: 15.5% (62)
Continuation of correct: 55% (220)
Correct changed to incorrect: 12.8% (51)
Continuation of incorrect: 16.8% (67)

For the incorrect action 'Hold on to a tree and try to stay standing,' Table 6.15

shows the majority of children (67.9%) picked 'No,' the correct answer. This proportion

increased by 6.7% after ShakeOut while the proportion of children selecting 'Not sure'

decreased by 5.7%. At the individual level, 60.5% maintained correct knowledge and

15% improved their knowledge, but 24.6% of children resulted in or maintained incorrect

knowledge. Again, this level of incorrect knowledge may be due to the likelihood some

children have not been explicitly taught what to do if they are outdoors during an

earthquake.

Table 6.15

Incorrect outdoor action: Hold on to a tree and try to stay standing

Population level changes

Responses	Pretest	Posttest	%Change
No (correct)	67.9% (322)	74.6% (359)	+6.7%
Yes	13.1% (62)	12.1% (58)	-1%
Not sure	19% (90)	13.3% (64)	-5.7%
Total	474 [21]	481 [26]	

Individual level totals
Incorrect changed to correct: 15% (59)
Continuation of correct: 60.5% (239)
Correct changed to incorrect: 9.4% (37)
Continuation of incorrect: 15.2% (60)

In the survey, children were also asked to select the best protective action from a selection of answers for the question, *What would be the best thing to do if you are inside but don't have a desk or table near you during an earthquake?* The correct answer was 'Drop to my knees and cover my head and neck.' The population level changes, presented in Table 6.16, indicate more than half of children selected the correct action during the pretest, and the proportion of children selecting the correct answer increased slightly by 5.3% after ShakeOut. Also, the proportion of children selecting the incorrect answer 'Go outside to an open area' decreased by 6.9%. The individual level changes reveal that about half of the children (53.1%) maintained correct knowledge and 14.3% improved their knowledge after ShakeOut. On the other hand, 22.8% of children resulted in or maintained incorrect knowledge and a smaller portion, 9.8%, changed from correct knowledge to incorrect knowledge.

Table 6.16

Question: What would be the best thing to do if you are inside but don't have a desk or table near you during an earthquake? (pick one)

Population level changes

Responses	Pretest	Posttest	%Change
Drop to my knees and cover my head and neck (correct)	60.7% (287)	66% (322)	+5.3%
Go to another room to find a desk or table to cover under	14% (66)	16.4% (80)	+2.4%
Go outside to an open area	16.1% (76)	9.2% (45)	-6.9%
Find an adult	2.3% (11)	3.3% (16)	+1%
Incorrect answers total:	*32.4%*	*28.9%*	*-3.5%*
I don't know	7% (33)	5.1% (25)	-1.9%
Total	473 [22]	488 [17]	

Individual level totals
Incorrect changed to correct: 14.3% (57)
Continuation of correct: 53.1% (212)
Correct changed to incorrect: 9.8% (39)
Continuation of incorrect: 22.8% (91)

Children were also asked, *Would you 'Drop, Cover, and Hold On' if you are at home during an earthquake?* Most children (79.9%) chose 'Definitely would' or 'Probably would' during the pretest, and this proportion remained relatively the same at 81.1% during the posttest. A small portion of children, 13.9%, chose 'Probably not' or 'Definitely not' during the posttest, and 5% chose 'Not sure.'

6.3.5 Disaster-related upset

Children were also asked to rank their level of upset when thinking or talking about earthquakes or tsunami. As illustrated in Table 6.17, most children indicated they do not or rarely feel upset when they think or talk about earthquakes and tsunamis. There was no significant change in children's response selections after ShakeOut, including at the individual level.

Table 6.17

Question: Do you feel upset when you think or talk about earthquakes and tsunamis? (pick one)

Responses	Pretest	Posttest	%Change
Not at all	58% (279)	58.2% (286)	+0.2%
Only once in a while	15% (72)	15.7% (77)	+0.7%
Sometimes	15.2% (73)	14.9% (73)	-0.3%
Most times	5.2% (25)	4.7% (23)	-0.5%
Every time	6.7% (32)	6.5% (32)	-0.2%
Total	481 [14]	491 [14]	

Teachers were also asked to rank their level of upset when thinking or talking about earthquakes and tsunamis. Twenty-five teachers (86.2%) indicated they do not or rarely feel upset when they think or talk about earthquakes or tsunamis. Four teachers (14%) indicated they become upset most times or every time; yet, two of these four teachers indicated that they did additional activities on earthquake and tsunami preparedness with their classrooms. One teacher spent less than one hour on the activities, while the other teacher spent two to five hours on the activities.

6.4   Discussion

A number of positive learning outcomes from the 2012 ShakeOut drill and previous drills were identified. Children demonstrated high levels of familiarity and correct knowledge of protective actions for earthquakes and tsunamis both before and after ShakeOut, indicating that these children have a strong base of knowledge from previous drills and education. In general, most children identified correct protective actions, for both familiar and less familiar scenarios, and for several questions, the proportion of correct answers increased after ShakeOut. Most children also recognized that the head is the most important part of the body to protect. In addition, both children

and teachers indicated low levels of upset when thinking or talking about earthquakes or tsunamis, and responses in this regard remained relatively the same from the pretest to the posttest. This is a positive sign that the ShakeOut drills were executed in a way that did not increase fears or anxiety about disasters.

While many positive outcomes of the drill were identified, some results of this study challenge the theory that routine school drills result in learning outcomes that will effectively mitigate injuries and deaths among children during an earthquake or tsunami. The findings indicate that significant portions of children have varying levels of knowledge and comprehension of the risks that cause injury and in some cases had difficulty recognizing incorrect actions, such as going to a doorway or moving outside or inside during an earthquake. Approximately a third of children chose an incorrect action or indicated uncertainty in scenarios not commonly practiced in school earthquake drills, such as when they are outside, or inside but not near a table or desk. In addition, approximately 80% of children were not aware of the risk of falling during an earthquake, or did not perceive falling as a risk, both before and after ShakeOut. While flying objects and broken glass pose the greatest risk of injury, more than a third of children believe building collapse is a more common cause of injury. Incorrect knowledge and risk perceptions may prompt responses during disasters that cause serious injuries, such as running outside during an earthquake due to fear of building collapse.

Also, the ShakeOut drills did not change most children's perceptions of outdated or non-credible advice. In the posttest approximately the same proportion of children, two-thirds, incorrectly responded that it would be protective to go to a doorway during an earthquake. Also, 54% of children were mostly uncertain of whether getting next to a

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desk, also known as the "triangle of life" advice, would be protective during an earthquake.

Another important finding was that more than a quarter of students in both school districts who participated in ShakeOut did not know or were not sure if they practiced tsunami evacuation. This suggests that observations of children practicing correct actions during drills may not be a good indicator that all children understand the safety procedures. Students should be provided more comprehensive information about the intention and purpose of vertical evacuation drills for tsunamis. If children do not understand why school leaders have chosen vertical evacuation instead of evacuation by foot or vehicle to higher ground, children may become confused and frightened during an emergency and may not follow instructions. This is a particular risk for students who have the ability to leave the school grounds on their own after an earthquake.

A frequent but often unheeded policy recommendation is that school drills test more realistic emergency scenarios, for example, by holding a drill at an unexpected time and location or placing children in different locations (Hull, 2011; Johnston et al., 2011; Lund, 2013). Some children's difficulty in applying knowledge of protective actions to unfamiliar scenarios may result from a lack of opportunity to problem-solve during school drills and receive constructive feedback on responses. For example, when asked what they would do if they were not near a desk or table during an earthquake, almost a third of children chose incorrect answers, including 'Go to another room to find a desk or table to cover under.' This illustrates how some children faced with an unfamiliar scenario may default to what has been memorized without reflection on the potential risks of that action in a different situation. Research supports the idea that drills have

improved learning outcomes if children learn both how and why protective actions are practiced, and there is evidence that teaching and practice of responses in different scenarios produces better learning of response skills (Jones et al. 1981, 1989; Soffer et al., 2009). For example, Soffer et al. (2009) compared the outcomes of three different earthquake education interventions for 5th and 6th graders - a lecture, an earthquake drill, and a combination of both – and found that each individual method increased children's earthquake knowledge, but the combination of a lecture and drill garnered the best results. Students in North Beach and Ocosta School Districts would likely benefit from school drills for different scenarios, such as when they are outside or traveling between classes, along with explicit lessons on adaptive protective actions in those scenarios.

As a case study of an evaluation technique using written questionnaires to test children's adaptive response capacities, the study method was successful in identifying gaps in children's understanding of protective actions for disasters, and these findings can be used to improve future drills. It was particularly useful to examine individual-level changes in knowledge and attitudes. A review of evaluations of disaster educations programs for children found that most programs were considered successful if there was an increase in the average proportion of children's correct answers to knowledge-based questions (Johnson et al., 2014c). Based on this precedent, this study would conclude that the ShakeOut drill was successful in helping the majority of children maintain or improve their knowledge of correct protective actions. However, individual-level changes reveal that on average, 21.5% of children maintained incorrect knowledge, and 9% of children moved from correct to incorrect answers, for several key questions. For example, for the incorrect outdoor action 'Go inside to get under a table or desk,' the population-level

averages show 67.4% of children chose 'No,' the correct answer, during the pretest and this proportion changed by less than a percentage point in the posttest, suggesting the same group of children maintained correct knowledge. However, the individual-level data reveals that 12.8% of children changed from a correct answer in the pretest to an incorrect answer in the posttest. One limitation of the quantitative questionnaire method is the ability to collect in-depth data on why this occurs. The addition of qualitative data through open-ended questions or interviews would be useful to determine the reasons for changes from correct to incorrect answers.

One important finding of this study is the critical role of school-based disaster education for children. Most children indicated that they learned about disaster preparedness at school, while less than half of children indicated they learned about preparedness outside of school. Therefore, beyond basic practice of correct protective actions when children are at their desks, school drills should also practice less familiar scenarios and explicitly teach children: 1) do not run outside during an earthquake and move as little as possible during ground shaking, as flying objects and broken glass pose the greatest danger; 2) stay inside if inside, and if there is no desk or table to shelter under, "drop, cover and hold" near an interior wall and away from windows; 3) stay outside if outside, and "drop, cover and hold" where you are unless you need to move away from overhead hazards like power lines; and 4) "drop, cover and hold" applies almost anywhere you are during an earthquake, including at home (see also American Red Cross, n.d.; Earthquake Country Alliance, 2012;). The integration of curricular lessons on disaster risks and preparedness could also improve children's resilience, particularly through homework activities that engage children's households in disaster

preparedness (Kagawa & Selby, 2012).

The schools' participation in ShakeOut was deemed worthwhile and worth continuing because it facilitated communication between the school districts and the local and state emergency management departments, which is important for building relationships critical for emergency response. It also provided the opportunity to collect data from multiple school districts, useful to both the schools and emergency management agencies. The evaluation findings suggest that the state-wide ShakeOut event could be better leveraged by school leaders, parents and emergency managers to facilitate opportunities for household and community interaction with schools on disaster preparedness. For example, ShakeOut drills in schools could include parents or incorporate afterschool or take-home activities that provide additional information on the local hazard risks, the most current preparedness advice, and answers to common questions about preparedness and response.

This study has a number of limitations. First, the study lacked a control group that did not participate in ShakeOut. The inclusion of a pretest for gathering baseline data and the relatively large number of respondents helps to overcome this design limitation. Also, the study was not able to determine the content and breadth of some teachers' concurrent, voluntary classroom activities on the topic of disasters, which may have influenced children's pre- and posttest responses. However, data was available on some teachers' review of the correct answers before the posttest and a separate comparative analysis found negligible impacts from these activities (Johnson, 2013). Another threat to internal validity was differential attrition that may have been created by children's ability to decline participation in the pre- and posttests. Also, although the questionnaires were

carefully conceived to be age-appropriate and were piloted in advance of the evaluation, some children may have misunderstood the intent of some of the questions, and where this may have occurred is noted in the results. To mitigate non-response and guessing due to uncertainty or memory bias, the responses 'Don't know' and 'Not sure' were added to all relevant questions. Finally, the situational specifics of the earthquake and tsunami drills performed in North Beach and Ocosta School Districts (e.g., timing, local risks, extent of the measurement, and population demographics) limits the potential generalizability of these results to other school districts that perform earthquake and tsunami drills or participate in ShakeOut. However, several of study's findings, particularly the value of triangulating drill observations with methods such as surveys, are useful for other jurisdictions seeking to measure learning outcomes from school drills.

End of published paper

6.5   Quality and feasibility of the outcome indicators

For this evaluation, the outcome indicators were built from a program theory matrix of ShakeOut, previously presented in Chapter 5 (Johnson et al., 2014b), and displayed below in Table 6.18. The success criteria (column 2, Table 6.2) for the earthquake and tsunami drills, which are practiced annually in North Beach and Ocosta School Districts, are: 1) in a disaster, there are no preventable injuries among children; 2) in absence of a disaster, children can identify how and when they should respond to prevent injury in different scenarios; and, 3) in absence of a disaster, children can identify how *not* to respond in different scenarios.

The purpose of the ShakeOut evaluation was to identify if children developed or maintained adaptive response skills that would help prevent injuries and deaths during earthquakes and tsunamis, whether they are at school or other locations. As discussed in Chapter 5 (Johnson et al., 2014b), children's participation in "drop, cover, and hold" with their peers and teachers provides elements of active involvement and social participation, which are learning techniques known to enhance children's learning. However, it is questionable whether drills are an effective learning technique because they often lack opportunities for problem-solving, self-reflection and knowledge transfer. It was theorized that adaptive response skills learned in drills could be identified through outcome indicators that measure: 1) children's comprehension of the most common causes of injury during earthquakes, a prerequisite for children's ability to strategically choose an appropriate protective action in an unfamiliar scenario; 2) children's comprehension of the purpose of practicing "drop, cover, and hold"; and 3) children's

ability to identify correct and incorrect protective actions in different earthquake scenarios, an indicator of their comprehension of how and why protective actions are used. In addition, an outcome indicator of children's reported levels of anxiety when thinking or talking about earthquakes and tsunamis would indicate whether the drills created anxiety in children that is non-constructive for learning response skills.

Specifically, the outcome indicators developed for the ShakeOut evaluation include:

Knowledge of the most common causes of injuries during earthquakes using answer selections such as (correct): falling, flying objects, and broken glass, and (incorrect): building collapse, car accidents, etc.;

Knowledge of the most important part of the body to protect (head)

Knowledge of correct and incorrect protective actions when an earthquake happens while you are inside a building using answer selections such as (correct): drop to my knees and cover my neck and head, and (incorrect): go outside to an open area, hold on to a desk and try to stay standing, etc.;

Knowledge of correct and incorrect protective actions when an earthquake happens while you are outside using answer selections such as (correct): cover my head and neck with my arms, move away from electrical lines, and (incorrect): go inside to get under a table or desk, etc.;

Knowledge of correct and incorrect protective actions after an earthquake when you are near the ocean using answer selections such as (correct): go to higher

ground or the top floor of a high building immediately, and (incorrect): stay where you are and wait for tsunami warning sirens, etc.;

Knowledge of what "drop, cover, and hold" stands for;

Comprehension of the purpose of "drop, cover, and hold" using answer selections such as (correct): to protect myself from flying objects, to prevent myself from falling, and (incorrect): to stay warm, to prevent fainting and heart attacks, etc.; and

Level of upset when you think or talk about earthquakes and tsunamis using a 5-point Likert scale.

These outcome indicators were specifically developed for use in written, quantitative questionnaires that were administered to the 6th through 12th grade students (age 10 and older) before and after the ShakeOut drill. As mentioned in the paper's Methods section, the pretest and posttest questionnaires (Appendix 4) were carefully conceived, following guidelines by Bell (2007) on designing and testing questionnaires for children. The questionnaire was piloted by colleagues with a small classroom of children aged 10 to 12 in Washington State. When the questionnaires were administered during the evaluation, a set of directions was read aloud to children clarifying that their answers would not be graded and the results would be anonymous.

Table 6.18: *Program theory matrix for ShakeOut, an earthquake and tsunami drill in two Washington State s...*

Questions:	What would success look like?	What are the factors that influence the achievement of each outcome?	Which factors are outside the direct influence of the program?	How does the program address these factors in order to bring about the outcome?	What performance informa... collect (quantitative and qu... indicators and comparisons...
1. Intended Outcome	*2. Success Criteria*	*3. Program Factors Affecting Success*	*4. Nonprogram Factors Affecting Success*	*5. Activities and Resources of the Program*	*6. Performance Information for Columns 2 to 5*
Comprehension of correct and incorrect protective actions in different earthquake scenarios	In a disaster, no preventable injuries among children In absence of a disaster, children can identify how and when they should respond to prevent injury in different scenarios In absence of a disaster, children can identify how *not* to respond in different scenarios	Teacher leadership during the drill Teacher comprehension of the rationale for school safety procedures and protective actions Participation of peers and teachers Annual repetition of the drill	Anxiety produced by the topic or activities Self-confidence in ability to protect oneself Trust in authorities Beliefs and past experiences with earthquakes Lack of earthquake conditions that cannot be simulated: e.g., ground shaking, anxiety, dangers Parent support for drills	Pre-drill notice to teachers and children Drill Repeat drill annually *Not always included in drills:* "Drop, cover, and hold" clearly explained by teachers in age-appropriate manner to children Risks and causes of injuries clearly explained Simulation of different scenarios: inside with cover, inside with no cover, outside, etc. Review of alternative response actions – protective and not protective	*Typically:* All children can demonstrat... cover, and hold" during a c... based simulation *Proposed for the evaluation...* Percentage of children who... they participated in an earthquak... drill Percentage of children that ... causes of earthquake injurie... Percentage of children that ... "drop, cover, and hold" stan... Percentage of children that ... important part of the body t... Percentage of children that ... correct and incorrect protec... different scenarios Levels of disaster-related an...

The strengths and weaknesses of the program theory model and outcome indicators used in the case study evaluation of ShakeOut are explored below using an adapted set of quality and feasibility criteria for evaluative outcome indicators first developed by Wall et al. (2010, pp. 6-7). Wall's criteria functioned as a framework for reviewing outcome indicators for emergency response. The criteria used and adapted for the analysis of the outcome indicators used here include:

Strength of the scientific evidence: reflecting the extent to which the literature supports the use of the indicator;

Conformity with accepted practice: reflecting the degree to which use of the indicator is consistent with current evaluation practice;

Reliability: reflecting the evaluator's estimation of the extent to which the indicator would garner consistent results;

Face validity: reflecting the evaluator's estimation of the extent to which judgments about and measurement of the indicator would appear valid and relevant to policy makers and other stakeholders who use the results of an evaluation to justify continued support or changes to policy and program approaches;

Utility: reflecting the extent to which the evaluator believes the indicator helped to answer key evaluation questions;

Resources needed: reflecting the amount of money, time and effort needed to collect reliable and precise data on the indicator and to analyze primary or secondary data;

User-friendliness: reflecting the evaluator's opinion of the level of technical knowledge needed to understand and analyze results from the indicator;

Affectivity: reflecting the potential for the indicator to affect a negative or unpleasant emotional reaction among research participants, namely children; and

Overall quality: reflecting the evaluator's opinion.

6.5.1   Strength of the scientific evidence

There is evidence that children's adaptive response skills for emergencies can be measured through outcome indicators measuring children's cognitive comprehension of disaster risks and protective actions. For example, Jones et al. (1989) studied young children's skill acquisition for fire response, and the quality of their skill acquisition using different training procedures including a behavioral condition (where children practiced fire response, but were not provided specific explanations as to why certain actions should be used), an elaborative condition (where children were provided information on correct responses, and opportunity for questions, but did not participate in behavioral practice), and an elaborative-behavioral condition (where children participated in both interventions). The authors found children in the elaborative-behavioral condition performed significantly better in the drill and on a knowledge-based skills test, which included questions on correct responses in different scenarios, compared to children in the other conditions. The authors concluded the behavioral and cognitive components

were both important to producing maximal adaptive response skills, consistent with other previous studies by the authors on effective fire response training (Hillman, Jones, & Farmer, 1986; Jones et al., 1981; Williams & Jones, 1989). Also, Soffer et al. (2009) compared the outcomes of three different earthquake education interventions for 5th and 6th graders: a lecture, an earthquake drill, and a combination of both. The authors found that each individual method increased children's earthquake knowledge, but the combination of a lecture and drill garnered the best results, suggesting education on earthquake safety should include instruction on both the theoretical and practical aspects of safety procedures. In sum, research supports the idea that children need to learn both how and why protective actions are practiced, and there is evidence that teaching and practice of responses in different scenarios produces better learning of response skills.

In this evaluation, the assessment only tested the types of knowledge that were acquired or maintained by children during participation in ShakeOut and through previous school drills. The school earthquake drills performed in the two Washington school districts are similar to the behavioral alone condition in the Jones et al. (1989) study in that they included little to no explanation of the response procedures. Future research that examines the impact of adding a cognitive component to a school earthquake drill is recommended. Research could test the theory proposed in this study's conclusion that the inclusion of explicit explanation on the causes of injury and correct and incorrect response actions, as well as practice in locations outside the school classroom. Drills should also include a feedback component, where children can ask questions about what they practiced, in order to promote flexible problem-solving skills and improve children's adaptive response capacities for earthquakes and tsunamis.

6.5.2   *Conformity with accepted practice*

As mentioned in the paper's introduction, children's learning from school drills is typically assessed through observations of children's individual and group behaviors during drills. The primary outcome indicator in these types of evaluations is a visual confirmation of children correctly practicing the taught responses. For school earthquake drills, this is typically a visual confirmation of children practicing "drop, cover, and hold" under a table or desk in the classroom when prompted by the teacher or other adult authority. Therefore, the use of quantitative questionnaires to measure children's learned response skills from drills is relatively uncommon, except for the few studies mentioned previously (Hillman et al., 1986; Jones et al., 1989, 1981; Soffer et al., 2009; Williams & Jones, 1989).

The case study evaluation of ShakeOut demonstrated some of the benefits of using this research method to evaluate the effectiveness of drills. First, the evaluators were able to determine at a population and individual level what aspects of earthquake and tsunami response were less understood by children. For example, more than a quarter of children were not aware they had performed a vertical tsunami evacuation drill during ShakeOut, indicating this safety procedure requires more explicit teaching and instruction. Second, the evaluation distinguished specifically what types of knowledge are learned during drills and what types are not. Although most children could identify correct protective actions for earthquakes in different scenarios both before and after ShakeOut, the ShakeOut drill was generally not effective in changing children's perceptions of outdated or non-credible advice. For example, in the posttest approximately the same proportion of children, two-thirds, responded that it would be

protective to go to a doorway during an earthquake although this is no longer

recommended by emergency management authorities in Washington. The evaluation of

earthquake and tsunami drills for children would benefit from a change in the accepted

practice of evaluating drills only through observation.

6.5.3   Reliability

Because the questionnaires were carefully conceived to be age-appropriate, and

the questionnaire was pilot tested with a small group of children from Washington State,

it is expected that the indicators would garner consistent results among children from this

jurisdiction. Following guidelines by Bell (2007) for designing and testing questionnaires

for children, the pilot test checked for item non-response, unexpected findings, and

inconsistency in individuals' responses. There were still a small number of questions that

were potentially ambiguous and could be improved. One was the question where children

indicate "Go outside to an open area" as a correct or incorrect action during an

earthquake. Since some schools practice evacuating outdoors after a "drop, cover, and

hold" drill in the classroom, some children may have understood this question to concern

a protective action taken after the shaking has ended, not an action during shaking as the

question intended. This question could be improved with more explicit language such as

"during ground shaking" instead of "during an earthquake." The other question referred

to the "triangle of life," which was a phrase unfamiliar to many of the children. This

measure may be improved by using a direct question about the protective nature of

getting next to a desk, as opposed to under a desk, without specific reference to the

phrase. Also, some non-responses to questions were due to the fact the questionnaires

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were printed on double-sided paper and some children inadvertently skipped pages. This could be overcome by adding some additional instructions to the questionnaire.

Although a more comprehensive reliability test was outside the scope of the ShakeOut evaluation, the application of a reliability and construct validity test would also increase the reliability of the questionnaires. Several articles provide examples of test-retest reliability and construct validity studies and internal reliability coefficients to measure and enhance the reliability of questionnaires administered to children and adolescents (Cullen et al., 2001; Jokovic et al., 2002; Maloney, McGuire, & Daniels, 1988; Singh et al., 2011).

6.5.4 Face validity

The results of the evaluation appeared to be well-received by the stakeholders involved in planning the evaluation, including the school district superintendents and school principals, and the local and state level emergency managers. Because these stakeholders provided input to the evaluation and development of the questionnaires, the outcome indicators have a high level of face validity. The school Superintendents indicated they intend to improve the biannual school earthquake and tsunami drills based on findings from the evaluation. Face validity of the questionnaires would also be enhanced by including children in consultations about the measures' feasibility and face validity.

6.5.5 Utility

The outcome indicators were effective in helping to answer key evaluation questions about areas of the drill program that require additional teaching and context to

help children develop response skills. By using a pretest-posttest design, they were also capable of reflecting change in responses as a function of the intervention. One limitation of the quantitative outcome indicators is that they lacked the ability to gather in-depth information about why children chose incorrect responses in some cases, or how their risk perceptions about earthquakes and tsunamis may affect their response in a real disaster. To further understand children's adaptive response skills, the evaluation would have benefited from additional qualitative outcome indicators that could explore the depth and breadth of children's knowledge of risks and protective actions, including, for example, reasons underpinning endorsement of incorrect responses. Also, if an earthquake does occur in this region, the research relationship established with the school districts may provide the opportunity to retrospectively research the children's protective actions during the event and assess their true adaptive response capacities.

6.5.6   Resources needed

The outcome indicators were feasible from a costing and resources perspective because they required a negligible amount of money, time, effort, and human resources to collect and analyze the data on the indicators. On the other hand, the evaluation was part of a Ph.D. project, therefore, a question remains about the resource burden perceived by any particular school in relation to using questionnaires to evaluate drills.

6.5.7   User-friendliness

The outcome indicators were user-friendly because they did not require a high level of technical knowledge to understand and analyze the results. If the outcome indicators are used in a study using a representative sample from a larger population, the

researcher would need more advanced knowledge of statistical analysis methods in order to analyze the statistical significance of changes in answers from pretest to posttest. Additionally, in terms of the burden perceived by schools, discussed in the previous section, the lack of resources to enter and analyze the data may be an impediment to routine use of these measures.

6.5.8   Affectivity

The teachers who administered the questionnaires did not report any instances where the evaluation or specific questions in the evaluation affected a negative or unpleasant emotional reaction among the participating children. During the development of the questionnaire, affectivity was taken into special consideration. For example, questions were framed around the causes of injury (e.g., flying objects and broken glass) rather than the types of potential injuries (e.g., crushing and head wounds) in order to avoid conjuring unpleasant feelings and emotions. It will be important to report to schools that these and other study indicators have been found to have low affectivity (e.g., Ronan et al., 2001, 2010, 2012), since focus group research reported on earlier in this dissertation found that some teachers in New Zealand were reluctant to discuss disaster-related topics with children for fear of upsetting them (Johnson, 2011; Johnson & Ronan, 2014).

6.5.9   Overall quality

Based on the previous considerations, the outcome indicators are considered to be high quality and feasible for use in large-scale evaluations involving children. The indicators were carefully constructed, reviewed through a process of extensive

consultation and development, including pilot work, and were shown to be sensitive to the effects of intervention. Overall, the indicators produced new and useful knowledge about the effectiveness of the ShakeOut drill. They also had high face validity among adults who would use of these measures in the future, including school personnel and emergency managers. The measures could be further improved by the application of more comprehensive reliability and construct validity test, and consultations with children about the face validity of the measures.

6.6   Link to Chapter 7: Paper 4

Chapter 6 (Johnson et al., 2014a) described a case study of a quantitative quasi-experimental evaluation of ShakeOut in two Washington State school districts. The evaluation assessed the role of ShakeOut drills in improving or maintaining children's adaptive response capacities for earthquake and tsunamis. While some positive outcomes were found, the study's results also challenged a key theory that routine school drills result in learning outcomes that will effectively mitigate injuries and deaths among children during a disaster. Among other findings, approximately a third of children chose an incorrect action or indicated uncertainty in scenarios not commonly practiced in school earthquake drills, such as when they are outside, or inside but not near a table or desk. A review of the quality and feasibility of the outcome indicators concluded that the indicators produced useful knowledge, and were feasible, reliable, and had high face validity with adult stakeholders. As noted in the previous section, an important caveat here is that the measure's feasibility for routine use in a school setting is currently not known, although there were some indicators that would support routine use (e.g., face validity, user-friendliness, low affectivity, etc.).

Chapter 7 (Johnson, Ronan, Johnston, & Peace, 2014d) describes the second case study evaluation: a theory-based process evaluation of *What's the Plan, Stan?,* a voluntary teaching resource distributed to New Zealand primary schools for the purpose of integrating disaster education into school curricula. Based on a stage step model of the program's theory of use, first introduced in Chapter 5, the study used intervening, facilitating, and deterrent factors of resource awareness and use as a framework for a qualitative analysis of mixed methods data.

Chapter 7: Paper 4 Implementing Disaster Preparedness Education in New Zealand Primary Schools

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Abstract

Purpose – This paper assesses the national implementation of disaster preparedness education in New Zealand primary schools through the dissemination of *What's the Plan, Stan?,* a voluntary, curriculum-based teaching resource.

Design/methodology/approach – Results and findings from a focus group study with school teachers and local civil defence staff in 2011 and a nationally representative survey of schools in 2012 were analyzed to identify intervening, facilitating, and deterrent factors of uptake and use of the resource.

Findings – The main intervening factors between resource promotion and school teachers' awareness of the resource are word of mouth among school teachers and teachers' proactive lesson plan research. The strongest facilitating factor was school-wide

use of the resource. Lack of awareness of the resource and the perceived need for teacher training are the greatest deterrents to use of the resource.

Practical implications – Based on the findings, several recommendations are provided for increasing use of the resource including web-based technology for teacher training, integration of disaster preparedness messaging into other children's programs, ongoing evaluation, and curriculum requirements.

Originality/value – An evaluation of the implementation of *What's the Plan, Stan?* adds to the limited body of knowledge on the benefits and challenges to distributing a voluntary teaching resource as a national strategy for curriculum integration of disaster education. The findings and lessons are relevant for nations meeting the Core Indicators of progress towards the *2005-2015 Hyogo Framework For Action*.

7.1　Introduction

In 2006, the New Zealand Ministry of Civil Defence and Emergency Management (MCDEM) developed *What's the Plan, Stan?*, a curriculum-based resource for teaching disaster science and preparedness to students in Years 1-8 in New Zealand primary schools (MCDEM, 2006a). Disaster preparedness is a significant policy focus in New Zealand, particularly due to the impacts of the 2011 Christchurch earthquake, which resulted in 185 deaths and significant damage (GNS Science, 2011). Like New Zealand, many national governments and local emergency management agencies are attempting to implement disaster education for children in response to the increasing threats and community impacts of disasters and climate change. In 2005, 168 Member States of the

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United Nations endorsed the *2005-2015 Hyogo Framework For Action* (HFA), agreeing

to five priority actions to reduce disaster risks globally, including Priority for Action #3:

Use knowledge, innovation and education to build a culture of safety and resilience at all

levels (UNISDR, 2005, p. 18). The integration of disaster risk reduction education in

school curricula is one of four Core Indicators of progress towards the HFA Priority for

Action #3 (UNISDR 2007a, p. 24). That and the goals of the *2005-2014 UN Decade for*

Education and Sustainable Development (UNESCO, 2005) have been the impetus for a

sustained policy focus on the introduction of school-based disaster education (Wisner,

2006).

Currently, there is very little empirical research on the implementation and

impacts of school-based disaster education programs. In a comprehensive and systematic

search of the published and grey literature (Johnson, Ronan, Johnston, & Peace, 2014c),

the authors identified only three evaluation studies of national programs, including

studies of programs in Nepal (Shiwaku et al., 2007), Israel (Soffer et al., 2009) and

Turkey (TR Ministry of Education et al., 2005). Yet, there is a wide array of activities

internationally to implement disaster risk reduction education in schools. In a case study

of thirty countries, Selby and Kagawa (2012) found the most common approach is the

infusion of disaster-related themes and topics into required school subjects, particularly

through textbooks or voluntary teaching resources. An in-depth evaluation of the

implementation of *What's the Plan, Stan?* adds to the limited body of knowledge on the

benefits and challenges to distributing a voluntary teaching resource as a national strategy

for curriculum integration of disaster education.

MCDEM developed *What's the Plan, Stan?* to provide a consistent platform for teaching disaster preparedness in all New Zealand primary schools (MCDEM, 2006). The resource comes in several formats including a hard copy binder of materials and a public website (http://www.whatstheplanstan.govt.nz/) where materials can be viewed and downloaded (MCDEM, 2009b). The teaching materials include unit plans, fact sheets, and activities that cover content on a wide range of disasters that occur in New Zealand and actions children and adults should take to prepare for and respond to disasters. The materials align with the New Zealand Curriculum and principles of inquiry learning so that teachers can incorporate activity-based instruction on CDEM topics in any area of the required curriculum, including Science, English, Social Studies, and Health and Physical Education.

In 2006 and 2009 respectively, MCDEM provided one hard copy binder of the resource to every primary school in New Zealand (MCDEM, 2009a). While *What's the Plan, Stan?* is sponsored by MCDEM at the national level, local CDEM staff are responsible for promoting and providing support for the use of the resource in schools.

This paper analyzes findings from two distinct evaluations of national uptake and use of *What's the Plan, Stan?* in primary schools. The first is a focus group study with primary school teachers in 2011, referred from here on as the "Johnson study," that was executed to gather in-depth perspectives from primary school educators and local CDEM staff on the motivators and challenges to use of the resource (Johnson, 2011). The focus groups took place just after the unforeseen 2011 Christchurch earthquake (Johnson & Ronan, 2014).

The other study included in the analysis are survey results and findings described in the *Report of the 2012 "What's the Plan, Stan?" survey of New Zealand primary schools*, prepared by the Research and Evaluation Services, Strategy and Governance Branch of the Department of Internal Affairs (Renwick, 2012). The intention of this study, referred from here on as the "Renwick study," was to gather nationally representative data on use of the resource in schools. A key finding of this survey, which was completed primarily by school principals and other school leadership, was that approximately 31% of primary schools have used the resource for a teaching or standard classroom activity since its release in 2006. MCDEM and the Ministry of Education considered this result positive given the low investment in the resource (Renwick, 2012). However, these survey results do not identify the percentage of teachers in schools who have used the resource nor the extent of usage. National uptake among individual school teachers is likely to be much lower than 31%.

For this paper, the results from both studies are compared to develop a typology of intervening, facilitating, and deterrent factors to awareness and use of the resource. The findings inform recommendations for integrating disaster risk reduction education in schools through national distribution of a free, voluntary teaching resource.

7.2 Methodology

The Johnson study used a mixed methods design. Focus groups were planned in seven regions across New Zealand including Auckland, Taranaki, Hawke's Bay, Manawatū-Wanganui, Wellington, Nelson-Tasman, and Southland (Johnson, 2011). For each focus group, local CDEM staff in the eight jurisdictions were asked to choose an

opportunity sample of 5 to 15 local primary schools that represented a mix of small, medium, and large schools that were likely to respond to the invitation. Use of *What's the Plan, Stan?* was not a requirement for participation. Ultimately, 31 schools chose to participate, providing 49 teachers and principals for the focus groups. Also, 12 teachers from the focus groups who indicated they had used the resource in their classroom completed an online follow-up survey. Individual and group interviews with one or more local CDEM staff were also conducted in the seven focus group jurisdictions.

The Renwick study included a self-completion questionnaire that was sent to all 2,115 New Zealand primary schools in February and March 2012 (Renwick, 2012). The study requested one survey from each school to be completed by the school staff member who knew most about the school's civil defence activities. The survey received responses from 1,020 schools during the survey period (47.3%). The report provides more detailed information about the methodology and survey results (Renwick, 2012).

For the purpose of this study, the focus group sessions and interview transcripts along with the results of the national survey were coded in NVivo software by the authors to identify themes, patterns, and informative excerpts relating to teachers' awareness and use of the resource (Braun & Clark, 2006). The data were analyzed to develop a typology of intervening, facilitating, and deterrent factors to primary school teachers' awareness and use of the resource. Figure 7.1 illustrates a simple program theory model of the implementation of *What's the Plan, Stan?*, which begins with the process of promoting the resource at the local level.

Figure 7.1 Program theory model of an implementation theory of *What's the Plan, Stan?*
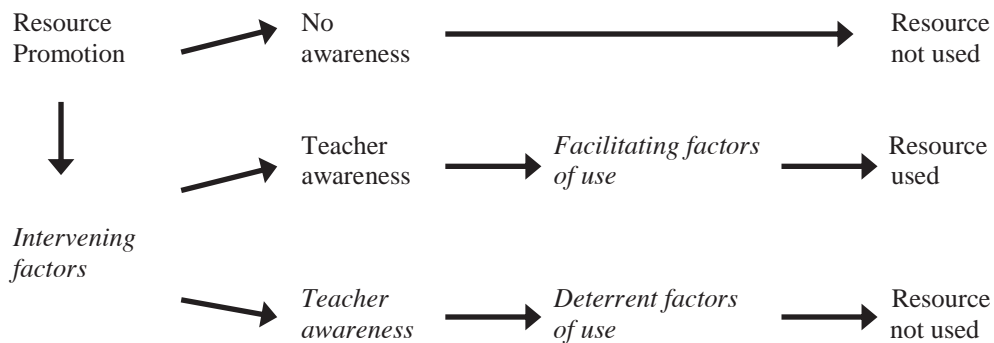
7.3 Results

Each subsection below provides a summary of the findings relating to the intervening, facilitating, and deterrent factors of the implementation theory followed by additional details from each study and illustrative excerpts from the studies' participants. Figure 7.2 provides a summary of facilitating and deterrent factors to resource use. The discussion following provides recommendations for increasing uptake of the resource and improving the integration of disaster education in New Zealand primary schools.

7.3.1 Intervening factors: Resource promotion to teacher awareness

The main intervening factors between resource promotion and school teachers' awareness of the resource are word of mouth among school staff and teachers' proactive lesson plan research. School engagement with local CDEM staff was also identified as an intervening factor.

The Renwick study captured the lack of awareness of the resource among school principals nationally. The study found that 24% of the survey respondents knew of the resource but had not read it, and an equal portion of respondents were not aware of the

resource before the survey. Only the Johnson study gathered information about how the resource was communicated to teachers in schools. Most responses related to word of mouth among teachers and school staff, which was most common, or lesson plan research. Several found the resource through research on the Internet using search terms such as "civil defence" and "earthquake for primary school," which sometimes led them to the *What's the Plan, Stan?* website. Some discovered the hard copy materials in the school resource room. Also, several indicated that they received information about the resource directly from local CDEM staff.

Figure 7.2 Facilitating and deterrent factors to use of *What's the Plan, Stan?*

Deterrent Factors
- Voluntary nature
- Lack of awareness of the resource
- Perception that training is needed for its use
- Lack of school-wide use
- Lack of relevancy when no disaster has occurred
- Incompatibility with teaching methods
- Competing extracurricular topics
- Lack of direct engagement with local CDEM staff

Facilitating Factors
- School-wide use of the resource
- Promotion of the resource by teachers
- Direct engagement with local CDEM staff
- Personal interest in the subject
- Student interest in the subject
- Good-quality design
- Recent disaster
- *Teacher training (potential)*

7.3.2   *Facilitating factors of resource use*

The analysis found that the strongest facilitating factor of teachers' classroom use of the resource was school-wide use of the resource, where "disasters" or "disaster preparedness" was chosen as a curriculum theme or as the focus of a school-wide event. Other facilitating factors include personal interest in the subject, student interest in the

subject, promotion of the resource by other school teachers, direct engagement with local CDEM staff, the design of the resource, and interest in the topic prompted by a recent disaster in New Zealand. Teacher training was identified as a potential facilitating factor.

Only the Johnson study gathered information from participants about what motivated them to use *What's the Plan, Stan?* The most common motivator cited was a classroom topic on "disasters" or "disaster preparedness" chosen by students or by the school as a "rich topic."[6] Other factors that facilitated use of the resource include personal interest in the subject, inspiration generated by the resource itself, and school-wide disaster drills and community events on disaster preparedness.

Engagement with local CDEM staff was identified in both studies as a motivator for school-wide or individual use of the resource. Based on an analysis of uptake and CDEM engagement, the Renwick study concluded that schools that have engaged with CDEM staff were more likely to have staff who have read or used the resource, and suggested that increased contact among schools and CDEM staff could facilitate uptake.

Both studies found the design of the resource was a facilitator in that several teachers who had used the resource felt it was high quality and easy to use, and consequently, recommended the resource to other teachers. In the Renwick study, respondents were asked how satisfied they were with the materials. Of the respondents (n=770), 36% indicated they were satisfied and 29% indicated they were very satisfied. When asked if they would recommend the resource to other teachers, 68% indicated they would. Also, the Johnson study asked participants who had used *What's the Plan, Stan?*

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[6] New Zealand schools with a "Rich Topic Integrated Curriculum" choose a school-wide topic each term.

about positive and negative student experiences with the resource and most indicated that students had positive reactions to the program. Teachers provided several examples of positive impacts including students' enthusiastic participation in the interactive activities. One teacher related, "It appealed to all of their learning intelligences. It's very practical and it gave the opportunity for those kids who don't shine necessarily academically. They took some really important lead roles and they were in their element doing that." Also, many focus group participants expressed that it was advantageous to have a single, national teaching resource on the topic of disaster preparedness for consistent teaching across school levels.

Recent disasters in New Zealand were also found to be a facilitating factor. Some focus group participants mentioned using the resource in response to local disasters such as floods. Also, the 2011 Christchurch earthquake, which had occurred just before the focus groups, appeared to be a motivating factor for intentions to use the resource in the future. In the Renwick study, survey respondents were asked if their school would use *What's the Plan, Stan?* in 2012, and 52% percent of respondents indicated they would. In the Johnson study's follow-up survey, 11 of the 12 respondents indicated that it was planned or likely they would use the resource in 2012.

Teacher training was also mentioned in both studies as a potential facilitating factor. A few focus group participants in the Johnson study stated that if an outside expert offers to help them deliver the program, they are more likely to use the program. When asked for ideas to improve uptake of the resource, several focus group participants suggested more training workshops for teachers.

7.3.3   *Deterrent factors of resource use*

Beyond lack of awareness of the resource, the analysis found the two strongest deterrent factors of teachers' use of the resource were: 1) unfamiliarity with the resource and the perception that training is needed for its use, and 2) lack of time to incorporate disaster-related subjects into classroom activities. Other deterrent factors include lack of school-wide coordination, lack of relevancy when no disaster has occurred, incompatibility with an individual's teaching methods, competing extracurricular topics related to children's health and safety, and lack of direct engagement with local CDEM staff. Overall, the main challenge to integration is the fact that disaster education is voluntary.

When focus groups participants in the Johnson study were asked what dissuaded them from using *What's the Plan, Stan?,* the most common reason was lack of awareness of the resource. Among those who were aware of the resource but had not used it, several discussed the lack of time to integrate the topic of disaster preparedness into their classroom activities. Focus group discussions indicated that topic planning is highly influenced by current events and teaching trends, and consequently, before the 2011 Christchurch earthquake, disaster preparedness was not a common suggestion for a topic or curriculum strand. One teacher related, "In our school, we set as a whole school what our plan is for that year and unless everybody comes on board with the topic, individual teachers don't tend to say, 'I'm going to do this [disaster preparedness].' So in our school it has to be whole-school driven and I think other things have jumped in the way."

Just as a recent disaster like the 2011 Christchurch earthquake was a facilitating factor for use or intentions to use the resource, lack of relevancy to current events was a deterrent factor. Some teachers felt that it was difficult to garner interest among students or staff for a disaster topic unless a disaster actually occurs. A teacher stated, "We are all trying to make our teaching relevant and real. I guess it's not until something like the Christchurch earthquake happens that you go, 'This would be a really cool resource.' You don't really want to cover something for the sake of covering it."

Although several focus group participants felt the *What's the Plan, Stan?* materials aligned well with the New Zealand Curriculum, a few felt the format of the materials, which provide pick-and-choose lessons plans, games and activities, did not necessarily align with their teaching methods. One teacher related, "I think schooling is going away from 'Here's a unit, here's all your lessons.' Teaching is changing and it's not like that anymore. When you get these 'plug-in' programs, they are not that effective sometimes."

Both the Renwick study and the Johnson study found that teaching requirements and competing extracurricular topics decrease opportunities to use the voluntary resource. Focus groups participants discussed how they would only do an extracurricular topic like disaster preparedness once every two to five years, or only when it is relevant to students. Focus group participants mentioned many other voluntary health and safety programs similar to *What's the Plan, Stan?,* such as programs related to fire safety, life skills, anti-bullying and road safety. Focus group participants mentioned that the agencies that created these resources sometimes provide teacher training or provide expert volunteers who deliver the program directly to children in the classroom. Use of the resource in past

years was also identified as a deterrent factor to repeat use of the resource with new classrooms of children. The Johnson study found that most teachers had only used the resource once since its release in 2006.

Just as direct engagement with local CDEM staff was a facilitating factor, lack of engagement with CDEM was identified as a deterrent factor. Both studies concluded that schools' interaction with local CDEM staff varied widely from region to region. Among schools surveyed in the Renwick study, 53% indicated their school has not had contact with CDEM staff and 11% did not know. Similarly, in the Johnson study, approximately half of the focus group participants indicated they had no contact or were not aware of any contact with civil defence. Some participants discussed how they had proactively contacted civil defence, but in some cases the staff could not meet them in-person due to competing priorities.

The Johnson study also included insights from nine individual and group interviews with local CDEM staff in the seven focus group jurisdictions. The interview questions focused on CDEM interaction with schools and the challenges to promoting *What's the Plan, Stan?* The main finding was most local CDEM staff interaction with individual schools is reactive, not proactive, mainly due to few staff and other competing community priorities. CDEM staff prefer to do goal-oriented activities with schools, such as assisting with plan development and exercises as opposed to passive marketing of the resource, because they believe these activities have a greater impact. Also, school requests for information and engagements increase significantly after major disasters when staff resources are most strained (a recent example being the 2011 Christchurch earthquake).

7.4 Discussion

Although there are several cases studies of innovative approaches to integrating disaster education in schools (e.g., Mulyasari et al., 2011; Selby & Kagawa, 2012; Shiwaku & Fernandez, 2011), there is very little empirical research on the implementation of these initiatives. The results and comparisons of qualitative focus group data and survey data on the uptake and use of *What's the Plan, Stan?* in New Zealand provide useful insights on the benefits and challenges to integrating disaster education through the distribution of a voluntary teaching resource.

An analysis of the data identified intervening, facilitating, and deterrent factors of school teachers' awareness and use of the resource. Overall, the greatest challenge to the integration of disaster education in New Zealand schools is the fact that it is voluntary. While most participants in both studies indicated they were satisfied with the quality and breadth of *What's the Plan, Stan?*, the main deterrents to use are the lack of school-wide disaster education initiatives, competition with other extracurricular topics and programs related to health and safety, and the perceived need for teacher training. The Johnson study revealed that disaster preparedness is not often suggested during topic planning for the following school year. Also, the demand for teacher training on the resource suggests that teachers may lack the confidence to teach the subject. Although the 2011 Christchurch earthquake stimulated educators' interest in teaching disaster preparedness, this interest may not be enough to instigate use of the resource long-term. Thus, more active and consistent promotion and training is needed to increase and sustain both awareness and uptake. Both studies gathered ideas from teachers, principals, and CDEM staff on how increase awareness and uptake of the resource in schools. These ideas and

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the authors' interpretations of the studies' findings together inform the following recommendations.

7.4.1   Increase CDEM interaction with schools through web-based technology

Although the Renwick study concluded that increased contact among schools and CDEM staff is likely to facilitate greater use, interviews with CDEM staff in the Johnson study found in several regions there are too few CDEM staff to engage with every school and respond to requests for teacher training. Considering the demands on CDEM staff, particularly during emergencies, increased interaction with schools may require an adjustment in staff responsibilities to focus more of their time on interacting with schools. A more promising possibility is to utilize online resources such web-based seminars (webinars) and social media tools to address requests for information and training from schools, and to more cost-effectively promote the resource. Webinars can be interactive, accessed by large audiences in multiple locations, and can incorporate remote speakers (e.g., teachers and students who experienced the Christchurch earthquake).

7.4.2   Provide more teacher training

Although MCDEM developed the resource to be self-explanatory, results from both studies reveal that teachers want, and in some cases expect, training on the resource and subject matter. The Renwick study described the challenge posed by the high cost of teacher training, including the cost of providing relief teachers when training occurs during school hours. The Renwick study suggested a "train the trainer" approach where one person in each school is coached to train other teachers. Since teachers often seek teaching guidance from their peers, this model may be appealing if teachers experienced

in school disaster response are trained to serve as trainers (Johnson & Ronan, 2014). There are a few models of national train-the-trainer programs to integrate disaster education in schools, including programs in Turkey and Indonesia (Selby & Kagawa, 2012).

7.4.3 Establish and maintain ongoing evaluation of the resource

What's the Plan, Stan? has not yet been evaluated for effectiveness in achieving specific learning and behavioral outcomes. Interestingly, the Renwick study found that a positive bi-product of their national survey research was increased awareness and many requests for copies of the resource. An annual evaluation of the program would provide both longitudinal data to determine if new outreach strategies are working and serve as a form of national promotion of the resource.

7.4.4 Integrate disaster preparedness messaging into other children's programs

Currently, disaster preparedness is an extracurricular topic competing with other important health and safety topics for inclusion in schools' curricula. As suggested in the Johnson study, rather than distinguish *What's the Plan, Stan?* from other programs on safety skills, national agencies could work together to incorporate key disaster preparedness messages in children's programs. This process could help ensure the messaging reaches more children and teachers while strengthening relationships among key agencies, which is necessary for effective disaster response.

7.4.5 Require disaster preparedness education in schools

Potentially the most effective measure for integrating disaster preparedness

education in schools would be a curriculum requirement. A required curriculum topic on disaster preparedness could complement nationally mandated school fire drills that are monitored and evaluated by New Zealand's Education Review Office (Ministry of Education, 2008). Many schools in New Zealand already voluntarily conduct drills for other disaster scenarios beyond fire, particularly "drop, cover, and hold" drills for earthquakes (Coomer et al., 2009; Tarrant & Johnston, 2010). Therefore, in light of current activities in schools and renewed interest in disaster preparedness, there may be more support than expected for integration of disaster preparedness learning in the New Zealand Curriculum.

7.5   Conclusion

Use of *What's the Plan, Stan?* nationally is low and varies by region. School teachers who have used the resource are satisfied with the materials and many teachers desire opportunities to use it in their classrooms. However, the dissemination of well-designed teaching materials is not a whole solution to integrating disaster education in schools. Ongoing promotion and evaluation of the resource, meaningful relationships among schools and local CDEM staff, and leadership at the national and school level to drive school-wide implementation are necessary to establish a successful national disaster education program for children in New Zealand. These lessons are also valuable for other countries developing a voluntary teaching resource as a national strategy for curriculum integration of disaster preparedness education.

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7.6   Quality and feasibility of the outcome indicators

For this evaluation, the outcome indicators were built from a program theory of implementation of *What's the Plan, Stan?* reconstructed from the Ministry of Civil Defence and Emergency Management's *What's the Plan, Stan? Communications Strategy for 2009 Launch* (MCDEM, 2009a). The policy document focused heavily on the premise that promotion of the resource through seminars, print advertising, media, and student competitions would increase awareness of the resource, and thus increase uptake and use of the resource. A stage step model of the program theory, presented previously in Figure 7.1 and further described in Chapter 5 (Johnson, Peace, Ronan, & Johnston, 2014b), illustrated other unknown influencing factors of teachers' awareness and use of the resource.

The purpose of this evaluation was to identify ways to increase use of the resource. The data set available for analysis included focus group and interview transcripts used in the Johnson study (Johnson, 2011) and the results of a quantitative survey of schools conducted by the Department of Internal Affairs (Renwick, 2012). These studies included questions administered to teachers regarding how they received information about the resource, their opinions on the quality of the resource, and motivators and challenges to use of the resource.

The outcome indicators used in the analysis include:

Intervening factors that exist between resource promotion and teachers' awareness of the resource;

Facilitating factors that exist between teachers' awareness of the resource and their decision to voluntarily use the resource for classroom activities; and

Deterrent factors that exist between teachers' awareness of the resource and their decision not to the use resource.

These outcome indicators were used in a qualitative analysis to identify factors beyond MCDEM's promotion of the resource that may have influenced teachers' awareness and use *What's the Plan, Stan?* Knowledge of these factors can help policy makers identify ways to increase facilitating factors and possibly address deterrent and intervening factors, in order to more effectively increase use and uptake of the resource. Also, insights on the benefits and challenges to the *What's the Plan Stan?* process model may be useful to other nations attempting to integrate disaster education through the distribution of a voluntary teaching resource.

To identify the intervening, facilitating, and deterrent factors in the data set, the outcome indicators served as the three main categories for a thematic analysis using NVivo software. The study aimed to identify underlying ideas, conceptualizations, and theories through a process Braun and Clarke (2006, p. 84) define as "thematic analysis at the latent level." Before analysis began, the lead author developed 12 main codes under the three main categories of intervening, facilitating, and deterrent factors of use, which served as the study's conceptual framework (see codes, Appendix 5). Working separately, two raters then reviewed the data in NVivo software to identify the prevalence of particular concepts, words, and phrases for each code. Through this process, 77 sub-codes were created. The prevalence of coded concepts were then used to interpret the

frequent intervening, facilitating, and deterrent factors of uptake and use, and these factors were used as the basis for recommendations to improve the program.

The strengths and weaknesses of the program theory models and outcome indicators used in the case study evaluation of *What's the Plan, Stan?* are explored below using an adapted set of quality and feasibility criteria for evaluative outcome indicators first developed by Wall et al. (2010, pp. 6-7). Wall's criteria functioned as a framework for reviewing outcome indicators for emergency response. The criteria used and adapted for the analysis of the outcome indicators used here include:

Conformity with accepted practice: reflecting the degree to which use of the indicator is consistent with current evaluation practice;

Reliability: reflecting the evaluator's estimation of the extent to which the indicator would garner consistent results;

Face validity: reflecting the evaluator's estimation of the extent to which judgments about and measurement of the indicator would appear valid and relevant to policy makers and other stakeholders who use the results of an evaluation to justify continued support or changes to policy and program approaches;

Utility: reflecting the extent to which the evaluator believes the indicator helped to answer key evaluation questions;

Resources needed: reflecting the amount of money, time, and effort needed to collect reliable and precise data on the indicator and to analyze primary or secondary data;

User-friendliness: reflecting the evaluator's opinion of the level of technical knowledge needed to understand and analyze results from the indicator; and

Overall quality: reflecting the evaluator's opinion

7.6.1 Conformity with accepted practice

The program theory model and outcome indicators used in this evaluation conform highly with evaluation practice. It is accepted that aspects of program implementation influence program outcomes, and several literature reviews have confirmed this theory through meta-analyses of program evaluations (Derzon, 2003; DuBois, Halloway, Valentine, & Cooper, 2002; Durlak & DuPre, 2008; Stith et al., 2006; Wilson, Lipsey, & Fixsen et al., 2005). Although evaluation of program implementation is uncommon in the evaluation of disaster education programs for children (Johnson et al., 2014c), in other fields such as health promotion and education, thematic analysis of qualitative data is commonly used in program evaluations to understand aspects of a program's process, such as factors that may facilitate or deter the uptake and use of program resources and activities (Saunders, Evans, & Joshi, 2005; Wholey, Hatry, & Newcomer, 2010). In particular, focus group and interview methods are often used to gather and analyze narratives in order to identify influencing factors in program implementation such as participants' attitudes and opinions, as well as hidden social norms (Massey, 2011). Some examples of program evaluations that have employed

outcome indicators similar to intervening, facilitating, and deterrent factors influencing the voluntarily uptake and use of a school-based program include: Altshuld et al. (1999), which assessed factors of school contexts that influenced whether educational ideas or products were adopted and implemented; Barr et al. (2002), which studied relationships between features of implementation and teachers' amenability to deliver anti-tobacco programs; and Fagan and Mihalic (2003), which conducted a process evaluation using mixed methods to identify common implementation obstacles faced by schools implementing a drug prevention program.

7.6.2 Reliability

The intervening, facilitating, and deterrent factors of program uptake and use are fluid and will be different at any point in time due to a wide range of external variables such as a community's experience with a disaster, new teaching requirements, a reduction in program funding, or other events. However, if similar questions related to resource use and uptake are posed to teachers in future research, a qualitative analysis guided by a theoretical framework using intervening, facilitating, and deterrent factors should consistently garner information that is useful to identifying areas of improvement in program implementation.

As in all forms of qualitative research, the reliability of the results depends greatly on the level of rigor applied during the analysis. Thematic analysis is vulnerable to biases, such as experimenter expectancy bias, where the researcher interprets the results not in a bias-free manner, but according to personal expectations about what the results will show (Braun & Clark, 2006). In this evaluation, several methods were used to

increase the reliability and validity of the analysis, such as including a second rater in the coding process and providing adequate examples of the themes in the report. Other techniques that were used to enhance the validity of the analysis (described in Nastasi & Schensul, 2005) included triangulation (the use of multiple sources of data), prolonged engagement with the target population, and peer debriefing (discussion of the findings and data interpretation with both the program developers and program participants).

7.6.3   Face validity

If data collection and analysis maintain high levels of rigor, it is expected that the outcome indicators would produce findings that are valid and relevant to policy makers and other stakeholders. A key step is using the results to explain how the intervening, facilitating, and deterrent factors identified can be feasibly addressed to remove barriers to program implementation. The Ministry of Civil Defence and Emergency Management (MCDEM) received the evaluation results and was highly receptive to the findings. MCDEM's knowledge of the preliminary findings of the evaluation prompted a proactive planning effort with the Ministry of Education to promote the participation of schools in 2012 ShakeOut, a nation-wide earthquake drill, and promote *What's the Plan, Stan?* through New Zealand's ShakeOut website. Some reported challenges to implementing the policy recommendations were staff turnover and limited funding. However, MCDEM referred the findings of the evaluation in the *New Zealand: National progress report on the implementation of the Hyogo Framework for Action, 2011-2013* (Hamilton, 2013) and reported MCDEM is now developing plans to better encourage schools and support teachers to use the resource. Also, reviewers of the paper for publication in *Disaster Prevention and Management* indicated the findings were relevant to policy makers and

practitioners internationally.

7.6.4   Utility

The outcome indicators were effective in addressing key evaluation questions, specifically the question of how MCDEM could increase awareness and use of the resource. The outcome indicators identified several factors influencing program uptake that were not known to the program developers before the evaluation began, such as the perceived need for teacher training. The development of the stage step model of the program's implementation was effective in supporting the development of overarching categories for the qualitative analysis.

7.6.5   Resources needed

Because the evaluation used existing secondary data, the analysis in NVivo using the outcome indicators required a negligible amount of financial and human resources. However, the time and effort involved in the analysis was substantial. First, the two raters, including the author, had to familiarize themselves with the NVivo software, which was a necessary tool for managing the large data set. All the documents included in the data set, including the seven focus group transcripts, the seven CDEM interview transcripts, and the Renwick survey report, were reviewed three times during the coding process in order to increase the reliability and validity of the analysis. In sum, the outcome indicators identified for the qualitative analysis require a time-intensive research effort. This does not include the significant amount of time, money, and effort employed in the original data collection processes. The use of secondary data certainly made the evaluation more feasible, but few organizations will have secondary data available from

other sources for the purpose of a program evaluation. However, the intervening, facilitating, and deterrent factors of resource use identified in this evaluation can be used as both benchmarks and guides for ongoing evaluations of a program, a strategy that may reduce the amount of time and resources needed for future studies. For example, in a future evaluation of *What's the Plan, Stan?*, an online survey could be used to question teachers about the identified factors such as the availability of teacher training, opportunities for school-wide use, and engagement with local CDEM staff, to determine if these changing factors have influenced uptake.

7.6.6   *User-friendliness*

Use of the outcome indicators would require a moderate level of technical knowledge on qualitative analysis methods like thematic analysis. However, the intervening, facilitating, and deterrent factors to resource use are understandable to a lay audience and are generalizable to a wide range of programs. In addition, the indicators derived in this study can be translated into a user-friendly survey format and thus have wider applicability, including through online surveys that could efficiently capture both quantitative data and qualitative data on the indicators.

7.6.7   *Overall quality*

Overall, the stage step model of program implementation and the outcome indictors of intervening, facilitating, and deterrent factors used in a qualitative analysis were successful in garnering rich, in-depth insights on the challenges to the implementation of *What's the Plan, Stan?* in New Zealand primary schools. In particular, these outcomes indicators identified important factors external to the quality and

dissemination methods of the resource that had both positive and negative impacts on the program's delivery and uptake in schools. Consequently, the authors were able to develop a set of policy recommendations on ways to increase uptake and use of the resource.

From a feasibility standpoint, the outcome indicators require some technical knowledge of qualitative analysis methods to achieve a rigorous analysis using mixed methods data. Also, unless secondary data is available, the data collection for a qualitative or mixed methods evaluation using these outcome indicators would likely require significant time, funding, and human resources. One way to increase the feasibility of the outcome indicators would be to conduct an initial evaluation using mixed methods to gather in-depth knowledge and use the results to frame questions in future studies using methods that require fewer resources, such as online surveys.

7.7   Link to Chapter 8

Chapter 7 (Johnson et al., 2014d) was a case study evaluation of the implementation of *What's the Plan, Stan?,* a teaching resource for integrating disaster education in New Zealand primary schools. Based on a stage step model of program implementation, a qualitative analysis of mixed methods data was conducted using categories of intervening, facilitating, and deterrent factors of the resource's uptake and use. Several factors affecting the program's deliver were identified, including school-wide use of the resource, teachers' perceived need for training on the resource, and schools' engagement with CDEM staff. The results challenge the program theory that the dissemination of well-designed teaching materials to all primary schools will increase school children's exposure to disaster education in New Zealand. Based on these findings, several policy recommendations are provided. This chapter also reflected on the quality and feasibility of the outcome indicators, and concluded that the indicators overall were effective and useful, but also required time and technical knowledge to engage in the qualitative analysis.

Chapter 8, the Conclusion chapter, draws on findings from the four papers (Chapters 4-7) to discuss the strengths and weaknesses of the theory-driven evaluation approaches and the outcome indicators and data collection methods tested in the two case studies. The chapter provides recommendations to improve the content, quality, and delivery of disaster education programs for children and approaches to develop a cumulative body of knowledge about the impact and scalability of programs.

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Chapter 8: Conclusion

8.1 Introduction

This chapter begins with a synopsis of the literature review presented in Chapter 2 and a summary of the research undertaken and the results. The chapter then discusses the implications of the research on the evaluation disaster education programs for children, including the international policy implications. Finally, opportunities for future research are presented.

8.2 Background and context

Due to an increase in disaster risks and disaster vulnerability caused by climate change, development, increasing income inequality, and low levels of household preparedness, practitioners and policy-makers have focused on new approaches to motivate disaster risk reduction, including disaster education for children. There is an international consensus that disaster education programs for children produce outcomes that improve children and families' resiliency and preparedness for disasters, evidenced by the promotion of these programs in policy including the United Nations' *2005-2015 Hyogo Framework for Action* (UNISDR, 2005). However, evaluations of these programs have not substantiated the key underlying theories of program effectiveness and implementation (Anderson, 2005; FEMA, 2010b; Ronan & Johnston, 2005; Ronan & Towers, 2014; Selby & Kagawa, 2012).

This study began with the research question: *How can we measure the outcomes and societal impacts of disaster education programs for children?* Within the extant

literature, there is little empirical evidence of the causal link between children's participation in disaster education and instrumental action towards disaster risk reduction, particularly instrumental actions that save lives and reduce physical and psychosocial injuries. There is also a dearth of research on the scalability and reach of programs and curricular integration efforts. These research gaps limit our understanding of how children's disaster education programs achieve the intended impacts of changing social behaviors that substantially reduce hazards and the destructive outcomes of disasters.

The literature review in Chapter 2 summarized the available research supporting and challenging key underlying theories of disaster education programs for children. The first theory is disaster education for children can increase children's hazard awareness, realistic risk perceptions and knowledge of protective actions. Empirical studies, including those by Ronan and Johnston (2001a, 2001b, 2003, 2005), Ronan et al. (2001, 2010, 2012), Finnis et al. (2004, 2010), Gulay (2010), Shiwaku and Shaw (2007), Clerveaux et al. (2010), Çelen and Üner (2002), and Özgüven and Öztürk (2006), provide evidence that disaster education for children can increase children's knowledge of risks, protective actions, and preparedness strategies. Observational case studies of disaster education programs also describe children learning about disasters, practicing protective actions, and preparing for disasters in their schools, homes, and communities (Cameron et al., 2010; Mitchell et al., 2009; Plan International, 2010; Reyes et al., 2011; Selby & Kagawa, 2012; Shiwaku & Fernandez, 2011; ThiMyThi & Shaw, 2013; UNICEF et al., 2011; Wisner, 2006). However, since most studies used correlational and case study methods, the research has not adequately distinguished disaster education programs for

children as the cause of household preparedness measures, planning, and practice, or community preparedness measures.

The second theory is that children can be taught self-protective actions for disasters for the purpose of preventing disaster-related injuries and deaths. The main method for teaching children self-protective actions is school emergency drills, which have been executed in schools internationally for many decades to ensure children practice safety procedures for sudden-onset disasters. During drills, children and adults practice procedures such as evacuation for fires, "drop, cover, and hold" for earthquakes, evacuation to high ground for tsunamis, and shelter-in-place for tornados (Brodkin & Coleman, 1994; Heath et al., 2007; Hull, 2011). Traditionally, school drills have been evaluated through visual observations (e.g., Central U.S. Earthquake Consortium, 2011; Coomer et al., 2009; Green & Petal, 2010; Johnston et al., 2011, 2010; McBride et al., 2013; Petal et al., 2011; Petal & Green, 2008). There remains a lack of research examining the quality of children's learning during routine drills, and children's ability to apply learned response actions in scenarios not typically practiced in school drills. Also, while there is anecdotal evidence of children using learned protective actions in disasters, there is no empirical evidence confirming the relationship between school drills and children's ability to protect themselves during a real disaster. There are further opportunities for research that draw on more interdisciplinary understandings of children's capacities to learn.

A third theory is that children can constructively contribute to and lead disaster preparedness and response in their households and schools, and provide added capacity to community efforts. The concept of Child-Led Disaster Risk Reduction (CLDRR), also

known as child-centered disaster risk reduction, was developed by international child advocacy organizations including Save the Children and Plan International. CLDRR initiatives embrace principles of children's rights, including the right to life, survival, and development. The positive outcomes of CLDRR programs are mainly interpreted from descriptive case studies sponsored by organizations such as Save the Children (Benson & Bugge, 2007), UNICEF (2012), Plan International (2010), and scholars including Gaillard and Pangilinan (2010) and Mitchell et al. (2009). Although there is a considerable body of informally reported evidence of children leading and contributing to disaster risk reduction activities, Mitchell et al. (2009) found some negative outcomes in one of the first attempts to analytically examine CLDRR programs in El Salvador and the Philippines. One of the negative impacts was some children's belief that they were being exploited for adults' political gain. These initiatives require further study to understand both the positive and potentially negative impacts of this method of disaster education for children.

A fourth theory is that children who participate in disaster education can transfer knowledge to adults and influence adults' risk awareness and behaviors. Although there is a substantial amount of education, public health, and market research on the roles of children and youth as communicators (e.g., Berey & Pollay, 1968; Crawford et al., 1990; Duvall & Zint, 2007), few studies have examined children's roles in disseminating disaster risk reduction knowledge learned through education (Kasperson & Kasperson, 2005; Mitchell et al., 2009). In some cases, disaster education prompted discussion among children and their guardians (Mitchell et al., 2008; Ronan et al., 2010; Ronan & Johnston, 2001a, 2003), but it cannot be assumed that child-to-parent knowledge transfer

occurs in programs where parents are not directly involved in the program or take-home activities. One research study found that household knowledge transfer did not consistently occur among children who participated in disaster education (Tarrant & Johnston, 2010). There remains a gap in the literature on mechanisms in disaster education programs for children that facilitate intergenerational learning and social change, and on the quality of child-to-parent knowledge transfer.

Lastly, there is a theory that disaster education can reduce, rather than increase, anxiety and fear in children. Scholars found some programs reduced or did not change children's reported levels of disaster-related fear, but the same programs also did not increase children's self-efficacy for emotional coping in a future disaster (Ronan et al., 2001, 2012; Ronan & Johnston, 2001a, 2003; Tarrant & Johnston, 2010). It is questionable whether reduced or unchanged anxiety is a worthy goal of disaster education since there is no evidence a low level of disaster-related fear before a disaster translates to better disaster outcomes and emotional coping. Further, there are mixed findings about the role of disaster anxiety in motivating or deterring people's motivation to prepare for disasters (Mishra & Suar, 2012). There is a particular need for more investigation of this unknown in the context of children since children have less capability to implement hazards adjustments in a home or community compared to adults.

In sum, there are many unchallenged assumptions and theories about the role of disaster education for children in changing behaviors and motivating disaster risk reduction in children's homes and communities. The existing literature provides promising evidence of constructive program outcomes, but they are limited in their applicability and generalizability because of weaknesses in many of the studies' designs,

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scope, and data collection methods. For example, in several studies, children's exposure to previous disaster education and home hazard adjustments were based on child reports that may be prone to biases, such as children's inability to reliably remember past events and mundane household factors. Also, descriptive case studies, a common research design in studies of disaster education programs for children, do not provide empirical measurement of the relationships between program delivery and program outcomes and impacts.

To address some of these gaps, this research aimed to first, illuminate the current state of evaluation of disaster education programs for children, including evaluation methodologies and outcome indicators traditionally used to define program impacts. Second, it aimed to build new theories of evaluative outcome indicators that could be used to test the underlying assumptions and theoretical constructs of programs. These indicators were tested in two distinct case study evaluations of large-scale disaster education programs in order to produce new knowledge about program impacts and examine the indicators' quality and feasibilty in measuring program outcomes and societal impacts.

8.3   Summary of the research undertaken and results

The four papers presented in Chapters 4 to 7 describe the investigation process and findings from a case study that addressed the research question developed for this research: *How can we measure the societal impact and implementation of disaster education programs for children?* The case study included four components described below.

8.3.1   Chapter 4/Paper 1: Evaluations of Disaster Education Programs for Children: A Methodological Review (Johnson, Ronan, Johnston, & Peace, 2014c)

A methodological literature review of disaster education programs for children, published in the *International Journal of Disaster Risk Reduction*, was undertaken to characterize the current state of evaluation and identify the outcome indicators traditionally used to measure program outcomes and implementation. Thirty-five evaluations were identified in a search of the published and grey literature. The papers were analyzed using a grounded theory approach to develop codes and categorize the methodological components of the studies, including the types and sources of evaluations, research methods and designs, research participants, outcome indicators, approaches to analysis, and research limitations. In particular, this study examined the types of outcome indicators used to measure program impacts. Other variables of interest included the data collection methods used in studies involving children, evaluation conclusions, common research constraints, and promising research methods and practices.

The methodological review found most of what is known about the effectiveness of disaster education programs for children is based on results of quantitative studies with children. The evaluations primarily focused on measuring children's knowledge of disaster risks and protective actions and child reports of preparedness actions. Most studies used descriptive, correlational, and quasi-experimental designs, and the most common data collection tool was a written questionnaire with multiple-choice or Likert-type scale questions. While these studies provide evidence of valuable knowledge change in children, there is still little empirical evidence of how disaster education programs

facilitate children's roles in household preparedness, their self-protective capacities, or their likelihood of preparing for disasters as adults. Further, few studies assessed process outcomes, such as program uptake, feasibility, and instructor satisfaction with the learning tools. In the analysis process, some promising research methods were identified, including outcome indicators and examples of tools to measure children's self-efficacy, adaptive capacities, subject comprehension, and knowledge transfer. The incorporation of theory-based evaluation methods is proposed as a way to examine program theories and develop meaningful outcome indicators. Theory-based evaluation models are featured in the following paper and the two respective case study evaluations.

8.3.2 Chapter 5/Paper 2: Improving the Impact and Implementation of Disaster Education Programs For Children Through Theory-Based Evaluation (Johnson, Peace, Ronan, & Johnston, 2014b)

A main weakness in evaluation practice identified in the methodological review was evaluators' propensity to assess program effectiveness based on changes in children's knowledge. Most evaluators did not articulate an explicit program theory of how a program would achieve desired outcomes and impacts related to instrumental action towards disaster risk reduction in households and communities. The second paper, submitted for publication, described the advantages of constructing program theory models for the purpose of theory-based evaluation of disaster education programs for children. Following a review of some potential frameworks for program theory development, including the logic model (Cooksy, Gill, & Kelly, 2001), the program theory matrix (Funnell, 2000), and the stage step model (Lipsey & Pollard, 1989), the paper provided some working examples of these frameworks in practice. First, a program

theory matrix was used for constructing a program theory and outcome indicators for the case study evaluation of ShakeOut, an earthquake and tsunami drill practiced in two Washington State school districts. The model illustrates a theory of action, specifically the effectiveness of school earthquake drills in preventing injuries and deaths during disasters. The second working example was a stage step model used for constructing a process theory of *What's the Plan Stan?*, a voluntary teaching research distributed to all New Zealand primary schools for curricular integration of disaster education. The model illustrates a theory of implementation, specifically expanding the reach of disaster education for children through the national distribution of a voluntary teaching resource.

The process of developing the two program theory models is discussed, including the development of model components such as a hierarchy of intended outcomes, research questions, success criteria, influencing factors external to programs affecting success, activities and resources of the program, performance information (also known as outcome indicators), and sources of data. The two models featured in this paper served as the basis for the theory-based evaluation approaches used in the two respective case study evaluations following. The two case study evaluations were planned to test new evaluative outcome indicators that would examine programs' theoretical constructs and underlying assumptions about their outcomes and implementation.

8.3.3   Chapter 6/Paper 3: Evaluating Children's Learning of Adaptive Response

Capacities from ShakeOut, an Earthquake and Tsunami Drill in Two Washington

State School Districts (Johnson, Johnston, Ronan, & Peace, 2014a)

The third paper, submitted for publication, is a case study of a theory-based impact evaluation of ShakeOut, an earthquake and tsunami drill that took place in two Washington State school districts in October 2012. The synopsis of the program theory of ShakeOut is that drills practiced in school classrooms provide children an adequate understanding of protective actions that will effectively prevent injuries and deaths among children during an earthquake or tsunami. Based on a program theory matrix of the program's theory of action, described in the previous paper (Johnson et al., 2014b), unique outcome indicators were developed to measure the maintenance or development of children's self-protective skills and adaptive response capacities for earthquakes and tsunamis. These indicators included measurements of students' knowledge and perceptions of: 1) protective actions for earthquakes and tsunami, 2) actions they should take and actions to avoid during earthquakes and tsunami when inside and outside buildings, 3) the causes of injury during earthquakes, and 4) what "drop, cover, and hold on" stands for and why this action is practiced. The evaluation was a quasi-experimental design using written pretest-posttest questionnaires administered to 574 children in grades 6 through 12. The analysis examined population and individual-level changes in children's responses to investigate children's maintenance and improvements in correct knowledge. The analysis also examined children's maintenance of incorrect knowledge and changes from correct to incorrect answers after ShakeOut. A teacher survey was also

administered to gather information additional information about the context of the

ShakeOut drill and other learning activities undertaken in the classroom.

The ShakeOut evaluation found that the participating children had high levels of

familiarity and correct knowledge of protective actions for earthquakes and tsunamis both

before and after ShakeOut, indicating that these children have a strong base of knowledge

from previous drills and/or education. The majority of children identified correct

protective actions, for both familiar and less familiar scenarios, and recognized that the

head is the most important part of the body to protect. However, some results of this

study challenge the theory that routine school drills adequately teach children response

skills that will effectively mitigate injuries and deaths among children during an

earthquake or tsunami. Approximately a third of children chose an incorrect action or

indicated uncertainty in scenarios not commonly practiced in school earthquake drills,

such as when they are outside, or inside but not near a table or desk. Other findings

include: 1) approximately 80% of children were not aware of the risk of falling during an

earthquake, or did not perceive falling as a risk, both before and after ShakeOut; 2) more

than a third of children had the incorrect knowledge of the most frequent cause of injury

during an earthquake (falling and flying objects), which could prompt dangerous

responses during disasters, such as running outside during an earthquake; and 3)

ShakeOut did not change children's perceptions of outdated or non-credible advice,

including the outdated advice of getting in a doorway during earthquakes, and the

incorrect advisement to get next to a solid object rather than under it (an action known as

the "triangle of life"). Another important finding was that more than a quarter of students

in both school districts did not know or were not sure if they practiced a tsunami

evacuation drill during ShakeOut. This finding suggests that some children are not aware of the school's tsunami safety procedures, and observations of children practicing correct actions during drills may not be a good indicator of children's comprehension of protective actions. Also, the evaluation findings suggest the state-wide ShakeOut event could be better leveraged by school leaders, parents, and emergency managers to facilitate opportunities for household and community interaction with schools on disaster preparedness.

As a case study of an evaluation technique using written questionnaires to test children's adaptive response capacities, the study method was successful in identifying gaps in children's understanding of the actions they are practicing during the drills. The findings can be used to improve the school drills, for example, by adding discussion, practice, and feedback on what children should do when they are outside, and teaching about the rationale and purpose of the vertical evacuation procedure for tsunamis.

The program theory matrix of the program's theory of use and the resulting outcome indicators were effective in developing an evaluation that answered key evaluation questions and examined the program's theoretical constructs. Although the indicators did not conform with the accepted practice of evaluating drills through visual observation, the outcome indicators contributed new and important knowledge about children's learning outcomes from the drills that could not be identified through observation alone. The evaluators were able to determine at a population and individual level what aspects of earthquake and tsunami response were less understood by children. Although there are some limitations to using a quantitative questionnaire for evaluating learning outcomes, particularly the inability to gather in-depth insights on why certain

responses were given, the quantitative outcome indicators required a negligible amount of money, time, and effort to collect and analyze the data on the indicators. The questionnaires were carefully conceived and tested to increase their reliability and there were no reports of the questions affecting a negative emotional reaction among the participating children. Also, the outcome indicators had strong face validity due to the involvement of stakeholders early the evaluation planning. Overall, the outcome indicators contributed new knowledge to the practice of evaluating learning outcomes from disaster education programs for children and helped identify ways to improve drills in order to enhance skills that prevent injuries and deaths during disasters.

8.3.4   *Chapter 7/Paper 4: Implementing Disaster Preparedness Education in New Zealand Primary Schools (Johnson, Ronan, Johnston, & Peace, 2014d)*

The fourth paper, accepted for publication in *Disaster Management and Prevention*, is a case study of a theory-based process evaluation of *What's the Plan, Stan?*, a free, voluntary disaster teaching resource that was distributed to all New Zealand primary schools as part of an effort to integrate disaster education in school curricula. The synopsis of the process theory of *What's the Plan, Stan?* is that an increase in resource promotion will increase uptake of the resource. Using the stage step model of the program's theory of implementation, outcome indicators were developed to identify intervening, facilitating, and deterrent factors of uptake and use of the resource. Qualitative focus group and interview data gathered for a previous study by the author in 2011 (Johnson, 2011) and quantitative national survey data gathered by the Department of Internal Affairs in 2012 (Renwick, 2012) were used in a qualitative analysis of intervening, facilitating, and deterrent factors of use. Using a process Braun and Clarke

(2006) define as "thematic analysis at the latent level," 12 main codes were developed by the author under the three main factors, which served as the study's conceptual framework. Two raters then coded the data in NVivo software to identify the prevalence of particular concepts, words, and phrases for each code, which resulted in the creation of 77 sub-codes. The results of thematic analysis were then interpreted to identify the factors influencing teachers' awareness and use of the resource, which served as the basis for policy recommendations to improve delivery of the program.

The evaluation found that there are other factors beyond the quality and awareness of the resource that deter teachers' use of *What's the Plan, Stan?* Low awareness of the resource was identified as a major challenge to uptake, but overall, the greatest challenge to the integration of disaster education in New Zealand schools is the fact that use of the resource is voluntary. Most participants in both the Johnson and Renwick studies indicated they were satisfied with the quality of *What's the Plan, Stan?* However, many teachers did not use the resource and cited diverse reasons such as lack of school-wide disaster education initiatives, competition with other extracurricular topics and programs related to health and safety, and the perceived need for teacher training. Of teachers that did use the resource, the main facilitating factor was school-wide use of the resource, where "disasters" or "disaster preparedness" was chosen as a curriculum theme or as the focus of a school-wide event. Other facilitating factors included personal interest in the subject, student interest in the subject, promotion of the resource by other school teachers, direct engagement with local civil defence and emergency management (CDEM) staff, the design of the resource, and interest in the topic prompted by a recent disaster in New Zealand. Also, the main intervening factors between resource promotion

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and school teachers' awareness of the resource were word of mouth among school staff and teachers' proactive lesson plan research. The paper concluded with several policy recommendation to increase uptake and use of the resource, including 1) increase CDEM interaction with schools through web-based technology, 2) provide more teacher training, 3) establish and maintain ongoing evaluation of the resource, 4) integrate disaster preparedness messaging into other children's programs, and 5) require disaster preparedness education in schools.

There were significant advantages to combining the mixed methods data to analyze intervening, facilitating, and deterrent factors of the resource's uptake and use. The focus group study of teachers (Johnson, 2011) revealed underlying reasons of some teacher's non-use of the resource, but could not identify true levels of uptake or draw conclusions generalizable to all teachers. Likewise, the Department of Internal Affair's national survey of school representatives (Renwick, 2010) identified low uptake nationally and high satisfaction with the quality of the resource but did not gather in-depth insights on reasons for the resource's low uptake, or factors that facilitated its use by some schools. Through analyzing the data and results of both studies, it was determined that uptake remains low despite ongoing promotional efforts. To increase uptake, CDEM staff would need to execute low-cost methods of teacher training on the resource and further cultivate relationships with school leaders who can encourage school-wide use of the resource. The authors also suggested that there needs to be other methods of exposing children to disaster education, and these approaches would require collaboration among stakeholders including CDEM staff, the Ministry of Education, school leadership, and individual teachers.

The stage step model of program implementation and the outcome indicators of intervening, facilitating, and deterrent factors used in a qualitative analysis were successful in garnering rich, in-depth insights on the challenges to the implementation of *What's the Plan, Stan?* in New Zealand primary schools. In particular, these outcome indicators identified important factors external to the quality and dissemination methods of the resource that had both positive and negative impacts on the program's delivery in schools. Several methods were used to increase the reliability of the results of the outcome indicators, such as including a second rater in the coding process and providing adequate examples of the themes in the text. Also, triangulation, prolonged engagement with the target population, and peer debriefing increased the validity of the results. The Ministry of Civil Defence and Emergency Management considered the results valid and relevant to the program, and referred to the evaluation in New Zealand's *National progress report on the implementation of the Hyogo Framework for Action* (Hamilton, 2013). One challenge to the use of the indicators is that the time and effort involved in the analysis can be substantial and requires some technical knowledge of qualitative analysis methods. However, the intervening, facilitating, and deterrent factors of resource use identified in this evaluation can be used as benchmarks for ongoing evaluations of *What's the Plan, Stan?*, a strategy that may reduce the amount of time and resources needed for future studies. Overall, the outcome indicators contributed new knowledge to the practice of evaluating the implementation of disaster education programs for children and helped identify ways to increase of the reach of school-based programs that are implemented through the dissemination of voluntary teaching resources.

8.4   Implications for evaluating disaster education programs for children

The findings of the case study research provide new knowledge in some key aspects of evaluating disaster education for children, which are discussed in more detail below. First, the case study evaluations tested core theoretical assumptions about two large-scale programs and garnered evidence that some common theories about the effectiveness and delivery methods of programs are faulty. Second, program theories were reconstructed and new evaluative outcome indicators of effectiveness and implementation were developed and tested. These theory-based evaluation approaches were effective in producing meaningful information that can be used to improve the outcomes, reach, and societal impacts of programs. Third, the research found observations are inadequate for measuring the outcomes and intended impacts of school drills. This section ends with international policy implications of the research.

8.4.1   Some common theories about disaster education programs for children are faulty

The case study evaluations found that some program theories common to many disaster education programs for children were faulty. The ShakeOut evaluation critically examined the program theory that perfunctory, school-based drills that allow children to practice basic response actions in the classroom lead to the acquisition of response skills that will prevent injuries and deaths during an earthquake or tsunami (Johnson et al., 2014a). The significance of this program theory is that it underpins basic school drills performed in many schools internationally. While the results of the evaluation found that most children had familiarity with correct protective actions, significant portions of children had difficulty applying what they had practiced in the classroom-based drill to

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scenarios not practiced in the drills, such as an earthquake that happens when children are outside or inside but not near a table or desk. Also, more than 25% of students in both school districts were not aware they had practiced a vertical evacuation drill for tsunamis. These findings challenge the theory that drills are an effective teaching strategy that provides all children adaptive response skills for self-protection. The uncertainty and deficiency in knowledge transfer among children in regards to appropriate response actions in different scenarios suggest school drills, as they are currently practiced, may not achieve the intended impact of reducing injuries and deaths among children during disasters. However, based on some findings in previous research by scholars including Soffer et al. (2009) and Jones et al. (1989), the addition of a cognitive component to the drills may enhance children's learning of adaptive response skills. A cognitive component may include classroom discussion on the rationale for the protective actions, scenario-based problem-solving activities, and post-drill feedback about children's actions during the drill. Further research is needed to evaluate the efficacy of drills that have an added cognitive component.

The *What's the Plan, Stan?* evaluation also found weaknesses in the program implementation theory that increased promotion of the teaching resource would increase awareness and uptake of the resource among teachers in New Zealand (Johnson et al., 2014d). This program theory is significant because several nations are disseminating voluntary teaching resources as a method of integrating disaster education in schools (Ronan et al., 2014; Selby & Kagawa, 2012). This evaluation found that investment is needed to promote collaborations and partnerships among schools and the CDEM sector in New Zealand, since there are several deterrents to use of *What's the Plan, Stan?*,

including lack of school leadership and school-wide use of the resource, lack of teacher training, low interest in the topic, and competing voluntary subjects. Without improved relationships between schools and the CDEM sector, increased promotion of the resource is unlikely to increase uptake. The facilitating and deterrent factors of use identified in this study may be similar to those of voluntary programs in other nations, like the United States, where disaster education is not formally integrated in the school curricula. Nations that invest heavily in the promotion of voluntary teaching resources to increase uptake may fall short in addressing the true challenges to curricular integration.

8.4.2 *Theory-based evaluation practices can improve the evaluation of disaster education programs for children*

The methodological review of disaster education programs for children found that traditional evaluation methods for disaster education programs for children are problematic (Johnson et al., 2014c). Despite research that has found a tenuous relationship between knowledge and preparedness activities, evaluators have primarily characterized program effectiveness as a positive change in children's knowledge of disaster risks and protective actions, and child reports of household hazard adjustments. Although knowledge change is valuable, there is no research evidence that these program outcomes would achieve societal impacts such as reduced disaster-related injuries and deaths, instrumental action towards disaster risk reduction, or a decrease in preventable disasters. The lack of articulation and critical examination of program theories may be one reason evaluators have tended to use knowledge-based outcome indicators.

For the two case study evaluations, visual program theory models were created in order to develop theory-based outcome indicators of program effectiveness and implementation in regards to program's intended societal impacts or societal reach. The use of program theory to develop the outcome indicators had several major advantages. In the case of the ShakeOut evaluation, the program theory matrix provided a practical framework in which to deeply examine and articulate the program theory of how school-based emergency drills are expected to achieve reduced injuries. The theory-based approach was also useful in identifying ways to answer key evaluation questions about the effectiveness of drills. Through this process, the author discovered that a visual observation of the ShakeOut drill would not be adequate for collecting data on the outcome indicators, and that a questionnaire would be a better tool for gathering data. In the case of the *What's the Plan, Stan?* evaluation, the stage step model provided a framework for organizing a theory-driven qualitative analysis of the available data to answer key evaluation questions. In both evaluations, the outcome indicators were effective in revealing new knowledge about the programs and areas for program improvement.

8.4.3 *Observations are inadequate for measuring the outcomes and intended impacts of school drills*

Descriptive evaluation methods such as observations and case studies cannot effectively assess children's comprehension of protective response skills for disasters. School drills are often considered successful if most children correctly repeat an emergency response action, like "drop, cover, and hold," when prompted. However, the ShakeOut evaluation revealed that more than a quarter children could not distinguish

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correct and incorrect responses for earthquakes in different scenarios, and were not aware of their school's tsunami evacuation procedure. School drills are often evaluated through observation because the method is practical for a school setting. The ShakeOut evaluation found that quantitative questionnaires are also feasible in a school setting, and more effective than observations for evaluating children's risk perceptions, comprehension, and adaptive response skills. Results of the quantitative study helped identify what aspects of earthquake and tsunami response were less understood by children, which led the author to conclude that drills should include a cognitive element, such as explicit explanations of response actions, problem-solving activities, and discussion of correct and incorrect alternative actions in different scenarios. Without children's comprehension of why certain response actions are taken, the schools' coordination of the response in a real emergency could be very different than expected. Staff and parent's comprehension of the rationale for the school's safety procedures is also critical for an effective response, and this aspect should be explored in a future study using similar survey methods and outcome indicators.

8.4.4   International policy implications of the research

This research revealed there is a need to test major underlying assumptions of disaster education programs for children, otherwise international organizations, nations, states, and communities may spend decades investing in ineffective programs that do not achieve their intended societal impacts. In 2005, 168 member states of the United Nations endorsed the *2005-2015 Hyogo Framework For Action* (HFA), agreeing to five priority actions to reduce disaster risks globally, including Priority for Action #3: *Use knowledge, innovation and education to build a culture of safety and resilience at all levels*

(UNISDR, 2005, p. 18). The HFA supports the theory that "disasters can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities" (UNISDR, 2005, p. 9). The signatory nations committed to meeting several "Core Indicators" of progress, including the inclusion of disaster risk reduction elements in school curricula and dissemination of disaster education programs for children (UNISDR, 2007a). Unfortunately, the push by the United Nations to increase education and the dissemination of knowledge, particularly the education of children, is not supported with evidence-based educational approaches that are known to achieve instrumental action towards disaster risk reduction. Likewise, there hasn't been a significant push to date to evaluate these programs for effectiveness. However, program reviews and consultations (e.g., Ronan et al., 2014) indicate quite clearly a growing emphasis on the use of evidence and evaluation in program and policy development. Thus, the findings of this study may be helpful in these ongoing and future HFA initiatives.

There is a need to develop and refine research methods for research with children, using outcome indicators that apply theory from more robust fields of research, including education, psychology, and social science. There is also a need to evaluate programs of scale and national curriculum integration efforts, to identify delivery methods that can reach vulnerable populations of children. This research was a first step in proving that major assumptions about disaster education programs for children may be faulty. The outcome indicators developed for measuring the effectiveness of school drills and the

implementation methods for voluntary curricular integration can be applied to other program evaluations and be further refined through adaptation and iteration. The key to developing a cumulative body of knowledge on societal impacts of disaster education programs for children is identifying mechanisms in disaster education programs for children that achieve both learning and action, and high quality knowledge transfer from children to adults. This effort will require support for evaluation, the further development of age-appropriate research tools, and a proactive effort to challenge assumptions about what can be achieved through these programs.

8.4   Opportunities for future research

This dissertation sought to explore how we can measure the outcomes and societal impacts of disaster education programs for children. The case study evaluations tested two major underlying assumptions of large-scale programs: a school-based earthquake and tsunami drill and a national curricular integration program. In these cases, program theory models and new evaluative outcome indicators were developed and tested, and these methods were found to be effective and practical for use in other program evaluations. Due to the exploratory nature and limited scope of the study, there remain significant opportunities for future research in New Zealand, the United States, and other nations:

- To build on this research, there is a need to test new models of school drills that include a cognitive component, such as problem-solving and take-home activities, in order to assess the viability of these mechanisms in improving children's adaptive response capacities and knowledge transfer.

- New Zealand's integration of disaster education in the school curricula through the dissemination of *What's the Plan, Stan?* is just one method of increasing children's exposure to disaster education nationally. Considering the United Nation's goal to achieve curricular integration in all nations, there is a need to evaluate the implementation of other large-scale curriculum integration processes, in order to identify approaches that are both effective and feasible.

- Other key theories of disaster education programs for children require testing. For example, there is a need to identify the specific mechanisms in children's education programs that motivate disaster risk reduction activities in children's households and communities. These mechanisms should include and test the role of experiential learning, the direct involvement of parents, and children's direct participation in community activities.

- To understand programs' societal impact, there is a critical need to conduct research in post-disaster contexts to identify the association between participation in children's disaster education and improved disaster outcomes, such as prevented injuries, effective evacuation, family communication and reunification, and psycho-social recovery. This might include forward planning by evaluators of disaster education programs. For example, the data collected in Washington State for the ShakeOut evaluation could be used as baseline data for a post-disaster study of the effectiveness of school drills if an earthquake or tsunami occurs Washington.

- Also, building on current research (e.g., Johnson & Ronan, 2014), there will be opportunities to study emergent school-based disaster education in post-disaster contexts both within and outside disaster-affected areas. There is a need to identify how these emergent curricula could be better supported and leveraged as a practical method of facilitating psycho-social recovery of children in schools and communities.

Finally, all disaster education programs for children should be evaluated when possible, and these evaluations can be achieved through the further development and refinement of age-appropriate research methods and meaningful outcome indicators. Through ongoing evaluation of children's education, children can be protected and supported in their growth as resilient community members and leaders in disaster risk reduction.

References

Abercrombie, N., Hill, S., & Turner, B. S. (1984). *Dictionary of sociology*. Harmondsworth, UK: Penguin.

Alkin, M. (2004). *Evaluation roots*. Thousand Oaks, CA: Sage.

Altschuld, J. W., Kumar, D. D., Smith, D. W., & Goodway, J. D. (1999). School-based educational innovations: Case illustrations of context-sensitive evaluations. *Family & Community Health*, *22*(1), 66–79.

American Red Cross. (n.d). Earthquake Preparedness. Retrieved from http://www.redcross.org/prepare/disaster/earthquake

Anderson, A. (2010). *Combating climate change through quality education*. Washington, DC: The Brookings Institution. Retrieved from http://www.unisdr.org/files/15415_15415brookingspolicybriefclimatecha.pdf

Anderson, W. A. (2005). Bringing children into focus in the social science research agenda. *International Journal of Mass Emergencies and Disasters, 23*(3), 159–175.

Aptekar, L., & Boore, J. A. (1990). The emotional effects of disaster on children: A review of the literature. *International Journal of Mental Health, 19*(1990), 77–90.

Astbury, B., & Leeuw, F. L. (2010). Unpacking black boxes: mechanisms and theory building in evaluation. *American Journal of Evaluation*, *31*(3), 363–381. doi:10.1177/1098214010371972

Axinn, W., & Thornton, A. (1993). Mothers, children, and cohabitation: The intergenerational effects of attitudes and behavior. *American Sociological Review, 58*, 233–246. Retrieved from http://www.jstor.org/stable/2095968

Back, E., Cameron, C., & Tanner, T. (2009). *Children and disaster risk reduction: Taking stock and moving forward*. Retrieved from http://www.preventionweb.net/files/12085_ChildLedDRRTakingStock1.pdf

Balbus, J.M., & Malina, A.B. (2009). Identifying vulnerable subpopulations for climate change health effects in the United States. *Journal Occupational Environmental Medicine, 51*(1), 33–37. doi:10.1097/JOM.0b013e318193e12e

Ballantyne, R., Connell, S., & Fien, J. (1998). Factors contributing to intergenerational communication regarding environmental programs: Preliminary research findings. *Australian Journal of Environmental Education, 14*, 1–10.

Ballantyne, R., Fien, J., & Packer, J. (2001). Program effectiveness in facilitating intergenerational influence in environmental education: Lessons from the field. *The Journal of Environmental Education, 32*(4), 8–15. doi:10.1080/00958960109598657

Bamberger, M., Rugh, J., & Mabry, L. (2006). *Real world evaluation: Working under budget, time, data and political constraints*. Thousand Oaks, CA: Sage.

Barr, J. E., Tubman, J. G., Montgomery, M. J., & Soza-Vento, R. M. (2002). Amenability and implementation in secondary school antitobacco programs. *American Journal of Health Behavior, 26*, 3–15. doi:10.5993/AJHB.26.1.1

Bastiani, M. (2012). *Stone soup: A recipe for building resiliency among children* (Master's thesis). Available from DTIC Online. (ADA560483)

Battersby, S. E., Mitchell, J. T., & Cutter, S. L. (2011). Development of an online hazards atlas to improve disaster awareness. *International Research in Geographical and Environmental Education, 20*(4), 297–308. doi:10.1080/10382046.2011.619807

Becker, J. S., Paton, D., Johnston, D. M., & Ronan, K. R. (2012). A model of household preparedness for earthquakes: how individuals make meaning of earthquake information and how this influences preparedness. *Natural Hazards, 64*(1), 107–137. doi:10.1007/s11069-012-0238-x

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Bell, A. (2007). Designing and testing questionnaires for children. *Journal of Research in Nursing, 12*(5), 461–469. doi:10.1177/1744987107079616

Bellamy, J. A., Walker, D. H., McDonald, G. T., & Syme, G. J. (2001). A systems approach to the evaluation of natural resource management initiatives. *Journal of Environmental Management, 63*(4), 407–423. doi:10.1006/jema.2001.0493

Benson, L., & Bugge, J. (2007). *Child-led disaster risk reduction: A practical guide*. Retrieved from the Save the Children website: http://resourcecentre.savethechildren.se/library/child-led-disaster-risk-reduction-practical-guide-part-1

Berey, L., & Pollay, R. (1968). The influencing role of the child in family decision making. *Journal of Marketing Research, 5*, 70–72.

Berkes, F. (2007). Understanding uncertainty and reducing vulnerability: lessons from resilience thinking. *Natural Hazards, 41*(2), 283–295. doi:10.1007/s11069-006-9036-7

Bickman, L. (1987). The functions of program theory. *New Directions for Program Evaluation, 1987*(33), 5-18. doi:10.1002/ev.1443

Birckmayer, J. D., & Weiss, C. H. (2000). Theory-based evaluation practice: What do we learn? *Evaluation Review, 24*, 407–431. doi:10.1177/0193841X0002400404

Birmingham, J., Pechman, E. M., Russell, C. A., & Mielke, M. (2005). Shared features of high-performing after-school programs: A follow-up to the TASC evaluation. Retrieved from http://www.sedl.org/pubs/fam107/fam107.pdf

Black, L., & Powell, P. (2012). 4-H Teen Community Emergency Response Team (CERT). *Journal of Extension, 50*(5). Retrieved from http://www.joe.org/joe/2012october/iw4.php

Blanchet-Cohen, N., & Nelems, R. (2010). Preparing children for disasters: Evaluation of the Ready and Resilient program. *Journal of Emergency Management, 8*(4), 17–24.

Boon, H. J., Brown, L. H., Tsey, K., Speare, R., Pagliano, P., Usher, K., & Clark, B. (2011). School disaster planning for children with disabilities: A critical review of the literature. *International Journal of Special Education*, *26*(3), 223–237.

Borgers, N., & Hox, J. (2001). Item nonresponse in questionnaire research with children. *Journal of Official Statistics, 17*(2), 321–335.

Borgers, N., Hox, J., & Sikkel, D. (2003). Response quality in survey research with children and adolescents: The effect of labelled response options and vague quantifiers. *International of Public Opinion Research, 15*(1), 83–94.

Boruch, R. (2007). Encouraging the flight of error: Ethical standards, evidence standards, and randomized trials. *New Directions for Evaluation, 2007*(113), 55–73. doi:10.1002/ev.215

Brandon, P. R., & Singh, J. M. (2009). The strength of the methodological warrants for the findings of research on program evaluation use. *American Journal of Evaluation, 30*(2), 123–157. doi:10.1177/1098214009334507

Braun, V., & Clark, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. doi:10.1191/1478088706qp063oa

Brodkin, A. M., & Coleman, M. F. (1994). Equip kids to deal with disaster. *Instructor, 103*(9), 17-18. Retrieved from http://eric.ed.gov/?id=EJ487324

Buchanan, T. K., Casbergue, R. M., & Baumgartner, J. J. (2009). Young children's demonstrated understanding of hurricanes. In K. E. Cherry (Ed.), *Lifespan perspectives on natural disasters* (pp. 3–26). United States: Springer.

Buchanan, T. K., Casbergue, R. M., & Baumgartner, J. J. (2010). Consequences for classroom environments and school personnel: Evaluating Katrina's effect on schools and system response. In R. P. Kilmer, V. Gil-Rivas, R. G. Tedeschi, L. G. Calhoun, (Eds.), *Helping families and communities recover from disaster: Lessons learned from Hurricane Katrina and its aftermath* (pp. 117–139). Washington, DC: American Psychological Association.

Bullock, J. A., Haddow, G., & Coppola, D. P. (2010). *Managing children in disasters: Planning for their unique needs*. Baca Raton, FL: Taylor and Francis Group.

Burke, R. V., Iverson, E., Goodhue, C. J., Neches, R., & Upperman, J. S. (2010). Disaster and mass casualty events in the pediatric population. *Seminars in Pediatric Surgery, 19*(4), 265–270. doi:10.1053/j.sempedsurg.2010.06.003

Burnweit, C., & Stylianos, S. (2011). Disaster response in a pediatric field hospital: Lessons learned in Haiti. *Journal of Pediatric Surgery*, *46*(6), 1131–1139. doi:10.1016/ j.jpedsurg.2011.03.042

Cadag, J. R. D., & Gaillard, J. C. (2012). Integrating knowledge and actions in disaster risk reduction: the contribution of participatory mapping. *Area*, *44*(1), 100–109. doi:10.1111/j.1475-4762.2011.01065.x

Cameron, C., & Norrington-Davies, G. (2010). Children and disaster risk reduction in Asia and the Pacific: a way forward. Retrieved from http://www.unicef.org/eapro/AsiaPacific_DRR_final.pdf

Cameron, M. (2002). Peer influences on learning. *Set, 3*, 36-4. Retrieved from http://www.nzcer.org.nz/nzcerpress/set/articles/peer-influences-learning

Campbell, D. T. (1991). Methods for the experimenting society. *American Journal of Evaluation, 12*(3), 223–260. doi:10.1177/109821409101200304

Campbell, D. T., Stanley, J. C., & Gage, N. L. (1963). *Experimental and quasi-experimental designs for research* (pp. 171–246). Boston: Houghton Mifflin.

Campbell, J. R., & Verna, M. A. (2007). Effective parental influence: Academic home climate linked to children's achievement. *Educational Research and Evaluation*, *13*(6), 501–519. doi:10.1080/13803610701785949

Carboni, R. (1962, August). School fire drills are outdated. *Fire Engineering*. Retrieved from http://www.usfa.fema.gov/pdf/efop/efo47525.pdf

Celen, Ü. & Üner, S. (2002). Comparison of Ankara health professions high school students' information levels related with before and after earthquake education. In D. Yarbakir (Ed.), *National public health congress book* (Volume 2, No. 1878). Dicle University Press.

Central U.S. Earthquake Consortium. (2011). *Great central U.S. ShakeOut: Overview and final report*. Retrieved from http://www.shakeout.org/centralus/overview/index.html

Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 509–535). Thousand Oaks, CA: Sage.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Thousand Oaks, CA: Sage.

Chawla, L. (2002). "Insight, creativity and thoughts on the environment": Integrating children and youth into human settlement development. *Environment and Urbanization, 14*(2), 11–22. doi:10.1177/095624780201400202

Chen, H. T. (Ed.). (2005). *Practical program evaluation: Assessing and improving planning, implementation, and effectiveness*. Sage.

Chen, H. T., & Rossi, P. H. (1980). The multi-goal, theory-driven approach to evaluation: A model linking basic and applied social science. *Social Forces, 59*(1), 106–122. doi:10.1093/sf/59.1.106

Chen, H. T., & Rossi, P. H. (1983). Evaluating with sense: The theory-driven approach. *Evaluation Review, 7*(3), 283–302. doi:10.1177/0193841X8300700301

Chen, H. T., & Rossi, P. H. (1987). The theory-driven approach to validity. *Evaluation and Program Planning, 10*(1), 95–103. doi:10.1016/0149-7189(87)90025-5

Christie, C.A. (2003). What guides evaluation? A study of how evaluation practice maps onto evaluation theory. *New Directions for Evaluation, 2003*(97), 7–35. doi:10.1002/ev.72

Chung, S., Danielson, J., & Shannon, M. (2008). *School-based emergency preparedness: A national analysis and recommended protocol*, Rockville, MD: Agency for Healthcare Research and Quality. Retrieved from http://archive.ahrq.gov/prep/schoolprep/

Clague, J. J., & Orwin, J. (2005). *Tsunami hazard to North and West Vancouver, British Columbia*. British Columbia, Canada: Centre for Natural Hazard Research, Simon Fraser University. Retrieved from http://www.nsemo.org/sites/default/files/files/NSEMO report.pdf

Clerveaux, V., & Spence, B. (2009). The communication of disaster information and knowledge to children using game technique: The Disaster Awareness Game (DAG). *International Journal of Environmental Research*, *3*(2), 209–222.

Clerveaux, V., Spence, B., & Katada, T. (2010). Promoting disaster awareness in multicultural societies: The DAG approach. *Disaster Prevention and Management, 19*(2), 199–218. doi:10.1108/09653561011038002

Clover, D. (1996). Developing international environmental adult education: The challenge, theory and practice. In W. Filho, Z. Murphy, & K. O'Loan (Eds.), *A sourcebook for environmental education: a practical review based on the Belgrade Charter*. New York: The Parthenon Publishing Group.

Coca, C. (2004). Risk management and sustainability in educative sector experience of Bogota, Colombia. In I. Kelman (Ed.), *Regional Development Dialogue Journal*, *28*(2), 1–8. Retrieved from http://www.preventionweb.net/files/7673_CCocaODCardonaSchoolcasestudyofBogota.pdf

Cohen, J. A., & Mannarino, A. P. (2011). Supporting children with traumatic grief: What educators need to know. *School Psychology International, 32*(2), 117–131. doi:10.1177/0143034311400827

Cooksy, L. J., Gill, P., & Kelly, P. A. (2001). The program logic model as an integrative framework for a multimethod evaluation. *Evaluation and Program Planning, 24*(2), 119–128. doi:10.1016/S0149-7189(01)00003-9

Cook, T. D., Campbell, D. T., & Day, A. (1979). *Quasi-experimentation: Design & analysis issues for field settings* (pp. 19–21). Boston: Houghton Mifflin.

Coomer, M.A., Johnston, D. M., Edmonson, L., Monks, D., Pedersen, S., & Rodger, A. (2008). Emergency management in schools – Wellington survey. *GNS Science Report, 2008*(4), 1–32.

Coomer, M. A., Johnston, D. M., Wilson, T., Becker, J. S., Orchiston, C., & Page, S. (2009). West Coast ShakeOut exercise September 18th 2009: Observation of the exercise on the West Coast, South Island, New Zealand. *GNS Science Report, 2009*(65), 1–13.

Cooper, H. M. (1988). Organizing knowledge synthesis: A taxonomy of literature review. *Knowledge in Society, 1*, 104–126. doi:10.1007/BF03177550

Crawford, G. L., & Thurman, B. E. (2012). *Earthquake and tsunami information and resources for schools: Surviving great waves of destruction*. Retrieved from http://www.emd.wa.gov/hazards/documents/haz_EQ_TSU_Sch_Res_Guide-Intro-UNIT2.pdf

Crawford, I., Jason, L. A., Riordan, N., Kaufman, J., Salina, D., Sawalski, L., Ho, F. C., & Zolik, E. (1990). A multimedia-based approach to increasing communication and the level of AIDS knowledge within families. *Journal of Community Psychology, 18*(4), 361–373. doi:10.1002/1520-6629

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among the five traditions*. Thousand Oaks, CA: Sage.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice, 39*(3), 124–130. doi:10.1207/s15430421tip3903_2

Cronbach, L. J., Ambron, S. R., Dornbusch, S. M., Hess, R. D., Hornik, R. C., Phillips, D. C., Walker, D. F., & Weiner, S. S. (1980). *Toward reform of program evaluation*. San Francisco: Jossey-Bass Publishers.

Cullen, K. W., Baranowski, T., Rittenberry, L., Cosart, C., Hebert, D., & de Moor, C. (2001). Child-reported family and peer influences on fruit, juice and vegetable consumption: Reliability and validity of measures. *Health Education Research, 16*(2), 187–200. doi:10.1093/her/16.2.187

Damiani, V.B. (2011). *Crisis prevention and intervention in the classroom: What teachers should know*. Lanham, MD: Rowman & Littlefield Education.

Dane, A. V., & Schneider, B. H. (1998). Program integrity in primary and early secondary prevention: Are implementation effects out of control? *Clinical Psychology Review, 18*(1), 23–45. doi:10.1016/S0272-7358(97)00043-3

Datta, L. (2001). The wheelbarrow, the mosaic, and the double-helix: Challenges and strategies for successfully carrying out mixed methods evaluation. *Evaluation Journal of Australia, 1(*2), 33–40.

Davidson, J. (2005). Effectiveness. In S. Mathison (Ed.), *Encyclopedia of Evaluation* (p. 122). Thousand Oaks, CA: Sage.

Debachere, M.C. (1995). Problems in obtaining grey literature. *IFL4 Journal, 21*(2), 94–98.

Degnan, A. L., Thomas, G. A., Markenson, D., Song, Y., Fuller, E. J., & Redlener, I. E. (2004). *Uncommon sense, uncommon courage: How the New York City school system, its teachers, leadership and students responded to the terror of September 11*. Retrieved from the Columbia University website http://academiccommons.columbia.edu/item/ac:155278

De Leeuw, E. D., Borgers, N., & Smits, A. (2004). Pretesting questionnaires for children and adolescents. In S. Presser, J. M. Rothgeb, M. P. Couper, J. T. Lessler, E. Martin, & E. Singer (Eds.), *Methods for testing and evaluating survey questionnaires* (pp. 409–429). Hoboken, NJ: John Wiley & Sons.

DeMan, A. F., & Simpson-Housley, P. (1988). Correlates of response to two potential hazards. *Journal of Social Psychology, 128*(3), 385–391. doi:10.1080/00224545.1988.9713755

Dewey, J. (1938). *Logic: The theory of inquiry*. New York: Holt, Rinehart and Winston.

Dixon-Woods, M., Agarwal, S., Jones, D., Young, B., & Sutton, A. (2005). Synthesising qualitative and quantitative evidence: A review of possible methods. *Journal of Health Services Research & Policy, 10*(1), 45–53.

Dogan, M., & Pelassy, D. (1984). *How to compare nations: Strategies in comparative politics*. Chatham House Publishers.

Donaldson, S. I. (2012). *Program theory-driven evaluation science: Strategies and applications*. Routledge.

Donaldson, S. I., Christie, C. A., & Mark, M. M. (Eds.). (2009). *What counts as credible evidence in applied research and evaluation practice?*. Sage.

Donner, W., & Rodríguez, H. (2008). Population composition, migration and inequality: The influence of demographic changes on disaster risk and vulnerability. *Social Forces, 87*(2), 1089–1114. doi:10.1353/sof.0.0141

Doran, G.T. (1981). There's a S.M.A.R.T. way to write management's goals and objectives. *Management Review, 70*(11), 35–36.

Drabek, T. E. (1986). *Human system responses to disaster: An inventory of sociological findings*. Springer-Verlag.

DuBois, D. L., Holloway, B. E., Valentine, J. C., & Cooper, H. (2002). Effectiveness of mentoring programs for youth: A meta-analytic review. *American Journal of Community Psychology, 30*(2), 157–198. doi:10.1023/A:1014628810714

Dunbar, P. K. (2007). Increasing public awareness of natural hazards via the Internet. *Natural Hazards, 42*(3), 529–536. doi:10.1007/s11069-006-9072-3

Dunst, C. J. (2002). Family-centered practices birth through high school. *The Journal of Special Education, 36*(3), 141–149. doi:10.1177/00224669020360030401

Durlak, J. A., & DuPre, E. P. (2008). Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American Journal of Community Psychology, 41*(3–4), 327–350. doi:10.1007/s10464-008-9165-0

Duvall, J., & Zint, M. (2007). A review of research on the effectiveness of environmental education in promoting intergenerational learning. *The Journal of Environmental Education, 38*(4), 14–24. doi:10.3200/JOEE.38.4.14-24

Earthquake Country Alliance. (2012). *Recommended earthquake safety actions for parents and care providers of young children & infants*. Retrieved from http://www.shakeout.org/downloads/Earthquake_Safety_YoungChildren_Infants.pdf

Ebi, K. L., & Semenza, J. C. (2008). Community-based adaptation to the health impacts of climate change. *American Journal of Preventive Medicine, 35*(5), 501–507. doi:10.1016/j.amepre.2008.08.018

Eckstein, H. (2000). Case study and theory in political science. In R. Gomm, M. Hammersley, & P. Foster (Eds.), *Case study method: Key issues, key texts* (pp. 119–164). Thousand Oaks, CA: Sage.

Effectiveness. (2014). In *Oxford Dictionaries Online*. Retrieved from http://www.oxforddictionaries.com

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. Academy of Management Review, 50(1), 25–32. doi:10.5465/AMR.1989.4308385

Eisner, E. W. (1991). *The enlightened eye: Qualitative inquiry and the enhancement of educational practice*. New York: Macmillan.

El Nokali, N. E., Bachman, H. J., & Votruba- Drzal, E. (2010). Parent involvement and children's academic and social development in elementary school. *Child Development*, *81*(3), 988–1005. doi:10.1111/j.1467-8624.2010.01447.x

Fagan, A. A., & Mihalic, S. (2003). Strategies for enhancing the adoption of school-based prevention programs: Lessons learned from the Blueprints for Violence Prevention replications of the Life Skills Training program. *Journal of Community Psychology*, *31*(3), 235–253. doi:10.1002/jcop.10045

Falkiner, L. (2003). *Impact analysis of the Canadian Red Cross Expect the Unexpected Program*. Retrieved from http://www.redcross.ca/crc/documents/3-1-3-1-Independent-Impact-Analysis.pdf

Faupel, C. E., Kelley, S. P., & Petee, T. (1992). The impact of disaster education on household preparedness for Hurricane Hugo. *International Journal of Mass Emergencies and Disasters*, *10*(1), 5–24.

Fielding, N. G. (2009). Going out on a limb: Postmodernism and multiple method research. *Current Sociology, 57*(3), 427–447. doi:10.1177/0011392108101591

Finnis, K., Johnston, D. M., Ronan, K. R., & White, J. D. (2010). Hazard perceptions and preparedness of Taranaki youth. *Disaster Prevention and Management, 19*(2), 175–184. doi:10.1108/09653561011037986

Finnis, K., Standring, S., Johnston, D., & Ronan, K. (2004). Children's understanding of natural hazards in Christchurch, New Zealand. *Australian Journal of Emergency Management, 19*(2), 11–20.

Fitz-Gibbon, C. T., & Morris, L. L. (1996). Theory-based evaluation. *Evaluation Practice, 17*(2), 177–184. doi:10.1016/S0886-1633(96)90024-0

Fixsen, D. L., Naoom, S. F., Blasé, K. A., Friedman, R. M., & Wallace, F. (2005). *Implementation research: A synthesis of the literature*. Retrieved from http://ctndisseminationlibrary.org/PDF/nirnmonograph.pdf

Flurry, L., & Burns, A. (2005). Children's influence in purchasing decisions: A social power theory approach. *Journal of Business Research, 58*(5), 593–601. doi:10.1016/j.jbusres.2003.08.007

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219–245. doi:10.1177/1077800405284363

Fothergill, A., Maestas, E. G., & Darlington, J. D. (1999). Race, ethnicity and disasters in the United States: A review of the literature. *Disasters, 23*(2), 156–173. doi:10.1111/1467-7717.00111

Fothergill, A., & Peek, L. (2004). Poverty and disasters in the United States: A review of recent sociological findings. *Natural Hazards, 32*(1), 89–110. doi:10.1023/B:NHAZ.0000026792.76181.d9

Fothergill, A., & Peek, L. (2006) Surviving catastrophe: A study of children in Hurricane Katrina. In *Learning from catastrophe: Quick response research in the wake of Hurricane Katrina* (pp. 97–130). Boulder, CO: Institute of Behavioral Science.

Fothergill, A., & Peek, L. (2008). Permanent temporariness: Children's displacement in Louisiana after Katrina. In L. Weber, & L. Peek (Eds.), *Displaced: Life in the Katrina diaspora* (pp. 119–144). University of Texas Press.

Fournier, D. M. (2005). Evaluation. In S. Mathison (Ed.), *Encyclopedia of Evaluation* (pp. 139–140). Thousand Oakes, CA: Sage.

Frankenberg, E., Gillespie, T., Preston, S., Sikoki, B., & Thomas, D. (2011). Mortality, the family and the Indian Ocean tsunami. *The Economic Journal*, *121*(554), F162–F182. doi:10.1111/j.1468-0297.2011.02446.x

Frau, E., Midoro, V., & Pedemonte, G. M. (1992). Do hypermedia systems really enhance learning? A case study on earthquake education. *Educational and Training Technology International*, *29*(1), 42–51. doi:10.1080/0954730920290106

Funnell, S. C. (2000). Developing and using a program theory matrix for program evaluation and performance monitoring. *New Directions for Evaluation*, *2000*(87), 91–101. doi:10.1002/ev.1185

Gaillard, J. C., & Pangilinan, M. L. C. J. D. (2010). Participatory mapping for raising disaster risk awareness among the youth. *Journal of Contingencies and Crisis Management*, *18*(3), 175–179. doi:10.1111/j.1468-5973.2010.00614.x

Gebbie, K. M., Valas, J., Merrill, J., & Morse, S. (2006). Role of exercises and drills in the evaluation of public health in emergency response. *Prehospital and Disaster Medicine*, *21*(03), 173–182. doi:10.1017/S1049023X00003642

Gielen, A. C., Borzekowski, D., Rimal, R., & Kumar, A. (2010). *Evaluating and creating fire and life safety materials: A guide for the fire service*. Retrieved from http://www.nfpa.org/~/media/Files/Safety%20information/Public%20educators/guideforthefireservice.pdf

Giovinazzi, S., Wilson, T. M., Davis, C., Bristow, D., Gallagher, M., Schofield, A., Villemure, M., Eidinger, J., Tang, A. (2011). Lifelines performance and management following the 22 February 2011 Christchurch earthquake, New Zealand: Highlights of resilience. *Bulletin of the New Zealand Society of Earthquake Engineering*, *44*(4), 404–419.

Glaser, B. G., & Strauss, A. L. (2009). *The discovery of grounded theory: Strategies for qualitative research*. Transaction Publishers.

Glass, J., Bengtson, V., & Dunham, C. (1986). Attitude similarity in three-generation families: Socialization, status inheritance, or reciprocal influence? *American Sociological Review, 51*, 685–698. Retrieved from http://www.jstor.org/stable/2095493

Global Education Cluster. (2012). *Disaster risk reduction in education in emergencies: A guidance note for education clusters and sector coordination groups*. Retrieved from http://education.humanitarianresponse.info/document/disaster-risk-reduction-emergencies-guidance-note-education-clusters-and-sector

GNS Science. (2011). M 6.3, Christchurch, 22 February 2011. Retrieved from http://info.geonet.org.nz/display/quake/M+6.3,+Christchurch,+22+February+2011

Government Accountability Office. (2007). *Most school districts have developed emergency management plans, but would benefit from additional federal guidance*. Retrieved from http://www.gao.gov/products/GAO-07-609

Greene, J. C., & Caracelli, V. J. (1997). Defining and describing the paradigm issue in mixed-method evaluation. *New Directions for Evaluation, 1997*(74), 5–17. doi:10.1002/ev.1068

Greene, J.C. (2007). *Mixing methods in social inquiry*. San Francisco, CA: Jossey-Bass.

Green, J., & Hart, L. (1998). Children's views of accident risks and prevention: A qualitative study. *Injury Prevention, 4*(1), 14–21. doi:10.1136/ip.4.1.14

Green, R., & Petal, M. (2010). *Lesson learned from school participation in the 2008 ShakeOut*. Bellingham, WA: Western Washington University.

Guba, E. G., & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Newbury Park, CA: Sage.

Guba, E. G., & Lincoln, Y. S. (2001). *Guidelines and checklist for constructivist (aka fourth generation) evaluation*. Retrieved from http://www.wmich.edu/evalctr/archive_checklists/constructivisteval.pdf

Guha-Sapir, D., Vos, F., Below, R., & Ponserre, S. (2011). *Annual disaster statistical review 2010: The numbers and trends*. Retrieved from http://crmi-undp.org/documents/documentos/98.pdf

Gulay, H. (2010). An earthquake education program with parent participation for preschool children. *Educational Research and Reviews, 5*(10), 624–630. Retrieved from http://eric.ed.gov/?id=EJ911898

Gustafson, T. S. (2009). *Empowering children to lead change incorporating preparedness curricula in the K-12 educational system* (Doctoral dissertation). Retrieved from http://edocs.nps.edu/npspubs/scholarly/theses/2009/Mar/09Mar_Gustafson.pdf

Haeck, T. (2011, March 31). Quake survival: Triangle of Life or Drop, Cover and Hold? *MyNorthwest.com*. Retrieved from http://mynorthwest.com/11/454916/Quake-survival-Triangle-of-Life-or-Drop-Cover-and-Hold

Hamilton, J. (2013). *New Zealand: National progress report on the implementation of the Hyogo Framework for Action (2011–2013)*. Retrieved from http://www.unisdr.org/partners/countries/nzl

Hart, R. A. (2013). *Children's participation: The theory and practice of involving young citizens in community development and environmental care*. Routledge.

Heath, M. A., Ryan, K., Dean, B., & Bingham, R. (2007). History of school safety and psychological first aid for children. *Brief Treatment and Crisis Intervention, 7*(3), 206–223. doi:10.1093/brief-treatment/mhm011

Hillman, H. S., Jones, R. T., & Farmer, L. (1986). The acquisition and maintenance of fire emergency skills: Effects of rationale and behavioral practice. *Journal of pediatric psychology*, *11*(2), 247–258. doi:10.1093/jpepsy/11.2.247

Hilyard, K. M., Hocke, T. M, & Ryan, E. L. (2011). Disaster on the web? A qualitative analysis of children's disaster preparedness websites. *Prism, 8*(2), 1–18. Retrieved from http://www.prismjournal.org/fileadmin/8_2/Hilyard_Hocke_Ryan.pdf

Hull, B. (2011). Changing realities in school safety and preparedness. *Journal of Business Continuity & Emergency Planning*, *5*(1), 440–451.

Intergovernmental Panel on Climate Change. (2013a). *Climate change 2013: The physical science basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/report/ar5/wg1

Intergovernmental Panel on Climate Change. (2013b). Summary for Policymakers. In *Climate change 2013: The physical science basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/report/ar5/wg1

Izadkhah, Y. O., & Heshmati, V. (2007). Applicable Methods In Teaching Earthquakes To Preschool Children. *Proceedings of Fifth International Conference on Seismology and Earthquake Engineering*, Iran. Retrieved from http://www.preventionweb.net/files/5343_SEE5KINDERGARTEN.pdf

Izadkhah, Y. O., & Hosseini, M. (2005). Towards resilient communities in developing countries through education of children for disaster preparedness. *International Journal of Emergency Management*, *2*(3), 138–148.

Jacobs, W. J., Sisco, M., Hill, D., Malter, F., & Figueredo, A. J. (2012). Evaluating theory-based evaluation: Information, norms, and adherence. *Evaluation and Program Planning*, *35*(3), 354–369. doi:10.1016/j.evalprogplan.2011.12.002

Jang, S. J., Johnson, B. R., & Kim, Y. (2011). *Eagle Scouts: Merit beyond the badge*. Retrieved from http://www.scouting.org/About/Research/EagleScouts.aspx

Jaycox, L., Tanielian, T., Sharma, P., Morse, L., Clum, G., & Stein, B. (2007). Schools' mental health responses after Hurricanes Katrina and Rita. *Psychiatric Services, 58*(10), 1339–1343. doi:10.1176/appi.ps.58.10.1339

Jokovic, A., Locker, D., Stephens, M., Kenny, D., Tompson, B., & Guyatt, G. (2002). Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. *Journal of Dental Research*, *81*(7), 459–463. doi: 10.1177/154405910208100705

Johnson, V. A. (2011). *Disaster preparedness education in schools: Recommendations for New Zealand and the United States*. Wellington, New Zealand: Fulbright New Zealand. Retrieved from http://www.fulbright.org.nz/publications/2011-johnson/

Johnson, V. A. (2013). An impact evaluation of ShakeOut, an earthquake and tsunami drill in two coastal Washington State school districts. *GNS Science Report*, *2013*(19), 1–37.

Johnson, V. A., Johnston, D. M., Ronan, K. R., & Peace, R. (2014a). Evaluating children's learning of adaptive response capacities from ShakeOut, an earthquake and tsunami drill in two Washington State school districts. *Journal of Homeland Security and Emergency Management*. Advance online publication. doi: 10.1515/jhsem-2014-0012

Johnson, V. A., Peace, R., Ronan, K. R., & Johnston, D. M. (2014b). Improving the impact and implementation of disaster education programs for children through theory-based evaluation. Manuscript submitted for publication.

Johnson, V. A., & Ronan, K. R. (2014). Classroom responses of New Zealand school teachers following the 2011 Christchurch earthquake. *Natural Hazards*, *72*(2), 1075–1092. doi:10.1007/s11069-014-1053-3

Johnson, V. A., Ronan, K. R., Johnston, D. M., & Peace, R. (2014c). Evaluations of disaster education programs for children: A methodological review. *International Journal of Disaster Risk Reduction, 9,* 107-123. doi:10.1016/j.ijdrr.2014.04.001

Johnson, V. A., Ronan, K. R., Johnston, D. M., & Peace, R. (2014d). Implementing disaster preparedness education in New Zealand Primary Schools. *Disaster Prevention and Management*, *23*(4), 370-380.

Johnston, D. M., Becker, J., Coomer, M., Ronan, K., Davis, M., & Gregg, C. (2006). Children's risk perceptions and preparedness: Mt Rainier 2006 hazard education assessment tabulated results. *GNS Science Report, 2006*(16), 1–30.

Johnston, D. M., Driedger, C., Houghton, B., Ronan, K. R., & Paton, D. (2001). Children's risk perceptions and preparedness: A hazard education assessment in four communities around Mount Rainier, USA - preliminary results. *GNS Science Report, 2006*(16), 1–30.

Johnston, D., Orchiston, C., & Becker, J. (2012). Eastern Washington resident perceptions of natural hazard risk. *GNS Science Report, 2012*(5), 1–31.

Johnston, D., Paton, D., Crawford, G. L., Ronan, K., Houghton, B., & Bürgelt, P. (2005). Measuring tsunami preparedness in coastal Washington, United States. In *Developing Tsunami-Resilient Communities* (pp. 173–184). Springer Netherlands.

Johnston, D., Ronan, K., Becker, J., Gregg, C., & Davis, M. (2005). Children's risk perceptions and preparedness: Mt Rainier 2005 hazard education assessment tabulated results. *GNS Science Report, 2005*(29), 1–33.

Johnston, D. M., Tarrant, R. A., Tipler, K., Coomer, M. A., Pedersen, S., & Garside, R. (2010). An earthquake emergency response and evacuation exercise in a New Zealand school: A case study report. *GNS Science Report, 2010*(1), 1-11.

Johnston, D. M., Tarrant, R. A., Tipler, K., Coomer, M. A., Pedersen, S., & Garside, R. (2011). Preparing schools for future earthquakes in New Zealand: Lessons from an evaluation of a Wellington school exercise. *Australian Journal of Emergency Management, 26*(1), 24–30.

Jones, R. T., Kazdin, A. E., & Haney, J. I. (1981). Social validation and training of emergency fire safety skills for potential injury prevention and life saving. *Journal of Applied Behavior Analysis, 14*(3), 249–260. doi:10.1901/jaba.1981.14-249

Jones, R. T., Ollendick, T. H., & Shinske, F. K. (1989). The role of behavioral versus cognitive variables in skill acquisition. *Behavior Therapy, 20*(2), 293–302. doi:10.1016/S0005-7894(89)80075-9

Kagawa, F., & Selby, D. (2012). Ready for the storm: Education for disaster risk reduction and climate change adaptation and mitigation. *Journal of Education for Sustainable Development, 6*(2), 207–217.

Kaplan, A. (1964). *The conduct of inquiry: Methodology for behavioral science*. Scranton, PA: Chandler.

Kasperson, J. X., & Kasperson, R. E. (2005). *The Social Contours of Risk: Publics, risk communication and the social amplification of risk*. Earthscan.

Kenardy, J., Thompson, K., Le Brocque, R., & Olsson, K. (2008). Information–provision intervention for children and their parents following pediatric accidental injury. *European child & adolescent psychiatry, 17*(5), 316–325. doi: 10.1007/s00787-007-0673-5

Kiecolt, K. J., & Nigg, J. M. (1982). Mobility and perceptions of a hazardous environment. *Environment and Behavior, 14*(2), 131–154. doi:10.1177/0013916584142001

King, D. (2000). You're on your own: Community vulnerability and the need for awareness and education for predicatable natural disasters. *Journal of Contingencies and Crisis Management, 8*(4), 223–228. doi:10.1111/1468-5973.00143

King, D., & Gurtner, Y. (2005). After the wave: A wake up warning for Australian coastal locations. *Australian Journal of Emergency Management, 20*(1), 4–9.

Kirikkaya, E. B., Çakin, O., Imali, B., & Bozkurt, E. (2011). Earthquake training is gaining importance: the views of 4th and 5th year students on Earthquake. *Procedia-Social and Behavioral Sciences, 15*, 2305–2313. doi:10.1016/j.sbspro.2011.04.098

Kirschke, J., & Van Vliet, W. (2005). "How can they look so happy?" Reconstructing the place of children after Hurricane Katrina: Images and reflections. *Children Youth and Environments*, *15*(2), 378–391. Retrieved from http://www.jstor.org/stable/10.7721/chilyoutenvi.15.2.0378

Kolbe, A. R., Hutson, R. A., Shannon, H., Trzcinski, E., Miles, B., Levitz, N., ... & Muggah, R. (2010). Mortality, crime and access to basic needs before and after the Haiti earthquake: a random survey of Port-au-Prince households. *Medicine, Conflict and Survival*, *26*(4), 281–297. doi:10.1080/13623699.2010.535279

Krisberg, K. (2007, March 1). Planning ahead for health threats: School preparedness crucial for safety of children, communities. *The Nation's Health, 1*, 20–21.

Kronenberg, M. E., Hansel, T. C., Brennan, A. M., Osofsky, H. J., Osofsky, J. D., & Lawrason, B. (2010). Children of Katrina: Lessons learned about postdisaster symptoms and recovery patterns. *Child Development, 81*(4), 1241–1259. doi:10.1111/j.1467-8624.2010.01465.x

Kubicek, K., Ramirez, M., Limbos, M. A., & Iverson, E. (2008). Knowledge and behaviors of parents in planning for and dealing with emergencies. *Journal of Community Health, 33*(3), 158–168. doi:10.1007/s10900-007-9078-0

Kurita, T., Nakamura, A., Kodama, M., & Colombage, S. R. (2006). Tsunami public awareness and the disaster management system of Sri Lanka. *Disaster Prevention and Management, 15*(1), 92–110. doi:10.1108/09653560610654266

Kushner, S. (2005). Program Evaluation. In S. Mathison (Ed.), *Encyclopedia of Evaluation* (pp. 334–339). Thousand Oaks, CA: Sage.

Leeuw, F. L. (2003). Reconstructing program theories: Methods available and problems to be solved. *American Journal of Evaluation, 24*(1), 5–20. doi:10.1177/109821400302400102

Lenne, B., & Cleland, H. (1987). Describing program logic. *Program Evaluation Bulletin, 2*, 87.

Leonard, D.C. (2002). *Learning theories, A-Z*. Westport, CT: Greenwood Publishing Group.

Levac, J., Toal-Sullivan, D., & OSullivan, T. L. (2012). Household emergency preparedness: A literature review. *Journal of Community Health, 37*(3), 725–733. doi:10.1007/s10900-011-9488-x

Liikanen, J., Stoneman, P., & Toivanen, O. (2004). Intergenerational effects in the diffusion of new technology: The case of mobile phones. *International Journal of Industrial Organization, 22*(8), 1137–1154. doi:10.1016/j.ijindorg.2004.05.006

Lincoln, Y.S., & Guba, E.G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage.

Lindell, M. K., & Perry, R.W. (1992). *Behavioral foundations of community emergency planning*. New York: Hemisphere Publishing Company.

Lindell, M. K., & Perry, R.W. (2000). Household adjustment to earthquake hazard: A review of research. *Environment & Behavior, 32*(4), 461–501. doi:10.1177/00139160021972621

Lintner, T. (2006). Hurricanes and tsunamis: Teaching about natural disasters and civic responsibility in elementary classrooms. *The Social Studies*, *97*(3), 101–104. doi:10.3200/TSSS.97.3.101-104.

Lipsey, M. W. (1993). Theory as method: Small theories of treatments. *New Directions for Program Evaluation, 1993*(57), 5–38. doi:10.1002/ev.1637

Lipsey, M. W., & Pollard, J. A. (1989). Driving toward theory in program evaluation: More models to choose from. *Evaluation and Program Planning*,*12*(4), 317–328. doi:10.1016/0149-7189(89)90048-7.

Lund, J. K. (2013). *School fire drills: Incorporating fire prevention education to ensure they are a learning experience*. Emmitsburg, MD: National Fire Academy. Retrieved from http://www.usfa.fema.gov/pdf/efop/efo47525.pdf

Luvisi, S. (2013, October 19). Tsunamis - What to do at the beach? *The Daily World*. Retrieved from http://thedailyworld.com/sections/news/local/tsunamis-%E2%80%94-what-do-beach.html

Macaulay, J. (2004). Disaster education in New Zealand. In *International perspectives on natural disasters: occurrence, mitigation, and consequences* (pp. 417–428). Springer Netherlands.

Mahue-Giangreco, M., Mack, W., Seligson, H., & Bourque, L. B. (2001). Risk factors associated with moderate and serious injuries attributable to the 1994 Northridge earthquake, Los Angeles, California. *Annals of Epidemiology*, *11*(5), 347–357. doi:10.1016/S1047-2797(01)00220-4

Maloney, M. J., McGuire, J. B., & Daniels, S. R. (1988). Reliability testing of a children's version of the Eating Attitude Test. *Journal of the American Academy of Child & Adolescent Psychiatry*, *27*(5), 541–543. doi:10.1097/00004583-198809000-00004

Marlowe, J., & Lou, L. (2013). The Canterbury earthquakes and refugee communities. *Aotearoa New Zealand Social Work Review*, *25*(2), 58–68.

Masozera, M., Bailey, M., & Kerchner, C. (2007). Distribution of impacts of natural disasters across income groups: A case study of New Orleans. *Ecological Economics*, *63*(2), 299–306. doi:10.1016/j.ecolecon.2006.06.013

Massey, O. T. (2011). A proposed model for the analysis and interpretation of focus groups in evaluation research. *Evaluation and Program Planning*, *34*(1), 21–28. doi:10.1016/j.evalprogplan.2010.06.003

Masten, A. S., & Narayan, A. J. (2012). Child development in the context of disaster, war and terrorism: Pathways of risk and resilience. *Annual Review of Psychology, 63*, 227–257. doi:10.1146/annurev-psych-120710-100356

Mathison, S. (2005). *Encyclopedia of Evaluation*. Thousand Oaks, CA: Sage.

Maxcy, S. J. (2003). Pragmatic threads in mixed methods research in the social sciences: The search for multiple modes of inquiry and the end of the philosophy of formalism. In Tashakkori, A., & Teddlie, C. (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 51–89). Sage.

Mayer, R. E. (2002). Rote versus meaningful learning. *Theory into Practice, 41*(4), 226–232. doi:10.1207/s15430421tip4104_4

McBride, S. K., Becker, J. M., Coomer, M.A., Tipler, K., & Johnston, D. M. (2013). New Zealand ShakeOut observation evaluation report: A summary of initial findings. *GNS Science Report, 2013*(61), 1–39.

Mertens, D. M. (2009). *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods*. Sage.

Mertens, D. M., & Hesse- Biber, S. (2013). Mixed methods and credibility of evidence in evaluation. *New Directions for Evaluation*, *2013*(138), 5–13. doi:10.1002/ev.20053

Mertens, D. M., & Wilson, A. T. (2012). *Program evaluation theory and practice: A comprehensive guide*. Guilford Press.

Meyer, C. B. (2001). A case in case study methodology. *Field Methods*, *13*(4), 329–352. doi:10.1177/1525822X0101300402

Mileti, D. (1999). *Disasters by design: A reassessment of natural hazards in the United States*. Washington, DC: Joseph Henry Press.

Mileti, D., Nathe, S., Gori, P., Greene, M., & Lemersal, E. (2004). *Public hazards communication and education: The state of the art*. University of Colorado: Natural Hazards Center.

Mileti, D. S., & Sorensen, J. H. (1990). *Communication of emergency public warnings: A social science perspective and state-of-the-art assessment* (No. ORNL–6609). doi:10.2172/6137387

Ministry of Civil Defence and Emergency Management. (2006). *Public Education: What's the Plan, Stan?* Retrieved from http://www.civildefence.govt.nz/memwebsite.nsf/wpg_url/ for-the-cdem-sector-public-education-whats-the-plan-stan?

Ministry of Civil Defence and Emergency Management. (2007). *The Way Forward - Strategic Framework for the National CDEM Public Education Programme 2006-2015*. Retrieved from http://www.civildefence.govt.nz/memwebsite.nsf/wpg_URL/For-the-CDEM-Sector-Public-Education-Public-Education-Strategy?OpenDocument

Ministry of Civil Defence and Emergency Management. (2009a). *Communications Strategy for 2009 Launch*. Retrieved from http://www.civildefence.govt.nz/memwebsite.nsf/wpg_url/for-the-cdem-sector-public-education-whats-the-plan-stan?

Ministry of Civil Defence and Emergency Management. (2009b). *What's the Plan, Stan?* (2009 edition). Retrieved from http://www.whatstheplanstan.govt.nz/

Ministry of Civil Defence and Emergency Management. (2013). *Campaign Monitoring Research*. Retrieved from http://www.civildefence.govt.nz/memwebsite.nsf/Files/ MCDEM-Campaign-Monitoring-Research-July-2013/$file/Get-Ready-Get-Thru-report-Jul-2013.pdf

Ministry of Education. (2008). *Fire safety and design requirements for schools*. Retrieved from http://www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/PropertyTool Box/StateSchools/Design/FireSafetyandDesign.aspx

Mishra, S., & Suar, D. (2012). Effects of anxiety, disaster education, and resources on disaster preparedness behavior. *Journal of Applied Social Psychology, 42*(5), 1069–1087. doi:10.1111/j.1559-1816.2011.00853.x

Mitchell, J. T. (2009). Hazards education and academic standards in the Southeast United States. *International Research in Geographical and Environmental Education*, *18*(2), 134–148. doi:10.1080/10382040902861221

Mitchell, T., Haynes, K., Hall, N., Choong, W., & Oven, K. (2008). The roles of children and youth in communicating disaster risk. *Children Youth and Environments, 18*(1), 254–279. Retrieved from http://www.jstor.org/stable/10.7721/chilyoutenvi.18.1.0254

Mitchell, T., Tanner, T., & Haynes, K. (2009). *Children as agents of change for Disaster Risk Reduction: Lessons from El Salvador and the Philippines*. Retrieved from http://www.childreninachangingclimate.org/database/ccc/Publications/MitchellTannerHaynes_AgentsForChange-WorkingPaper1_2009.pdf

Moon, J. A. (2013). *A handbook of reflective and experiential learning: Theory and practice*. Routledge.

Morgan, D. L. (2007). Paradigms lost and pragmatism regained methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research, 1*(1), 48–76. doi:10.1177/2345678906292462

Morse, J. M., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2002). Verification strategies for establishing reliability and validity in qualitative research. *International Journal of Qualitative Methods*, *1*(2), 1–19.

Mulyasari, F., Takeuchi, Y., & Shaw, R. (2011). Implementation tools for disaster education. *Community, Environment and Disaster Risk Management, 7*, 137–151. doi:10.1108/S2040-7262(2011)0000007013

Mushkatel, A.H., & Weschler, L.F. (1985). Emergency management and the intergovernmental system. *Public Administration Review, 45*, 49-56. doi:10.2307/3134997

Nakahara, S., & Ichikawa, M. (2013). Mortality in the 2011 tsunami in Japan. *Journal of Epidemiology*, *23*(1), 70–73. doi:10.2188/jea.JE20120114

Nastasi, B. K., & Schensul, S. L. (2005). Contributions of qualitative research to the validity of intervention research. *Journal of School Psychology, 43*(3), 177–195. doi:10.1016/j.jsp.2005.04.003

National Commission on Children and Disasters. (2010). *2010 Report to the President and Congress*. Washington, DC: Agency for Healthcare Research and Quality. Retrieved from http://archive.ahrq.gov/prep/nccdreport/

National Implementation Research Nework. (n.d.). Implementation Defined. Retrieved from http://nirn.fpg.unc.edu/learn-implementation/implementation-defined

Naya, Y. (2007). How intercultural disaster reduction education change students: A case study of an evening course senior high school in Hyogo, Japan. In *Intercultural Collaboration* (pp. 368–381). Springer Berlin Heidelberg.

Nielsen, S., & Lidstone, J. (1998). Public education and disaster management: Is there any guiding theory? *Australian Journal of Emergency Management, 13*(3), 14–19.

Noblit, G.W., & Hare, R.D. (1988). *Meta-ethnography: Synthesizing qualitative studies*. Newbury Park, CA: Sage.

Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry: Interpersonal and Biological Processes, 65*(3), 207-239. doi:10.1521/psyc.65.3.207.20173

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology, 41*(1–2), 127–150. doi:10.1007/s10464-007-9156-6

Öcal, A., & Topkaya, Y. (2011). Earthquake preparedness in schools in seismic hazard regions in the South-East of Turkey. *Disaster Prevention and Management, 20*(3), 334–348. doi:10.1108/09653561111141754

Oganowski, J. L., & Wycoff-Horn, M. (2008). *2008 READY Evaluation Report*.

Oliver, P. (2008). *Writing Your Thesis* (2nd ed.). London: Sage.

Oliver-Smith, A. (1996). Anthropological research on hazards and disasters. *Annual Review of Anthropology, 1996*(25), 303–328. Retrieved from http://www.jstor.org/stable/2155829

Ollendick, T. H., King, N. J., & Frary, R. B. (1989). Fears in children and adolescents: Reliability and generalizability across gender, age and nationality. *Behaviour Research and Therapy, 27*(1), 19–26. doi:10.1016/0005-7967(89)90115-0

Onweugbuzie, A.J., & Combs, J.P. (2010). Emergent data analysis techniques in mixed methods research: A synthesis. In Tashakkori, A., & Teddlie, C. (Eds.), *Sage handbook of mixed methods in social & behavioral research* (pp. 397–430). Thousand Oaks, CA: Sage.

Onweugbuzie, A.J., Johnson, R.B., & Collins, K.M.T. (2009). Call for mixed analysis: A philosophical framework for combining qualitative and quantitative. *International Journal of Multiple Research Approaches, 3*(2), 114–139.

Osofsky, J. D. (Ed.). (2004). *Young children and trauma: Interventions and treatment*. New York: Guilford.

Osofsky, J. D., & Osofsky, H. J. (2013). Lessons learned about the impact of disasters on children and families and post-disaster recovery. In *Child and Family Advocacy* (pp. 91–105). Springer New York. doi:10.1007/978-1-4614-7456-2_7

O'Sullivan, M. (2012, October 19). Great ShakeOut drills increase earthquake awareness. *Voice of America*. Retrieved from http://www.voanews.com/content/great-shakeout-drills-increase-earthquake-awareness/1530002.html

Owen, J. (2005, January 18). Tsunami family saved by schoolgirl's geography lesson. *National Geographic News*. Retrieved from http://news.nationalgeographic.com/news/2005/01/0118_050118_tsunami_geography_lesson.html

Özgüven, B. & Öztürk, C. (2006). Effects of basic earthquake awareness education to given primary school students. *Turkish Journal of Disaster, 1*(1), 1–6.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66*(4), 543–578. doi:10.3102/00346543066004543.

Pane, J. F. (2006). *Student displacement in Louisiana after the Hurricanes of 2005: Experiences of public schools and their students*. Retrieved from http://www.rand.org/pubs/technical_reports/TR430.html

Pane, J. F., McCaffrey, D. F., Kalra, N., & Zhou, A. J. (2008). Effects of student displacement in Louisiana during the first academic year after the hurricanes of 2005. *Journal of Education for Students Placed at Risk, 13*(2–3), 168–211. doi:10.1080/10824660802350169

Patel, R. B., & Burke, T. F. (2009). Urbanization—an emerging humanitarian disaster. *New England Journal of Medicine, 361*(8), 741–743. doi:10.1056/NEJMp0810878

Paton, D. (2003). Disaster preparedness: A social-cognitive perspective. *Disaster Prevention and Management, 12*(3), 210–216. doi:10.1108/09653560310480686

Paton, D., Sagala, S., Okada, N., Jang, L. J., Buergelt, P. T., & Gregg, C. E. (2010). Making sense of natural hazard mitigation: Personal, social and cultural influences. *Environmental Hazards*, *9*(2), 183–196. doi:10.3763/ehaz.2010.0039

Paton, D., Smith, L., & Johnston, D. (2005). When good intentions turn bad: Promoting natural hazard preparedness. *Australian Journal of Emergency Management, 20*(1), 25–30.

Peace, R., & van Hoven, B. (2005). Computers, qualitative data, and geographic research. In I. Hay (Ed.), *Qualitative research methods in human geography* (pp. 234-47). Oxford University Press.

Peek, L.A. (2008). Children and disasters: Understanding vulnerability, developing capacities, and promoting resilience—An introduction. *Children, Youth and Environments, 18*(1), 1–29. Retrieved from http://www.jstor.org/stable/10.7721/chilyoutenvi.18.1.0001

Peek, L. A., & Mileti, D. S. (2002). The history and future of disaster research. In R. B. Bechtel, & A. Churchman (Eds.), *Handbook of environmental psychology* (pp. 511–524). Hoboken, NJ: John Wiley & Sons Inc.

Peek, L. A., & Richardson, K. (2010). In their own words: Displaced children's educational recovery needs after Hurricane Katrina. *Disaster Medicine and Public Health Preparedness, 4*(S1), S63–S70. doi:10.1001/dmp.2010.10060910

Petal, M. (2008). *Disaster prevention for schools: Guidance for education sector decision-makers*. Retrieved from http://www.unisdr.org/we/inform/publications/7556

Petal, M., & Green, R. (2008). *School disaster readiness: Lessons from the first great southern California ShakeOut*. Retrieved from http://www.riskred.org/schools/shakeout2008.pdf

Petal, M., Green, R., Wood, M., Reuss, L., & Nguyen, A. (2011). *2011 ShakeOut: California schools report*. Southern California Earthquake Center.

Petal, M., & Izadkhah, Y. O. (2008). *Concept note: Formal and informal education for disaster risk reduction*. Prepared for the International Conference on School Safety, Islamabad.

Pfefferbaum, B., Houston, J. B., North, C. S., & Regens, J. L. (2008). Youth's reactions to disasters and the factors that influence their response. *The Prevention Researcher, 15*(3), 3–6. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2785039/

Piaget, J., & Inhelder, B. (1969). *The psychology of the child*. Basic Books.

Picou, J. S., & Marshall, B. K. (2007). Social impacts of Hurricane Katrina on displaced K–12 students and educational institutions in coastal Alabama counties: some preliminary observations. *Sociological Spectrum, 27*(6), 767–780. doi:10.1080/02732170701534267

Plan International. (2010). *Child-Centred DRR toolkit*. Retrieved from http://www.childreninachangingclimate.org/database/plan/Publications/Child-Centred_DRR_Toolkit.pdf

Potter, C. (2006). Program evaluation. In M. Terre Blanche, K. Durrheim & D. Painter (Eds.), *Research in practice: Applied methods for the social sciences* (2nd ed., pp. 410–428). Cape Town: UCT Press.

Powell, P., Black, L., & Smith, M. (2009a). Involving youth in community emergency preparedness: Impacts of a multistate initiative. *Journal of Youth Development, 4*(4). Retrieved from http://ncfy.acf.hhs.gov/library/2009/involving-youth-community-emergency-preparedness-impacts-multistate-initiative

Powell, P., Black, L., & Smith, M. (2009b). *Training youth to prepare communities for disaster*. Retrieved from http://www.unce.unr.edu/publications/files/cy/2012/fs1209.pdf

Powell, P., Smith, M., & Black, L. (2011). 4-H Teen CERT: An evaluation of a two-day training. Retrieved from http://www.unce.unr.edu/publications/files/cd/2011/fs1150.pdf

Prinstein, M. J., La Greca, A. M., Vernberg, E. M., & Silverman, W. K. (1996). Children's coping assistance: How parents, teachers, and friends help children cope after a natural disaster. *Journal of Clinical Child Psychology, 25*(4), 463–475. doi:10.1207/s15374424jccp2504_11

Proctor, L. J., Fauchier, A., Oliver, P. H., Ramos, M. C., Rios, M. A., & Margolin, G. (2007). Family context and young children's responses to earthquake. *Journal of Child Psychology and Psychiatry*, *48*(9), 941–949. doi:10.1111/j.1469-7610.2007.01771.x

Rabiee, F. (2004). Focus-group interview and data analysis. *Proceedings of the Nutrition Society*, *63*(4), 655–660. doi:10.1079/PNS2004399

Ramirez, M., Kano, M., Bourque, L. B., & Shoaf, K. I. (2005). Child and household factors associated with fatal and non-fatal pediatric injury during the 1999 Kocaeli earthquake. *International Journal of Mass Emergencies and Disasters*, *23*(2), 129–147.

Ramirez, M., Kubicek, K., Peek-Asa, C., & Wong, M. (2009). Accountability and assessment of emergency drill performance at schools. *Family & Community Health*, *32*(2), 105–114. doi:10.1097/FCH.0b013e3181994662

Ramirez, M., & Peek-Asa, C. (2005). Epidemiology of traumatic injuries from earthquakes. *Epidemiologic Reviews*, *27*(1), 47-55. doi:10.1093/epirev/mxi005

Randolf, J. (2009). A guide to writing the dissertation literature review. *Practical Assessment, Research & Evaluation*, *14*(3), 1–13. Retrieved from http://lincs.etsmtl.ca/uploads/media/ v14n13.pdf

Rappaport, E. N. (2013). Fatalities in the United States from Atlantic tropical cyclones-new data and interpretation. Bulletin of the American Meteorological Society. doi:10.1175/BAMS-D-12-00074.1

Redlener, I. E., & Berman, D. A. (2006). National Preparedness Planning: the Historical Context and Current State of the US Public's Readiness, 1940-2005. *Journal of International Affairs*, *59*(2), 87–103.

Reich, J. A., & Wadsworth, M. (2008). Out of the floodwaters, but not yet on dry ground: Experiences of displacement and adjustment in adolescents and their parents following Hurricane Katrina. *Children, Youth and Environments*, *18*(1), 354–370. Retrieved from http://www.jstor.org/stable/10.7721/chilyoutenvi.18.1.0354

Renwick, J. (2012). *Report of the 2012 "What's the Plan, Stan?" survey of New Zealand primary schools*. Research and Evaluation Services, Strategy and Governance Branch of the Department of Internal Affairs. Retrieved from http://www.civildefence.govt.nz/ memwebsite.nsf/wpg_url/for-the-cdem-sector-public-education-whats-the-plan-stan?

Reyes, M. L., Diopenes, V. E., Co, R., Berse, P., Eng, K., Harianti, D…Lieu, N. T. T. (2011). *Disaster resilience starts with the young: Mainstreaming disaster risk reduction in the school curriculum*. Paper presented at the SEAN Member States on Mainstreaming Disaster Risk Reduction (DRR) in Education, Malacca, Malaysia. Retrieved from http://www.preventionweb.net/english/professional/publications/v.php?id=18743

Riemer, M., & Bickman, L. (2011). Using program theory to link social psychology and program evaluation. In M. M. Mark, S. I. Donaldson, & B. Campbell (Eds.), *Social Psychology and Evaluation* (pp. 104–138). New York: The Guildford Press.

Robson, C. (2002). Real World Research: A Resource for Social Scientists and Practitioner–Researchers (2nd ed.). Oxford: Blackwell.

Rog, D. J. (2005). Evaluation Design. In S. Mathison (Ed.), *Encyclopedia of Evaluation* (pp. 114–116). Thousand Oaks, CA: Sage.

Rogers, P. J., & Weiss, C. H. (2007). Theory-based evaluation: Reflections ten years on. *New Directions for Evaluation, 2007*(114), 63–81. doi:10.1002/ev.225

Rogers, P. J., Petrosino, A., Huebner, T. A., & Hacsi, T. A. (2000). Program theory evaluation: Practice, promise, and problems. *New Directions for Evaluation, 2000*(87), 5–13. doi:10.1002/ev.1177

Ronan, K. R. (1996). Building a reasonable bridge in childhood anxiety assessment: A practitioner's resource guide. *Cognitive and Behavioral Practice, 3*(1), 63–90. doi:10.1016/S1077-7229(96)80031-9

Ronan, K. R., Crellin, K., & Johnston, D. M. (2010). Correlates of hazards education for youth: A replication study. *Natural Hazards, 53*(3), 503–526. doi:10.1007/s11069-009-9444-6

Ronan, K. R., Crellin, K., & Johnston, D. M. (2012). Community readiness for a new tsunami warning system: Quasi-experimental and benchmarking evaluation of a school education component. *Natural Hazards, 61*(3), 1411–1425. doi:10.1007/s11069-011-0070-8

Ronan, K. R., Crellin, K., Johnston, D. M., Finnis, K., Paton, D., & Becker, J. (2008). Promoting child and family resilience to disasters: Effects, interventions, and prevention effectiveness. *Children, Youth and Environments, 18*(1), 332–353. Retrieved from http://www.jstor.org/stable/10.7721/chilyoutenvi.18.1.0332

Ronan, K. R., & Johnston, D. M. (2001a). Correlates of hazard education programs for youth. *Risk Analysis, 21*(6), 1055–1063. doi:10.1111/0272-4332.216174

Ronan, K. R., & Johnston, D. M. (2001b). *Hazards education in schools: Current findings, future directions*. Paper presented at the APEC Workshop on Dissemination of Disaster Mitigation Technologies for Humanistic Concerns (Phase I: Earthquake Disaster), Taipei, Taiwan.

Ronan, K. R., & Johnston, D. M. (2003). Hazards education for youth: A quasi-experimental investigation. *Risk Analysis, 23*(5), 1009–1020. doi:10.1111/1539-6924.00377

Ronan, K. R., & Johnston, D. M. (2005). *Promoting community resilience in disasters: The role for schools, youth, and families*. New York, NY: Springer.

Ronan, K. R., Johnston, D. M., Daly, M., & Fairley, R. (2001). School children's risk perceptions and preparedness: A hazards education survey. *Australasian Journal of Disaster and Trauma Studies, 1*, 2001–1. Retrieved from http://www.massey.ac.nz/~trauma/issues/ 2001-1/ronan.htm

Ronan, K. R., Petal, M., Johnson, V. A., Alisic, E., Haynes, K., Johnston, D. M., … Davie, S. (2014). *HFA Thematic Review/Indicator Research: 'Priority for Action (PFA) 3 – Core Indicator (CI) 2: School curricula, education material and relevant training include disaster risk reduction and recovery*. Input paper prepared for the UNISDR Global Assessment Report on Disaster Risk Reduction 2015. Manuscript submitted for publication.

Ronan, K. R., & Towers, B. (2014). Systems education for a sustainable planet: Preparing children for natural disasters. *Systems, 2*(1), 1–23. doi:10.3390/systems2010001

Rossi, P. H., Lipsey, M. W., & Freeman, H. E. (2004). *Evaluation: A systematic approach* (7th ed.). Thousand Oaks, CA: Sage Publications, Inc.

Rowley, K. M. (2007). GulfGove Reports: Education – An examination of the impact of Hurricanes Katrina and Rita on the public school districts in 15 communities. Retrieved from http://www.coweninstitute.com/our-work/applied-research/education-archive/education-transformation-archive/gulfgov-reports-an-examination-of-impacts-of-hurricanes-on-public-schools/

Runyan, W. M. (1980). A stage–state analysis of the life course. *Journal of Personality and Social Psychology, 38*(6), 951–962. doi:10.1037/0022-3514.38.6.951

Rustemli, A., & Karanci, A. N. (1999). Correlates of earthquake cognitions and preparedness behavior in a victimized population. *Journal of Social Psychology, 139*, 91–101. doi:10.1080/00224549909598364

Ryan, E. L., Hocke, T. M., & Hilyard, K. M. (2012). Ready or not, here it comes: Disaster preparedness messages on children's websites in the US. *Journal of Children and Media, 6*(3), 300–316. doi:10.1080/17482798.2011.630740

Sackett, D. L. (1979). Bias in analytic research. *Journal of Chronic Diseases, 32*(1), 51–63. doi:10.1016/0021-9681(79)90012-2

Saunders, R. P., Evans, M. H., & Joshi, P. (2005). Developing a process-evaluation plan for assessing health promotion program implementation: a how-to guide. *Health Promotion Practice, 6*(2), 134–147. doi:10.1177/1524839904273387

Save the Children UK. (2007). *Legacy of disaster: The impact of climate change on children*. Retrieved from http://www.savethechildren.org.uk/resources/online-library/legacy-of-disasters-the-impact-of-climate-change-on-children

School Safety Planning Manual. (2008). State of Washington, Office of the Superintendent of the Office of Public Instruction. Retrieved from http://www.k12.wa.us/Safetycenter/ Planning/Manual.aspx

Schothorst, B. (2012). *United States: National progress report on the implementation of the Hyogo Framework for Action (2011-2013) - interim*. Retrieved from http://www.unisdr.org/partners/countries/usa

Schwandt, T.A. (1994). Constructivist, interpretivist approaches to human inquiry. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 118–137). Thousand Oaks, CA: Sage.

Scriven, M. (1991). Pros and cons about goal-free evaluation. *American Journal of Evaluation, 12*(1), 55–62. doi: 10.1177/109821409101200108

Scriven, M. (1998). Minimalist theory: The least theory that practice requires. *American Journal of Evaluation, 19*(1), 57–70. doi:10.1177/109821409801900105

Seale, C. (1999). Quality in qualitative research. *Qualitative Inquiry, 5*(4), 465–478. doi:10.1177/107780049900500402

Seballos, F., Tanner, T., Tarazona, M., & Gallegos, J. (2011). *Children and disasters: Understanding impact and enabling agency*. Retrieved from http://www.childreninachangingclimate.org/database/CCC/Publications/IMPACTS%20and%20AGENCY_FINAL.pdf

Selby, D, & Kagawa, F. (2012). *Disaster risk reduction in school curricula: Case studies from thirty countries*. Retrieved from http://www.unicef.org/education/files/DRRinCurricula-Mapping30countriesFINAL.pdf

Selby, D. (1995). *EarthKind: A teacher's handbook on humane education*. Stoke-on-Trent (UK): Trentham.

Shadish, W. R., Cook, T. D., & Leviton, L. C. (1990). *Foundations of program evaluation: Theories of practice*. Thousand Oaks, CA: Sage.

Sharpe, J., & Kelman, I. (2011). Improving the disaster-related component of secondary school geography education in England. *International Research in Geographical and Environmental Education, 20*(4), 327–343. doi:10.1080/10382046.2011.619810

Shaw, R., Kobayashi, K. S. H., & Kobayashi, M. (2004). Linking experience, education, perception and earthquake preparedness. *Disaster Prevention and Management, 13*(1), 39–49. doi:10.1108/09653560410521689

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information, 22*(2), 63–75.

Shields, P.M., & Tajalli, H. (2006). Intermediate theory: The missing link in successful student scholarship. *Journal of Public Affairs Education, 12*(3), 313–334. Retrieved from http://www.jstor.org/stable/40215744

Shiwaku, K., & Fernandez, G. (2011). Innovative approaches in disaster education. In R. Shaw, K. Shiwaku, & Y. Takeuchi (Eds.), *Disaster Education (Community, Environment and Disaster Risk Management* (Vol. 7, pp.115–136). Emerald Group Publishing.

Shiwaku, K., & Shaw, R. (2008). Proactive co-learning: A new paradigm in disaster education. *Disaster Prevention and Management*, *17*(2), 183–198. doi:10.1108/09653560810872497

Shiwaku, K., Shaw, R., Kandel, R. C., Shrestha, S. N., & Dixit, A. M. (2007). Future perspective of school disaster education in Nepal. *Disaster Prevention and Management, 16*(4), 576–587. doi:10.1108/09653560710817057

Shoaf, K. I., Sareen, H. R., Nguyen, L. H., & Bourque, L. B. (1998). Injuries as a result of California earthquakes in the past decade. *Disasters, 22*(3), 218–235. doi:10.1111/1467-7717.00088

Shores, E. F., Grace, C., Barbaro, E., Flenner, M., & Barbaro, M. C. (2009). Reducing risks for young children: Indicators research can guide disaster preparedness of the early childhood sector. *Child Indicators Research, 2*(3), 293–301. doi:10.1007/s12187-009-9033-y

Shreve, R., Danbom, K., & Hanhan, S. (2002). "Wen the Flood Km We Had to Lv": Children's understandings of disaster. *Language Arts, 80*(2), 100–108. Retrieved from http://www.jstor.org/stable/41483297

Silva, E. (2009). Measuring skills for 21st-century learning. *Phi Delta Kappan*, 630–634. Retrieved from http://www.jstor.org/stable/27652741

Silverman, R. L. (1999). *"Where Do We Turn? What Should We Do?" Processes to help educators and their students recover from a natural disaster. A monograph for the plan for social excellence.* Retrieved from http://eric.ed.gov/?id=ED439524

Silverman, W. K., Greca, A. M., & Wasserstein, S. (1995). What do children worry about? Worries and their relation to anxiety. *Child Development, 66*(3), 671–686. doi:10.1111/j.1467-8624.1995.tb00897.x

Singh, A. S., Vik, F. N., Chinapaw, M. J., Uijtdewilligen, L., Verloigne, M., Fernández-Alvira, J. M., ... & Brug, J. (2011). Test-retest reliability and construct validity of the ENERGY-child questionnaire on energy balance-related behaviours and their potential determinants: the ENERGY-project. *International Journal of Behavioral Nutrition and Physical Activity, 8*(136), 1–12. doi:10.1186/1479-5868-8-136

Slovic, P., Fischhoff, B., & Lichenstein, S. (1981). Perceived risk: Psychological factors and social implications. *Proceedings of the Royal Society of London, 376*(1764), 17–34. doi:10.1098/rspa.1981.0073

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1984). Behavioral decision theory perspectives on risk and safety. *Acta Psychologica, 56*(1–3), 183–203. doi:10.1016/0001-6918(84)90018-0

Smith, K. (1993). *Environmental hazards: Assessing risk and reducing disaster*. London: Routledge.

Smith, N. L., & Brandon, P. R. (Eds.). (2008). *Fundamental issues in evaluation*. Guilford Press.

Smith, P. K., & Williams-Boyd, P. (2007). For they are us: 'Tools' for a post-Katrina curriculum and community. In S. P. Robinson, & M. C. Brown (Eds.), *The children Hurricane Katrina left behind: Schooling context, professional preparation, and community politics* (pp. 141–151). New York: Peter Lang.

Snider, L., Hoffman, Y., Littrell, M., Fry, M. W., & Thornburgh, M. (2010). Supporting children after Hurricane Katrina: Reflections on psychosocial principles in practice. In R. Kilmer, V. E. Gil-Rivas, R. G. Tedeschi, & L. G. Calhoun. (2010). *Helping families and communities recover from disaster: Lessons learned from Hurricane Katrina and its aftermath* (pp. 25–51). American Psychological Association.

Soffer, Y., Goldberg, A., Avisar- Shohat, G., Cohen, R., & Bar- Dayan, Y. (2010). The effect of different educational interventions on schoolchildren's knowledge of earthquake protective behaviour in Israel. *Disasters, 34*(1), 205–213. doi:10.1111/j.1467-7717.2009.01125.x

Sorensen, J. H. (1983). Knowing how to behave under the threat of disaster: Can it be explained?. *Environment and Behavior, 15*(4), 438–457. doi:10.1177/0013916583154003

Stake, R. E. (Ed.). (2004). *Standards-based and responsive evaluation*. Sage.

Stake, R. E. (2005). Qualitative case studies. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (3rd ed., pp. 433–466). Thousand Oaks, CA: Sage Publications.

Stith, S., Pruitt, I., Dees, J., Fronce, M., Green, N., Som, A., & Linkh, D. (2006). Implementing community-based prevention programming: A review of the literature. *Journal of Primary Prevention*, *27*(6), 599–617. doi:10.1007/s10935-006-0062-8

Strauss, A., & Corbin, J. M. (Eds.). (1997). *Grounded theory in practice*. Sage.

Stuart, K. L., Patterson, L. G., Johnston, D. M., & Peace, R. (2013). Managing temporary school closure due to environmental hazard Lessons from New Zealand. *Management in Education, 27*(1), 25–31. doi:10.1177/0892020612468928

Stufflebeam, D. L., & Shinkfield, A. J. (1985). *Systematic evaluation: A self-instructional guide to theory and practice*. Boston: Kluwer-Nijhoff.

Sturtevant, V., & Myer, G. (2013). *Fired Up: Youth working with communities to adapt to wildfire*. Research Note NRS-163. Retrieved from http://www.nrs.fs.fed.us/pubs/rn/ rn_nrs163.pdf

Suchman, E. A. (1967). *Evaluative research: Principles and practice in public service & social action programs*. New York: Russell Sage Foundation.

Sutherland, D., & Ham, S. (1992). Child-to-parent transfer of environmental ideology in Costa Rican families: An ethnographic case study. *The Journal of Environmental Education, 23*(3), 9–16. doi:10.1080/00958964.1992.9942797

Takeuchi, Y., Mulyasari, F., & Shaw, R. (2011). Roles of family and community in disaster education. In R. Shaw, K. Shiwaku, & Y. Takeuchi (Eds.). (2011). *Community, Environment and Disaster Risk Management* (Volume 7, pp. 77–94). Emerald Group Publishing Limited.

Tan, W. (2004). *Practical Research Methods* (2nd ed.). Prentice Hall, Singapore: Prentice Hall.

Tarrant, R.A.C., & Johnston, D.M. (2010). Preparedness to cope with hazards: A survey of Wellington Intermediate schools. *GNS Science Report, 2010*(2), 1–32.

Tashakkori, A., & Teddlie, C. (Eds.). (2010). *Sage handbook of mixed methods in social & behavioral research* (2nd ed.). Thousand Oaks, CA: Sage.

Taylor, M., & Moeed, A. (2013). The 2010 Canterbury earthquake: curriculum shockwaves. *International Research in Geographical and Environmental Education, 22*(1), 57–70. doi:10.1080/10382046.2012.759693

ThiMyThi, T., & Shaw, R. (2013). Building disaster resilience from school level: A case study in Thua Thien Hue Province, Central Vietnam. *Journal of Disaster Research, 8*(1), 205–206.

Tierney, K. J., Lindell, M. K., & Perry, R. W. (2001). *Facing the unexpected: Disaster preparedness and response in the United States*. Joseph Henry Press.

Tourangeau, R., Rips, L. J., & Rasinski, K. (2000). *The psychology of survey response*. Cambridge University Press.

TR Ministry of Education, Bog   aziçi University, Kandilli Observatory, Earthquake Research Institute. (2005). Basic disaster awareness in Turkish schools 2001–2005: Final report. Retrived from http://ztscompany.com/Assets/reports/TR%20SCHOOLS%20FINAL%20REPORT.pdf

Trochim, W. M. (1989). Outcome pattern matching and program theory. *Evaluation and Program Planning, 12*(4), 355–366.

Tucker, J. (2004). Making difference in the aftermath of the September 11th 2001 terrorist attacks. *Critique of Anthropology, 24*(1), 34–50. doi:10.1177/0308275X04041082

Turnbull, B. (2002). Program theory building: A strategy for deriving cumulative evaluation knowledge. *American Journal of Evaluation, 23*(3), 275–290. doi:10.1177/109821400202300304

United Nations. (1989). *International Decade for Natural Disaster Reduction. General Assembly, 85th plenary meeting*. Retrieved from http://www.un.org/documents/ga/res/44/ a44r236.htm

United Nations Children's Fund. (2012). *UNICEF and Child-Centred Disaster Risk Reduction*. Retrieved from http://www.unicef.org/files/DDR_final.pdf

United Nations Children's Fund and United Nations International Strategy for Disaster Reduction. (2011). *Children and disasters: Building resilience through education*. Retrieved from http://www.unicef.org/ceecis/Children_and_disasters_Building_resilience_throug h_education_final.pdf.

United Nations Educational, Scientific and Cultural Organization [UNESCO]. (2005). *UN Decade for Education and Sustainable Development 2005-2014*. Retrieved from http://unesdoc.unesco.org/images/0014/001416/141629e.pdf

United Nations Educational, Scientific and Cultural Organization [UNESCO]. (2007). *Disaster Education*. Paris: Building Research Institute and National Graduate Institute for Policy Studies and UNESCO.

United Nations Educational, Scientific and Cultural Organization [UNESCO]. (2013). *Disaster Preparedness: Education for Disaster Risk Reduction at UNESCO*. Retrieved from http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/disaster-risk-reduction/

United Nations International Strategy for Disaster Reduction [UNISDR] Terminology. (2007a, Aug 30). Disaster. Retrieved from http://www.unisdr.org/we/inform/terminology#letter-d

United Nations International Strategy for Disaster Reduction [UNISDR] Terminology. (2007b, Aug 30). Preparedness. Retrieved from http://www.unisdr.org/we/inform/ terminology#letter-d

United Nations International Strategy for Disaster Reduction [UNISDR] Terminology. (2009, Jan 23). Disaster risk. Retrieved from http://www.unisdr.org/we/inform/ terminology#letter-d

United Nations International Strategy for Disaster Reduction [UNISDR]. (2005). *Hyogo Framework for Action 2005–2015: Building the resilience of nations and communities to disasters*. Retrieved from http://www.unisdr.org/we/inform/publications/1037

United Nations International Strategy for Disaster Reduction [UNISDR]. (2007a). *Implementation of the Hyogo Framework for Action: Summary of Reports 2007– 2013*. Retrieved from http://www.unisdr.org/files/32916_implementationofthehyogoframeworkfo.pdf

United Nations International Strategy for Disaster Reduction [UNISDR]. (2007b). *Towards a culture of prevention: Disaster risk reduction begins at school*. Retrieved from http://www.unisdr.org/eng/about_isdr/isdr-publications/11- education-good-practices/education-good-practices.pdf

United Nations International Strategy for Disaster Reduction [UNISDR]. (2008). *Indicators of Progress: Guidance on measuring the reduction of disaster risks and the implementation of the Hyogo Framework for Action*. Retrieved from http://www.unisdr.org/we/inform/ publications/2259

United Nations International Strategy for Disaster Reduction [UNISDR]. (2009). *Disaster risk reduction in the United Nations*. Retrieved from http://www.unisdr.org/files/ 9866_DisasterRiskReductionintheUnitedNat.pdf

United Nations International Strategy for Disaster Reduction [UNISDR]. (2011). *2011 United Nations Global Assessment Report on Disaster Risk Reduction*. Retrieved from http://www.unisdr.org/we/inform/publications/19846

United Nations International Strategy for Disaster Reduction [UNISDR]. (2013). *2013 United Nations Global Assessment Report on Disaster Risk Reduction*. Retrieved from http://www.preventionweb.net/english/hyogo/gar/2013/en/home/index.html

United States Federal Emergency Management Agency [FEMA]. (2010a). *Bringing youth preparedness education to the forefront: A literature review and recommendations*. Retrieved from https://www.fema.gov/media-library/assets/documents/29982

United States Federal Emergency Management Agency [FEMA]. (2010b). *Student Tools for Emergency Preparedness (STEP) draft evaluation report*. Rockville, MD: ICF International.

United States Federal Emergency Management Agency [FEMA]. (2010c). *Youth emergency preparedness education paper*. Philadelphia, PA: Regional Advisory Council, FEMA Region III.

United States Federal Emergency Management Agency [FEMA]. (2013a). *Catalogue of youth disaster preparedness education resources* (updated). Retrieved from http://www.fema.gov/media-library/assets/documents/30503

United States Federal Emergency Management Agency [FEMA]. (2013b). *Earthquakes*. Retrieved from http://www.ready.gov/earthquakes

United States Federal Emergency Management Agency [FEMA]. (2013c). *Public information overview*. Retrieved from http://www.fema.gov/public-information

United States Federal Emergency Management Agency [FEMA]. (n.d.) *Plan, prepare & mitigate*. Retrieved from http://www.fema.gov/

United States Geological Survey (2013). *The effects of urbanization on water quality*. Retrieved from http://ga.water.usgs.gov/edu/urbanquality.html

United Way of America. (1996). *Measuring program outcomes: A practical approach*. Retrieved from

http://www.nrpa.org/uploadedFiles/nrpa.org/Professional_Development/Accredita
tion/COAPRT/Measuring_Program_Outcomes-UW.pdf

Vaughan, C., Gack, J., Solorazano, H., & Ray, R. (2003). The effect of environmental
education on schoolchildren, their parents, and community members: A study of
intergenerational and intercommunity learning. *The Journal of Environmental
Education, 34*(3), 12–21. doi:10.1080/00958960309603489

Victoria, L. P. (2009). Community capacity and disaster resilience. In R. Shaw, & R. R.
Krishnamurthy (Eds.), *Disaster management: Global challenges and local
solutions*. India: Universities Press.

Vosniadou, S. (2003). How children learn. In D. B. Rao (Ed.), *Successful Schooling* (pp.
16–33). New Delhi: Discovery Publishing House.

Wachtendorf, T., Brown, B., & Nickle, M. C. (2008). Big bird, disaster masters, and high
school students taking charge: The social capacities of children in disaster
education. *Children Youth and Environments, 18*(1), 456–469. Retrieved from
http://www.jstor.org/stable/10.7721/chilyoutenvi.18.1.0456

Wall H.K., Ladd, S., Rogers, T., Fulmer, E., Lim, S., Leeks, K., & Jernigan, J. (2010).
*Outcome indicators for policy and systems change: Improving emergency
response*. Retrieved from http://www.nacddarchive.org/nacdd-
initiatives/cardiovascular-
health/leadership/Emergency%20Medical%20Systems/draft-improving-
emergency-response-indicators

Washington Emergency Management Division. (2010). *Washington State enhanced
hazard mitigation plan*. Retrieved from
http://www.emd.wa.gov/plans/washington_state_hazard_ mitigation_plan.shtml

Wash. Rev. Code Ann. (2002*). RCW 28A.320.125: Safe school plans — Requirements —
Duties of school districts, schools, and educational service districts — Reports —
Drills — Rules*. Retrieved from
http://apps.leg.wa.gov/rcw/default.aspx?cite=28A.320.125

Weems, C. F., Watts, S. E., Marsee, M. A., Taylor, L. K., Costa, N. M., Cannon, M. F., ... & Pina, A. A. (2007). The psychosocial impact of Hurricane Katrina: Contextual differences in psychological symptoms, social support, and discrimination. *Behaviour Research and Therapy, 45*(10), 2295–2306. doi:10.1016/ j.brat.2007.04.013

Weiner, D. L. (2009). Lessons learned from disasters affecting children. *Clinical Pediatric Emergency Medicine, 10*(3), 149–152. doi:10.1016/j.cpem.2009.07.010

Weinstein, N. D., Lyon, J. E., Rothman, A. J., & Cuite, C. L. (2000). Preoccupation and affect as predictors of protective action following natural disaster. *British Journal of Health Psychology, 5*(4), 351– 363. doi:10.1348/135910700168973

Weiss, C. H. (1997). Theory-based evaluation: Past, present, and future. *New Directions for* Evaluation, 1997(76), 41–55. doi:10.1002/ev.1086

Weiss, C. H. (1998). *Evaluation*. Upper Saddle River, NJ: Prentice Hall.

When My Home Shook. (2012). Retrieved from http://whenmyhomeshook.co.nz/

Wholey, J. S., Hatry, H. P., & Newcomer, K. E. (2010). *Handbook of practical program evaluation* (Vol. 19). John Wiley & Sons.

Wholey, J. S. (1994). Assessing the feasibility and likely usefulness of evaluation. In J.S. Wholey, H.P. Hatry, & K.E. Newcomer (Eds.), *Handbook of practical program evaluation* (pp. 15–39). San Francisco: Jossey-Bass.

Williams, C. E., & Jones, R. T. (1989). Impact of self-instructions on response maintenance and children's fear of fire. *Journal of Clinical Child Psychology, 18*(1), 84–89. doi:10.1207/s15374424jccp1801_10

Wilson, R. A. (1997). The wonders of nature: Honoring children's ways of knowing. *Early Childhood News, 9*(2), 16–19. Retrieved from http://eric.ed.gov/?id=EJ543337

Wilson, S. J., Lipsey, M. W., & Derzon, J. H. (2003). The effects of school-based intervention programs on aggressive behavior: A meta-analysis. *Journal of Consulting and Clinical Psychology, 71*(1), 136–149. doi:10.1037/0022-006X.71.1.136

Wisner, B. (Ed.). (2004). *At risk: Natural hazards, people's vulnerability and disasters*. Psychology Press.

Wisner, B. (2006). Let our children teach us! A review of the role of education and knowledge in disaster risk reduction. Retrieved from http://www.unisdr.org/2005/task-force/working%20groups/knowledge-education/docs/Let-our-Children-Teach-Us.pdf

Wolmer, L., Laor, N., & Yazgan, Y. (2003). School reactivation programs after disaster: Could teachers serve as clinical mediators?. *Child and Adolescent Psychiatric Clinics of North America, 12*(2), 363–381.

Wood, K. C., Smith, H., & Grossniklaus, D. (2001). Piaget's stages of cognitive development. In M. Orey (Ed.), *Emerging perspectives on learning, teaching, and technology*. Retrieved from http://epltt.coe.uga.edu/index.php?title=Piaget%27s_Stages

Wood, M. M., Mileti, D. S., Kano, M., Kelley, M. M., Regan, R., & Bourque, L. B. (2012). Communicating actionable risk for terrorism and other hazards. *Risk Analysis*, *32*(4), 601–615. doi:10.1111/j.1539-6924.2011.01645.x

Zahran, S., Peek, L., & Brody, S. D. (2008). Youth mortality by forces of nature. *Children, Youth and Environments, 18*(1), 371–388. Retrieved from http://www.jstor.org/stable/10.7721/chilyoutenvi.18.1.0371

Zevenbergen, A. A., Sigler, E. A., Duerre, L. J., & Howse, E. (2000). The Impact of a natural disaster on classroom curricula. *Journal of Educational Thought, 34*(3), 285–304. Retrieved from http://eric.ed.gov/?id=EJ621922

Appendix 1: Statement of Contribution sheets for published and submitted journal papers

Chapter 4

Johnson, V. A., Ronan, K. R., Johnston, D. M., & Peace, R. (2014c). Evaluations of disaster education programs for children: A methodological review. *International Journal of Disaster Risk Reduction, 9,* 107-123. doi:10.1016/j.ijdrr.2014.04.001

Chapter 5

Johnson, V. A., Peace, R., Ronan, K. R., & Johnston, D. M. (2014b). Improving the impact and implementation of disaster education programs for children through theory-based evaluation. Manuscript submitted for publication.

Chapter 6

Johnson, V. A., Johnston, D. M., Ronan, K. R., & Peace, R. (2014a). Evaluating children's learning of adaptive response capacities from ShakeOut, an earthquake and tsunami drill in two Washington State school districts. *Journal of Homeland Security and Emergency Management*. Advance online publication. doi: 10.1515/jhsem-2014-0012

Chapter 7

Johnson, V. A., Ronan, K. R., Johnston, D. M., & Peace, R. (2014d). Implementing disaster preparedness education in New Zealand Primary Schools. *Disaster Prevention and Management, 23*(4), 370-380.

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STATEMENT OF CONTRIBUTION
TO DOCTORAL THESIS CONTAINING PUBLICATIONS

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Victoria A. Johnson

Name/Title of Principal Supervisor: Prof. David M. Johnston

Name of Published Research Output and full reference:
Evaluations of Disaster Education Programs for Children: A Methodological Review

In which Chapter is the Published Work: 4

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: 90%

  and / or

- Describe the contribution that the candidate has made to the Published Work:
  The candidate was responsible for the search strategy and execution, the coding and analysis, and preparation of all text. Kevin Ronan served as a second coder to the data, and all authors provided review and comments to the final full draft.

Victoria Johnson   *Digitally signed by Victoria Johnson DN: cn=Victoria Johnson, o=Massey University, ou=School of Psychology, email=v.johnson@massey.ac.nz, c=NZ Date: 2014.04.22 08:03:10 +12'00'*   22/4/2014
_____   _____
Candidate's Signature   Date

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Principal Supervisor's signature   Date

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STATEMENT OF CONTRIBUTION
TO DOCTORAL THESIS CONTAINING PUBLICATIONS

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Victoria A. Johnson

Name/Title of Principal Supervisor: Prof. David M. Johnston

Name of Published Research Output and full reference:
Improving the Impact and Implementation of Disaster Education Programs for Children Through Theory-Based Evaluation

In which Chapter is the Published Work: 5

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: 95%

    and / or

- Describe the contribution that the candidate has made to the Published Work:
    The candidate was responsible for the entire text, including the development of the program theory models. The authors provided edits and comments to the full final draft.

Victoria Johnson	22/4/2014
Candidate's Signature	Date

David Johnston	30/4/14
Principal Supervisor's signature	Date

GRS Version 3– 16 September 2011

MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

**STATEMENT OF CONTRIBUTION
TO DOCTORAL THESIS CONTAINING PUBLICATIONS**

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Victoria A. Johnson

Name/Title of Principal Supervisor: Prof. David M. Johnston

Name of Published Research Output and full reference:
Evaluating Children's Learning of Adaptive Response Capacities During an Earthquake and Tsunami Drill in Two Washington State School Districts

In which Chapter is the Published Work: 6

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: 95%

    and / or

- Describe the contribution that the candidate has made to the Published Work:
  The candidate was responsible for the development and execution of the evaluation, the analysis of the data and preparation of all text.

Victoria Johnson	Digitally signed by Victoria Johnson DN: cn=Victoria Johnson, o=Massey University, ou=School of Psychology, email=v.johnson@massey.ac.nz, c=NZ Date: 2014.04.22 08:15:07 +12'00'	22/4/2014
Candidate's Signature		Date

David Johnston	Digitally signed by David Johnston DN: cn=David Johnston, o=Massey University, ou=School of Psychology, email=david.johnston@gns.cri.nz, c=NZ Date: 2014.04.30 17:51:03 +12'00'	30/4/14
Principal Supervisor's signature		Date

MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION
TO DOCTORAL THESIS CONTAINING PUBLICATIONS

(To appear at the end of each thesis chapter/section/appendix submitted as an article/paper or collected as an appendix at the end of the thesis)

We, the candidate and the candidate's Principal Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of Candidate: Victoria A. Johnson

Name/Title of Principal Supervisor: Prof. David M. Johnston

Name of Published Research Output and full reference:
Implementing Disaster Preparedness Education in New Zealand Primary Schools

In which Chapter is the Published Work: 7

Please indicate either:

- The percentage of the Published Work that was contributed by the candidate: 90%

  and / or

- Describe the contribution that the candidate has made to the Published Work:
  The candidate was responsible for the coding and analysis of the data, and preparation of all text. Kevin Ronan served a second coder for the data.

Victoria Johnson	22/4/2014
Candidate's Signature	Date

David Johnston	30/4/14
Principal Supervisor's signature	Date

Appendix 2: Documentation for human ethics requirements

I.   Low risk ethics approval – What's the Plan, Stan? evaluation

II.   High risk ethics approval – ShakeOut evaluation

     a. Parent cover letter

     b. Parent information sheet

     c. Parental/caregiver non-consent form for children

     d. Teacher information sheet

29 November 2011

Victoria Johnson
2A/57 Boulcott Street
WELLINGTON 6011

Dear Victoria

Re: Evaluation of "What's the Plan, Stan?", a Teaching Resource on Disasters for Children in Schools

Thank you for your Low Risk Notification which was received on 21 November 2011.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

J. O'Neill

John G O'Neill (Professor)
**Chair, Human Ethics Chairs' Committee and
Director (Research Ethics)**

cc   Assoc Prof David Johnston   Assoc Prof Mandy Morgan, HoS
     School of Psychology   School of Psychology
     Wellington   **PN320**

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MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

7 September 2012

Victoria Johnson
2A/57 Boulcott Street
WELLINGTON 6011

Dear Victoria

Re: HEC: Southern B Application – 12/44
        **Impact evaluation of ShakeOut (state-wide earthquake exercise) in two Washington
        State (USA) schools**

Thank you for your letter dated 5 September 2012.

On behalf of the Massey University Human Ethics Committee: Southern B I am pleased to advise you
that the ethics of your application are now approved. Approval is for three years.   If this project has not
been completed within three years from the date of this letter, reapproval must be requested.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro
Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel
Overseas. In addition, the supervisor must advise the University's Insurance Officer.

If the nature, content, location, procedures or personnel of your approved application change, please
advise the Secretary of the Committee.

Yours sincerely

Dr Nathan Matthews, Chair
Massey University Human Ethics Committee: Southern B

cc   A/Prof David Johnston   A/Prof Robin Peace
      Joint Centre for Disaster Research   School of People, Environment & Planning
      WELLINGTON   **WELLINGTON**

      A/Prof Mandy Morgan, HoS   Dr Allanah Ryan, HoS
      School of Psychology   School of People, Environment & Planning
      PN320   **PN331**

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Parent Cover Letter

[School letterhead]

Dear Parent or Guardian,

On October 18, 2012, North Beach School District will participate in the *Great Washington ShakeOut*, the largest earthquake drill in U.S. History. At 10:18 a.m., students and staff will practice "Drop, Cover and Hold On" for earthquakes at the same time as millions of others in Washington, Oregon, Nevada and California. Afterwards, all classrooms will practice our school procedures for tsunami evacuation.

During this time of the year, teachers will discuss the importance of earthquake and tsunami preparedness with our students. This is the chance for us all to practice what to do during disasters to prevent potential injuries.

With assistance from the County and State emergency management offices, we are holding a parent information session about *ShakeOut*, our school's earthquake and tsunami procedures, and household disaster preparedness on **Monday, September 24, 2012 from 6:00 – 7:00 pm in the school library**. Parents and children are welcome to attend.

In October, we will be conducting an evaluation with students in Grades 6-12 on their knowledge and comprehension of "Drop, Cover and Hold On" and actions to protect themselves during an earthquake or tsunami. The survey is being developed by Vicki Johnson, an American PhD student at Massey University, for her dissertation. This evaluation will help our schools improve disaster preparedness drills and education in our schools.

For the evaluation, students will be asked to fill out a survey before and after the *ShakeOut* drill during class. Participation is completely voluntary and student responses will be anonymous. Students will have the opportunity to opt out of the survey activities if they do not wish to participate.

If you not consent to your child's participation in the *ShakeOut* evaluation, please return the attached parent/guardian non-consent form by **October 1, 2012** to your child's 3rd period teacher. To protect the health and safety of North Beach School District's students and staff, we would greatly appreciate the participation of every parent and child in this important educational safety activity.

Sincerely,

[School Superintendent]

Parent Information Sheet

An evaluation of *ShakeOut*

a state-wide Drop, Cover and Hold On drill on October 18th, 2012

INFORMATION SHEET FOR PARENTS

Researcher Introduction

Vicki Johnson is an American PhD student at Massey University (Wellington, New Zealand) and she will be evaluating student knowledge and comprehension of earthquake and tsunami procedures before and after ShakeOut. This research is being conducted in coordination with the Washington State Emergency Management Division and the Gray's Harbor County Emergency Management Office.

Project Description and Invitation

North Beach School District has volunteered to participate in *ShakeOut* and a study to determine if the school's participation helps children demonstrate and understand Drop, Cover and Hold On, and tsunami evacuation procedures. In addition to participating in the *ShakeOut* drill at 10:20am on October 18, 2012, classroom teachers may voluntarily teach about earthquakes and tsunami hazards in classroom activities and homework assignments before and after the *ShakeOut* drill.

The results of this study will help determine if *ShakeOut* is an effective means for teaching lessons on disaster preparedness and response in schools and areas for improvement.

We would greatly appreciate your child's participation in this evaluation.

Evaluation Activities

- During class, teachers will distribute and collect a questionnaire (20 minutes in length) to students in Grades 6-12 the week before the *ShakeOut* drill on October 18, 2012, and a similar questionnaire one week after the *ShakeOut* drill.
- Teachers will review the correct answers to the questionnaires with students. The questionnaires will not be graded, they are for research purposes only.
- The participating principal and teachers will have an opportunity to comment on the summary of the results before publication.

Data Management

- The parent non-consent forms will be securely stored by the researcher.
- Students responses will be anonymous to the researches and no personally identified information will be attached to the study results.

Participant's Rights

Your child is under no obligation to participate in the evaluation. If your child decides to participate, you and your child have the right to:

- decline to answer any particular question;
- withdraw from the study at any point;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name(s) will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded.

More information about ShakeOut, the evaluation and disaster preparedness at school, home and work will be provided at a teacher and parent conference on September 24th from 6:00-7:00pm in the school auditorium. Parents and children are welcome to attend.

If you do not consent to your child's participation in the evaluation, we ask that you please return the attached non-consent form at the parent meeting or to your child's third period teacher by October 1, 2012.

Project Contacts

Please feel free to contact the researcher or local emergency manager, Charles Wallace, if you have any questions about the evaluation.

Researcher:

Vicki Johnson
PhD Candidate in Emergency Management
Joint Centre for Disaster Research
Massey University (Wellington, New Zealand)
Ph: +64 220 896 893
Email: v.johnson@massey.ac.nz

County contact:

Charles T Wallace
Deputy Director of Emergency Management
Grays Harbor County
(360) 249-3911 x 290
Email: cwallace@co.grays-harbor.wa.us

PhD Supervisor:

Prof. David Johnston
GNS Science/Massey University
Email: david.johnston@gns.cri.nz
New Zealand Phone: + 64 4 570 1444

Committee Approval Statement

This project has been reviewed and approved by the Massey University Human Ethics Committee. If you have any concerns about the conduct of this research, please contact Dr Ralph Bathurst, Chair, Massey University Human Ethics Committee: humanethicsnorth@massey.ac.nz.

Parental/caregiver non-consent form for children

An evaluation of *ShakeOut,*

a state-wide earthquake drill in schools, October 18, 2012

Parental/caregiver non-consent form for children

If you **do not** want you child to participate in *ShakeOut* on October 18[th], or the classroom evaluation, or both, please return the attached parental non-consent form by **October 1, 2012** to your child's 3[rd] period teacher.

Name of Child: Date of Birth:

Parent/ Guardian:

Address:

Telephone (day):

Telephone (evening):

E-mail:

NON CONSENT (please read carefully)

I have read the Information Sheet and understand the details of the study. I understand that I may ask questions at any time.

I do not want my child to participate in:

_____ the ShakeOut drill on October 18, 2012

_____ the classroom evaluation of ShakeOut (student surveys)

Signature: Date:

Full Name printed:

[Massey letterhead]

An evaluation of *ShakeOut,*

a state-wide earthquake drill in schools on October 18, 2012

TEACHER INFORMATION SHEET

Researcher(s) Introduction

Vicki Johnson is an American PhD student at Massey University (Wellington, New Zealand) who is evaluating the effectiveness of ShakeOut as a school-based disaster education program for children.

Project Aims and Teacher Invitation

ShakeOut is a state-wide earthquake drill taking place on October 18th, 2012 at 10:18am (third period for Grades 6-12). On that day, Ocosta School District will practice "Drop, Cover and Hold On", as well as evacuation procedures for a tsunami. In October, teachers may voluntarily conduct classroom lessons and activities on earthquake and tsunami preparedness with students.

Vicki invites you to participate in an evaluation of ShakeOut as a tool for teaching children protective actions during earthquakes and tsunamis. The results of the evaluation will be part of Vicki's PhD thesis "Evaluating Disaster Education Programs for Children." The aim of the research is to identify the effectiveness of ShakeOut in meeting learning outcomes and to help Ocosta School District identify ways to improve classroom drills and school-based disaster preparedness activities.

Voluntary teacher participation involves the administration of a 20 minute pre-ShakeOut questionnaire to students between Oct. 1-12, and a 20 minute post-ShakeOut questionnaire to students between Oct. 19-26.

Because ShakeOut will take place at 10:18am on October 18, participating teachers would administer the questionnaires during 3rd period. Participating teachers can administer the questionnaires to their classroom at any time of day. Participation in the evaluation activities is voluntary and you may opt out at any time.

Student Participation

The questionnaires are for students age 10 and older in Grades 6-12. Parent consent is required for students age 8-15. In early September, Ocosta School District will send parents information packets that include a cover letter, a parent information sheet about the evaluation, and a parent non-consent form. A parent information meeting is also scheduled on Monday, September 24.

3rd period teachers of Grades 6-12 will be asked to collect the parent consent from their students by October 1, 2012.

The results of the students' questionnaires will be anonymous and no personal information will be included in the data or the resulting reports.

Children and their guardians can opt out of the evaluation at any time. We ask that teachers remain vigilant of any students exhibiting discomfort with the questionnaires before, during or after the evaluation activities, and remind students that they have the option to opt out.

Timeline of Evaluation Activities

Early September

The school administration office will mail an information packet to parents, including a parent non-consent form that must be returned to the child's teacher by October 1, 2012.

Tuesday, September 25

Vicki will be visiting Ocosta School District to provide participating teachers with an individual packet that includes student questionnaire instructions, copies of the pre- and post-Shakeout questionnaires for their students, and a short post-ShakeOut teacher survey. Vicki will be on-site on Sep 24 for any questions you may have.

Please remind students at this time to return their parent non-consent forms if they have one.

A parent information meeting is scheduled after school on Monday, September 25.

Monday, October 1 – Friday, October 5

We ask that participating teachers collect parent non-consent forms from your 3rd periopd students by Monday, October 1. Please collect and save the consent forms in a marked envelope with your name and grade. The consent forms will be collected by Vicki in November.

On any day from October 1-5, you may administer the 20-minute pre-ShakeOut questionnaire to your 3rd period classroom. If any students have returned a parent non-consent form, please provide those students a quiet alternative writing activity during the administration of the questionnaire.

Please collect the completed questionnaires and save them in the envelope provided in your packet (packets will be provided on Sep. 24)

During October you may voluntarily conduct classroom lessons and activities on earthquake and tsunami preparedness leading up to ShakeOut.

Thursday, October 18th

At 10:18am, the state-wide ShakeOut exercise will commence. The school Principal will facilitate an earthquake drill using Drop, Cover and Hold On, followed by a vertical tsunami evacuation drill. The Principal will provide additional information about these drills.

On any day from October 19-26, you may administer the 20-minute post-ShakeOut questionnaire to your 3rd period classroom. For those students that returned a parent non-consent form, please provide those students a quiet alternative writing activity during the administration of the questionnaire.

While administering this questionnaire to students, we invite you to complete a voluntary post-ShakeOut teacher survey provided in your packet.

Please collect the completed student questionnaires and save them in the envelope provided in your packet. Correct answers to the questionnaire will be provided in the teacher packets. We strongly encourage you to review the correct answers with your students after they have returned their completed questionnaires.

November (dates TBA)

Vicki will collect three envelopes from each participating teacher including the: 1) parent non-consent forms, 2) completed pre-ShakeOut questionnaires, 3) completed post-ShakeOut questionnaires, 4) completed post-ShakeOut teacher survey.

Data Management

Vicki will collect the parent non-consent forms and the completed questionnaires from Ocosta School District in November and securely store them in accordance with the university's ethics guidelines. No personally identified information will be attached to data or study results.

Participant's Rights (Teachers, Students and Parents/Guardians)

Teachers, students and students' guardians are under no obligation to participate in the ShakeOut evaluation. If a teacher, student or student's guardian choose to participate, each have the right to:

- decline to answer any particular question;
- withdraw from the study at any point;
- ask any questions about the study at any time during participation;
- provide information on the understanding that his or her name(s) will not be used unless permission is given to the researcher; and
- be given access to a summary of the project findings when it is concluded.

Project Contacts

Please feel free to contact the researcher and/or supervisor if you have any questions about the project.

Researcher:

Vicki Johnson
PhD Candidate in Emergency Management
Joint Centre for Disaster Research
Massey University (Wellington campus)
U.S. Phone: (571) 215-1735
Email: johnson.va@gmail.com

County contact:

Chuck Wallace, Deputy Director of Emergency Management
Grays Harbor County
310 W. Spruce Street, Montesano WA 98563
Ph: (360) 249-3911 x 290

PhD Supervisor:

Prof. David Johnston
GNS Science/Massey University
Email: david.johnston@gns.cri.nz
New Zealand Phone: + 64 4 570 1444

Committee Approval Statement

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 12/44. If you have any concerns about the conduct of the research, please contact Dr Nathan Matthews, Chair,

Massey University Human Ethics Committee: Southern B, telephone +64 06 350 5799 x 8729, email humanethicsouthb@massey.ac.nz.

Appendix 3: Codes used in the methodological literature review (Chapter 4 / Paper 1)

Below are the codes developed for the categorization and analysis of evaluations of disaster education programs for children presented in Chapter 4 (Johnson et al., 2014c). Categories marked with a star were coded but the results were not presented in the paper due to the length limitations of manuscripts submitted to the *Journal of International Disaster Risk Reduction*.

I. Program Description

Freq.	Program developers
9	Academic researchers
3	Local or state emergency management agency
6	National agency *(eg federal, Ministry)*
5	NGO/non-profit
3	School
1	Collaborations
3	Not specified
10	N/a *(for non-specific education)*

Freq.	Program Content*
23	Multi-hazard
7	Single hazard
10	N/a *(for non-specific education)*

Freq.	Program Format
22	Course/workshop
3	Course and drill
6	Self-study *(eg Internet, book, TV program)*
2	Game
10	Not specified

Freq.	Program Location
18	USA
22	Abroad (countries noted)

Freq.	Program Duration*
3	1 hour or less
3	1-6 hours
4	2-3 days (6+ hours)
7	1-2 weeks
1	4-10 weeks

1	1 year
6	Varies
15	Not specified

II. Evaluation Context

Freq.	Evaluator type
32	Academic researchers
3	Professional evaluators
0	Local or state emergency managers
0	Federal employees
0	Non-governmental organizations
0	School staff

Freq.	Publisher
22	Academic journal *(peer-reviewed)*
2	Book
11	Research organization *(internal study/peer review)*
1	Government agency
1	NGO/non-profit
1	Not published *(not publically available)*

Freq.	Type of evaluation
23	Impact *(educational effectiveness)*
2	Process *(program implementation)*
10	Both *(impact & implementation)*

Freq.	Evaluation Location*
25	School
7	Afterschool/extracurricular program *(including summer camps)*
1	Media-based *(eg online users)*
2	N/a *(e.g., document analysis)*

III. Research Design

Freq.	Participants
18	Children *(list age range – 12 and under)*
18	Teens *(list age range – 13 and older)*
3	Parents
4	Instructors *(those who deliver the program to children)*
1	Instructor trainers
7	School teachers *(who are not instructors)*
3	School representatives *(eg principal or emergency management lead speaking on behalf of the school)*

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1	Emergency managers
1	Observers
1	Adults *(general public)*
2	N/a *(e.g., document analysis)*

Freq.	**# of research participants (fill in)**
11	(1-100) 17-93
7	(101-300) 101-282
6	(301-500) 356-452
3	(501-1,000) 501-767
6	(1,000+) 1,065-9,000
2	N/a *(e.g., document analysis)*

Freq.	**Type of sample**
7	Provided response rate
2	Response rate – partial info only
20	Opportunity sample *(chosen sample that is not intended to be representative of a larger group)*
5	Not specified
2	N/a *(e.g., document analysis)*

Freq.	**Demographics of participants described in the study**
8	No
2	N/a *(e.g., document analysis)*
	Yes >
17	Age
18	Sex
8	Ethnicity
1	Family socioeconomic status
1	Homeownership status
1	Parent education level
1	Individual's location
1	Medical conditions
1	Education level *(of the participant)*
7	Disaster experience
6	Previous preparedness education
1	Type of dwelling
1	Years of teaching experience
1	Class size *(at school)*
1	Other

- Scout experience

Freq.	**Study effects of demographic variables?**
20	No

2	N/a (*e.g., document analysis*)
	Yes >
3	Age
3	Sex
1	Ethnicity
0	Family socioeconomic status
1	Homeownership status
0	Parent education level
0	Individual's location
0	Medical conditions
1	Education level (*of the participant*)
4	Disaster experience
6	Previous preparedness education
0	Type of dwelling
1	Years of teaching experience
1	Class size (*at school*)
1	Other

- Scout experience

Freq.	Evaluation Design
7	Mixed methods (*list multiple methods below*)
17	Descriptive>
4	Case-study
2	Naturalistic observation
5	Survey (*snapshot of current state*)
2	Longitudinal time-lag (*multiple surveys over time with different cohorts like fifth graders*)
1	Focus groups
5	Interviews
1	Diary
10	Descriptive – sole method
10	Correlational>
0	Case-control study (*outcome comparison of participants assigned to treatment or control [cannot show causation]*)
10	Observational study (*outcome comparison of two or more existing groups [no treatment]*)
9	Correlational – sole method
1	Experimental (*random assignment to intervention and control groups that are 'matched' ["gold standard" - can show causation]*)
14	Quasi-experimental>
7	One group pretest/posttest
3	One group retrospective pretest/posttest (*this is a post-test only design*)
1	One group pretest/posttest with benchmarking
1	Treatment and control group pretest/posttest design (*no random assignment to groups [intact groups like classrooms]*)
1	Treatment and control posttest only design (*no random*

assignment to groups [intact groups like classrooms])
9   Quasi-experimental – sole method

Freq.   **Impact outcome indicators**
3   Knowledge of hazard science *(causes of disaster)*
22   Knowledge of hazard risks *(likelihood and consequences of disasters)*
2   Knowledge of causes of injury
18   Knowledge of protective actions during an emergency *(e.g., evacuation, Drop, cover hold)*
12   Knowledge of preparedness actions and resources *(e.g., what to put in disaster kit)*
4   Knowledge of mitigation actions *(e.g., do not build in risk zone)*
1   Knowledge of recovery actions
2   Actions during an emergency in the past *(e.g., did you Drop Cover Hold during the ChCh earthquake? – for retrospective evaluation of education)*
3   Demonstration of protective actions *(e.g., practice drill)*
4   Information seeking (*by participant*)
11   Family emergency plan – indicated as done
0   Family emergency plan – intended
14   Discussion with household members – indicated as done
4   Discussion with household members - intended
4   Discussion with peers
3   Discussion with teachers
16   Home hazards adjustments – indicated as done *(e.g., home kit)*
4   Home hazards adjustments – intended
5   Home-based practice *(e.g., practice drill with family)*
3   Identification of helpful people/networks
2   School hazards adjustments- indicated as done
2   School drills – indicated as done
1   School drills - desired
10   Anxiety level *(personal)*
7   Anxiety level perceived in parents
5   Perceived coping ability *(personal)*
7   Confidence level *(i.e., participants own perceived self efficacy)*
2   Confidence level – observed *(by the evaluator)*
12   Preparedness attitudes *(i.e., participant's value of preparedness)*
7   Perceived knowledge and learning *(e.g., survey asked "Did you learn something new?")*
2   CPR and other responder certifications
7   Interest in subject matter
1   Usability criteria
3   Adaptive capacities *(i.e., ability to apply knowledge to new problem/decision-making skills)*
2   Other
- Content alignment with vulnerability/capacity matrix
- Public service career intention

- Drug related risk behaviors

Freq.	**Process evaluation indicators**
2	Communication of the resource
3	Uptake of resource(s)
2	Number of program participants
5	Motivators to use
4	Deterrents to use
2	Components used
4	Frequency of use
2	Preferences of learning tools – children
3	Preferences of learning tools - instructors
2	Satisfaction with learning tools - children
6	Satisfaction with tools provided - instructors
3	Satisfaction with training - instructors
1	Satisfaction with educational program – children
4	Satisfaction with educational program – instructors
1	Internal evaluation of resource
1	School staff discussion with parents
1	Links to community initiatives
2	Communication with locals EMs *(emergency managers)*
2	Execution of school drills
2	School hazards adjustments *(including planning)*
2	Instructor preparation *(before delivering the program)*
4	Instructor recommendations
1	How learning tools are used

Freq.	**Data collection tools**
2	Questionnaire – not specified
22	Quantitative questionnaire
0	Qualitative questionnaire
7	Mixed methods questionnaire (*e.g., used both stats and coding for analysis*)
5	Individual interviews
2	Group interviews
2	Focus groups
4	Observations
2	Literature search
1	Diary

Freq.	**Analysis methods**
1	Not specified
12	Quantitative analysis - basic

- Counting *(very small samples)*
- Basic stats *(e.g., percentages without CIs/census stats)*

19	Quantitative analysis – advanced

- paired t-Test
- ANOVA
- Kruskal-Wallis test
- correlation analysis
- cross-tabulation
- chi-squared
- Wilcoxon non-parametric statistical query

8   Qualitative analysis *(coding transcripts / written open-ended responses)*

2   Case study

1   Content analysis *(coding documents/websites)*

IV. Research Outcomes

Freq.	Limitations
14	Not specified
3	Sample not random
5	Small sample
1	No non-treatment control group
7	Limited data collection tool

- children may not have understood question(s)
- teachers did not have time to complete
- young children had unreadable responses

Freq.	Limitations
4	Recency effect

- recent disasters
- other recent education campaigns or media

Freq.	Limitations
6	Limited data collection method
1	Perceived rather than tested or observed knowledge *(perceived by the participant)*
2	Theorized rather than observed outcomes *(theorized by the evaluator)*
6	Only assesses short-term impact
3	Not generalizable to other populations
2	Longitudinal analysis limited (*did not survey the same exact group*)
2	Type I/II error *(false positive and false negative)*
4	Correlational and exploratory nature of study
1	Study may have artificially instigated positive outcomes (*e.g., the pretest prompted home hazards adjustments*)
1	Author bias
2	Low response rate
1	Low recruitment rate
1	Lack of parent permission
1	Lack of school board consent

Freq.	Conclusions
24	Mostly positive

5	Mixed *(equal parts positive and negative)*
4	No effect
2	No conclusion/Not conclusive

Freq.	Suggested programmatic improvements
6	None
16	Suggestions for improved evaluation data
10	Suggestions for changed content *(i.e., what is taught, eg more home-based activities)*
2	Suggestions for changed learning tool *(i.e., how content is held – online,*
3	*book, etc.)*
11	Suggestions for how content is taught *(to children - e.g., better teacher training, more community activities)*
15	Suggestions for program delivery *(i.e. how program is executed)*

Appendix 4: Documentation from the ShakeOut evaluation (Chapter 6 / Paper 3)

PRE SHAKEOUT QUESTIONNAIRE

Grades 6-12 (age 10+)

Name: _____

Age: _____   Grade: _____

Teacher: _____

Participation in this survey is completely voluntary. You will not be graded and your name will not be used with your answers.

Some questions ask you to check one answer; other questions ask you to check all answers that are true.

1. Have you learned about what to do to prepare for earthquakes that can happen in Washington state?

_____ No

_____ Not Sure

_____ Yes

If you checked "Yes", please indicate where you learned about what to do to prepare for earthquakes *(check all that apply):*

     _____ At school   _____ Boy Scouts / Girl Scouts

     _____ Summer camp   _____ At home

     _____ Other *(please fill in where)*_____

2. If you hear the words "Drop, Cover and Hold On", what would you do?

Check one:

_____ Drop what you are doing, cover your ears, hold on to your belongings

_____ Drop to the ground, take cover under a desk or table if near by, hold on to the desk or table until the shaking stops

_____ Drop what you are doing, run for cover, hold on to your belongings

_____ None of the above

_____ I don't know

3. Why do you "Drop, Cover and Hold On" during an earthquake?

Check all answers that are true:

_____ To protect myself from flying objects

_____ To stay warm

_____ To prevent myself from falling

_____ To protect my ears from loud noises

_____ To prevent fainting and heart attacks

_____ I don't know

4. If an earthquake happened <u>while you are inside a building</u>, there are couple different things you could do that would help protect you from injuries.

Check *Yes, No* or *Not Sure* for each possible action during an earthquake.

Actions	Yes	No	Not Sure
Go outside to an open area			
Hold on to a desk and try to stay standing			
Drop to my knees and cover my head and neck			
Go to a doorway			
Take cover under a desk or table if possible			
Get next to a desk to create a "triangle of life"			

5. What would be the best thing to do if you are inside but don't have a desk or table near you during an earthquake?

Check one:

_____   Go to another room to find a desk or table to cover under

_____   Drop to my knees and cover my head and neck

_____   Go outside to an open area

_____   Find an adult

_____   I don't know

6. What do you think has caused <u>the most</u> injuries during earthquakes in the United States?

Check one:

_____   Fainting

_____   Flying objects and broken glass

_____   Building collapse

_____   Car accidents

_____   Being stuck outside in bad weather

_____   I don't know

7. If an earthquake happened <u>while you are outside</u>, there are couple different things you could do to protect yourself from injuries.

Check *Yes, No* or *Not Sure* for each possible action.

Actions	Yes	No	Not Sure
Go inside to get under a table or desk			
Hold on to a tree and try to stay standing			
Cover my head and neck with my arms			
Move away from overhead hazards			
Move away from electrical line			

8. What is the most important part of your body to protect from injury during an earthquake?

Check one:

_____ Arms

_____ Legs

_____ Feet

_____ Head

_____ I don't know

9. Would you "Drop, Cover and Hold On" if you are at home during an earthquake?

Check one:

_____ Definitely not

_____ Probably not

_____ Not sure

_____ Probably would

_____ Definitely would

10. Have you learned about what to do to prepare for tsunamis that can happen in Washington state?

_____ No

_____ Not Sure

_____ Yes

If you checked "Yes", please indicate where you learned about what to do to prepare for tsunamis *(check all that apply):*

_____ At school

_____ Boy Scouts / Girl Scouts

_____ Summer camp

_____ At home

_____ Other *(please fill in where)* _____

11. If you are near the ocean and an earthquake occurs, what should you do once the shaking stops?

Check one:

_____ Go to the beach to see if a tsunami is coming

_____ Go to higher ground or the top floor of a high building immediately

_____ Stay where you are and wait for tsunami warning sirens

_____ Call 911 to find out if there is a tsunami warning

_____ I don't know

12. Do you feel upset when you think or talk about earthquakes and tsunamis?

_____ Every time

_____ Most times

_____ Sometimes

_____ Only once in a while

_____ Not at all

POST SHAKEOUT QUESTIONNAIRE
Grades 6-12 (age 10+)

Name: _____

Age: _____   Grade: _____

Teacher: _____

Participation in this survey is completely voluntary. You will not be graded and your name will not be used with your answers.

This survey is about the ShakeOut disaster drill that took place at your school on Thursday, October 18.

Some questions ask you to check one answer; other questions ask you to check all answers that are true.

1. During the ShakeOut earthquake drill in your school, did you Drop, Cover and Hold on? *Check one:*

_____ Yes

_____ No

_____ Not Sure

_____ I was not there

2. During the ShakeOut earthquake drill in your school, did you practice evacuation for a tsunami?

Check one:

_____ Yes

_____ No

_____ Not Sure

_____ I was not there

3. Have you learned about what to do to prepare for earthquakes that can happen in Washington state?

_____ No

_____ Not Sure

_____ Yes

If you checked "Yes", please indicate where you learned about what to do to prepare for earthquakes *(check all that apply):*

    _____ At school   _____ Boy Scouts / Girl Scouts

    _____ Summer camp   _____ At home   _____ Other

4. If you hear the words "Drop, Cover and Hold On", what would you do?
Check one:

_____ Drop what you are doing, cover your ears, hold on to your belongings

_____ Drop to the ground, take cover under a desk or table if near by, hold on to the desk or table until the shaking stops

_____ Drop what you are doing, run for cover, hold on to your belongings

_____ None of the above

_____ I don't know

5. Why do you "Drop, Cover and Hold On" during an earthquake?
Check all answers that are true:

_____ To protect myself from flying objects

_____ To stay warm

_____ To prevent myself from falling

_____ To protect my ears from loud noises

_____ To prevent fainting and heart attacks

_____ I don't know

6. If an earthquake happened <u>while you are inside a building</u>, there are couple different things you could do that would help protect you from injuries.

Check *Yes, No* or *Not Sure* for each possible action during an earthquake.

Actions	Yes	No	Not Sure
Go outside to an open area			
Hold on to a desk and try to stay standing			
Drop to my knees and cover my head and neck			
Go to a doorway			
Take cover under a desk or table if possible			
Get next to a desk to create a "triangle of life"			

7. What would be the best thing to do if you are inside but don't have a desk or table near you during an earthquake?
Check one:

_____   Go to another room to find a desk or table to cover under

_____   Drop to my knees and cover my head and neck

_____   Go outside to an open area

_____   Find an adult

_____   I don't know

8. What do you think has caused <u>the most</u> injuries during earthquakes in the U.S.?
Check one:

_____   Fainting

_____   Flying objects and broken glass

_____   Building collapse

_____   Car accidents

_____   Being stuck outside in bad weather

_____   I don't know

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9. If an earthquake happened <u>while you are outside</u>, there are couple different things you could do to protect yourself from injuries.

Check *Yes, No* or *Not Sure* for each possible action.

Actions	Yes	No	Not Sure
Go inside to get under a table or desk			
Hold on to a tree and try to stay standing			
Cover my head and neck with my arms			
Move away from overhead hazards			
Move away from electrical line			

10. What is the most important part of your body to protect from injury during an earthquake?
Check one:

_____ Arms

_____ Legs

_____ Feet

_____ Head

_____ I don't know

11. Would you "Drop, Cover and Hold On" if you are at home during an earthquake?
Check one:

_____ Definitely not

_____ Probably not

_____ Not sure

_____ Probably would

_____ Definitely would

12. Have you learned about what to do to prepare for tsunamis that can happen in Washington state?

_____ No

_____ Not Sure

_____ Yes

If you checked "Yes", please indicate where you learned about what to do to prepare for tsunamis *(check all that apply):*

_____ At school   _____ Boy Scouts / Girl Scouts

_____ Summer camp   _____ At home

_____ Other *(please fill in where)* _____

13. If you are near the ocean and an earthquake occurs, what should you do once the shaking stops?

Check one:

_____ Go to the beach to see if a tsunami is coming

_____ Go to higher ground or the top floor of a high building immediately

_____ Stay where you are and wait for tsunami warning sirens

_____ Call 911 to find out if there is a tsunami warning

_____ I don't know

14. Do you feel upset or when you think or talk about earthquakes and tsunamis?

Check one:

_____ Every time

_____ Most times

_____ Sometimes

_____ Only once in a while

_____ Not at all

15. On a scale of 1 to 5, with 1 being "Nothing" and 4 being "A lot", please circle how much you knew before ShakeOut and after ShakeOut:

*What I knew **before** ShakeOut about what to do during an earthquake:*

Circle one:

| 1 | 2 | 3 | 4 |

| Nothing | Very little | Some | A lot |

*What I know **after** ShakeOut about what to do during an earthquake:*

Circle one:

| 1 | 2 | 3 | 4 |

| Nothing | Very little | Some | A lot |

*What I knew **before** ShakeOut about what to do during a tsunami:*

Circle one:

| 1 | 2 | 3 | 4 |

| Nothing | Very little | Some | A lot |

*What I know **after** ShakeOut about what to do during a tsunami:*

Circle one:

| 1 | 2 | 3 | 4 |

| Nothing | Very little | Some | A lot |

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ShakeOut Evaluation

POST SHAKEOUT QUESTIONNAIRE FOR TEACHERS

Grades 6-12

Please fill out after October 18, 2012 and return to your envelope

Name: _____ Grade: _____

This survey is about the ShakeOut disaster drill that took place at your school on Thursday, October 18, 2012. Participation in this survey is completely voluntary. I am collecting additional information about your school's classroom activities for disaster preparedness before ShakeOut (in September and October). Your answers are anonymous and your name will not be identified with your responses. Your name here is for tracking purposes only.

1. Did your classroom practice "Drop, Cover and Hold On" during the ShakeOut drill on Thursday, October 18?

_____ Yes   _____No   _____ Other: _____

2. Did your classroom participate in the full-school tsunami procedures on Thursday, October 18?

_____ Yes   _____No   _____ Other: _____

3. Did you voluntarily do any other classroom or homework activities on earthquake and tsunami preparedness before ShakeOut on October 18?

_____ Yes   _____ No

If yes, which activities did you do?

_____ Classroom lesson on earthquake science (e.g. plate tectonics)

_____ Classroom lesson on earthquake protective actions (e.g. Drop, Cover and Hold On)

_____ Homework activity on earthquake preparedness (e.g. home kits)

_____ Classroom lesson on tsunami science (e.g. causes)

_____ Classroom lesson on tsunami protective actions (e.g. go to high ground)

_____ Homework activity on tsunami preparedness (e.g. family plan)

_____ Other: _____

             _____

             _____

If yes, how much classroom time did you spend on these activities?

_____ Less than 1 hour

_____ 1-2 hours

_____ 2-5 hours

_____ More than 5 hours

4. Do you feel upset or when you think or talk about earthquakes and tsunamis? Check one:

_____ Every time

_____ Most times

_____ Sometimes

_____ Only once in a while

_____ Not at all

5. Did you review the correct answers to student Shakeout survey with your students (included in your packet)?

_____ No

_____ Yes once, after I administered the pre-ShakeOut survey

_____ Yes once, after I administered the post-ShakeOut survey

_____ Yes twice, after I administered the pre-ShakeOut & after post-ShakeOut survey

_____ Other: _____

             _____

             _____

6. Have you used the new teaching resource (May 2012) "Earthquake and Tsunami Information and Resources for Schools: Surviving Great Waves of Destruction"?

_____ Yes

_____ No

_____ Not aware of this resource

7. How often do you think your school should conduct school-wide earthquake and tsunami drills?

_____ More than twice a year   _____ Once every two years

_____ Twice a year   _____ Once every three years

_____ Once a year   _____ Never

Teacher Instructions

Teacher Instructions for the ShakeOut Evaluation
Student Questionnaires, Grades 6-12

Pre-ShakeOut Questionnaire: Administer between Oct 1-5, 2012

The Pre-ShakeOut questionnaires in your packet are for children age 10 and older in Grades 6-12.

The Pre-ShakeOut questionnaire is an individual writing activity. The questionnaire takes 20 minutes or less to complete, and students are under no obligation to participate. If any student chooses not to participate, or if you feel any student cannot provide informed consent or would be vulnerable due to the content of the questionnaires, please provide those students a quiet, alternative writing activity.

If any students have questions during the survey, please help clarify words or phrases they do not understand, but please do not provide or review correct answers until after all the participating students complete the questionnaire.

Children have the right to opt out of the evaluation if they do not wish to participate. Please remain vigilant of any students exhibiting discomfort with the questionnaires before, during or after the survey activities, and remind those students that they have the option to opt out.

Read-Aloud Instructions for the Pre-ShakeOut Questionnaire

Today our classroom will take a survey about earthquakes and tsunamis. As you may know, our classroom is participating in ShakeOut on October 18. On that day, our entire school will practice what to do in case of an earthquake or tsunami. The survey is to help us learn how much you already know. We will do the same survey after ShakeOut to see what you learned. The survey has 12 questions.

You will not be graded on your answers and your name will not be used in any reports. The results of the survey are for a research project by Vicki Johnson, a university student, for her PhD thesis. Please do the best you can and please raise your hand if you have a question during the survey.

You do not have to take the survey if you do not want to. If you do not want to, please let me know when I come by with the survey and I will give you another writing activity.

Post-ShakeOut Questionnaire: Administer between Oct 19-26, 2012

The Post-ShakeOut questionnaires in your packet are for children age 10 and older in Grades 6-12.

The Post-ShakeOut questionnaire is an individual writing activity. The questionnaire takes 20 minutes or less to complete, and students are under no obligation to participate. If any student chooses not to participate, or if you feel any student cannot provide informed consent or would be vulnerable due to the content of the questionnaires, please provide those students a quiet, alternative writing activity.

If any students have questions during the survey, please help clarify words or phrases they do not understand, but please do not provide or review correct answers until after all the participating students complete the questionnaire.

After your students complete the Post-ShakeOut Questionnaire, we encourage you to <u>review the correct answers</u> to the survey (provided in your packet) and have a discussion with the students about earthquake and tsunami preparedness.

Please remain vigilant of any students exhibiting discomfort with the questionnaires before, during or after the evaluation activities, and remind those students that they have the option to opt out.

Read-Aloud Instructions for the Post-ShakeOut Questionnaire

Today our classroom will take the second survey about earthquakes and tsunamis. The survey is about ShakeOut last Thursday (October 18), when we practiced what to do in case of an earthquake or tsunami. The survey is to help us see what you learned from ShakeOut. The survey has 16 questions.

You will not be graded on your answers and your name will not be used in any reports. Please do the best you can and please raise your hand if you have a question during the survey.

You do not have to take the survey if you do not want to. If you do not want to, please let me know when I come by with the survey and I will give you another writing activity.

When everyone is finished the surveys, we will discuss the correct answers.

SHAKEOUT QUESTIONNAIRE CORRECT ANSWERS

Grades 6-12 (age 10+)

4. If you hear the words "Drop, Cover and Hold On", what would you do?
Check one:

_____ Drop what you are doing, cover your ears, hold on to your belongings

__x__ Drop to the ground, take cover under a desk or table if near by, hold on to the desk or table until the shaking stops

_____ Drop what you are doing, run for cover, hold on to your belongings

_____ None of the above

_____ I don't know

5. Why do you "Drop, Cover and Hold On" during an earthquake?
Check all answers that are true:

__x__ To protect myself from flying objects

_____ To stay warm

__x__ To prevent myself from falling

_____ To protect my ears from loud noises

_____ To prevent fainting and heart attacks

_____ I don't know

Explanation:

"Drop, Cover and Hold On" is an action that includes dropping to the floor, making yourself as small a target as possible, and protecting your head, neck and chest by taking cover under a sturdy desk or table or near an interior wall, covering your head with your hands and arms. Holding on to your cover - a desk leg or other sturdy furniture – helps you stay underneath the sturdy furniture even if it slides around during shaking. "Drop, Cover and Hold On" helps prevent falling and helps protect your body from flying objects during an earthquake. Smaller tremors may come before and after a larger earthquake, so stay under the desk or furniture for at least a few minutes after shaking has stopped.

6. If an earthquake happened <u>while you are inside a building</u>, there are couple different things you could do that would help protect you from injuries.

Check *Yes, No* or *Not Sure* for each possible action during an earthquake.

Actions	Yes	No	Not Sure
a. Go outside to an open area		X	
b. Hold on to a desk and try to stay standing		X	
c. Drop to my knees and cover my head and neck	X		
d. Go to a doorway		X	
e. Take cover under a desk or table if possible	X		
f. Get next to a desk to create a triangle		X	

Explanation:
a. It is dangerous to run outside of a building during an earthquake. The area near the exterior walls of a building is the most dangerous place to be. Windows, facades and architectural details are often the first parts of the building to collapse. To stay away from this danger zone, stay inside if you are inside and outside if you are outside.

b. & c. Shaking can be so strong that you will not be able to move far without falling down, and objects may fall or be thrown at you that you do not expect. Emergency management recommends you drop to the ground to prevent falling (a major cause of injuries) and get under a desk or table to protect your body from flying objects and glass. The most important parts of your body to protect are your head, neck and chest.

*d. **Do NOT stand in a doorway:** An enduring earthquake image from California is a collapsed adobe home with the door frame as the only standing part. From this came our belief that a doorway is the safest place to be during an earthquake. This is true only if you live in an old, unreinforced adobe house or some older wood frame houses. In modern houses, doorways are no stronger than any other part of the house, and the doorway does not protect you from the most likely source of injury - falling or flying objects. You could also be injured by a door flapping on its hinges during strong shaking. You are safer under a table.*

*e. The main goal of "Drop, Cover, and Hold On" is to protect you from falling and flying debris and other nonstructural hazards, **and** to increase the chance of your ending up in a safe space in the unlikely event the building collapses. The space under a sturdy table or desk is likely to remain even if the building collapses - pictures from around the world show tables and desks standing with rubble all around them, and even holding up floors that have collapsed.*

*f. **Do NOT follow the "triangle of life" advice:** In recent years, an e-mail has been circulating which describes an alternative to the long-established "Drop, Cover, and Hold On" recommendation from emergency management. The so-called "triangle of life" advice is potentially life threatening, and the credibility of the source of this advice has been broadly questioned. The "triangle of life" advice (which is: always get next to a table rather than underneath it) is based on several <u>wrong</u> assumptions, namely:*

- *buildings always collapse in earthquakes (wrong- especially in developed nations like the U.S., and flat "pancake" collapse of buildings is rare anywhere);*
- *when buildings collapse they always crush all furniture inside (wrong- people DO survive under furniture or other shelters);*
- *people can always anticipate how their building might collapse and anticipate the location of survivable void spaces (wrong- the direction of shaking and unique structural aspects of the building make this nearly impossible); and*
- *during strong shaking people can move to a desired location (wrong- strong shaking can make moving very difficult and dangerous).*

Some other recommendations in the "triangle of life" e-mail are also based on wrong assumptions and very hazardous. For example, the recommendation to get out of your car during an earthquake and lay down next to it assumes that there is always an elevated freeway above you that will fall and crush your car. Of course there are very few elevated freeways, and laying next to your car is very dangerous because the car can move and crush you, and other drivers may not see you on the ground.

7. What would be the best thing to do if you are inside but don't have a desk or table near you during an earthquake?
Check one:
_____ Go to another room to find a desk or table to cover under
__x__ Drop to my knees and cover my head and neck
_____ Go outside to an open area
_____ Find an adult
_____ I don't know

Explanation:
If you are in a room without sturdy furniture, the best thing to do is "Drop, Cover and Hold On" where you are, or kneel next to an interior wall away from windows, hanging light fixtures, unsecured shelves, or any other piece of furniture that might fall over.

If you are in a hallway, drop to the ground against a wall and away from windows. Cover your head and neck with your arms.
You should not go to another room or outside or search for an adult, because you may fall due to the ground shaking or be exposed to hazards such as flying objects, broken glass and

unreinforced masonry. It is recommended that you "Drop, Cover and Hold On" until the shaking has stopped.

After the earthquake you may eventually go outside. Make sure to look around your surroundings to identify any dangers such as broken glass or downed power lines that might pose a threat to your safety.

8. What do you think has caused <u>the most</u> injuries during earthquakes in the U.S.?
Check one:
_____ Fainting
__x__ Flying objects and broken glass
_____ Building collapse
_____ Car accidents
_____ Being stuck outside in bad weather
_____ I don't know

Explanation:
The greatest danger is from falling and flying objects. Studies of injuries and deaths caused by earthquakes over the last several decades show that you are much more likely to be injured by falling or flying objects (TVs, lamps, glass, bookcases, ceiling tiles, etc.) than be injured in a collapsed building. "Drop, Cover, and Hold On" will protect you from most of these injuries.

While images of collapsed structures in earthquakes around the world are frightening and get the most attention from the media, most buildings do not collapse at all, and few completely collapse. In earthquake prone areas of the U.S. and in many other countries, strict building codes have worked to greatly reduce the potential of structure collapse. However, there is the possibility of structural failure in certain building types, especially unreinforced masonry (brick buildings), and in certain structures constructed before the latest building codes. Rescue professionals are trained to understand how these structures collapse in order to identify potential locations of survivors.

The ONLY exception to the "Drop, Cover and Hold On" rule is if you are in a country with non-engineered construction, and if you are on the ground floor of an unreinforced mud-brick (adobe) building, with a heavy ceiling. In that case, you should try to move quickly outside to an open space.

9. If an earthquake happened <u>while you are outside</u>, there are couple different things you could do to protect yourself from injuries.

Check *Yes, No* or *Not Sure* for each possible action.

Actions	Yes	No	Not Sure
Go inside to get under a table or desk		x	
Hold on to a tree and try to stay standing		x	
Cover my head and neck with my arms	x		
Move away from overhead hazards	x		
Move away from electrical lines	x		

Explanation:
The best thing to do if you are outside during an earthquake is to stay outside and move into an open area away from buildings, trees, fences, utility wires, playground equipment, or anything else that might fall over. If you do not have overhead hazards, kneel on the ground where you are and cover your head and neck until shaking has stopped. Sometimes smaller tremors come before and after a larger earthquake, so don't move for at least a few minutes after shaking has stopped.

10. What is the most important part of your body to protect from injury during an earthquake?

Check one:
_____ Arms
_____ Legs
_____ Feet
__x__ Head
_____ I don't know

Explanation:
Head injuries are these most dangerous injuries to your health. If you do not have a table or desk to cover under during an earthquake, use your arms to protect your head and neck, and kneel in a ball to make yourself as small as possible and protect your chest.

11. Would you "Drop, Cover and Hold On" if you are at home during an earthquake?

Check one:

_____ Definitely not

_____ Probably not

_____ Not sure

__x__ Probably would

__x__ Definitely would

Explanation:

Emergency management recommends "Drop, Cover and Hold On" when you are at school, at home, in other buildings or outside. Sometimes you will need to move away from overhead hazards during an earthquake when you do not have a desk or table to cover under.

13. If you are near the ocean and an earthquake occurs, what should you do once the shaking stops?

Check one:

_____ Go to the beach to see if a tsunami is coming

__x__ Go to higher ground or the top floor of a high building immediately

_____ Stay where you are and wait for tsunami warning sirens

_____ Call 911 to find out if there is a tsunami warning

_____ I don't know

Explanation:

A tsunami is a series of waves caused by an earthquake on land or under the ocean. The moving earth displaces the water in the ocean and causes the water to move and create large waves. These waves travel faster than a person can run, and can be very dangerous. When the tsunami gets close to the shore, the waves grow. In shallow water the waves can get very high – as high as 100 feet.

Coastal communities in Washington State and other parts of the U.S. have a tsunami risk. Very few communities in the world have tsunami warning sirens and for those that do, there is still uncertainty whether they will be heard or will work properly during an earthquake.

There may be only a few minutes after an earthquake before the tsunami comes. Therefore, if you a near the ocean and there is a large earthquake causing heavy shaking for more than 30 seconds, it is recommended that you go immediately to higher ground or the top floor of a high building. Do not call 911 for information (as this may overload phone lines) or wait for a tsunami warning siren. Do not go on or towards the beach. You may have just a few minutes to get safely to higher ground. In some cases, it may be faster to move by foot than by a vehicle if there is heavy traffic or damaged roads and bridges.

Appendix 5: Codes used in the *What's the Plan, Stan?* evaluation (Chapter 7 / Paper 4)

Below are the codes developed for the analysis of the data sets used in the evaluation of *What's the Plan, Stan?* The results of the qualitative analysis are presented in Chapter 7 (Johnson et al., 2014d).

I. Intervening factors of awareness

Freq.	Codes and sub-codes
75	Awareness of resource
26	Non-awareness
9	Had not heard of before focus group
4	I'm a new teacher
44	Received info on WTPS
2	Don't remember
2	Advertising
29	In school
3	Binders arrived by mail
2	Email notification
10	Found in resource room
2	Deputy Principal
1	Librarian
4	Other teacher
2	Resource manager
2	Staff meeting
11	Internet search
2	Involved in creation of WTPS
10	Local civil defence engagement
3	TKI resource

II. Facilitating factors of use

135	Teacher reactions to WTPS
45	Satisfaction with resource
20	Good quality
12	Easy to incorporate
36	Positive student reactions
10	Intended use in the future
44	Motivations to use WTPS
4	Disaster occurred

15	Disasters as a classroom topic
6	Fit the rich topic
7	Choice through curricular rotation
2	Relevance to New Zealand
15	School-wide events
2	Community events
3	New resource
10	Importance of safety (personal interest)
4	User-friendly
3	School engagement with civil defence

III. Deterrent factors to use

10	No/low engagement with civil defence
3	Few CDEM staff
2	Increased school requests during Christchurch response
27	Issues with resource
2	Too many topics / too much information
2	Not compatible with teaching methods
23	Changes suggested
101	Challenges to using WTPS
6	Low buy-in
37	Competition with other programs
6	Do not want to repeat topic
3	Enquiry model approach
11	Need expert help/training
19	Not a required topic
5	Not considered their responsibility
2	Parent push back
4	Relevancy
9	Time
24	Topic planning
72	Needs to implement WTPS
18	Teacher training
5	Need for low-cost training
10	External experts to deliver
18	Support for disaster education requirement
2	Ongoing evaluation

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Appendix 6: Additional relevant papers prepared during the course of the PhD study

Johnson, V. A. (2011). *Disaster preparedness education in schools: Recommendations for New Zealand and the United States*. Wellington, New Zealand: Fulbright New Zealand. Retrieved from http://www.fulbright.org.nz/publications/2011-johnson/

Johnson, V. A. (2013). An impact evaluation of ShakeOut, an earthquake and tsunami drill in two coastal Washington state school districts. *GNS Science Report, 2013*(19), 1-37.

Johnson, V. A., & Ronan, K. R. (2014). Classroom responses of New Zealand school teachers following the 2011 Christchurch earthquake. *Natural Hazards*, *72*(2), 1075-1092. doi:10.1007/s11069-014-1053-3

Ronan, K. R., Petal, M., Johnson, V. A., Alisic, E., Haynes, K., Johnston, D. M., … Davie, S. (2014). *HFA Thematic Review/Indicator Research: 'Priority for Action (PFA) 3 – Core Indicator (CI) 2: School curricula, education material and relevant training include disaster risk reduction and recovery*. Input paper prepared for the UNISDR Global Assessment Report on Disaster Risk Reduction 2015. Manuscript submitted for publication.