THE USE OF A NARRATIVE SIMULATION IN RURAL RESIDENTIAL FIRE PREVENTION: A PRELIMINARY STUDY OF CHANGES IN BEHAVIORAL INTENTION

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THE USE OF A NARRATIVE SIMULATION IN RURAL RESIDENTIAL FIRE PREVENTION: A PRELIMINARY STUDY IN CHANGES OF BEHAVIORIAL INTENTION

DISSertation

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Education in the College of Education at the University of Kentucky

By
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Lexington, Kentucky
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2013

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Rural Kentucky residents suffer twice as many fire residential deaths than the national average. Fire prevention programs are primarily aimed at elementary school children however these children do not make the decisions nor take the precautions necessary to alter these conditions; their adult parents do. There is little research into the development of fire safety instructional interventions that need to reach these rural at-risk adults. In this study, a well-designed story simulation *Uncle Charlie’s Christmas* was developed to provide an instructional intervention to prevent injury and fatality from rural residential fires.

An intervention-control repeated measure research design was conducted to investigate participants’: (1) exposure to fire hazard risk, (2) the knowledge of risks and (3) safe practices in the event of a fire and also (4) participants’ behavioral intentions to make changes to prevent fire through hazard reduction and to understand decision making in the event of a fire.

The *Uncle Charlie’s Christmas* narrative simulation instructional materials were effective at engaging participants in decision-making situations they might encounter in an actual fire emergency situation. Participants’ responses to the simulation demonstrated knowledge of hazards, however, a sub-group of responses *did* reveal many ‘bad’ decisions (resulting in failure to exit or other unsafe practices) during the use of the simulation. The Thinking Talking and Acting (TTAS) proxy measure of behavioral intention had high internal reliability at a .93 Chronbach Alpha, demonstrating the utility of the measure for future research. A limitation was a low participation rate (n=52), requiring Wilcoxon non-parametric analyses. There were no significant differences
between the intervention and control groups on the pre-post TTAS behavioral change proxy measure. There were significant pre-post (2 week) differences within the intervention group when the Thinking, Talking and Acting scales scores were analyzed. These trends suggest that further research with a robust sample size is needed for a generalizable assessment of the effectiveness of the narrative simulation instructional materials. Low literacy levels of participants suggest alternative audio formats may also improve utility of the instructional approach in real-world community settings to reach those at risk of exposure to rural residential fire hazards.

Keywords: Rural Fire Prevention, Narrative-Simulations, Adult Education, Decision Making Situations, Behavioral Intentions
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ACKNOWLEDGMENTS

This research project would have not been completed had it not been for the assistance I received from the Letcher, Knot, Laurel and Pike County Head Start Program; principally, Brett Sexton; Larry Bishop, pastor, Cynthiana Christian Church, and Lt. Joey Nelson, Cynthiana Fire Department. Their interest in the livelihood and wellbeing of people in their counties, church and local community was exemplary. Thank you.

No one gets through life without a “little help from their friends.” My friend and colleague, Hank Cole, EDD, is such a friend and my mentor not only on this project but in many other ways that space prohibits my annunciation. I have known Hank for almost a quarter of a century from our work together with the United Brotherhood of Carpenters Union in 1990, and then on our separate projects for Johns Hopkins University, 2003. It was while we were at Johns Hopkins, that Hank introduced me to Joan Mazur, PhD, the chair of my research committee. There is nothing I can say Joan other than ‘thank you.’ Another person that needs mention is Angela Tombari; my statistical guru and learned instructor. Many thanks.
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Chapter 1: Introduction

The purpose of this dissertation was to investigate the use of a narrative simulation as an instructional intervention for rural residential fire prevention. The outcomes for the study were changes in behavioral intention as measured by as stages of change measure (Prochaska & Velciner) and participants’ performance on decision points within a carefully constructed simulation exercise in which rural adults were presented with a series of events related to a late night residential fire. The purpose of using a narrative-simulation design was to cognitively engage rural residents, provoke critical reflection of their choices and use the embedded decision points to measure change in their knowledge of specific preparatory actions for the prevention of rural household fires and deaths.

The problem – Residential Fires in Rural Communities

Rural households report more incidents of fire when compared to urban households. In addition, rural households report more injuries and deaths because of fire, based on research conducted by Allareddy, Peek-Asa, Yang and Zwerling (2007). Their research articulates causal relationships based on low population density, lack of available services—reporting the fire, the absence of operational smoke alarms, the distance responders must travel to the home, and the household environment, both inside and out the home (Allareddy et al., p.265). Examples of factors related to the inside home environment would be the age and type of home construction, electrical wiring, multiple floors, alternative heating sources (e.g. wood stoves, kerosene heaters and electric space heaters), and relaxed housekeeping and clutter that would prevent ease of egress for the occupants within. Examples of factors related to the outside home environment include lack of home maintenance, visible water damage, holes in the walls,
overgrown grass and weeds next to the house and/or general dilapidation (Allareddy et al., p. 265). A final factor in rural communities relates to education. More urban schools have fire prevention programs for their students than do those in rural areas. Children from low-income rural homes are at greater risk for fire related deaths than is the case for urban and suburban communities.

Confounding the physical and environmental problems of the structure are the factors related to occupants of the home. For older adults, burns and fire related injuries is the second most frequent cause of death from accidental injury, for both urban and rural populations (Ehrlich, Bak, Wald, Cagan, & Greenberg, 2008). Decreased mobility, hearing loss, vision impairments and the onset of dementia are the primary risk factors among the old-old, people over 85. The risk of injury and death to this over-85 group increases to four times the national average for deaths that occur as the result of a fire (Ehrlich et al., p 985). The use of a functioning smoke detector, a warning device, is the primary intervention in the reduction of fire related injury and death. In nursing homes and assisted living facilities, as in rural households, residents are at risk from many additional factors. These include physical disabilities related to disease, being wheelchair bound, being bedridden, needing the use of a walker/cane, or residents ignoring the warnings. At night, additional risk comes from reduced staff yielding a higher resident to staff ratio in the event of an evacuation (Jaslow, Ufberg, Yoon, McQueen, Zecher & Jakubowski, 2005).

The Kentucky Context: Three Recent Studies

Three recent studies report data specific to Kentucky rural and urban residential fires. In the first study, McCool (2010) reported on three smoke alarm installation programs were conducted from 1998-2001, 2001-2006 and 2006-2009 (study continued
with funding until 2012, not reported). Study participants were limited to counties with no city of more than 60,000 inhabitants. Thus, these studies focused on rural counties and/or cities that typically do not have paid fire departments, often manned by volunteer fire fighters. The fire department or district volunteer fire services within sample counties applied for inclusion in the smoke alarm program and were responsible for the distribution and installation of the smoke alarms. Based on this first study, in the McCool 2010 data, *Kentucky residential fire mortality rates for 2006 were 1.7 times higher than the national average and have remained higher since 1981.*

In the second, separate report of rural residential fire data focusing on the type of fire and injury data, drawn from the 2005-2009 demographic data from the smoke alarm installation program developed for the Kentucky Injury Prevention & Research Center by McCool (KIPRC, 2010) also showed a high percentage of residential structure fire, resulting in 685 hospitalizations and thousands of fire-related outpatient emergency room (ER) visits. Cooking fires and secondary heating system fires are the most prevalent causes of Kentucky fires.

The third study, conducted by the United States Department of Agriculture, Economic Research Service, Economic Information Bulletin Number 40, *Rural America At A Glance,* October 2008, and also reported by the U.S. Center for Disease Control (CDC) 2009, over the same time period examined specific Kentucky fire risk data and also provided comparisons to a national sample. The CDC found the risk to African American Kentucky residents was 13% higher than white Kentuckians. Also, the risk to all Kentuckians was higher for those with lower incomes, and for those with more residents living in the home, especially for younger children. Unfortunately, the CDC
also noted that rural schools often lack school based fire prevention programs. The CDC study found that smoking was the most common cause of Kentucky residential fires. Interestingly, in both the KIPRC and CDC studies there were noted positive effects of safety programs and messages. The KIPRC program had documented 82 Kentucky lives saved over the life of its program. The CDC study cited did not include this type follow-up.

In summary, recent research points to three confounding impediments to fire preparedness and prevention in rural households. The first is that rural schools tend to lack school based fire prevention programs. The second problem is that the education and income levels of rural families, the number of household occupants, wide range of occupants ages, frequency of health related disorders, and general condition of the home are associated with a lower perception of fire risk and lower to non-existent fire preparedness (Allareddy et al., 2007, p. 266). The third problem is where and how to deliver the necessary education in order to inform rural residents of potential household fire dangers, and to mitigate the loss of life that is a direct result of their socio-economic status, geographic location, and lack of knowledge and implementation of fire prevention preparedness. A review of the relevant literature found little evidence that local, state or a national fire prevention outreach programs existed for rural residents.

**Narrative Simulations and Community Safety Interventions**

Narrative simulations have been used extensively for prevention of injury and fatalities in many situations and for many populations exposed to risk. Interventions in mine safety, agricultural safety, and other real world settings have been developed that use a strategic structure to simulate conditions such as exposure to hazard, and life-saving
decisions one would need to make in a real emergency situation. Each exercise is designed to influence participant knowledge, attitude and conduct, specific to the hazard presented in the narrative. Narrative-simulations are based on actual cases where problematic decisions and alternative actions must be considered. Feedback, and the consequences of those decisions or actions, is immediate and evaluated for correctness (Cole, 1997, pg.325).

Decision making in emergencies is unlike problem solving in academic settings. Real world emergencies are ill defined and problematic. There is no “one best solution.” Alternatives compete based on limited and inadequate information. “Difficult decisions must be made among alternatives without knowing a priori the consequences of those decisions” (Cole, 1998, p. 154). Once a decision is made it becomes irreversible. The decision maker must predict future outcomes based on the information or cues present (Halpren, 1984). There is no checklist or step one, two three. Human behavior can be non-rational and not adaptive and at the same time irrational because possible and logical alternatives are not considered (Sime, 1990).

In this study, a well-designed story simulation *Uncle Charlie’s Christmas* was developed to provide an instructional intervention to prevent injury and fatality from rural residential fires. The simulation (described fully in Chapter Three, and shown in its entirety in Appendix A) presents a case-based and rate-based story of an elderly man and his niece and her children and a fire that starts on Christmas Eve in their wood frame two story home is a rural community. As study participants work through the story, they encounter decision points, select options and get feedback on their choices.
Research Questions

The research questions for this study are as follows:

Question 1: What Primary Causes of Residential Fires do Participants Report?

Question 2: What exposure to fire risk do these rural residents report?

Question 3: Do research participants demonstrate their knowledge of potential risks after completing a narrative-simulation designed for that purpose?

Question 4: Does the use of a narrative-simulation exercise for the identification of potential rural residential fire hazards result in the participants’ actually taking steps to reduce those risks?

1. The treatment group and the control group attitude and behaviors (TTAS₁) will be similar on the pre-measure survey, Time 1 (T₁) (h₁: N₁ = N₂.)

2. The treatment groups’ attitude and intended behaviors related to fire preparedness will increase following the simulation intervention, Time 2 (T₂) (h₂: N₃ ≠ N₄; TTAS₂ – T₁ and T₂ Treatment vs. Control).

Originally, this dissertation study was designed to employ an intervention /control repeated measures design with analysis of variance on outcome measures. Participant pools from local churches in several rural communities made commitments to assist with recruitment and provided letters to this effect for the University of Kentucky IRB protocol #11-0941-P4S approved on 20 December, 2011. However, after ten months of working diligently in local rural communities and soliciting participation from groups as varied as church members to county extension home-makers, the researcher was not able to enroll enough participants to support the statistical analyses originally proposed. After consultation with my chair, the study was closed and a non-parametric analysis
conducted. The data were still robust. A demographic measure provided surveillance data on the situations of these rural at-risk residents and intervention group participants did show gains in knowledge of fire hazard and changes in behavioral intention toward safer fire prevention practices.

**Organization of the Dissertation**

In the chapters that follow, the conceptual framework and relevant literature for the study are developed in Chapter Two, the study Methodology is described in Chapter Three, findings are presented in Chapter Four and Chapter Five explores a discussion of findings and suggestions for further research.
Chapter two: Theoretical framework and literature review

The following section describes educational theories, psychological theories, and their application to instructional interventions for adults to become more aware of the risks of residential fires and more committed to engage in behaviors that reduce risk of fire and fire related injuries. These topics include cognitive development, adults as learners (preferences), storytelling and narrative theory, engagement, assessment and human behavior in safety training, in this case, fire prevention and safety behaviors.

Next, I present a review of relevant literature related to fire safety and prevention. This review includes empirical data regarding the prevalence and causes of injury and fatality due to fire as well as research about how people react in situations where split-second decisions can mean the difference between life and death. The final topic in this chapter will discuss two safety and health behavior models that inform the design and delivery of community based interventions.

Relevant psychological and educational theories

Cognitive Development. There are numerous theories, or models, of cognitive development and forms of intelligence testing that have influenced the education of youth and adult learners. Most notably we remember Perry’s (1970) “Nine Positions and Transitions” of cognitive development for pre-teens, Piaget’s (1972) “Four Stages of Development” for children, and the Vygotsky (1978) “Zone of Proximal Development” for children. Additionally, we have King and Kitchener’s (1994) “Reflective Judgment Model” of epistemic cognition, used with college students that addresses the way people understand their process of knowing, and the work of Belenky, Clinchy, Goldberg, and Tarule (1986) “Women’s Ways of Knowing.” There are many more models of cognitive
development, but two major themes emerge. The first theme is that of *dialectical thinking* that allows for the acceptance of *alternative truths* or ways of thinking about the many contradictions and paradoxes adults face in everyday life” as championed by Reigel (1983), Kramer (1983, 1989), and Keagan (1994). The other theme is that of *contextual factors* influence on cognition that comes from social, cultural, economic and political factors as championed by Vygotsky (1978), Bruner (1990), and many others.

**Cognitive Constructivism**

Cognitive learning theory, which includes socio-cultural constructivism, is championed by Dewey (1938), Piaget (1958), Bloom (1957), Bruner (1956), and Vygotsky (1978). Constructivism is a psychological theory of knowledge that argues that humans generate knowledge and meaning from their experiences. Constructivism is not a specific pedagogy, it is a theory describing how learning happens, regardless of whether learners are using their experiences to understand a lecture or following the instructions for building a model airplane. In both cases, the theory of constructivism suggests that learners construct knowledge out of their experiences. It is often associated with pedagogic approaches that promote active learning or learning by doing. Socio-cultural constructivism extends constructivism and adds a view of learning that reflects a layer of influences visible in the cultural scripts followed and tools employed by learners in social settings. In other words, the way we make meaning depends on our past experiences, situations, and is influenced and molded by social communities or practice. (Burr, 1995)

**Adults as Learner: Preferences and Motivations**

Many adult students use and prefer an experiential learning style and have a developed ability to learn from “hands-on” and situated experiences as Dewey (1938) suggested. The Association for Experiential Education regards experiential education "as
a philosophy and methodology in which educators purposefully engage with learners in direct experience and focused reflection in order to increase knowledge (cognitive), clarify values (affective) and develop skills (psychomotor)” (http://www.aee.org/about/whatIsEE, 2012). This mirrors Bloom’s Taxonomy (1956) of educational objective domains as foundational and provides the student a more holistic form of education.

The central focus of this paper is adult education and training. An example of this would be the teaching of adults to think divergently and creatively followed by an evaluation of the success of this endeavor through an activity involving the generation of multiple solutions for a hypothetical problem. Generally, in adult training little variance is expected during skill acquisition. Vocational education involves both education and training. Examples include training skills to automaticity while at the same time educating adults to multiple perspectives, interpretations and response to a variety of situations and environments.

**Experiential Learning**

Kolb developed a model for experiential learning derived from the work of Dewey (1925) and Lewin (1945). According to Kolb’s model (1985), effective experiential education relies on four different learning modes:

*Concrete Experience* that is the basis for *Reflective Observation* assimilated into an *Abstract Conceptualization* or theory from which new implications for action can be deduced serving as guides to *Active Experimentation*.

That is, the learner must be involved -- fully, openly, and without bias -- to new experiences; s/he must be able to reflect on and observe these experiences from many
perspectives; s/he must be able to create concepts that integrate observations into logically sound theories; and he must be able to use these theories to make decisions and solve problems. (McLeod, S. A., 2010)

This dissertation will demonstrate that a well-designed simulation incorporates and draws upon all four styles of Kolb’s learning model because it vicariously involves the student in real-world predicaments that the student has faced or will face in the future.

Communities of Practice

Students involved in shared learning experiences become their own learning community, as Lave and Wenger (1991) explained -- a community of practice. Communities of practice are social constructs whether they are in like-minded organizations, a neighborhood, or a group classroom. Most communities of practice occur outside the classroom, in the neighborhood, at social gatherings, professional associations or organizations, or on the work site. Utilizing master-to-apprentice or student-to-student dialogue, shared experiences and the telling of experiences by others from within the community enhances student cognitive engagement and reinforces new knowledge because it has ‘community’ social value (McLoughlin, 2002; Tinto, 1997; Vygotsky, 1987). Additionally, the sense of ‘belonging’ to a community (learning) enhances cognitive engagement in discussion and further scaffolds student social motivation to master the skills and content (Read, Archer & Leatherwood, 2003; Yorke & Thomas, 2003). Novices or new entrants into the community participate on the outer edge or periphery. They participate by: (1) listening to the stories, (2) learning the language and meanings within and of the community; and learning the history of the community and the leadership hierarchy (Lave & Wenger, 1991, p. 110-112). In light of Lave and
Wegner’s (1991) findings and for the purposes of the inquiry presented here, the proposed narrative-simulation intervention will be administered to local gatherings of rural adults in multiple group settings rather than a heterogeneous audience of dissimilar participant backgrounds. The participants in this dissertation study are in community settings but are not yet coalesced into any community of safe practices. However, working with local agencies, churches and civic groups in the delivery of the Uncle Charlie’s Christmas simulation exercise may shed light on the development of a community of safety practice in local rural settings. Advocacy for fire safety and prevention (or for any safety practices) is a top aim of public health and safety instructional interventions.

**Story Telling – The Narrative & Simulation Foundation**

Generally, adults do not like an authoritarian classroom. They have an expectation: to be engaged in participatory dialogue and learning (Owenby, 1992). One of the best ways to engage adult students is through stories that are relevant to and resonate with their life experiences. Jerome Bruner, in *The Culture of Education* (1996), provides us several insights into the power of narrative (story telling):

> Stories set out a sequence of events that recount a violation of canonicity – they tells us of something that is unexpected or something the narrator has reason to doubt; a sequence of events and then an evaluation of those events. (p. 121)

Stories are judged by their “verisimilitude” or life-likeness and do not need scientific proof because they complete the hermeneutic circle for interpretation not explanation (Bruner, 1996, p. 122). The narrative is a product of the narrator and his/her points of view. Additionally, stories are about human agents, their desires, beliefs,
knowledge, and intentions (Bruner, 1996, p.123). Stories also provide the fertile ground for the narrator to set up speculative models: a sequence of events for interpretation (Bruner, 1996, p.124). Bruner (1996) uses the term “narrative heuristic,” he explains that by turning the event we want to explore into narrative form, in order to highlight what is canonical and expected in our way of viewing, the listener can better discern what is “fishy,” needs explanation and explication (Bruner, 1996, p. 125). To finalize, Bruner (1996, p. 127) tells us, “The art of asking good questions are those that pose dilemma, subvert the obvious or canonical truths and force incongruities upon our attention.”

Green and Brock (2000) re-examined the psychology behind story-based (narrative) learning. Their research revealed that narratives transport[ed] the reader or listener into the scene of the story where the student became part of the experience because the story painted a vivid picture of the scene and provided a sense of strong “emotion reminiscent of first-hand experience” (p. 702). In an early study, Schank and Abelson (1975) concluded that narratives triggered our reminding’s. The student is ‘reminded’ of and compelled to reflect on his or her personal experiences and behavior. Narratives must be familiar enough to the student, but surprising enough to evoke student critical reflection, thought and evaluation that would lead to the prediction of consequences. Sherer and Rogers (1984) add that narratives supply the concrete details the student may not have imagined and thereby add to the “verisimilitude” or life-likeness (Bruner, 1990, p. 122) of the event or situation.

**Engagement.** Narratives and simulations must engage the student in critical and reflective thinking. There must be an element of interaction. When learning goals are intrinsically interesting, there is no need for external motivation or a system of student
rewards (Reiber, Smith, & Noah, 1998). An interactive and interesting simulation, when combined with the student’s ability to self-monitor his or her progress, fulfills the behaviorist emphasis (*operant conditioning* and the *law of affect* e.g. the student’s immediate knowledge of the consequences to his or her choice of a response in a decision-making predicament) (Reiber et al., 1998). Furthermore, active student engagement with simulations also depends on the meaningful nature of the problem or task presented. Can the student relate to the task and is the task relevant and engaging enough for the student’s investment of time and mental effort (Kearsley & Shneiderman, 1998)? Harper, Squires and McDonald (2000) add that narratives and simulations should provide the student with *multiple perspectives for exploration, self-explanation* and *engagement*. The student, transported by the narrative and engaged by the simulation, will evaluate and initiate *self-explanation* of event components. By including and evaluating multiple perspectives, the student begins to develop a heuristic strategy for problem solving (Harper, Squires, & McDonald, 2000).

**Cognitive load and narrative simulation.**

Sweller’s (1988), research on cognitive load theory (CLT) focused on the development of instructional methods that recognize the limited amount, ability and efficiency of a student’s working memory and mental processes whereby the student can add information to his or her knowledge base. Designers of narratives and simulations must also consider student cognitive load. In this sense, designers should not give the student too much information at one time. Doing so can overload the student and frustrate his/her problem-solving efforts. By their nature, narratives must unfold and be constructed to reveal the environmental and contextual aspects of the problem under
consideration. Like workplaces, narratives and simulations are not static but dynamic, ever changing, and confounded by human agents and predicaments that require flexible thinking and decision-making. Within the construct of CLT, designers should consider the “intrinsic cognitive load,” the overall number of elements that are requisite to solve the problem presented by the simulation (Paas, Renkl, & Sweller, 2003).

Cognitive load theory assumes that intrinsic load cannot be altered by instructional design. While this may be true, these researchers hypothesized that instructional design could reduce overall intrinsic load by breaking intrinsic load demands into smaller units of germane load (modular units - constructivism) which would leave the student “sufficient cognitive resources available to invest extra effort in processes that are directly relevant to learning … schema construction” (Gerjets et al., 2004, p. 39). To further articulate their point, Gerjets et al., (2004, p. 35) noted that Atkinson, Catrambone and Merrill (2003) stated that problem solving is often characterized by ‘computational friendly’ molar solutions where multiple solution steps are reduced to a single formula that represents the entire solution procedure, e.g. Einstein’s $E=MC^2$. Additionally, Renkl (1999) suggested that students often ‘suffer from the illusion of understanding when seeing worked examples and give a false impression of having grasped the solution rationale’ (Gerjets et al., 2004, p. 38).

The Gerjets research team concluded that the modular method of instructional design is most effective with novice and intermediate learners because it triggers student inquiry and self-explanation of the events. However, they also noted the effects fade as the students become increasingly skilled and automatize their problem-solving strategy into long-term memory. The Gerjets team cited similar findings by Kalyuga, Ayres,
Chandler and Sweller (2003), *the expertise reversal effect of redundancy on cognitive load*, and Rikers, Van Gervin and Schmidt (2004), *cognitive load to increase expertise development.* Both Kalyuga, et al. (2003) and Rikers, et al. (2004), noted the fading effect as demonstrated by the Gerjets team however, their approaches were completely different.

Applying the modular approach to educational simulations is not a daunting task. However, instructional designers are challenged to sequence the simulation into ‘teachable moments’ or ‘decision points’—a modular approach. At the decision points student biases or ‘rules of thumb’ can be confronted and perturbed (Keller & Koop, 1987; Means, Jonassen, & Dwyer, 1997), additional information added, application of theories revealed, and ‘checks’ for student understanding, also known as embedded assessment, introduced. Embedded testing is a powerful method for communicating to learners and instructors what students know and do not know or what students can perform or not perform, and for assisting students and instructors in collaboration: working together to overcome student’s misunderstandings or skills deficiencies so the student can achieve mastery in both content knowledge and requisite vocational skills (Bloom, 1968; Cole, 1984; Guskey & Monsass, 1979). Additionally, Moreno’s (2004), research indicates that the type of feedback the student receives will also influence a student’s performance.

The design of narrative-simulations reduces cognitive load. As the narrative unfolds, questions or decision points are posed related to only the most recent portion of the story necessitating participant response. Several possible responses are presented from which the participant may choose. Their response is compared to the correct response. Each response is accompanied by a full explanation of why this is the correct or
incorrect answer intended to clarify misunderstandings. These *teachable moments* provide a path for participant exposure to additional information that is in context. Additionally, *teachable moments* provide an opportunity for the participant to reflect on their decision (Keller & Koop, 1987).

**Assessment Embedded in Narrative Simulation**

As Bandura (1989) suggests, instructional designers and instructors should scaffold the student’s problem-solving efforts, ownership and empowerment to make decisions. For adult learners as well as students in general, tests, examinations, and assignments have provided the traditional methods and means of assessment. A conventional definition of assessment is that it is standards based or norm-referenced. By using this “standard” method of assessment, we continue to grade, separate, compare, rank, and divide students. Biggs (1999) provides an analysis of why assessment processes involving standardized or norm-referenced tests that are frequently used in higher education are inappropriate assessment devices *within* higher education when what we want to measure is affect change, i.e., changes in attitudes and life-long learning ability and style. He continues by suggesting that norm-referenced testing can only determine the characteristics of the student at some fixed point in time. Additionally, Moreno’s (2004), research indicates that the type of feedback the student receives also will influence a student’s performance.

Assessment has become a major focus for educational research and development. Affect outcomes in the form of values, attitudes, and related attributes or dispositions have consistently proved difficult to assess by traditional examination and assignment (Barrie, 2004; James & Brown, 2005). The problems include the “difficulty of clearly
conceptualizing some aspects of learning that are seen as highly desirable (attitudes, dispositions, values, identities), but do not have a common interpretation in the way that straightforward practical or cognitive skills do” (James & Brown, 2005, p. 9).

Bloom, Hastings and Madaus (1971) identified the difficulties associated with assessing affective outcomes. However, they did provide a suggestion of how courses that promote the acquisition of values, attitudes and behaviors can be evaluated by the degree to which they enable students to achieve the required outcomes. They advised that “evaluation can be achieved on a group-wide basis and that this approach avoids some of the really difficult issues in assessing individuals’ values and related affective outcomes” (Gerretson & Golson, 2005, p. 144).

Review of Relevant Literature

Residential Fires in Rural Communities

Rural households report more incidents of fire when compared to urban households. In addition, rural households report more injuries and deaths because of fire, based on research conducted by Allareddy, Peek-Asa, Yang and Zwerling (2007). Their research articulates causal relationships based on low population density, lack of available services—reporting the fire, the absence of operational smoke alarms, the distance responders must travel to the home, and the household environment, both inside and out the home (Allareddy et al., p.265). Examples of factors related to the inside home environment would be the age and type of home construction, electrical wiring, multiple floors, alternative heating sources (e.g. wood stoves, kerosene heaters and electric space heaters), and relaxed housekeeping and clutter that would prevent ease of egress for the occupants within. Examples of factors related to the outside home
environment include lack of home maintenance, visible water damage, holes in the walls, overgrown grass and weeds next to the house and/or general dilapidation (Allareddy et al., p. 265). A final factor in rural communities relates to education. More urban schools have fire prevention programs for their students than do those in rural areas. Children from low-income rural homes are at greater risk for fire related deaths than is the case for urban and suburban communities.

Confounding the physical and environmental problems of the structure are the factors related to occupants of the home. For older adults, burns and fire related injuries is the second most frequent cause of death from accidental injury, for both urban and rural populations (Ehrlich, Bak, Wald, Cagan, & Greenberg, 2008). Decreased mobility, hearing loss, vision impairments and the onset of dementia are the primary risk factors among the old-old, people over 85. The risk of injury and death to this over-85 group increases to four times the national average for deaths that occur as the result of a fire (Ehrlich et al., p 985). The use of a functioning smoke detector, a warning device, is the primary intervention in the reduction of fire related injury and death. In nursing homes and assisted living facilities, as in rural households, residents are at risk from many additional factors. These include physical disabilities related to disease, being wheelchair bound, being bedridden, needing the use of a walker/cane, or residents ignoring the warnings. At night, additional risk comes from reduced staff yielding a higher resident to staff ratio in the event of an evacuation (Jaslow, Ufberg, Yoon, McQueen, Zecher & Jakubowski, 2005).
The Kentucky Context: Tragic Current Events and Three Recent Studies

Fire Fatalities in Kentucky: The first quarter of 2013

As reported recently on the local Lexington, KY WKYT television news fatalities from house and apartment fires for 2013 do not exceed the previous year’s totals. However, the circumstances seem to have changed radically from previous years. Entire families and multiple person fatalities have been reported thus far in the first quarter of 2013, as reported to the Federal Emergency Management Authority (FEMA) retrieved on 04 April 2013 (http://apps.usfa.fema.gov/civilian-fatalities/incident/report.) On 09 January 2013, four children and one adult died in rural Pike County: turned over space heater. February 14, 2013, a man found dead from a turned over space heater, Laurel County. February 16, 2013, in rural Jefferson County a man was found dead in a house fire: turned over space heater. On March 9, 2013, in Knox County (Gray, Kentucky) seven members of one family (five children, pregnant wife, and husband) perished in a house fire. The reason for this multiple fatality situation is currently under investigation. However, the currency of the narrative simulation designed for and used in this study is evident. Moreover, the need for community based fire safety intervention programs that target the populations most at risk. All of these recent tragedies involved young children and adults who might have made a difference in the outcomes of these horrific events: either through fire prevention practices or informed decision making during a fire emergency.

Three Recent Studies Focused on Kentucky Data

Three recent studies report data specific to Kentucky rural and urban residential fires. In the first study, McCool (2010) reported on three smoke alarm installation programs were conducted from 1998-2001, 2001-2006 and 2006-2009 (study continued
with funding until 2012, not reported). Study participants were limited to counties with no city of more than 60,000 inhabitants. Thus, these studies focused on rural counties and/or cities that typically do not have paid fire departments, often manned by volunteer fire fighters. The fire department or district volunteer fire services within sample counties applied for inclusion in the smoke alarm program and were responsible for the distribution and installation of the smoke alarms. Based on this first study, in the McCool 2010 data, Kentucky residential fire mortality rates for 2006 were 1.7 times higher than the national average and have remained higher since 1981.

Table 2.1

*Average Residential Fire Mortality Rates per million as reported by McCool (2010).*

<table>
<thead>
<tr>
<th>YEAR</th>
<th>KENTUCKY*</th>
<th>NATION*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>27.5</td>
<td>21.6</td>
</tr>
<tr>
<td>1986</td>
<td>19.3</td>
<td>18.2</td>
</tr>
<tr>
<td>1991</td>
<td>20.7</td>
<td>14.5</td>
</tr>
<tr>
<td>1996</td>
<td>19.6</td>
<td>12.5</td>
</tr>
<tr>
<td>2001</td>
<td>17.0</td>
<td>9.9</td>
</tr>
<tr>
<td>2006</td>
<td>15.5</td>
<td>9.1</td>
</tr>
</tbody>
</table>

*Note: *Mortality Rates from US Center for Disease Control and Prevention / Rates are per Million.

In the second, separate report of rural residential fire data focusing on the type of fire and injury data, drawn from the 2005-2009 demographic data from the smoke alarm installation program developed for the Kentucky Injury Prevention & Research Center by McCool (KIPRC, 2010). As shown in Table 2.2 the data show a high percentage of residential structure fire, resulting in 685 hospitalizations and thousands of fire-related
outpatient emergency room (ER) visits. Cooking fires and secondary heating system fires are the most prevalent causes of Kentucky fires.

Table 2.2

<table>
<thead>
<tr>
<th>Summary of KIPRC Rural Residential Structural Fires</th>
</tr>
</thead>
<tbody>
<tr>
<td>351 structural fires – 94% residential</td>
</tr>
<tr>
<td>685 structural fire related hospital discharges</td>
</tr>
<tr>
<td>2,826 structural fire related outpatient ER visits</td>
</tr>
</tbody>
</table>

(Note: hospital discharges were less than double the fatalities rate – Kentucky residential structure fires tend to either produce relatively minor injuries or be fatal.)

The most common cause of Kentucky residential fires is cooking – seldom fatal

The second most common cause of Kentucky residential fires is secondary heating systems (fireplaces, wood stoves, electric wall and space heaters used during “cold snaps”)

Kentucky residents were more likely to take action by following fire prevention messages when messages were delivered by local fire departments

The third study conducted by the Center for Disease Control (CDC, 2009) over the same time period examined specific Kentucky fire risk data and also provided comparisons to a national sample. The CDC found the risk to African American Kentucky residents was 13% higher than white Kentuckians. Also, the risk to all Kentuckians was higher for those with lower incomes, and for those with more residents living in the home, especially for younger children. Unfortunately, the CDC also noted that rural schools often lack school based fire prevention programs. The CDC study found that smoking was the most common cause of Kentucky residential fires. Interestingly, in both the KIPRC and CDC studies there were noted positive effects of
safety programs and messages. The KIPRC program had documented 82 Kentucky lives saved over the life of its program. The CDC study cited did not include this type follow-up.

Table 2.3

<table>
<thead>
<tr>
<th>CDC study of Residential Fires in Kentucky compared to the United States as a whole for the years 2005-2009.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The risk of a residential fire for Kentucky African-Americans was 13% higher than for white Kentuckians.</td>
</tr>
<tr>
<td>The most common cause of fatal Kentucky residential fires is smoking, with smoking-related fires being the highest in the nation for this state (2006.)</td>
</tr>
<tr>
<td>Smoking and secondary heating system fires are more likely to be fatal because they occur at night when residents are asleep.</td>
</tr>
<tr>
<td>Smoking fires usually begin in close proximity to one or more of the victims.</td>
</tr>
<tr>
<td>Having a smoke alarm in the home decreased the risk of fire by 38%. Presence of a smoke detector heightened awareness based on fire safety education.</td>
</tr>
<tr>
<td>According to US Census Data Kentucky ranked 47th in the nation for median household income - $52,029 US vs. $38,466 (2008.)</td>
</tr>
<tr>
<td>The probability of a person taking action on a fire prevention message increased by 30% for each additional $10,000 of income using $20,000 as baseline income.</td>
</tr>
<tr>
<td>The risk of having a residential fire increased by 13% for every $10,000 decrease in household income with the average household income per Kentucky Census Data as the baseline.</td>
</tr>
<tr>
<td>When comparing the fire probability of 2 people in a dwelling versus 3 to 4 people in a dwelling there was no difference. However, for dwellings with five or more occupants there was an increase of 29% in the probability of a fire.</td>
</tr>
<tr>
<td>For children less than 17 years old, the risk of injury in a residential fire was 10% higher than for those 17 years and older.</td>
</tr>
<tr>
<td>If there was a home fire escape plan, the risk of a residential fire decreased by 37%.</td>
</tr>
</tbody>
</table>
To summarize, recent research points to three confounding impediments to fire preparedness and prevention in rural households: (1) rural schools tend to lack school based fire prevention programs, (2) the education and income levels of rural families, the number of household occupants, wide range of occupants ages, frequency of health related disorders, and general condition of the home are associated with a lower perception of fire risk and lower to non-existent fire preparedness (Allareddy et al., 2007, p. 266) and (3) where and how to deliver the necessary education in order to inform rural residents of potential household fire dangers.

**The Green and Kreuter Health Intervention Model**

Intervention strategies are needed to mitigate the loss of life that is a direct result of their socio-economic status, geographic location, and lack of knowledge and implementation of fire prevention preparedness. A review of the relevant literature found little evidence that local, state or a national fire prevention outreach programs existed for rural residents. Green and Kreuter (2005) developed a health and safety promotion model that focuses on delivering the health and safety information or training *where the at-risk populations* live or work and experience exposure to hazard or risk. The Green and Kreuter model have been foundational to several recent nationally funded safety interventions in agricultural injury (Mazur et al, 2005; 2010). In this dissertation study, the researcher sought out rural residents at highest risk of injury and fatality from fire in local community settings such as churches, food programs and head start programs.
Designing the Narrative Simulation Intervention: Conceptual Foundations

Human behavior in fire: An international perspective

The purpose of this dissertation is to describe the decision-making performance of rural adults confronted by a residential fire based on a carefully constructed simulation exercise. The simulation content and structure is based on multiple post-fire interviews with people that escaped from residential fires. This research was conducted in England from 1988 to 1990. Researchers rode with fire crews and interviewed structure fire survivors. Interviewers paid particular attention to human agency and all aspects of early response activity and evacuation (Canter, 1990). P. G. Wood (1990) compiled the responses to the 1553 personal interviews gathered in the 1990 Canter study. More than 50% of the responses were from single-family residences: the remainder of the responses came from apartment building occupants and industrial building fire survivors. Wood identified four major behavior themes: first actions, building evacuation, movement through smoke, building re-entry (Wood, 1990, p. 83-84).

Some type of warning device or a cue from the fire itself initiated first actions. Those behaviors reported were, in order of highest percentages; ambiguity – time needed to discern implications; fight the fire – more frequently among men than women; call the fire department; investigate the fire – more frequently among men than women; warn others – more frequently among women than men; evacuate oneself from the building – more frequently among women than men; and evacuate others – more frequently among women than men. Wood compared these findings with a similar study from the US. He concluded that more US men would stay and fight fire than would English men because
US men were more concerned with saving property than were English men (Wood, 1990, p. 85).

Building evacuation and movement through smoke behaviors depended on home versus work environment and by the amount of smoke the fire had generated. More people would evacuate their home with heavy smoke present than was the case for heavy smoke in their workplace. When there was little or no smoke, survivors would continue completing work tasks or initiate shutdown procedures for the machines they were working on. With little or no smoke in their home, survivors would spend time investigating the source of the fire before taking any other actions. Building evacuation also was age dependent – younger people would evacuate sooner than older. Evacuation was dependent on the time of day – more frequently fire survivors evacuated sooner if it was dark outside. If a person had some fire or awareness training, their initial response was to evacuate at the first sign of alarm (fire alarm, presence of smoke, and/or smell of smoke). Additionally, training was particularly important to children and older adults because alternative escape routes and procedures could be defined and practiced. Without training and practice, children and older adults would go to the most familiar entrance to exit the building and not consider any alternate evacuation routes. Finally, building evacuation was dependent on familiarity with the building. People familiar with the building responded in a more casual manner than those that did not know the building layout very well (Wood, 1990, p. 85-86).

The last and most dangerous behavior Wood’s (1990) articulated was that of building re-entry. Survivor behavior was dependent on gender – more frequently, women than men, would re-enter the building to rescue a child, another person or pet and not to
save personal property. More survivors would re-enter a burning building during the day than at night depending on the amount of smoke. Building re-entry was also dependent on training. A more experienced and trained survivor would not re-enter a burning building where an untrained person would, often resulting in fire related injury or fatality.

As one of the on-site interviewers, Wood observed that if evacuated survivors had “something to do” or were distracted in some way, they were less likely to consider and act on their impulse to re-enter a burning structure (1990, p. 92).

To summarize the Wood (1990) study: warning devices or fire cues should initiate residential occupants to act immediately. Delays in first actions are the primary reasons for residential fire injuries and deaths: building evacuation and alternative escape routes should be practiced especially where children and older adults are present in the home. Finally, re-entry into a burning building must be avoided whenever possible.

The Haddon Injury Matrix.

The objective of this research is to measure performance tasks, presented as decision points, within a simulation and to provide the adult participants immediate feedback on the consequence and effectiveness of their responses.

The framework for the narrative simulation will utilize Haddon Injury Phase by Factor Matrix. Dr. William Haddon, Jr., is considered the father of injury epidemiology. In 1968, Haddon argued that a scientific approach to injury prevention and practice was needed. He is well known for developing a framework for the conceptualization and understanding of how injuries occur and strategies for their intervention and prevention (Runyan, 2003). Prior to Haddon’s work, most injury prevention programs and interventions focused on the injury event. For example a safety ad campaign might focus
on 30 second radio spots “ALWAYS use your seatbelt!” However, Haddon’s insight was that this focus on injury events did provide opportunities for people to understand the events leading up to an injury event (Haddon, 1972). He devised three phases for any injury event: (1) The pre-injury phase, (2) the injury phase and (3) the post-injury phase. He also explored factors that were in play during these injury event phases. These were: (1) human / person (host), (2) injury agent (vehicles and equipment for transmission of the agent), and (3a & 3b) environment (a. physical and b. socio-economic). Figure 2.1 shows a diagram of the Haddon Phase by Factor model as it is typically represented in the injury prevention literature.

**Figure 2.1**

_Haddon Injury Phase by Factor Matrix_

<table>
<thead>
<tr>
<th>Injury Phase</th>
<th>Person (Host)</th>
<th>Injury Agent (Vehicle/Equipment)</th>
<th>Environment Physical</th>
<th>Environment Socio-cultural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Event</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Event</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The utility of Haddon’s model provides narrative simulation designers and interdisciplinary subject matter experts a framework to develop more realistic and robust simulations (Runyan, 2003, p. 61). The fourth column of the matrix entitled “environment socio-cultural” is of vital importance in understanding the economic and cultural context of the simulation. In 1979, Urie Bronfenbrenner proposed a social-ecologic theory that defines the various levels of the social environment that depicts the
nested roles of intra- and inter-personal relationships and the cultural contexts in which accidents occur (Bronfenbrenner, 1979). Socio-ecologic considerations enhance the matrix by adding the hidden contributing factors that are part of the context in which the event occurs. Haddon (1980) adopted Bronfenbrenner’s work and added the fourth column as part of the matrix that is used for the narrative simulation presented (see Appendix A for the matrix used for this simulation exercise).

Within the narrative-simulation, decision points are presented at key points in the scenario as questions with possible alternative actions. Participants select from a series of problematic and competing alternatives that are typical of those actually confronted by survivors of a residential fires. These decision points provide teachable moments. Participants examine their decisions and the consequences, revise their critical thinking skills, and become aware of new alternatives through critical reflection. The narrative-simulation uses a constructionist psychology and social cognitive theory whereby through dialogue and group knowledge participants examine their decisions, build emphasis on key attitudinal aspects and expectations while developing more effective attitudes and behaviors (Bandura, 1986; Lave & Wenger, 1991; Millard & Dollard, 1941; Vygotsky, 1978). The objective of the simulation is to develop and measure adult learner affective attitudes, behavioral choices and knowledge gain within the socio-cultural context of the simulation.

Decision making in emergencies is unlike problem solving in academic settings. Real world emergencies are ill defined and problematic. There is no “one best solution.” Alternatives compete based on limited and inadequate information. “Difficult decisions must be made among alternatives without knowing a priori the consequences of those
decisions” (Cole, 1998, p. 154). Once a decision is made it becomes irreversible. The decision maker must predict future outcomes based on the information or cues present (Halpren, 1984). There is no checklist or step one, two three. Human behavior can be non-rational and not adaptive and at the same time irrational because possible and logical alternatives are not considered (Sime, 1990).

The narrative simulation used in this dissertation study (described more fully in Chapter Three) is located in Appendix B. The simulation packet includes instructions, the problem booklet (simulation exercise), and answer sheet and feedback on possible responses to the decision point selections that simulation users provide as they work their way through the story depicted in Uncle Charlie’s Christmas.

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Chapter three: Methodology

The theoretical frame of this research is that adults will change behavior when they are actively and cognitively engaged, and supported by their peers. By using a narrative – simulation and a modular constructed format, integrated with “decision points” (teachable moments), this can be accomplished and should be considered as one of the primary modes of adult instruction. The two specific topics investigated by this research are: attitude and behavioral shift.

The research questions for the study are as follows:

Question 1: What Primary Causes of Residential Fires do Participants Report?

Question 2: What exposure to fire risk do these rural residents report?

Question 3: Do research participants demonstrate their knowledge of potential risks after completing a narrative-simulation designed for that purpose?

Question 4: Does the use of a narrative-simulation exercise for the identification of potential rural residential fire hazards result in the participants’ actually taking steps to reduce those risks?

The following four hypotheses were proposed originally. However, due to the lack of responses from participants for the six (6) week delayed posttest, hypotheses 3 & 4 below were dropped from the study.

1. The treatment group and the control group attitude and behaviors (TTAS₁) will be similar on the pre-measure survey, Time 1 (T₁) (h₁: N₁ = N₂.)

2. The treatment groups’ attitude and intended behaviors related to fire preparedness will increase following the simulation intervention, Time 2 (T₂) (h₂: N₃ ≠ N₄; TTAS₂ – T₁ and T₂ Treatment vs. Control).

3. The treatment group will demonstrate actual fire safety actions related to the installation of smoke detectors as determined by the 6 week delayed posttest survey, Time 3 (T₃) (h₃: N₅ [smoke detector installed] ≠ N₆ [smoke detector not installed].)
4. The treatment group will have developed and implemented a fire escape plan for their family, Time 3 (T3) (h₄: N₇ [fire escape plan and discussion] ≠ N₈ [no fire escape plan just discussion or neither].)

Study Design

This study employed an intervention/control repeated measures design. The intervention was the *Uncle Charlie’s Christmas* simulation (described more fully below and in its entirety in Appendix B). Participants in the control group did not receive the narrative-simulation intervention. However, both treatment and control groups completed the demographic pre-test measure and the Thinking/Talking/Acting pre-post proxy measure of behavioral intention (described below).

Measures

Four measures will be used in this study:

1. A 30 item pre-measure demographic (see Appendix C – C₁) with the embedded fire risk exposure metric (Appendix C – C₂) and the 20 item “Thinking, Talking and Acting Safely (TTAS₁)” attitudinal behavior survey will be given to all participants’ intervention or control (T₁) (see Appendix D- D₁).

2. Two weeks after the simulation exercise, the Intervention group will be mailed a 15 item modified TTAS₂ (T₂) (Appendix D – D₂) to evaluate participant attitude and behavioral change induced by the simulation. The Control group, after initial contact, will also be mailed TTAS₂ as a measure to determine if the initial survey research had any influence on their current attitude or behavior.

3. A 15-item evaluation of the narrative simulation exercise (Appendix F).
4. A delayed 15 item modified TTAS$_3$ (Appendix D – D$_3$) of participants’ actual implementation of any fire prevention practices 6 weeks following the intervention. Each measure is described briefly below.

The pre-intervention survey, entitled “Thinking, Talking, and Acting Safely (TTAS$_1$)” (Appendix D – D$_1$) was grounded in a modified stages of change model (Prochaska & Velicer, 1997) survey developed by Cole, Colligan and Sharf (2000). Additionally, the demographic survey has embedded within it a fire risk exposure survey (see Appendix C - C$_2$) modified from the research of Allareddy, Peel-Asa, Yang, and Zwerling (2007). Following the intervention, and attached to the answer sheet (see Appendix G) accompanying the simulation, the treatment group completed a series of evaluation questions. The questions focus on the verisimilitude and applicability of the narrative-simulation exercise (Appendix F). Two weeks following the initial TTAS$_1$ survey (Appendix D$_1$), both the control and treatment groups will again be surveyed using TTAS$_2$ (Appendix D$_2$). TTAS$_1$, TTAS$_2$, TTAS$_3$ use the same questions however, the responses have been modified to measure participant attitude and behavioral changes that occurred within the last two weeks. Six weeks following the simulation intervention, the treatment group was surveyed yet again using TTAS$_3$ (Appendix D$_3$) for actual fire prevention practice(s). TTAS$_2$ and TTAS$_3$ were mail-in surveys. Each participant was mailed the surveys with a return stamped envelope included. The necessary time to respond to survey questions was less than five minutes. A summary table for the study design and measures is shown in Table 3.1.
Table 3.1

*Experimental Design for the study, showing groups and measures at pre and post times.*

<table>
<thead>
<tr>
<th>Experimental Condition</th>
<th>O1 Intervention</th>
<th>O2</th>
<th>O3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Rural Resident 1</td>
<td>TTAS₁</td>
<td>RFS-C FRE</td>
</tr>
<tr>
<td>Treatment</td>
<td>Rural Residents 2</td>
<td>TTAS₁</td>
<td>RFS-T FRE</td>
</tr>
</tbody>
</table>

Legend

RFS-C = Rural Fire Demographic Survey – Control Group with Fire Risk Exposure (FRE) questions
RFS-T = Rural Fire Survey Demographic – Treatment Group with Fire Risk Exposure (FRE) questions
UCC = Uncle Charlie’s Christmas simulation
PSE = Post Simulation Evaluation
FPIP = Fire Prevention in Practice
TTAS = Thinking, Talking & Acting Safely (Attitudinal Proxy for Behavior Change – D₁,₂,₃)

*Note:* The questions used in all TTAS surveys are directly linked to the KIPRC findings listed on pages 2 – 3.
Study participants

The target populations were residents of rural areas who were possibly at risk for rural residential fires. Study participants did not need to own a rural residence. However, the pool of study participants had to be living in some permanent structure, not a mobile home; persons residing in doublewide homes were included in the participant pool. All participants were adults over the age of 18, married or single, and with or without children living in the home. The treatment group had (n=22) and the controls (n=30) (N= 52.) The control group consisted of 28 women age range of 26 – 82; average age of 47 and two men. The intervention group consisted of 5 men range of 29 – 65; average age of 49 and 18 women.

Negotiating access to participants: Community based trials

Rural residents are dispersed and separated by longer distances than urban residents. In order to facilitate this research, places where rural residents congregate, on a regular basis, were targeted as the focal points for recruitment -- primarily churches and community centers. As previously mentioned in the Introduction to this dissertation, local churches in several rural communities made initial commitments to assist with recruitment and provided letters to this effect for the University of Kentucky IRB protocol, # 11-0941-P4S approved on December 20, 2012 (Appendix E). However, after ten months of working diligently in local rural communities and soliciting participation from groups as varied as church members to county extension home-makers, the researcher was not able to enroll enough participants to support the statistical analyses originally proposed. Data were collected in three community sites. After consultation with my chair, the study was closed and a non-parametric analysis conducted. Issues and
implications regarding challenges encountered during this community based study are discussed more fully in Chapter Five.

**The intervention: A narrative simulation “Uncle Charlie’s Christmas”**

“Uncles Charlie’s Christmas” is a narrative-simulation that was carefully constructed, theoretically-informed interactive exercise based on case-based real world fire reports and rate based information (such as its setting in a wood frame house, a structure reported by the CDC and KIPRC as a high risk and prevalent structure in Kentucky). The simulation also presents pre-event, event, and post event situations in sync with the Haddon Matrix (1972) (Appendix A) approach to safety interventions.

Within the narrative-simulation, *decision points*, in the form of questions, are presented. Participants select from a series of problematic and competing alternatives that were actually confronted and reported by survivors of residential fires. The narrative-simulation uses a constructionist psychology. The objective of the simulation is to develop and measure adult learner attitudes and behavioral choices within the socio-cultural context of the simulation.

“Uncle Charlie’s Christmas” is an “emergency” situational simulation. Decision making in emergencies is unlike problem solving in academic settings. Real world emergencies are ill defined and problematic. There is no “one best solution.” Alternatives compete based on limited and inadequate information. “Difficult decisions must be made among alternatives without knowing *a priori* the consequences of those decisions” (Cole, 1998, p. 154). Once a decision is made, it becomes irreversible. The decision maker must predict future outcomes based on the information or cues present (Halpren, 1984).
As the narrative unfolds, decision points related to only that portion of the story are posed, which necessitate participant response. An illustration and sample of this approach is shown below in Figure 3.1 that includes the narrative stem and alternative answers available.

**Figure 3.1**

Sample question from “Uncle Charlie’s Christmas.” A sample of feedback provided for a response choice is also shown in the parenthetical frame.

Startled, she realizes there is fire. She cannot see into the parlor because of the smoke and flames. She cannot see Charlie but calls for him. Charlie does not answer! What should Debbie do?

T F 48. Get her cell phone from the car and call the fire department.
   [F - Not a good idea – she does not know the number, 911 services are out of her cell phone range AND she does not have her car keys!]

T F 50. Run through the kitchen and out of the house.
   [T - GET OUT and STAY OUT of the house!]

The complete simulation, answer sheet and feedback are provided in Appendix G.

**Procedural steps in administering exercise.**

After introducing the exercise to study participants, the treatment group completed the simulation. Immediately following the completion, the participants discussed their responses in a group setting and noted the feedback from the exercise. One unanticipated situation in administering the exercise in this study was the low literacy level of study participants. In some cases, it was necessary to read both the exercise and decision choices to participants. This procedure was not thought by the researcher to confound the study in any way, as the story and the choices are the key elements, not that participants read it specifically.
Data Collection

After consents were obtained, the researcher met with participants and during the pre-intervention session and obtained the demographic, embedded FRE, and the TTAS₁ pretest for both intervention and control groups. The intervention group engaged in the simulation exercise and completed the post-use evaluation form. Two weeks following post testing included the post TTAS₂. All data were tagged with a unique subject identifier, site number and logged into a data tracking spreadsheet. Data were matched with consents. Data and responses from each measure were then tallied and compiled in spreadsheet format, and then exported to SPSS for analyses.

Data Analysis

For the purpose of data analysis, the IBM SPSS program, Version 20, was used. From the initial survey it was possible to characterize the samples, both the control and treatment groups’ family demographics, e.g., number of people within the home, their ages, number of children, number of elderly (65+), any disabilities (includes smoking and drug use), education level, income level, and condition of the home, use of alternative heat source, installed smoke detector or fire escape plan. These data provided a snapshot into Kentucky rural family living circumstances. The embedded fire risk exposure survey provided, by inference, additional insight into the participant’s attitudes and beliefs of a fire occurring in their home.

At each decision point, within the simulation, correct and incorrect answers were be discussed by the group based on their consequential outcomes, e.g., what to do at first signs of fire, seeking more information and location of the fire, prioritizing escape
activities, choosing an escape route, notifying others, deciding what to do when others cannot be saved, and going back into the building. A group, and participant, frequency distribution for each correct and incorrect decision provided a performance profile for each participant and the groups were then displayed as histograms. Additionally, participant’s choices and scores were compared to the groups’ score to identify and correct their critical thinking skills. Based on the participants’ responses to the simulation choices, it was possible to understand the misconceptions and barriers to implementing effective fire prevention preparedness. Participant’s evaluation of the simulation was considered as a part of the post intervention survey.

**Parametric and/or non-parametric evaluation.**

In the original dissertation proposal the researcher anticipated the treatment and control groups would each be comprised of approximately sixty (60) volunteers in order to facilitate the use of standard parametric analysis techniques, e.g. mean, median, mode, standard deviations ($s$), correlations ($r$), $t$-tests reported as t-values, chi squared ($\chi^2$), and ANOVAs. These anticipated numbers were based on preliminary commitments from community located groups who submitted support letters for the IRB protocol application. Had these numbers comprised the study data set it would have facilitated generalizations and implications from the findings from this research. However, the number of final participants did not meet these anticipated quantities.

Non-parametric data analysis is used when the number of participants is substantially less than optimal and thus it was only be possible to show trends in the data. Consequently, for this dissertation data, the Wilcoxon Matched-Pairs Signed Rank test was used. The Wilcoxon test “incorporates information about the magnitude of the
differences between paired values” (George & Mallery, 2009.) The Wilcoxon signed-rank test is used when there are two nominal variables and one measurement variable. One of the nominal variables has only two values, such as "Time 1" and “Time 2," and the other nominal variable often represent individuals. This procedure is the non-parametric test analogue to the paired t-test, and should be used if the distribution of differences between pairs may be non-normally distributed (MacDonald, 2008.)

**Characteristic demographics as experimental variables**

Education and income levels of rural families, the number of household occupants, wide range of occupants ages, frequency of health related disorders, and general condition of the home are directly associated with a lower perception of fire risk exposure (FRE) and lower to non-existent fire preparedness (Allareddy et al., 2007, p. 266). The characteristic demographic survey of the participants in this research project will be compared similarly as in the Allareddy et al. (2007) statistical analysis report on fire risk exposure (FRE.) Each variable has a value of zero (0 = yes) or one (1= no.) Scores are added and averaged giving a Fire Risk Exposure (FRE) value for the group.

Additionally, in this research the modified Cole, et al. (2000) “Thinking, Talking and Acting Safely” (TTAS) with the addition of the narrative intervention will be used to measure and infer fire preparedness in the treatment group(s) six weeks after the intervention. Bloom, Hastings and Madaus (1971) identified the difficulties associated with assessing affective outcomes. However, they did provide a suggestion of how courses that promote the acquisition of values, attitudes and behaviors, can be evaluated by the degree to which they enable students to achieve the desired outcome. Gerretson and Golson (2005) advised that evaluation can be achieved on a group-wide basis and
that this approach avoids some of the really difficult issues in assessing individuals’ values and related affective outcomes. By using a delayed post survey (TTAS₃), it will be possible to evaluate the extent to which the narrative-simulation provoked the desired affect change in the participants.
Chapter Four: Data Analysis

Research Question 1: What Primary Causes of Residential Fires do Participants Report?

Data for Research Question One are drawn from the Demographic Survey of both intervention and control groups. Those data are reported here. As shown in table 4.1, overwhelmingly, the participant group was that of women, with 90% female subjects in both groups (N=46). Men (N=5) only accounted for 10% of the population. The age range for women was 26 - 82 years with an average age of 47 years. The age range for men was 29 – 65 years with an average of 49 years, with participants reporting their “age as the year in which they were born.

Table 4.1
Gender distribution of research participants across group (Treatment vs. Control).

<table>
<thead>
<tr>
<th>Gender by Group</th>
<th>Total Participants</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>Men</td>
<td>1</td>
<td>2.00</td>
</tr>
<tr>
<td>Women</td>
<td>29</td>
<td>98.00</td>
</tr>
<tr>
<td>Intervention</td>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>Men</td>
<td>4</td>
<td>8.00</td>
</tr>
<tr>
<td>Women</td>
<td>18</td>
<td>92.00</td>
</tr>
</tbody>
</table>

From the demographic survey participants reported the type of home construction where they lived (see Table 4.2). Three of the participants reported living in all wood homes (3/52); wood constructed and sided with wood siding or a siding type exterior veneer. Eight (8/52) of participants reported living in all brick homes. Upon further investigation it was revealed these “all brick homes” were “ancestral;” passed down through their families. The majority (41/52) of the participants reported living in homes
that were wood constructed and then sided with vinyl or vinyl sided over an existing exterior veneer. The remaining participants (10/62) did not report the kind or type of home where they lived.

Only forty-two (42/62) participants reported the type and kind of permanent heating units used in their homes. Heat pumps were reported by 30 of the volunteers. Heat pumps both heated and cooled their homes. These units were either installed new with the house or were retrofitted. Natural gas heating units were reported by eleven (11/62) participants. Natural gas is usually not available in most rural areas in the state of Kentucky however; these participants lived closer to areas where natural gas was available. The cost to run a natural gas line from the source to the home, in rural Kentucky, is paid for by the home owner and for most rural residents this cost can be prohibitive. Under the classification of “other,” only 1 participant reported. Several of the participants were interviewed as to the type and kind of winter heat source they used. While not surveyed for, and upon interviews with participants, secondary heat sources, e.g. kerosene heaters, electric heaters, and fireplaces were used as a primary heat source in the colder months.

Table 4.2
*Additional demographic survey data reported by individuals living in the household of all research participants.*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>% of Total 62</th>
<th>Valid Percent* % of 51</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children present in household**</td>
<td>27</td>
<td>43.53%</td>
<td>51.92%</td>
</tr>
<tr>
<td>No children present in household</td>
<td>24</td>
<td>38.70%</td>
<td>46.15%</td>
</tr>
<tr>
<td>Non-Response</td>
<td>1</td>
<td>0.02%</td>
<td>-----</td>
</tr>
<tr>
<td>Table 4.2 (continued)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of adults over age 64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No adults over the age of 64 are present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least one adult over the age of 64 present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-response</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of individuals with disabilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No disabled individual present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least one disabled individual present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-response</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of individuals who smoke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No individuals who smoke in the household</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least one individual who smokes in the household</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-response</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of supplemental heat source</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above $20,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below $20,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not reported</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education (at least one person)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Response</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brick</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veneer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.2 (continued)

<table>
<thead>
<tr>
<th>Type of heating unit</th>
<th>FRE</th>
<th>% of FRE</th>
<th>% of FRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat pump</td>
<td>30</td>
<td>49.80%</td>
<td>58.82%</td>
</tr>
<tr>
<td>Gas furnace</td>
<td>11</td>
<td>18.03%</td>
<td>21.56%</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>0.02%</td>
<td>0.02%</td>
</tr>
</tbody>
</table>

Note: *Valid percent excludes those individuals with missing responses. **A follow-up question related to the ages of children is not reported in this table due to discrepancies in participant response. These discrepancies are hypothesized to issues related to foster children temporarily inhabiting homes and should be addressed with modified questions in any future research concerning this or similar populations.

Research Question 2: What exposure to fire risk do these rural residents report?

Demographic data for safety prevention and interventions has the additional function (beyond describing the study sample/population) of providing surveillance information on participants’ exposure to risk or hazard embedded in the demographic survey. In public health and safety research surveillance data provides important empirical data on exposure to hazards that may cause injury or fatality. In the section below the demographic data from this study provides information that is presented as evidence of participants’ exposure to risk/hazard.

There were thirteen items in the demographic pre-survey that were embedded as indicators of fire risk exposure (FRE), as modeled after Allareddy et al., 2007. These thirteen items are contained in Appendix C-2 and are reported in the paragraphs that follow.

These FRE participant characteristics derived will be compared and analyzed similarly as in the Allareddy et al. (2007) statistical analysis report that produced the fire risk exposure (FRE) metric. To derive this metric, Alareddy gave each variable a value of zero (0 = yes) or one (1= no.) Scores are added and averaged giving a Fire Risk Exposure (FRE) value for the group. Originally in Alareddy’s work, a “no” response was coded as
1 and a “yes” was coded as 0. However, since a larger number typically is seen to represent MORE of a construct, it was decided to reverse code these items so that a “no” was coded as zero (0) and a “yes” response was coded as one (1). With this new coding scheme, each participant received an overall score between the ranges of 0 and 13. Larger values indicated a greater perception of fire risk exposure.

The FRE survey responses for the entire sample of 52 control and intervention participants are shown in Table 4.3. Ten of 52 (10/52 = 19.2%) reported a fire in the home that required first responders be called to the scene. Twenty-seven percent (27%) report family members that smoke in the embedded Fire Risk Exposure (FRE) survey. Information on the presence of and proper use of smoke alarms is problematic. Although the majority of respondents report having a smoke alarm (50/52), 12% never test them or don’t know if they work, and fully half (25/50) have disabled an alarm in their home (although there may be other in working order, that is not known from the questions asked). The same concerns follow for a fire escape plan, with 29/50 reporting they have one, but one-third (7/29) report not practicing the plan, a strategy that is key to implementing an escape in the chaos of an actual fire. Children in the home under the age of 7 present a special fire hazard risk. From playing with matches or incendiaries or requiring special fire safety measures as they must be “told what to do” or must have repeatedly practiced fire escape procedures. Eighteen of twenty-nine (18/29) respondents (62%) reported children in the home age seven and under. Additionally, one third (19/52) participants reported family members, living in the home, that were elderly, partial/fully disabled, prescription/recreational drug use and/or alcohol users; each of which has their own “special needs” when escaping a burning building. Half (24/50) reported having a
fire extinguisher, however, participants were not asked if it was current or in working order. Another potential hazard relates to participants claims that 15/52 (29%) do their own electrical work. Clearly these participants are not certified electricians, and the extent to which they had this work inspected and approved to code is likely very low as taken from the FRE survey. Finally, supplemental heat or complications from supplemental heat kill more rural Kentucky residents, in the winter months, than any other fire hazard. Fully sixty-two percent (29/43) of participants reported use of wood stoves or fireplaces, distributed as follows: (17), electric heaters (9), or kerosene heaters (3) as their secondary or supplemental heat source in the cooler/colder months.

Other possible correlations from this statistical data were not extrapolated or compared. For example, correlations were not explored between FRE factors such the use of supplemental heat and, say; a fire escape plan; children under the age of 7; family members with disabilities; drug or alcohol use; family members that are smoking; elderly, or any other combination of fire risk exposure factors. The sample size was just too small to run the correlations and make any generalizable statements. From the available data it can only be inferred that participants recognized many of the potential fire risk hazards. However, they did little or nothing to mitigate those conditions.

Table 4.3
Response totals for embedded Fire Risk Exposure survey questions.

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No or No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire in the home with first responders</td>
<td>10</td>
<td>42</td>
</tr>
<tr>
<td>Family members that smoke</td>
<td>14 yes</td>
<td>-- Both Parents 8</td>
</tr>
<tr>
<td>Weeds against the house</td>
<td>6 yes</td>
<td></td>
</tr>
<tr>
<td>Building materials storage</td>
<td>4 yes</td>
<td></td>
</tr>
<tr>
<td>against the house / under porch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.3 (continued)
Smoke alarms in the home
Test smoke alarms
Every Month – 14, Three month – 11, Yearly - 7
Don’t know if they work - 2
Never – 4

Disabled an alarm 25
Fire escape plan 29
Practice fire escape plan 22
Fire extinguisher 24
Supplemental heat
Wood stove or fireplace – 17
Electric heater – 9
Kerosene heater – 3

Do your own electrical work 15 yes

The FRE Score calculated as noted above, ranged from 3 to 11 from a total of 13 possible fire risk factors for all participants in this study. Lower scores indicated lower fire risk exposure. Frequencies of FRE computed scores are shown in Table 4.4. Scores reported are for participants that answered 10 or more of the FRE. This procedure (shown in Table 4.5) was selected for use because it retained 51 of the 62 participants. The remaining participant had five missing responses of 13, which was deemed too much missing data to extrapolate from.

Table 4.4
Fire Risk Exposure (FRE) Descriptives Statistics for participants responding to 10 or more FRE items on the demographic pre-survey (N=51).

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid %</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.00</td>
<td>1</td>
<td>1.6</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>4.00</td>
<td>2</td>
<td>3.2</td>
<td>3.9</td>
<td>5.9</td>
</tr>
<tr>
<td>5.00</td>
<td>11</td>
<td>17.7</td>
<td>21.6</td>
<td>27.5</td>
</tr>
<tr>
<td>6.00</td>
<td>10</td>
<td>16.1</td>
<td>19.6</td>
<td>47.1</td>
</tr>
<tr>
<td>7.00</td>
<td>9</td>
<td>14.5</td>
<td>17.6</td>
<td>64.7</td>
</tr>
<tr>
<td>8.00</td>
<td>8</td>
<td>12.9</td>
<td>15.7</td>
<td>80.4</td>
</tr>
<tr>
<td>9.00</td>
<td>6</td>
<td>9.7</td>
<td>11.8</td>
<td>92.2</td>
</tr>
<tr>
<td>10.00</td>
<td>3</td>
<td>4.8</td>
<td>5.9</td>
<td>98.0</td>
</tr>
</tbody>
</table>
Note: *Using the more appropriate median scores to evaluate participants self-reported Fire Risk Exposure, the conclusion is that this sample was moderately exposed to risk with 27 of 52 participants reporting at or above the median score of 7 (of 13) as the highest possible FRE score.

Research Question 3: Do research participants demonstrate their knowledge of potential risks after completing a narrative-simulation designed for that purpose?

Responses to Embedded Decision Making Questions in the Simulation

The embedded decision points within the simulation contain evidence of participants’ knowledge and understanding of several concepts and principles related to fire safety and prevention practices. In the section below I present (1) the overall tally of participants’ correct and incorrect (or problematic responses) in Table 4.6 and, (2) a grouping of the questions to represent specific lacks in knowledge or misconceptions that participants have about safe behaviors either to prevent a fire or in the event of an actual fire, as shown in Table 4.7.
Correct and Incorrect responses to all questions/decision points in the
Simulation

The intervention participants’ responses to each decision point within the
simulation exercise are shown in Table 4.6 below. For each question the number correct
and the number of incorrect responses of the total (n=22) are shown, with an
accompanying percentage of correct responses. These questions are displayed in the order
in which the questions or decision points appear in the narrative simulation and are taken
from the answer sheet provided to respondents.

Table 4.6

Overall tally of intervention participant’s correct (C) and incorrect (I) responses (n=22).

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct</th>
<th>Incorrect</th>
<th>Total</th>
<th>% Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>18</td>
<td>4</td>
<td>22</td>
<td>82</td>
</tr>
<tr>
<td>Q2</td>
<td>19</td>
<td>3</td>
<td>22</td>
<td>86</td>
</tr>
<tr>
<td>Q3</td>
<td>7</td>
<td>15</td>
<td>22</td>
<td>32</td>
</tr>
<tr>
<td>Q4</td>
<td>21</td>
<td>1</td>
<td>22</td>
<td>95</td>
</tr>
<tr>
<td>Q5</td>
<td>20</td>
<td>2</td>
<td>22</td>
<td>91</td>
</tr>
<tr>
<td>Q6</td>
<td>10</td>
<td>12</td>
<td>22</td>
<td>45</td>
</tr>
<tr>
<td>Q7</td>
<td>19</td>
<td>3</td>
<td>22</td>
<td>86</td>
</tr>
<tr>
<td>Q9</td>
<td>20</td>
<td>2</td>
<td>22</td>
<td>91</td>
</tr>
<tr>
<td>Q10</td>
<td>21</td>
<td>1</td>
<td>22</td>
<td>95</td>
</tr>
<tr>
<td>Q11</td>
<td>21</td>
<td>1</td>
<td>22</td>
<td>95</td>
</tr>
<tr>
<td>Q12</td>
<td>19</td>
<td>3</td>
<td>22</td>
<td>86</td>
</tr>
<tr>
<td>Q15</td>
<td>20</td>
<td>2</td>
<td>22</td>
<td>91</td>
</tr>
<tr>
<td>Q16</td>
<td>16</td>
<td>6</td>
<td>22</td>
<td>73</td>
</tr>
<tr>
<td>Q17</td>
<td>20</td>
<td>2</td>
<td>22</td>
<td>91</td>
</tr>
<tr>
<td>Q18</td>
<td>20</td>
<td>2</td>
<td>22</td>
<td>91</td>
</tr>
<tr>
<td>Q19</td>
<td>19</td>
<td>3</td>
<td>22</td>
<td>86</td>
</tr>
<tr>
<td>Q20</td>
<td>19</td>
<td>3</td>
<td>22</td>
<td>86</td>
</tr>
<tr>
<td>Q21</td>
<td>20</td>
<td>2</td>
<td>22</td>
<td>91</td>
</tr>
<tr>
<td>Q22</td>
<td>22</td>
<td>0</td>
<td>22</td>
<td>100</td>
</tr>
<tr>
<td>Q23</td>
<td>15</td>
<td>7</td>
<td>22</td>
<td>68</td>
</tr>
<tr>
<td>Q24</td>
<td>22</td>
<td>0</td>
<td>22</td>
<td>100</td>
</tr>
<tr>
<td>Q25</td>
<td>22</td>
<td>0</td>
<td>22</td>
<td>100</td>
</tr>
</tbody>
</table>
An Examination of Most Frequently Selected Incorrect Decisions Related to Fire Safety Practices

By grouping the questions that were most frequently missed by participants (<50% Correct) during their use of the simulation instructional exercise, we see an interesting and perhaps troubling pattern. As shown in Table 4.7, as a group, these questions deal with fire prevention knowledge and strategies directly. They were also those questions for which participants in this intervention group most often selected the least safe decision option for the simulated situation depicted in Uncle Charlie’s Christmas.
<table>
<thead>
<tr>
<th>Text of Question from Simulation</th>
<th>Percentage of Correct Responses &lt;50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 35: His house electrical system could be overloaded by having both the lamp and the radio on at the same time</td>
<td>18%</td>
</tr>
<tr>
<td>Question 39: Yell to her kids to break open the window and climb onto the back porch and jump down to her.</td>
<td>23%</td>
</tr>
<tr>
<td>Question 43: Immediately move the kids away from the house and the fire. Then run back into the kitchen and up the stairs to rescue Debbie.</td>
<td>23%</td>
</tr>
<tr>
<td>Question 3: His house electrical system could be overloaded by having both the lamp and the radio on at the same time.</td>
<td>32%</td>
</tr>
<tr>
<td>Question 41: Tell Uncle Charlie to wait by the porch and catch the two kids if she puts them out the window onto the porch roof.</td>
<td>41%</td>
</tr>
<tr>
<td>Question 6: Run a new propane gas line for a new wall heater.</td>
<td>45%</td>
</tr>
<tr>
<td>Question 42: Leave the door to the parlor closed. Then run up the stairs to the bedroom grab her two children and get them out of the house.</td>
<td>48%</td>
</tr>
</tbody>
</table>

Two separate and distinct themes emerge. The first theme is that of fire prevention and the second is safe fire decision making (Question 3 and Question 6). The second theme that emerges, and is much more important to fire survivability; “what actions (behavioral choices) do I take in order to survive a residential fire.” Fire prevention and safe decision making tell us more about participants’ understanding of
how their house and its internal systems work and the application of fire prevention measures. However, a more serious problem appears in the second theme. The behavioral choices group – derived from the text of the remaining Questions 35, 39, 43, 41, and 42; during the chaos of a residential fire and how those choices are made even more difficult and intense when small children are at risk. So, as Seim has noted (1990) human behavior can be characterized as non-rational when it is not adaptive and at the same time irrational because possible and logical alternatives are not considered.

Post Simulation Evaluation: Participant Feedback on Verisimilitude and Applicability

Any instructional intervention needs to be evaluated for acceptability as a matter of appropriate instructional design best practice. After participants had finished the simulation, they filled out 14 evaluation questions related to feedback on the contents of the simulation exercise, shown in Figure 4.1 below. The simulation evaluation questions are shown in Appendix F, as part of the complete simulation package materials.

Figure 4.1

Post use evaluation questions for the Uncle Charlie’s Christmas simulation.

| Q1. The situation in the story could happen to me. |
| Q2. I learned nothing new from this exercise.     |
| Q3. This exercise will help me remember the fire risks in my own home. |
| Q4. Because of this exercise, I will take precautions when using any form of supplemental heat in my home. |
| Q5. Because of this exercise, I will encourage others to be aware of fire risks in their home. |
| Q6. This exercise was too long.                  |
| Q7. I liked doing this exercise.                 |
| Q8. The written directions were easy to understand. |
| Q9. The pictures and drawings added to the exercise. |
A Likert Scale was used for participant responses as follows: 1 Not Very Likely; 2; 3 Maybe; 4; 5 Very Likely; 0 Not Applicable. The responses to this evaluation are shown in Table 4.8. Again, here, the median response for this ordinal scale is most appropriate to consider (rather than a mean). Of particular interest are participant responses to Questions 1, 4, and 5 that focus on the extent to which respondents could personally relate to the story or situation in the narrative. Inferring from the ‘likeliness’ of the 4 and 5 response mode scores, participants were actively and cognitively engaged, thinking about potential actions, and critically thinking about their own need to take a proactive active approach their own fire safety and prevention measures (thought, talked and acted). Question 5 suggests participant intention to “talk to others” (act) and expand the influence of the exercise concerning “others” fire risk and behaviors. Question 3 suggests that participants will remember to look for fire risks in their own home (thought and act). When using a narrative simulation as a learning device Question 6, 7, 8, 9, 10, 12 and 13 are important evaluation questions for simulation designers to consider. It is important the exercise is “likable,” easy to read (for those who were literate), the characters are realistic and that the exercise is not too long so as to be boring. The facts contained within the narrative are real and it is the responsibility of the narrative designer to weave those facts into a story line that holds the participants interest and has a certain
entertainment value to it (Owenby, 1992). Moreno’s (2004) article on the type and kind of participant feedback and learning from “communities” as Lave & Wenger (1991), suggest is the purpose of Question 11. Did the participants have the opportunity to talk over their answers with other in their small groups? This question relates to an important learning construct when working with adult students who prefer to interact and learn from the experiences of others (Knowles, 1987). Time must be provided for adults learning from each other, and in the case of this simulation, participants found this quality of the simulation acceptable. Additionally, Question 14 tells us that participants were not just “satisficing” – responding just to answer a question (Krosnick, Narayan, & Smith, 1996, pg. 30). They managed to catch the reverse-coded question. This overall response suggests that individuals were paying attention to the items on the post-simulation evaluation.

Table 4.8

*Post Simulation Evaluation for the intervention group. (Likert Scale 1-5)*

<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q6</th>
<th>Q7</th>
<th>Q8</th>
<th>Q9</th>
<th>Q10</th>
<th>Q11</th>
<th>Q12</th>
<th>Q13</th>
<th>Q14</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Valid</td>
<td>21</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>22</td>
<td>21</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>21</td>
<td>20</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Median</td>
<td>3.0000</td>
<td>3.0000</td>
<td>5.0000</td>
<td>5.0000</td>
<td>5.0000</td>
<td>3.0000</td>
<td>4.5000</td>
<td>5.0000</td>
<td>5.0000</td>
<td>5.0000</td>
<td>5.0000</td>
<td>5.0000</td>
<td>5.0000</td>
<td>1.5000</td>
</tr>
<tr>
<td>Mode</td>
<td>3.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Most responses were noted as ‘4’ or ‘5’ indicating participants could relate to the story, were able to understand its contents and to learn from it. There were issues related to literacy, and these will be discussed in chapter five. Participants often needed assistance with reading the narrative. However, they clearly understood its contents.
Research Question 4: Does the use of a narrative-simulation exercise for the identification of potential rural residential fire hazards result in the participants’ actually taking steps to reduce those risks?

Data for the results of the pre-post behavioral intention proxy measure, the TTAS are reported in this section. The two hypotheses that were examined are:

1. The treatment group and the control group attitude and behaviors (TTAS₁) will be similar on the pre-measure survey, Time 1 (T₁) (h₁: N₁ = N₂.)

2. The treatment groups’ attitude and intended behaviors related to fire preparedness will increase following the simulation intervention, Time 2 (T₂) (h₂: N₃ ≠ N₄; TTAS₂ – T₁ and T₂ Treatment vs. Control).

Behavioral Intention Measure: Thinking, Talking, Acting Safely (TTAS)

Reliability of Measure

The Cronbach’s Alpha procedure was computed on the Thinking, Talking and Acting Safely inventory to check for internal reliability. The subscales of Thinking, Talking and Acting (TTAS) each consisted of 15 items. Cronbach’s alphas (α) for Thinking were .922 (α=.992 N=15), Talking .932 (α=.932 N=15), and Acting .935 (α=.935 N=15) respectively. The TTAS inventory was found to be highly reliable in all three subsets.
Pre-Post Thinking, Talking and Acting Safely (TTAS) Scores for Intervention vs. Control Groups: Behavioral Intention Measures

To refresh the reader, it was anticipated (in the study proposal) that the treatment and control groups would each be comprised of sixty (60) volunteers in order to facilitate the use of standard parametric analysis techniques, e.g. mean, median, mode, standard deviations (s), correlations (r), t-tests reported as t-values, chi squared ($\chi^2$), and ANOVAs. Using these data would have facilitated making generalizations and implications from the findings from this research. However, the study was not able to enroll a number of participants required to meet the standard statistical analyses and necessitated the use of the non-parametric Wilcoxon signed-rank test for comparison of respondent answers to TTAS$_1$, TTAS$_2$, and TTAS$_3$. For this sample, due to highly skewed distributions, the median and mode are more accurate than the mean in portraying the average score for these variables. Overall scores are shown. There were no significant differences in the overall median scores between the intervention and control groups as shown below in Table 4.9.
Table 4.9

*Differences between Control vs. Intervention TTAS1 – TTAS2. Descriptive statistics for overall “Thought, Talked, and Act” scores by participant group (Control vs. Intervention) and time of pre-post administration (Time 1 vs. Time2).*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>SD</th>
<th>Time 1</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>SD</th>
<th>Time 2</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thought</td>
<td>.885</td>
<td>.800</td>
<td>.33</td>
<td>.675</td>
<td>1.103</td>
<td>.867</td>
<td>.73</td>
<td>.597</td>
<td></td>
<td></td>
<td></td>
<td>.823</td>
<td>.600</td>
<td>.13</td>
<td>.694</td>
</tr>
<tr>
<td>Talked</td>
<td>.702</td>
<td>.733</td>
<td>.73</td>
<td>.463</td>
<td>.899</td>
<td>.775</td>
<td>.53</td>
<td>.510</td>
<td></td>
<td></td>
<td></td>
<td>.695</td>
<td>.333</td>
<td>.07</td>
<td>.779</td>
</tr>
<tr>
<td>Act</td>
<td>.493</td>
<td>.367</td>
<td>.00</td>
<td>.517</td>
<td>.731</td>
<td>.767</td>
<td>.47</td>
<td>.355</td>
<td></td>
<td></td>
<td></td>
<td>.543</td>
<td>.267</td>
<td>.00</td>
<td>.721</td>
</tr>
</tbody>
</table>

As shown in Table 4.10, there were no significant differences between the pre and post TTAS scores between the intervention and control groups.

Table 4.10

*Wilcoxon statistics for Pre-post Matched-Paired Scores for the intervention and control groups on the TTAS showing between group Time2 scores.*

<table>
<thead>
<tr>
<th>Wilcoxon “T”</th>
<th>Thinking</th>
<th>Talking</th>
<th>Acting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (n=12) vs. Intervention (n=19)</td>
<td>0.173</td>
<td>0.214</td>
<td>0.123</td>
</tr>
</tbody>
</table>

It was hypothesized that a significant difference would be shown but this was not the case and the null hypothesis is retained.
The data reported in Tables 4.11-4.13 show a closer look at trends in the data set, examining the separate thinking, talking and acting scales of the TTAS pre-post between the intervention and control groups. The figures 4.2-4.4 that follow each table plot out the trend data for each group.

Table 4.11

*Median scores on the overall “Thought” construct from time 1 to time 2 for intervention group and control groups.*

<table>
<thead>
<tr>
<th>Group</th>
<th>Thought1</th>
<th>Thought2</th>
<th>T-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (n=12)</td>
<td>0.733</td>
<td>0.775</td>
<td>.176</td>
</tr>
<tr>
<td>Intervention (n=19)</td>
<td>0.333</td>
<td>1.233</td>
<td>.01*</td>
</tr>
</tbody>
</table>

Figure 4.2. Overall median scores on “Thought” construct from time 1 to time 2 split by treatment group (control vs. intervention).

Table 4.12

*Median scores on the overall “Talked” construct from time 1 to time 2 split out by treatment group (control vs. intervention).*

<table>
<thead>
<tr>
<th>Group</th>
<th>Talked1</th>
<th>Talked2</th>
<th>T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.733</td>
<td>0.775</td>
<td>.006</td>
</tr>
<tr>
<td>Intervention</td>
<td>0.333</td>
<td>1.233</td>
<td>.012*</td>
</tr>
</tbody>
</table>
**Figure 4.3**: Overall median scores on “Talked” construct from time 1 to time 2 for the intervention and control groups.

**Table 4.13**

<table>
<thead>
<tr>
<th>Group</th>
<th>Act 1</th>
<th>Act 2</th>
<th>T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>.367</td>
<td>.767</td>
<td>.006</td>
</tr>
<tr>
<td>Intervention</td>
<td>.267</td>
<td>.967</td>
<td>.016*</td>
</tr>
</tbody>
</table>

There were significant within group effects for the intervention groups to support rejecting the null hypothesis.
Summary Findings

The demographic data show that this study was conducted with a population at risk for rural residential fires, based on their self-reports of the kinds of structures in which they reside and other demographic factors related to fire hazard such as education level, children in the home, etc. They were, however, moderately exposed to base on their responses to the Fire Risk Hazard survey items (such as portable heaters in the home, etc).

The *Uncle Charlie’s Christmas* narrative simulation instructional materials were effective at engaging participants in decision making situations they might encounter in an actual fire emergency situation. However, participant responses to the simulation did reveal how many ‘bad’ decisions (resulting in failure to exit or other unsafe practices) this group of users made in going through the simulation. A post-use evaluation showed that users found the simulating realistic and engaging.

The Thinking Talking and Acting proxy measure of behavioral intention had high internal reliability at a .93 Chronbach Alpha, demonstrating the utility of the measure for future research.

There were no significant differences between the intervention and control groups on the pre-post TTAS behavioral change proxy measure, for the two week post-test follow up, as computed using the Wilcoxon parametric procedures. There were significant pre-post (2 week) differences within the intervention group when the Thinking, Talking and Acting scales scores were analyzed.

A discussion of findings and considerations for further research follows in Chapter Five.
Chapter Five – Discussion and Implications for Further Study

Narrative Simulation

One important outcome of this study has been the development and initial field testing in actual rural towns and communities of a well-designed narrative simulation for fire prevention interventions, that embodies theoretical foundations and is rooted in case-based and rate based fire injury and fatality statistics. No such intervention current exists and participants in this study found the story engaging and were able to relate to the circumstances and decision situations in the story simulation.

Literacy Levels of Participants and Audio Formats for the Simulation

One initially unanticipated issue with the use of the text-based simulation (with vivid visual illustrations) was the low literacy levels of the study participants. In many cases the researcher had to assist with aural reading of the story or decision point choices. It was not felt that this additional assistance hampered comprehension, as it was clear that participants could and did understand the questions or situations after hearing them read aloud. However, future versions of the simulation should include an audio-taped version that addresses the literacy concerns or perhaps a training session where local fire personnel or other community workers could learn to read and use the instructional materials packet to deliver the safety information, which is clearly needed.

Additional Instruction to Complement the Simulation: Implications for a Community Fire Prevention Program.

As the performance data from the use of the simulation show, not only did the participants exhibit many poor decision choices, but these choices indicated a lack of knowledge about basic fire safety, procedures in a fire, and other important lifesaving practices. Given the poor decision choices and lack of basic fire knowledge by participants, perhaps a more didactic “how to” training session component on such topics as; “where in the home smoke detectors are needed” or “how to properly install a smoke detector,” could be scheduled for follow-up sessions. In other words, the simulation could provide clear direction on the lacks in knowledge and skill of at-risk rural residents so that follow up community information sessions could be targeted to upgrade their knowledge of fire safety practices.
Measures - Thinking/Talking Acting Proxy Measure for Behavioral Intention

Prochaska and Velicer’s Stages of Change measures, as was used in this study, were intentionally designed by these researchers to be customized to address a particular target behavior that would be the outcome of a health or safety ‘change’ intervention. Thus the reliability and validity of such measures is always important to consider. The internal reliability measure for the TTAS that was designed for this study had a high Cronbach’s alpha (α .93) and it may thus have further utility in future studies aimed at addressing changes in behavioral intention regarding fire safety and prevention practices that use narrative simulations as the instructional intervention.

Fire Prevention Activities for Rural Residents: Challenges of Reaching the At-Risk Populations

Despite the many challenges of conducting this study, the use of narrative-simulations was appropriate for this somewhat difficult adult population at high risk for fire injury or fatality in rural Kentucky areas. Despite the difficulties observed, for example, reading comprehension problems, and literacy, and frankly obvious effects of poverty and poor nutrition, the participants’ reported a positive experience with the simulation exercise. Participants believed the scenario real, engaging, and thought provoking. These challenges do not limit at-risk persons’ learning potential. Clearly, they can learn from experiential and mentally engaging type educational programs that challenge them and provoke critical thinking and decision-making, such as the Uncle Charlie’s Christmas simulation story. A narrative-simulation builds on adult experience and when combined with peer group learning support, even if their initial answer / decisions were not correct, provided the participants in this study the opportunity for adults to learn from each other and acts as reinforcement in attitude and shifts in behavioral intention. This insight was confirmed statistically by the Intervention groups “Thinking, Talking and Acting Safely” (TTAS) Wilcoxon “T” determination to “reject the null hypothesis” from Time1 and post-intervention Time 2. Regardless of the Wilcoxon “T” determination to “retain the null hypothesis” between the Control and Intervention groups’ Time2 scores; there were significant positive gains within the Intervention group. Additionally, the TTAS1 and TTAS2 proxy measure analysis for the Control group did show a “significant difference” in the “Act” behavioral construct as
shown in Table 4.13 and in Figure 4.4. The Control group consisted of Head Start volunteers that evaluate rural-living circumstances and make recommendations for change for their participants. Part of Head Start volunteer training is fire safety. TTAS₁ did initiate, what is known as, the “exposure effect” in the Control group and confirmed by the pre-post TTAS₂ score. While the Control group did not show a significant difference in the “thinking” or “talking” about fire safety they were stimulated to “Act” more on fire safety. A question about previous fire safety training should be added to the participant demographic survey to further study the “exposure effect” phenomenon as cited by the Canter Study (1990.)

Complexities of Reaching At-Risk Populations

There are three separate conclusions regarding not only the high need, but the difficulties of reaching at-risk rural populations with fire safety interventions that can be drawn from this study. The first is that rural populations who are most at risk of death and serious injuries related to residential fires are also under-served for a number of reasons. Principally, as the researcher observed again and again, they are distrustful of governmental authorities and have a fear of “outsider” intrusions and evaluations of their living conditions. Even the year spent in the field researching this project was not nearly enough time for those residents to feel comfortable with research personnel and intent of the project. This situation does not mean that research studies should not be undertaken with rural populations. What it does indicate however, is that research projects should be planned for the long-term and not just a yearlong “snapshot.”

A second category of limitations could be labeled as “fear of regulatory/governmental agencies.” Several of the intervention participants signed-up for the free smoke detector program however, the fire service was never allowed in the home to install them. FEMA requirements mandated “installation” and verification of the installation. When fire service volunteers attempted to enter the home and install the detectors they were turned away by the occupants. Several reasons were cited: fear of other building code violations reported to other agencies, fear of economic reprisal by the property owner if the renting tenant allowed anyone in the house, or did not want strangers to see their untidy living conditions. Considering the gender imbalance of study
volunteers, women to men, would also necessitate the question of authority within the household. By-in-large, women respondents wanted the smoke detectors installed in the home, and signed up for installation, because of their concern for children and others living in the home. However, when the requirements of the program were explained to the husband the answer was “no.” It is believed that by notifying the husband in advance and getting his permission (buy-in) in the decision to install smoke detectors, this “machismo effect” can be mitigated.

The third category of limiting circumstance can only be described as “educational”; principally participants’ literacy. In every instance it was required the study participant consent form, demographic inventory and most statements used in the “Thinking Talking and Acting Safely” (TTAS) survey needed to be read and explained. This was true for both the Control and Interventions groups. The low response to the Control TTAS2 post-contact survey may have been limited for this reason. Most of the intervention participants wanted the narrative-simulation read to them and also required the “true-false” questions be read to them. The Flesch Readability Rating for Uncle Charlie’s Christmas was 78.6 at a Flesch-Kincaid grade level of 4.7.

In reviewing the paperwork requirements for the entire project it can only be concluded there was too much and took too much time to fill out. Additionally, an audio rendition of the exercise is needed to accompany the written narrative in both English and Spanish given the current demographic trend. It is also not known if the sight of the necessary paperwork packets and the time necessitated in filling them out, about 20 minutes, also limited the number of willing volunteers and consequently the sample size. In reviewing the research notes many perspective participants were “turned-off” by the paperwork. The narrative-simulation exercise itself, the time spent answering the questions and evaluation, did not appear objectionable as evidenced by the Simulation Evaluation results listed in Table 4.8 (pg. 55).

Limitations of the Study

As previously mentioned, the small sample sizes contributed several issues related to these findings and findings are not generalizable to a larger population of at-risk rural residents. The small sample size did not reduce the import of this preliminary study and its potential value to this body of educational instruction. As previously mentioned, the
Flesch Rating for the narrative was 78.6 however; none of the measures, the TTAS$_{1,2,3}$ and demographic surveys, were rated for readability.

**Further Research**

The results of the analyses of the participant response choices in the narrative simulation reveal the high need for fire prevention and safety programs that can be delivered to and comprehended by these rural at-risk residents. Many select inappropriate decisions in emergency situations and make poor choices that would result in injury, possibly death, in an actual fire escape situation. More research is clearly needed with a sample size that could inform the generalizability of the trends observed in this study regarding the effectiveness of the use of the narrative simulation to improve knowledge of safe behaviors and fire prevention measures.

Another research direction that might prove useful is to train local fire volunteers in the use of the narrative simulation and discussion techniques and assess the effectiveness of that approach. These local residents might be less threatening to local residents and the acceptability of the training. Likewise, providing a comprehensive, systematic in-school fire prevention program in rural school districts is also needed. Children in middle and high school could certainly handle the use of the simulation and its associated discussions and lessons.

As previously mentioned, an audio version of the *Uncle Charlie’s Christmas* simulation would address the low literacy/reading levels of many at-risk rural residents (and children) who need to have access to this important fire safety information. Creating such a version of the simulation used in this study could also be available as an MP3 download from a popular outlet such as iTunes or other MP3 podcasting website.

**Conclusion**

To conclude, a key contribution of this study was the development and implementation of a carefully designed fire safety narrative simulation problem booklet, with decision choice feedback and associated research measures that have, up to this point, not been available for use in fire prevention and safety programs for rural residents. Additional research is needed to hone the delivery (in format and practice) of such interventions to those at highest risk for injury or fatality from fires, both adults and children who often live in unsafe structures and who have poor access to emergency fire.
services. One can only imagine that had the father in the tragic fire in Cynthiana, Kentucky in January 2013 had such training, he might have decided differently and saved the lives of his two young daughters. After discovering a house fire, the father and one daughter escaped. While he manned the hose in an attempt to put out the fire, he said to his daughter, “Go find your sister!” The young girl re-entered the burning building, thinking her sister had probably hidden in a closet in their room. The bodies of both girls were found; one in the closet, the other heading toward it, after the fire department had extinguished the blaze.
Appendix A

Uncle Charlie’s House via the Haddon Matrix

<table>
<thead>
<tr>
<th>Injury Phase</th>
<th>Human (Host)</th>
<th>Injuring Agents</th>
<th>Environment Physical</th>
<th>Environment Socio-Cultural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-event</td>
<td>Charlie-saving money buying old smoke alarms/leaking heater, alcohol use, Girls sleeping upstairs-“camping out”</td>
<td>Leaking kerosene heater Charlie’s slow burning cigar</td>
<td>Threadbare carpets and drapes Missing ceiling plaster exposes floor joists and floor above House kept very warm for the “campers”</td>
<td>Debbie asleep in down stairs sleeping room Charlie’s “four fingers” of sipping whisky Charlie falls asleep while smoking</td>
</tr>
<tr>
<td>Event</td>
<td>Charlie / Debbie asleep downstairs Smoke alarms never tested</td>
<td>Leaked kerosene Charlie’s cigar ignites leaked kerosene on carpet then drapes</td>
<td>Charlie’s clutter in the parlor–add to fire load Threadbare carpets and drapes Exposed joists and floor</td>
<td>False sense of security Smoke alarms fail to alert Charlie or Debbie</td>
</tr>
<tr>
<td>Post-event</td>
<td>Children do not consider alternatives to exit bedroom onto porch roof then to ground Debbie goes back in the house to save children</td>
<td>Smoke inhalation Second floor joists and flooring loose ability to support weight of people</td>
<td>House fully engulfed in flames and collapses with Charlie, Debbie and children inside</td>
<td>Uncle Charlie devastated Naomi and Rachel—loss of mother Debbie DEAD</td>
</tr>
</tbody>
</table>

Injury Phase by Factors Matrix for Uncle Charlie’s House.
Appendix B

Uncle Charlie’s Christmas

This is a story about an older rural resident and a tragedy that involved him, his niece and her two children.

Instructions

Get together with two or three of your friends. Then read the story and answer the questions that appear in the story.

Mark your answers on the answer sheet. Please don’t write in the problem booklet. After you have selected your answers to a question, discuss your choices with your friends, but please don’t change your answers. Continue reading the story while answering and discussing the questions.

When you finish the story, ask the instructor for a copy of the answer key. Compare your answers to those in the key. Discuss the story and answers with your friends and the instructor but please don’t change your answers. When you finish, complete the questionnaire attached to the answer sheet. Give the booklet and the completed answer sheet to the instructor. Your answers will be used to improve the exercise. Thanks!

Background

Charlie is retired, 69 years old and lives in a rural part of the state about ten miles from the nearest town. He lives alone in the same house that has been in the family for eighty years. Charlie’s grandfather wired the electric for the house in 1940. There are only three electrical outlets (wall plugs) in the house. All are on the first floor. Charlie’s best friend Danny lives 3 miles away. Danny collects junk and garage sale items to sell at a local flea market.

1 Developed by William Goetz with supervision from Henry Cole
Charlie’s house is a two story brick and frame construction. It has masonry walls and stone fireplaces on each end and frame construction in between. The fire places have not been used for the last 20 years and are in poor condition. There is a first floor covered porch on the back of the house. Because the house has no basement, Charlie stores chain saws, gasoline cans, old tires and scrap lumber under the back porch. The house floor plan is shown in Figure 1.

Charlie has replaced the original wood-burning cooking stove with a propane unit. He also uses propane to run a gas wall heater in the upstairs bedroom and a second wall heater in the sleeping room next to the kitchen. There is no heat in any of the other rooms.

![Figure 1: Floor plan for the first and second floors of Uncle Charlie’s house](image)

Charlie has a couch in the parlor next to the window and the only electrical outlet in that room. A table lamp, a small radio, and an ash tray sit on a small table next to the couch near the window. The radio and the table lamp are plugged into the outlet. Their electrical cords are old, brittle and cracked. The window curtains his mother made 30 years ago are still hanging on the window and brush against the table. The curtains are falling apart.

In the evening when he is done with chores Charlie sits on the couch near the lamp, reads his mail and the newspaper, smokes his cigars, and often falls asleep. There is a pile of old envelopes and newspapers on the floor at the end of the couch near the table and curtain. The carpet on the floor is old, worn, and ragged.

**Question A**

What potential hazard does Charlie’s placement of his couch, table, radio, lamp and ashtray create?

1. As long as he plugs only the radio and the lamp into the wall outlet there is no potential hazard.
   
   [F – The cracked lamp and radio electrical cords could contact and create sparks that set the old curtains, newspapers, and carpet on fire.]
2. If he used a large ashtray there is no particular hazard.
   [F – Even with a large ashtray he could misplace the cigar. It could fall and start a fire.]

3. His house electrical system could be overloaded by having both the lamp and the radio on at the same time.
   [F – Having only the radio and the lamp plugged into this one outlet would not overload the circuit.]

4. The combination of the old curtains and newspapers being close to his ashtray is a major fire hazard.
   [T – A pile of flammable material is near both the cracked and brittle electrical cords and smoking materials in the ashtray.]

[After you have marked your answers, please continue with the story.]
Question B

It is the morning of December 24, Christmas Eve. Charlie is happy because his niece Debbie and her two children age four and six are coming to visit him mid-morning and stay overnight. Charlie plans to get a Christmas tree and put it in the unheated parlor. He worries that the parlor will be too cold for Debbie and the kids. What additional heat source should Charlie consider for the parlor? (For each item, circle T or F on the answer sheet.)

5. Borrow an old plug-in a 200 watt electrical heater with a fan from his neighbor Danny.
   [F – These types of electrical heaters typically draw 20 amps or more and would overload the electrical circuit.]

6. Run a new propane gas line for a new wall heater.
   [T – This is the safest choice, but it will take time, effort and money. First he would have to find and buy a wall heater and additional gas line. Then he would have to install the heater and test the heater and gas lines for leaks. He doesn’t have time to complete this work before Debbie and her kids arrive.]

7. Get a used kerosene heater.
   [F – Kerosene is highly flammable. It can be spilled when filling the heater, or leak from the heater tank. If so the carpet could act like a wick. In addition, unless properly maintained the heater could produce deadly carbon monoxide (CO).]

[After you have marked your answers, please continue with the story.]
Question C

Charlie drives over to see his neighbor. Danny says, “I’ve got an old but good Kerosene heater you can have for $15.00.” What are some possible problems associated with Charlie’s buying and using the heater in the parlor?

_**T**_ F 9. The heater can be knocked over easily by Debbie’s kids. The kids also could be burned by the heater.

_**T**_ F 10. The old heater may be in poor condition produce smoke and deadly carbon monoxide (CO) gas.
[T – If the wick is in poor condition incomplete combustion may produce soot and deadly carbon monoxide gas that has no odor or color.]

_**T**_ F 11. Charlie could spill kerosene while fueling the heater or the old heater tank could leak.
[T – Both are possible. This old style heater has no drip pan. Any spilled or leaking kerosene will soak into the carpet.]

_**T**_ F 12. As long as Charlie is careful and sets the heater out of the way there is no problem.
[F – There are many potential fire hazards associated with using this old style heater in his house.]

[After you have marked your answers, please continue with the story.]
Question D

While at Danny’s garage Charlie spies a carton of smoke alarms. They look band new and are in their original boxes. Charlie buys a smoke alarm because it costs only $2.50. Given what you know about Charlie and his house should he buy a smoke alarm?

15. He doesn’t really need a smoke alarm. Charlie has lived in the house for a long time and never had a fire.
   [F – Many residents of old rural homes think they don’t need smoke alarms. However fires in old poorly maintained old homes are common. Smoke alarms save lives by alerting people while escape is still possible.]

16. Yes. All he needs to do is to take the smoke alarm home, take it out of the box and install it in his home. He will then be protected.
   [F – Getting a smoke alarm is a good idea but there are other things he needs to do.]

17. Before purchasing and installing the smoke alarm he should open the box and push the test button.
   [T – If a charged battery is installed and the smoke detector is functional, the alarm will sound. If the alarm does not sound either the battery is dead or the smoke detector is broken. When a new battery is installed and the test button pushed the alarm should sound.]

[After you have marked your answers, please continue with the story.]
Question E

Charlie decides to buy and install the smoke alarm. How many smoke alarms does he need and where should they be placed?

T  F  18. Only one smoke alarm is needed. It can be placed anywhere in his house.
[F – One alarm is better than none but not the best option. Proper placement of the alarm is important.]

T  F  19. Only one smoke alarm if it is placed in the parlor.
[F – It would be a good idea to have a smoke alarm in the parlor where there is fire hazard, but fires also frequently start in kitchens, bedrooms, and elsewhere.]

T  F  20. The best arrangement is to have three smoke alarms, one in the parlor, one in the kitchen, and one in the upstairs bedroom.
[T – This is provides the best protection because there is one alarm on each floor, one alarm near each heat source, and one alarm in each sleeping area. People often die from smoke inhalation and carbon monoxide poisoning without ever waking up when there is only a smoldering fire and no visible flame. A functioning smoke alarm that sounds at the first wisps of smoke wakes people and saves lives.]

[After you have marked your answers, please continue with the story.]
Question F

Charlie buys the smoke alarm. He thinks a good place for it is on the parlor wall opposite the kitchen door. Before he installs the smoke alarm what else should he do?

T F 21. Nothing else is necessary. These things are ready to go.  
[F – He needs to do something else.]

T F 22. Check to see if a battery is installed.  
[T – Correct. However, the battery may be dead. If so it must be replaced.]

T F 23. Turn the alarm on and then it is ready to go.  
[F – He needs to do something else.]

T F 24. Push the alarm test button.  
[T – If a new battery is installed and the test button is pushed, the alarm will sound. It is does not sound when a new battery is installed the alarm is defective and should be discarded.]

T F 25. Once Charlie has installed the smoke alarm and it is working he doesn’t need to worry about it for two or three years.  
[F – Although a battery may last a year or so, he should conduct a maintenance procedure a couple of times a year by installing a new battery and pushing the “test” button. Some smoke detectors “chirp” when the battery is low. A good plan is to change the battery when daylight savings time starts in the spring and stops in the fall.]

[After you have marked your answers, please continue with the story.]
Question G

Charlie’s house and living areas are cluttered and poorly maintained. Which of the following problems increase the risk of a structure fire and may make escape from the fire more difficult?

T  F  26. His house is cluttered with old cardboard boxes, piles of old clothing, newspapers, and magazines piled on the kitchen counter top and table and stacked along the sides of rooms and on the sides of the stairs to the second floor.

[T – All of these items are flammable that if ignited will accelerate a structure fire. In addition, the presence of such clutter slows and makes escape from a fire much more difficult. The flammable materials stored on the stairs to the second floor are particularly dangerous because if ignited the stairwell would act as a chimney. The flames and smoke will rush up the stairwell making escape impossible.]

T  F  27. The outsides walls of his house are surrounded by large clusters of tall dead weeds and dried grass and assorted piles of junk that lying up against the weathered wooden siding.

[T – A discarded cigar or cigarette, match, or an exhaust from a lawn mower or other heat source could ignite the dried weeds, grass and junk. The wooden siding would quickly catch on fire.]

T  F  28. The gasoline cans, chainsaws, old tires, and scrap lumber that Charlie keeps under the back porch.

[T – If ignited these materials will burn very rapidly and quickly and ignite the back porch. Escape from the house by the back door would become impossible.]

T  F  29. Three years ago the house roof leaked. As a result a large section of the parlor plaster ceiling fell down leaving the old wood lathe exposed as well as the wooden beams and boards of the upstairs floor. Charlie repaired the roof but not the parlor ceiling.

[T – Even a small fire in the parlor could quickly ignite the dry wooden lathe and upstairs floor beams and floor boards and rapidly spread to the upstairs rooms.]

[After you have marked your answers, please continue with the story.]
Question H
Because the smoke alarm is new Charlie takes it out of the box and installs it on the parlor wall. He doesn’t check the battery or test the alarm. Just as he finishes Debbie arrives with her two children. Everyone is in the “Christmas spirit.” Charlie usually cuts his own Christmas tree but this year he, Debbie, and the kids, drive into town to the farm store. The store is closed, but a sign says, “Take any tree for $2.00. Drop your money in the door slot. Merry Christmas!” Charlie and Debbie love bargains. The pick the best looking of the three remaining cedar trees and put $2.00 in the door slot. The tree looks good but is a little “old” and dry. What are some potential problems with Charlie and Debbie’s bargain tree?

T  F  30. A dry cedar tree is highly flammable and easily ignited.
[T - The pleasant odor of the tree is from resins in the needles and wood. The resins are highly flammable, especially when the tree is very dry.]

T  F  31. Old fashion Christmas tree lights like Charlie’s can ignite the tree.
[T – The insulation on the wires of these old lights often is brittle and cracked. The heat from the lights releases the tree’s resin. Even a slight spark from an electrical short can instantly ignite the tree.]

T  F  32. If ignited the entire tree will burst into flame nearly instantly and create a fire equivalent to burning a gallon or more of gasoline depending on the size of the tree.
[T – The total amount of resin in a dry cedar tree is spread throughout its needles and wood. The combined surface area of the needles is huge. When any one needle is ignited the fire spreads rapidly in an explosive manner to the rest of the tree and to any flammable materials near the tree.]

T  F  33. As long as the base of the tree is placed in a container of water there is no fire hazard.
[F – The sticky dried up pitch (resin) at the bottom of the tree prevents water from being drawn up the tree. It will remain dry and flammable.]

Debbie with the bargain cedar tree outside Charlie’s house

[After you have marked your answers, please continue with the story.]
Question 1

Charlie puts the tree in the corner of the parlor next to the window. When the curtains are drawn back anyone coming to the house can see the tree. After the lights, popcorn and paper chains the children made and other decorations are on the tree and the presents under the tree. Charlie exclaims, “What a wonderful sight!”

Look at the photo above and the Figure 1 first floor plan. The tree is at the end of the couch visible on the left and directly in front of the old window curtains. The front door to the house (not shown) is on the wall just to the left of the tree. The door to the kitchen and the stairs to the second floor are on the inside wall at the end of the couch opposite the tree. Directly over the tree is the place where the roof leaked and the ceiling plaster fell down three years ago. Are there any safety problems with where the tree is placed?

T  F  34. No. It doesn’t matter where the tree is placed. Any place in the parlor is OK.

[F – This is a poor choice. The window curtains brush against tree. The tree is close to the table with the ash tray, lamp, and radio as well as the old newspapers at the end of the couch where Charlie sits, smokes, and reads. If the tree caught fire it would compromise escape through the front door. It also would ignite the couch and spread to the cardboard boxes on the sides of the stairs to the second floor. The exposed wood lath, wooden beams and floor boards of the second floor that are visible where the ceiling plaster fell also could easily ignite.]

T  F  35. The safest place would be by the parlor fireplace.

[T – This places the tree away from Charlie’s smoking area making it less likely to be ignited. It also is away from the old dry curtains, the front door to the house, and the inside door to the kitchen and the stairs to the second floor. If the tree did catch on fire there would be more time to escape from upstairs by coming down the stairs and then going into the kitchen and out the back door or into he parlor and out the front door.]

[After you have marked your answers, please continue with the story.]
Question J

As the evening wears on the parlor becomes colder. Charlie brings the heater and kerosene can in from the porch. As he fills the heater he spills a little kerosene on the parlor carpet. Charlie tells Debbie, “That’s OK. It will dry by morning.” Then he lights the heater to warm the room. Everyone is warm and happy as they sit on the couch by the tree in the warm glow of the heater and Christmas tree lights. At bedtime, the children want to “camp out” in the upstairs bedroom that overlooks the back porch roof. Debbie agrees. Later she will go up later to “tuck them in” and then sleep in the spare bed in that same room.

Upstairs sleeping room overlooking the back porch

Debbie fixes Charlie some snacks and takes them to him in the parlor. Then she goes to the kitchen to finish some last minute wrapping. She would like to call her Mom but the old phone in the kitchen is not working. When all the presents are wrapped and tagged she sits at the table reading a magazine. The room is warm. She slowly dozes off.

In the parlor as the chill deepens Charlie moves the kerosene heater close to the couch, where he is sitting with his feet up. Charlie doesn’t drink alcohol very often but likes his “sipping whiskey” on special occasions like this. He pours “three fingers” of whiskey into a tumbler, sits back on the couch and lights one of his cigars. As Charlie settles in on the couch to reminisce about Christmas’ pasts he places his lit cigar in the ashtray. Soon his is very relaxed and sleepy.

What is wrong with this scene?

<p>| | | |</p>
<table>
<thead>
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</thead>
<tbody>
<tr>
<td>T</td>
<td>F</td>
<td>36. Charlie could misplace the cigar and it could fall and start a fire. [T – If so it could easily ignite the carpet, papers, curtains and tree.]</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>37. If placed securely in the ashtray the cigar would not fall and start a fire. [F – As the lit end burns down the weight of the other end can tip and the cigar then falls out of the ashtray onto the floor and start a fire.]</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>38. Smoking while drinking alcohol greatly increases the risk of structure fires. [T – Many fires result from persons who are intoxicated from alcohol or drugs when smoking materials ignite bedding or furniture.]</td>
</tr>
</tbody>
</table>

[After you have marked your answers, please continue with the story.]
Question G

At 11:20 PM Charlie falls asleep. The cigar continues to burn in the ashtray. At 11:25 with the lit end burned to ash the cigar falls out of the ashtray. As it hits the floor sparks fly and the old carpet begins to smolder. A puff of air from the drafty window fans the sparks. At 11:28 flames appear and spread to the area where the kerosene was spilled. The fire spreads rapidly toward both the kitchen door and the Christmas tree. The paper wrappings on the gifts under the tree ignite. Instantly the entire tree explodes in flame igniting the window curtains and the papers at the end of the couch. The papers under the couch and cardboard boxes along the wall at the opposite end of the couch start on fire. The fabric on the couch begins to smolder and burn Three minutes later at 11:31 a wall of flames separates Charlie from the kitchen door.

At 11:33 Debbie while still sleeping with her head on the kitchen table wakes us. She hears a roaring and crackling sound and sees and smells smoke coming under the door to the parlor. She opens the door only a crack. She can’t see the couch because of the smoke and flame. She yells to Charlie but can’t see or hear him. Forced back by the heat smoke she closes the door and yells to Charlie. Then she runs out the back door. She sees Uncle Charlie as he runs around the corner. He is coughing and out of breath. He points up to the windows above the back porch. Debbie turns and sees her two kids standing at the window. They are crying and trying to open the window but it is stuck. It is now 11:34. What should Debbie do now?

T  F  39. Yell to her kids to break open the window and climb onto the back porch and jump down to her.
   [F – The kids may not be able to hear or understand Debbie.]

T  F  40. Run back into the kitchen and crack open the door to the parlor to check on the fire.
   [F – Dangerous! The flames and smoke will rush into the kitchen and up the stairs to the bedroom where the children are.]

T  F  41. Tell Uncle Charlie to wait by the porch and catch the two kids if she puts them out the window onto the porch roof.
   [T – This may be the only way out of the fire comes into the kitchen and up the stairs]

T  F  42. Leave the door to the parlor closed. Then run up the stairs to the bedroom grab her two children and get them out of the house.
   [T – This is the best option, but she must hurry before the fire spreads to the stairway. If she delays even a few seconds the fire may advance up the stairway and trap both her and her two children.]

[After you have marked your answers, please continue with the story.]
Debbie enters the kitchen from the back porch. She sees the door to the parlor is still closed. There is a lot of smoke in the stairwell but no fire. She runs up the stairs to the bedroom. Her two kids meet her at the top of the stairs and grab her legs. She drags them to the window and tries to force it open. It won’t budge. She breaks out the glass with her shoe. She puts both kids on the roof and tells them to jump down to Uncle Charlie. The kids scramble to the edge of the roof and jump down. Just as Debbie puts one foot out the window there is a terrific roar as a ball of fire and smoke flashes up the stairs and engulfs the entire bedroom. Debbie falls back into the room. The children and Uncle Charlie call to her but she doesn’t answer and they can’t see her. What should Uncle Charlie do now?

T  F  43. Immediately move the kids away from the house and the fire. Then run back into the kitchen and up the stairs to rescue Debbie.
[F – It is too late to rescue Debbie. If he tries to do so he also will be injured or die. This action will place the children at risk of injury or death either from the fire or from the cold.]

T  F  44. Move the kids well away from the house. Put them in his truck and get in with them while starting the truck and moving it away from the house.
[T – There is nothing he can do to save Debbie or his house. The best he can do is to comfort and keep her kids safe and warm.]

T  F  45. Break the window in Debbie’s car. Get her cell phone and call 911.
[T – There is nothing he can do to save Debbie or his house. By calling 911 he will alert both the fire department and other officials who will be needed to help him and the two children.

[After you have marked your answers, please continue with the story.]

Something to think about.

Only 15 minutes after the initial sparks from the falling cigar ignited the fire, the entire house was enveloped in flame. (See the photo below.) Charlie called 911 on Debbie’s cell phone after breaking out her car window. When the volunteer fire company arrived 20 minutes later the roof and upper floor had collapsed onto the ground floor. The cold dry weather and the winter wind in combination with the accumulated clutter in the house and its old dry wood construction resulted in a very rapid, hot and deadly fire.

Had Charlie’s smoke detector worked, he and Debbie would have been awakened. All could have escaped easily. Had he not drunk a large amount of alcohol he might have awakened at the first smell of smoke and might even have been able to put out the initial
small fire in the carpet before it ignited the Christmas present wrappings and the Christmas tree.

Had Charlie and Debbie and the kids discussed and planned an escape route from a potential fire, and selected a meeting place outside of the house, that too may have made a difference and saved Debbie’s life. For example, a better choice related to the children’s safety would have been to have them bed down in the sleeping room on the first floor just off the kitchen.

After you have marked your answer sheet, ask the instructor for a copy of the answer key. Check the answers and discuss any differences of opinions with your friends. Then read and discuss the short articles about rural residential fires found on the following pages.

When you have finished your discussion, please complete the questionnaire attached to your answer sheet. Give your completed answer sheet and questionnaire to the person who is conducting the class session or meeting.
Appendix C – C1

Demographic: Rural Fire Survey & Questionnaire

SECTION 1

1. *Have you or anyone in your household experienced a fire? Yes_1__ No_2__
2. *In your home? Yes_1__ No_2__
3. *Do you have a smoke alarm(s) installed in your home? Yes_1__ No_2__
4. Is there a smoke alarm outside the area where you sleep? Yes_1__ No_2__
5. How many alarms do you have? (number) ______
6. How many stories is your home? (number) ______
7. Is there a basement? Yes_1__ No_2__
8. Is there an attic? Yes_1__ No_2__
9. Do you have smoke alarms on each floor of your home? Yes_1__ No_2__
10. In the attic? Yes_1__ No_2__
11. In the basement? Yes_1__ No_2__
12. *Do you test the alarm(s)? Yes_1__ No_2__
13. How often? Every month_1__ Every 3 months_2__ twice a year_3__ Once a year_4__ Never_5__ I don’t know if they work ______
14. *Have you ever disabled a smoke alarm because the sound was annoying? Yes_1__ No_2__

SECTION 2

15. *Does your family have a fire escape plan? Yes_1__ No_2__
16. Have you ever practiced the escape plan with your family? Yes_1__ No_2__
17. Does your plan have a special meeting place outside the home?  
   Yes_1__ No_2__

18.* Is there a fire extinguisher in your home? Yes_1___ No_2___

SECTION 3

Tell us about your home.

19. Approximately how old is your home? (number) ______
   Wood construction with a brick veneer? ___1____
   Wood construction with wood or vinyl siding? __2___
   A brick constructed home? ___3__

20.* What type of heating unit does your home use?  
   Check all the kinds of heat sources your family uses.
   Heat pump_1__
   Gas furnace_2__
   Fuel Oil _3__
   Wood stove or fireplace_4__
   Electric wall heaters or electric space heaters_5__
   Kerosene heater(s)_6___

21. Are there weeds against your home that are not regularly removed?  
   Yes_1__ No_

22. Are there any building materials stored near, against, or under your  
   porch? Yes_1__ No_2__

24. How old is the electrical wiring in your home? (approximate number of years)  
   ______

25.* Do you do the electrical work and repairs in your home? Yes_1__  
   No_2__

SECTION 4

Tell us about you and your family.
26. Are you married? Yes _1_ No _2_

27. Single, widowed and/or divorce? Yes _1_ No _2_

28. Do you own or rent your home? Own _1_ Rent _2_

29. *Are there children living in the home? Yes _1_ No _2_

   Number of children age 5 or less ____

   Number of children aged 6-17 ____

29. Number of adults older than 64 years living in the home ____

30. *Are there people in your home with any of the following disabilities – vision loss, hearing loss, physically or mentally disabled, bedridden, wheelchair bound, uses a “walker”, pronounced forgetfulness or has arthritis/osteoporosis, alcohol, problems with prescriptive medications illegal substances? Yes _1_ No _2_

31. *Number of family members that smoke. ________

32. Is your household income above or below $20,000 per year?

   Above ___ Below ___

33. Is there at least one person in your family that finished high school or has some college education or a college degree? Yes _1_ No _2_

*Items embedded to measure fire risk exposure of household fire for respondents (see Appendix C-2 that follows).
Appendix C – C2

Demographic Data: Embedded Fire Risk Survey

Within the four sections of the demographic pre-measure are several items that serve as an embedded cohort survey that will give us insight into the respondents’ perceived risk and heightened awareness of a potential fire in their home.

1. Have you or anyone in your household experienced a fire? Yes____ No____

2. In your home? Yes____ No____

3. Do you have a smoke alarm(s) installed in your home? Yes_____ No_____

12. Do you test the alarm(s)? Yes_______ No_______

14. Have you ever disabled a smoke alarm because the sound was annoying? Yes_____ No_____

Section 2

15. Does your family have a fire escape plan? Yes_____ No_____

18. Is there a fire extinguisher in your home? Yes_____ No_____

Section 3

20. What type of supplemental heating unit does your home use?

Wood stove or fireplace____  
Fuel Oil furnace____  
Electric wall heaters or electric space heaters____  
Kerosene heater(s)____

Section 4

24. Are there children living in the home? Yes____ No____

25. Do you do the electrical work and repairs in your home? Yes_1__ No_2__

29. Are there children living in the home? Yes_1__ No_2__  
Number of children age 5 or less ______

Number of children aged 6-17 _____

30. Are there people in your home with disabilities – vision loss, hearing loss, physically or mentally disabled, bedridden, wheelchair bound, uses a “walker”, pronounced forgetfulness or has arthritis/osteoporosis or problems with prescriptive medications?

Yes____ No____

31. Do any of your family members that smoke? Yes____ No____
### Appendix D-D

**Thinking, Talking about and Acting Safely to Prevent Residential Fires and Fire-related Injuries**

This is a list of residential fire safety prevention and safety ideas you may have thought about, talked about, or did something about in the past month. Each item is one idea. There are three headings to the right of each of the 15 ideas. After you have read each idea, please mark an X in the box that tells how many times in the last month you thought about, talked about, or did something to prevent a possible residential fire injury to yourself or another person. When you finish each of the 15 ideas you should have only one X marked in each of the three columns, (thought, talked, did something). Thanks!

<table>
<thead>
<tr>
<th>{thought about the idea in the past month}</th>
<th>{talked to others about the idea in the past month}</th>
<th>{did something to prevent a possible injury in the past month}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times Not at all (0)</td>
<td>Times Not at all (0)</td>
<td>Times Not at all (0)</td>
</tr>
<tr>
<td>A few times (1-4)</td>
<td>A few times (1-4)</td>
<td>A few times (1-4)</td>
</tr>
<tr>
<td>Several times (5-10)</td>
<td>Several times (5-10)</td>
<td>Several times (5-10)</td>
</tr>
<tr>
<td>Many times (11 or more)</td>
<td>Many times (11 or more)</td>
<td>Many times (11 or more)</td>
</tr>
</tbody>
</table>

1. Your ideas that within the last month you have thought about, talked to others something about to prevent a possible fire-related injury to yourself or another family member.
2. A family member might be hurt by a fire in your home.
3. Accumulation of clutter in your home is a fire hazard.
4. A bed or while drowsing on a couch can start a fire.
5. Smoke detectors save lives by alerting people to exit a home.
6. A family escape plan can save lives in case of a fire.
7. Fire can spread and trap sleeping family members.
8. Young children can complicate escape from a fire.
9. The idea to obtain and install smoke alarms in your home.
10. The idea to discuss and have family fire escape drills.
11. The idea increases with use of kerosene and electric heaters.
12. Or disabled people in a home complicates escape from fire.
13. Fire extinguisher in a home can save property and life.
14. Frayed electrical wires can cause a fire.
15. Iifications and alcohol can compromise escape from fires.
16. A meeting place outside the home in case of a fire.

When you finish making one X for how much you thought about, one X for how much you talked about, and one X that you did something about for each idea, please complete the following questions.

16. When you talk to people about these and similar ideas, to whom do you talk to? (Check all that apply): My friends My parents Grandparents Another family member Fire fighter Landlord Nurse Doctor Other person(s) (Please list ________________________________)

17. Have you ever had a fire in your home to which fire fighters responded? Yes No
18. Have you or anyone else living in your home ever have had to escape from a fire in your home? Yes No
19. If "Yes" to item 18 did anyone in your home have difficulty escaping from the home? Yes No
20. If "Yes" to item 18 please describe that person by checking the appropriate line. The persons was a Child Adolescent Young adult Older adult Disabled person Other
21. In what year were you born? _______________
22. What is your gender? Male or Female
Appendix D-D2  
Thinking, Talking about and Acting Safely to Prevent Residential Fires and Fire-related Injuries

This is a list of residential fire safety prevention and safety ideas you may have thought about, talked about, or did something about in the past two weeks. Each item is one idea. There are three headings to the right of each of the 15 ideas. After you have read each idea, please mark an X in the box that tells how many times in the last month you thought about, talked about, or did something to prevent a possible residential fire injury to yourself or another person. When you finish each of the 15 ideas you should have only one X marked in each of the three columns, (thought, talked, did something). Thanks!

<table>
<thead>
<tr>
<th>Item num.</th>
<th>Injury and safety ideas that within the last month you have thought about, talked to others about, or done something about to prevent a possible fire-related injury to yourself or another person.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>How you or a family member might be hurt by a fire in your home.</td>
</tr>
<tr>
<td>2.</td>
<td>How excessive accumulation of clutter in your home is a fire hazard.</td>
</tr>
<tr>
<td>3.</td>
<td>How smoking in bed or while drowsing on a couch can start a fire.</td>
</tr>
<tr>
<td>4.</td>
<td>How smoke detectors save lives by alerting people to exit a home.</td>
</tr>
<tr>
<td>5.</td>
<td>How having a family escape plan can save lives in case of a fire.</td>
</tr>
<tr>
<td>6.</td>
<td>How quickly a fire can spread and trap sleeping family members.</td>
</tr>
<tr>
<td>7.</td>
<td>How having young children can complicate escape from a fire.</td>
</tr>
<tr>
<td>8.</td>
<td>How it is a good idea to obtain and install smoke alarms in your home.</td>
</tr>
<tr>
<td>9.</td>
<td>How it is a good idea to discuss and have family fire escape drills.</td>
</tr>
<tr>
<td>10.</td>
<td>How risk of fire increases with use of kerosene and electric heaters.</td>
</tr>
<tr>
<td>11.</td>
<td>How older and/or disabled people in a home complicates escape from fire.</td>
</tr>
<tr>
<td>12.</td>
<td>How one or more fire extinguisher in a home can save property and life.</td>
</tr>
<tr>
<td>13.</td>
<td>How frayed and cracked electrical wires can cause a fire.###############################################################################</td>
</tr>
<tr>
<td>14.</td>
<td>How some medications and alcohol can compromise escape from fires.</td>
</tr>
<tr>
<td>15.</td>
<td>How to plan for a meeting place outside the home in case of a fire.</td>
</tr>
</tbody>
</table>

When you finish making one X for how much you thought about, one X for how much you talked about, and one X that you did something about for each idea, please complete the following questions.
Appendix D-D₃
Thinking, Talking about and Acting Safely to Prevent Residential Fires and Fire-related Injuries

This is a list of residential fire safety prevention and safety ideas you may have thought about, talked about, or did something about in the past month. Each item is one idea. There are three headings to the right of each of the 15 ideas. After you have read each idea, please mark an X in the box that tells how many times in the last month you thought about, talked about, or did something to prevent a possible residential fire injury to yourself or another person. When you finish each of the 15 ideas you should have only one X marked in each of the three columns, (thought, talked, did something). Thanks!

<table>
<thead>
<tr>
<th>Item num.</th>
<th>Injury and safety ideas that within the last month you have thought about, talked to others about, or done something about to prevent a possible fire-related injury to yourself or another person.</th>
<th>In the last six weeks, I thought about...</th>
<th>In the last six weeks, I talked about...</th>
<th>In the last six weeks, I did something about...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Not at all (0)</td>
<td>A few times (1-4)</td>
<td>Several times (5-10)</td>
</tr>
<tr>
<td>1.</td>
<td>How you or a family member might be hurt by a fire in your home.</td>
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<td></td>
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<tr>
<td>2.</td>
<td>How excessive accumulation of clutter in your home is a fire hazard.</td>
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<tr>
<td>3.</td>
<td>How smoking in bed or while drowsing on a couch can start a fire.</td>
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<td>4.</td>
<td>How smoke detectors save lives by alerting people to exit a home.</td>
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<td>How having a family escape plan can save lives in case of a fire.</td>
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<tr>
<td>7.</td>
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<td></td>
</tr>
<tr>
<td>13.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>How some medications and alcohol can compromise escape from fires.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>How to plan for a meeting place outside the home in case of a fire.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When you finish making one X for how much you thought about, one X for how much you talked about, and one X that you did something about for each idea, please complete the following questions.
Appendix E: IRB Protocol for Study

Initial Review

Approval Date: December 18, 2012
IRB Number: 11-0941-018

TO: William Goetz
Education Curriculum & Tests
3311 Mine Rd.
Lexington, KY 40516
Phone: (859) 312-3145

FROM: Chairperson/Vice Chairperson
Non-medical Institutional Review Board (IRB)

SUBJECT: Approval of Protocol Number 11-0941-018

DATE: December 20, 2011

On December 20, 2011, the Non-medical Institutional Review Board approved your protocol titled:

The Use of Simulations in Rural Residential Fire Prevention

Approval is effective from December 20, 2011, until December 18, 2012, and extends to any consent/assent form, overview letter, and/or phone script. If applicable, attach any IRB-approved consent/assent document(s) to be used when enrolling subjects. [Note: Subjects can only be enrolled using consent/assent forms which have a valid "IRB Approval" stamp unless signed waiver has been obtained from the IRB.] Prior to the end of this period, you will be sent a Continuation Review Request Form which must be completed and returned to the Office of Research Integrity so that the protocol can be reviewed and approved for the next period.

In implementing the research activities, you are responsible for complying with IRB decisions, conditions, and requirements. The research procedures should be implemented as approved by the IRB protocol. It is the principal investigator’s responsibility to ensure any changes desired for the research are submitted for review and approval by the IRB prior to implementation. Protocol changes made without prior IRB approval to alter apparent benefits to the subject(s) should be reported in writing immediately to the IRB. Furthermore, discontinue a study or cessation of a study is considered a change in the protocol’s status and therefore the IRB should be promptly notified in writing.

Use information describing investigator responsibilities after obtaining IRB approval, download and read the document "PI Guidance to Responsibilities, Qualifications, Records and Documentation of Human Subjects Research." (See the Office of Research Integrity’s Guidance on Policy Documents with web page [http://www.research.uc.edu/PolicyDocuments/Training/PI]). Additional information regarding IRB review, federal regulations, and institutional policies may be found through IRB’s website (http://www.research.uc.edu/). If you have questions, need additional information, or would like a paper copy of the above-mentioned document, contact the Office of Research Integrity at (859) 237-0928.

[Signature]
Chairperson/Vice Chairperson

[Date]
### Simulation Post-Use Evaluation Questions

<table>
<thead>
<tr>
<th>Questions</th>
<th>Not Very Likely 1</th>
<th>2</th>
<th>Maybe 3</th>
<th>4</th>
<th>Very Likely 5</th>
<th>Not Applicable 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The situation in the story could happen to me.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2. I learned nothing new from this exercise.</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>3. This exercise will help me remember the fire risks in my own home.</td>
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<td></td>
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<tr>
<td>4. Because of this exercise, I will take precautions when using any form of supplemental heat in my home.</td>
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<tr>
<td>5. Because of this exercise, I will encourage others to be aware of fire risks in their home.</td>
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</tr>
<tr>
<td>6. This exercise was too long.</td>
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<td></td>
<td></td>
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<tr>
<td>7. I liked doing this exercise.</td>
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<td></td>
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<tr>
<td>8. The written directions were easy to understand.</td>
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<tr>
<td>9. The pictures and drawings added to the exercise.</td>
<td></td>
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<tr>
<td>10. The story was easy to read.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>11. I had a chance to talk about the story and share my ideas.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. The story and the characters are realistic.</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>13. I will recommend that my friends will complete this exercise.</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>14. This was a freak accident.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Appendix G

Uncle Charlie’s Christmas

Answer Sheet

As you read the problem booklet, mark your answers in the boxes below. Circle a T or F in front of each answer number. Please don’t write in the problem booklet.

<table>
<thead>
<tr>
<th>Question A</th>
<th>Question B</th>
<th>Question C</th>
<th>Question D</th>
<th>Question E</th>
</tr>
</thead>
<tbody>
<tr>
<td>T F 4.</td>
<td></td>
<td>T F 12.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Question F</th>
<th>Questions G</th>
<th>Question H</th>
<th>Question I</th>
<th>Question J</th>
</tr>
</thead>
<tbody>
<tr>
<td>T F 25.</td>
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<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>Question K</th>
<th>Question L</th>
</tr>
</thead>
<tbody>
<tr>
<td>T F 39.</td>
<td>T F 42.</td>
</tr>
<tr>
<td>T F 40.</td>
<td>T F 43.</td>
</tr>
<tr>
<td>T F 41.</td>
<td>T F 44.</td>
</tr>
<tr>
<td>T F 42.</td>
<td></td>
</tr>
</tbody>
</table>
References


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VITA

WILLIAM C. GOETZ, WSO-CSM, CSHM

Professional Safety Engineer - Competent Person - Vocational Education Design

EDUCATION


PROFESSIONAL EXPERIENCE

Hatch Mott MacDonald 2011
Portland, OR – Port Authority – Safety Engineer

US DEPT. of ENERGY, FELLOWSHIP 2007-2009
University of Kentucky, College of Agriculture, Bio-System & Agricultural Engineering (BAE)

HEALTH & SAFETY CONSULTANT 1996-present

Compliance Technologies, LLC, Lexington, Kentucky, Current

Owner and principal consultant in health, safety, administration, and organizational management.

Adjunct Professor 2005
Environmental Sciences, Blue Grass Comm. & Technical College, Fall 2005

Allied Uniking 2002

equipment installation for Toyota Motor Manufacturing Indiana (Princeton IN).
Contract Safety.

Siemens Dematic International, Materials Handling Division (Louisville KY & Offenbach, Germany). 2000
Site Safety Manager

Williams Union Boiler, Steel Erection Division (Louisville KY & Nitro WV) 1999
Site Safety Manager

Senior Safety Engineer
   Design and Fabrication for Safety Modifications

Johns-Manville (Willow CA) 1999
   Safety consultant

3M Corporation (Minneapolis MN) 1996
   Expert Witness/Consultant respiratory protection products

HEALTH & SAFETY FIELD INVESTIGATOR 1992-1996
   Program and Training Development under Longshore Compensation Guidelines
   Occupational Health & Safety and Hygiene Training in maritime operations.

HEALTH & SAFETY FUND OF NORTH AMERICA 1990-1992
   Federal grants programs, Washington, D.C.
   Worked with contractor associations: conduct site research of problematic environmental, safety & health (EH&S), ergonomic and accident investigations, including adaptation of tools and design of appropriate mitigative training.

DIRECTOR, ASBESTOS ABATEMENT TRAINING PROGRAM 1988-1989
   A private grant program, Washington, D.C.
   Designed and implemented nationwide asbestos abatement training program.
QUALIFICATIONS

• Qualified EPA, OSHA (EH&S) NIOSH Health/Safety Trainer-60,000+ contact hours (ISO 9000/14000)
• OSHA Industrial Hygiene (OH&S) Trained
• Ergonomic / Risk evaluation and management
• Customized site-based training models around federal/state requirements
• Vocational Arts Instructor (KY)
• Emergency/ Critical Incident Protocol Evaluation – Planning - Training
• SIC Construction Engineer (Industrial Process Equipment Installation and Compliance with Ergonomic Design Criteria)
• Experienced Journeyman Maintenance Mechanic (Install, “Run In,” Alterations, Rigging)
• Recognized Industry “Competent Person”
• Negotiation, mediation, and conflict management
• Certified Safety Manager (Int’l and U.S.)
• Experienced in Practical Application of Existing Technologies
• Presentation skills: Public speaking, conference/ seminar design, graphic and video presentations
• Qualified Job Site Drug Screening Technician
USE OF SIMULATIONS IN RURAL FIRE PREVENTION

PRESENTATIONS & PAPERS


Primary Presenter, “Managing Vital Performance and Safety Through Critical Work Activities,”

WSO, World Congress on Safety Education, Waco TX, 2000. A joint presentation with Liberty Mutual Insurance, USA.


PROFESSIONAL CERTIFICATIONS & MEMBERSHIPS

Certified Safety Manager, WSO (#1053).
Certified Safety & Health Manager; Institute for Safety and Health Management, USA (#1627).
Affiliate Member, World Safety Organization (WSO), a United Nations Category II Consulting Organization, Social and Economic Committee (#015518).
Member, National Safety Management Society, Bethesda MD (#8184 1001 R).

ADDITIONAL EXPERIENCE

- Safety Management, 89 hours, Independent Study, Western States University for Prof. Studies (WSO)
- Respiratory Protection Instructor Training, Georgia Tech University.
- Nuclear Asbestos Abatement Training, US Department of Energy, Hanford WA.
- Industrial Abatement Supervisor Training, Environmental Institute.
- Sampling Airborne Asbestos Dust Training Program, NIOSH #582.
- U.S. Department of Labor OSHA Training #521, Industrial Hygiene.
- Qualified Instructor, Hazardous Waste Worker Training, University of Illinois.
- Accredited AHERA Inspector, U.S. Environmental Protection Agency (EPA).
- Licensed Asbestos Abatement Supervisor, New York NY.
- Licensed Lead Abatement Supervisor, Commonwealth of Massachusetts.
- Mobile Crane Safety & Operation, (ANSI B30.5) Crane Institute of America, Inc.
- Certified Arc, MIG & TIG Welder.
- Qualified Fork Truck Instructor & Licensed Operator, OSHA.
- Qualified Aerial Lift Instructor & Licensed Operator (single arm & platform lift).
- Qualified & Licensed in Power Rigging, OSHA.
- Qualified Construction Safety Instructor, OSHA #500 (10 hour & 30 hour).
- Qualified Industrial Safety Instructor, OHSA #501 (10 hour & 30 hour).
- Qualified Combustion Turbine Technician – Siemens/Westinghouse – General Electric
- Accredited Instructor, Asbestos Abatement, Commonwealth of Kentucky
- Accredited Instructor, Lead Abatement, Commonwealth of Kentucky
- Accredited Instructor, Water Treatment, EPA/California Water Program, No. I 706
- Qualified Ergonometer – OSHA #2250
- University of Kentucky Lean Manufacturing Institute Training
- Eastern Kentucky University Fire & Rescue – Basic Fire & Rescue Training
- Green River Fire Association – arson investigation training – fire service safety and health