Evaluating Instructional Efficiency in a National Response Plan Training Course

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Certification Statement

I hereby certify this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed_____
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Abstract

In 2006 the Golden Fire Department (GFD) training division was tasked with efficiently training first responders in the National Response Plan (NRP). The problem was the efficiency of a two-hour Electronic Student Response Technology (ESRT) course had not been compared to the recommended four-hour Direct Instruction (DI) course for teaching the NRP. The purpose of this investigation was to compare instructional efficiency through evaluative research. A level of significance of 0.05 was selected to test three null hypotheses. The assessment tool was a standardized NRP examination. All Golden firefighters (N=64) were randomly assigned to control and treatment groups, instructed, assessed, and data was analyzed. Statistically significant results suggested ESRT instruction was more efficient. Further evaluative research on instructional strategies, communication of the results of this experiment to others, and elevating this study to Level III research is recommended.

Table of Contents

List of Figures

List of Tables

Introduction

The *9/11 Commission Report*, published by the National Commission on Terrorist Attacks Upon the United States (2004), contains the summary statement, "Our detailed recommendations are designed to fit together. Their purpose is clear: to build unity of effort across the U.S. government. As one official now serving on the front lines overseas put it to us: 'One fight, one team' " (¶116). In support of a unified effort, the National Response Plan (NRP) "establishes a unified and standardized approach within the United States for protecting citizens and managing homeland security incidents" (Department of Homeland Security, 2005a, ¶ 3). The NRP's genesis, Homeland Security Presidential Directive 5 (HSPD-5), also produced the National Incident Management System (NIMS) (White House, 2003a). The NRP was published in June of 2005, and the training strategy for Colorado responders was distributed through the document *State of Colorado: Training Needs Assessment -2006* (State of Colorado, 2006). The document stated, "HB [House Bill] 02-1315 added the requirement that the Division [Colorado Division of Fire Safety] coordinate all training related to terrorism with the Office of Preparedness, Security, and Fire Safety" (p. 9). This placed the Colorado Fire Service in a leadership role to provide NRP training.

The Golden Fire Department (GFD) is an emergency response agency that falls under the training mandates of the State of Colorado. The GFD training division has been assigned the lead role for NRP training of all GFD firefighters, and those with potential emergency response responsibility within the city, by City Manager M. Bestor (personal communication, June 1, 2006). When discussing NIMS and NRP training, the Chief of GFD (J. E. Bales, personal communication, May 18, 2006) stated, "Golden Fire has received over $300,000 in grants in recent years, and our compliance with Presidential Directives is essential to remain eligible for

future grants. Training our firefighters, and all City of Golden responders, in the NRP is an extension of this commitment." Additional funding, training time, resources, or personnel do not accompany the increased training responsibility. This has created a challenge for the GFD training division.

Previous investigations by this researcher focused on the instructional methods used by the GFD training division to train firefighters. Direct Instruction (DI), the same method suggested by the State of Colorado for NRP training, was identified as the primary methodology used to train firefighters (Milan, 2003). In a 2005 Applied Research Project (ARP) by this researcher, the effectiveness of using Electronic Student Response Technology (ESRT) in an introductory NIMS course was compared to DI. Through evaluative research, statistically significant differences in posttest scores were achieved by firefighters using ESRT, when compared to those taught with DI (Milan, 2005). However, the efficiency of ESRT as compared to DI has not been previously investigated with GFD firefighters.

As early as 1979, McCormack (1979) referenced the importance of fire training efficiency stating, "Making our instructors more efficient makes the entire fire service more efficient" (p. 26). As with NIMS training in 2005, in 2006 the GFD training division is faced with an additional NRP training mandate, without an increase in available training time. Evaluating the efficiency of ESRT with GFD firefighters would assist the GFD training division with instructional strategy decision making. If statistically similar improvements on standardized posttest scores could be achieved in a shortened time frame using ESRT, more efficient learning would be demonstrated. The implication for GFD is that an efficient use of training time equals more time to meet the new training mandates.

The problem is the efficiency of a two-hour Electronic Student Response Technology (ESRT) course has not been compared to a four-hour Direct Instruction (DI) course to teach an introductory NRP course. The purpose of this Applied Research Project is to compare the efficiency of a two-hour ESRT with a four-hour DI course to teach an introductory NRP course. Evaluative research, using a true experimental design, is envisioned for this ARP. Three null hypotheses to be tested using the Pretest Posttest Control Group Experiment Design are:

Null hypothesis number one; There is no significant difference in the means of posttest scores, of randomly assigned firefighters, on a standardized National Response Plan assessment between a two-hour Electronic Student Response Technology and a four-hour Direct Instruction course.

Null hypothesis number two; There is no significant difference in the means of posttest scores, of randomly assigned firefighters, on a standardized National Response Plan assessment between a two-hour Electronic Student Response Technology and a four-hour Direct Instruction course after adjusting for differences in the pretest scores of subjects.

Null hypothesis number three; There is no significant difference between the slopes of the regression lines for each of the two groups (a two-hour Electronic Student Response Technology and a four-hour Direct Instruction course) considered separately, and the slope of the overall within group's regression.

The entire population of firefighters serving Golden, Colorado (N=64) will be randomly assigned into two groups, an experimental group receiving the two-hour ESRT course, and a control group receiving the suggested four-hour DI course. All firefighters will be pre-tested on their knowledge of the NRP prior to administering the treatment. The content and assessments

are those supplied by the State of Colorado for teaching the National Response Plan, and will be the same for both groups. A true experiment design, the Pretest-Posttest Control Group Design will be used for the investigation. The independent variable will be the length of instruction time, i.e. two-hour ESRT versus four-hour DI. The recommended DI method and time frame of four hours will serve as the control group. A two-hour ESRT course will serve as the experimental group. The performance on a standardized assessment is the dependent variable. To adjust for possible differences in pre-course knowledge, the covariate will be performance on a standardized pretest. The Federal Emergency Management Agency (FEMA) IS-800 (2006) assessment will be used for both the pre and posttest. This test is reproduced with permission in Appendix A. Data collected will be analyzed using analysis of variance (ANOVA), analysis of covariance (ANCOVA), and analysis of regression.

Johnson (2004), the managing editor of *Training Magazine*, stated, "Combining technology and education is an investment, and we have to justify that investment" (p. 40). This ARP, using evaluative research, will assist the GFD training division in making informed decisions about ESRT, and to consider whether or not ESRT is efficient as well as effective for training first responders. ESRT is a technological approach to learning.

Background and Significance

Golden, Colorado is a community of over 17,000 residents, and is considered a suburb of Denver, Colorado (City of Golden, 2006). W. Miderhoff, in the Golden Office of Emergency Management (personal communication, August 29, 2006) reports that the city has complied with HSPD-5 by adopting NIMS through formal resolution and training all first responders in incident command and NIMS. In 2003, seven facilities in the City of Golden were identified as critical infrastructure. The Federal program which was the impetus for analyzing infrastructure was

Operation Liberty Shield. The White House (2003b) explains this program as, "A comprehensive national plan to protect the homeland in the current state of heightened alert" (¶ 4).

The leadership of GFD has chosen to train all firefighters in the NRP. Operations Chief J. K. Ferry (personal communication June 3, 2006) stated, "The reality is many members may fill the role of company officer and incident commander due to staffing challenges. Training all of our members in the NRP makes sense for our department." W. Miderhoff (personal communication, August 29, 2006) suggests Golden has the potential to be the genesis for an Incident of National Significance, based on the *Operation Liberty Shield* threat assessment that identified areas of large public assembly, financial centers, major transportation corridors, governmental facilities, and transcontinental energy distribution lines in the city. In the NRP, the Department of Homeland Security (2005a) explains, "An incident of national significance is described as an incident with high impact requiring an extensive and well-coordinated response by federal, state, local, tribal, and nongovernmental authorities to save lives, minimize damage, and provide the basis for long-term community and economic recovery" (¶ 9).

In addition to firefighters, the City of Golden has committed to training 68 other employees in the NRP. These individuals are potential first responders from other departments within the city, such as police and public works (P. Heimbach, personal communication, July 6, 2006). The Molson / Coors Brewing Company is a non-governmental organization located in Golden that contracts with the GFD for fire protection and emergency response training. Molson / Coors has requested training for 20 key employees in the NRP (K. Patton, personal communication, August 22, 2006). The responsibility for training 64 firefighters, and 88 additional individuals will impact the GFD training division. Identifying a more efficient method

of instruction could increase the amount of available time for GFD instructors to teach these additional courses.

In the past, ARPs by this researcher have identified and compared various instructional strategies in an effort to improve organizational effectiveness. In a 2003 ARP, Milan determined DI was the primary instructional method used to train firefighters. A 2004 survey revealed over 80% of GFD student firefighters believed ESRT improved their learning (Milan, 2004). When experimentally compared, ESRT showed a statistically significant improvement on test scores in an introductory NIMS course (Milan, 2005). Statistically, ERST was found to be more effective. However, presently the question remains as to whether ESRT is also a more efficient way of delivering training to Golden Firefighters. If it is found to be more efficient, i.e. the same learning could take place in less time, the future implications would be far reaching for the GFD training division. This ARP can assist in a decision making process concerning ESRT for training GFD first responders.

The subjects for this envisioned experiment are virtually the same as the participants included in the research on the effectiveness of ESRT in 2005, i.e. the entire population of firefighters serving the City of Golden, Colorado. This researcher is in a unique position to continue research with this group of learners using a similar experiment. V. Hastings, the President of the GFD Pension Board (personal communication, July 17, 2006) reported, “There have been retirements, resignations, and recruitment in the past year, however, the overwhelming majority of the personnel here today was here in 2005 and participated in the NIMS research.”

This ARP directly relates to the Executive Leadership Course presented at the National Fire Academy in April of 2006. The manual (Department of Homeland Security, 2005b) states that the course, “Examines contemporary public sector and fire service issues using a case study

approach to enhance the officer's ability to perform at the executive level" (p. iii). The pressing contemporary public sector issues at the present time are the implications of Homeland Security Presidential Directives, which increase the amount of training the GFD training division must complete, without an increase in overall training time. The contemporary fire service issue for the GFD is finding the most efficient method of delivering NRP training to Golden first responders.

The United States Fire Administration (2002) operational objective, "To respond appropriately in a timely manner to emergent issues" (¶1) is addressed by this ARP. The future impact of changes in training and education are emergent issues that can have a positive effect on the organizational effectiveness of GFD, and the fire service. Arizona State University professors Xavier and Spanias (1998) foreshadow the future of training stating:

> Education in the next century will rely more on a technology based distributed environment interacting through electronic courseware rather than the traditional classroom environment …research supports this trend and has shown overwhelmingly that classical non interactive lecturing is very ineffective. (¶ 2)

The use of ESRT is an emergent learning technology. The timely investigation of its effectiveness and efficiency with first responders is an issue worthy of evaluative research.

Literature Review

This review of literature included sources from the Learning Resource Center at the National Fire Academy, universities in the Denver metropolitan area, and the Internet. The review was limited to literature related to the title of this ARP, and this researcher focused on the findings of others regarding the National Response Plan, Electronic Student Response Technology, and evaluative research.

National Response Plan (NRP)

The City of Golden, Colorado has identified critical infrastructure using established federal criteria. W. Miderhoff (personal communication, August 29, 2006), a police sergeant in the Golden Office of Emergency Management, stated:

> In 1999, the Federal Government requested the City of Golden Police Department identify, through established criteria, a list of Key Assets and Critical Infrastructure located within the city limits. This list was completed and consisted of the following confidential locations….By identifying these seven facilities and developing an All Hazards approach to the Infrastructure, the Federal Government has made equipment grants available to the city. By subscribing to the Buffer Zone Protection Plan and National Infrastructure Protection Plan, the City of Golden has dedicated response efforts to fall in line with the national approach to Homeland Security, which includes the following Federal Documents: HSPD 3: Homeland Security Advisory System, HSPD 5: Management of Domestic Incidents (Initial NRP), HSPD 7: Critical Infrastructure Identification, Prioritization, and *HSPD* 8: National Preparedness, and the following Federal Initiatives; NIMS: National Incident Management System, NRP: National Response Plan, and NIPP: National Infrastructure Protection Plan.

Miederhoff further explained the decision to train all Golden public safety personnel, i.e. police and fire, as well as other key individuals, in the NRP.

> The first responders of the City of Golden, in order to have a functional and baseline understanding of the Federal response authorities must be trained to an awareness level of all Federal programs in which the City of Golden may become involved, in the event of a response to a Critical Infrastructure or Key Asset event within the city limits.

The descriptions and mandates identified in this research influenced this researcher to study the most efficient way to train Golden's first responders in the NRP.

The NRP and NIMS constitute similar subject matter, and fall within the cognitive domain of learning. Molino (2004) describes the relationship of the NRP and the National Incident Management System (NIMS). "The NRP and NIMS are inseparable; one sets the strategic tone (NRP), and the other sets an operational framework" (p. 33). Buchanan & Dana (2006) identify topics in the cognitive domain for fire service learners as: "Infectious disease control, Healthcare Insurance Portability and Accountability [HIPPA], and the National Incident Management System [NIMS] – all topics that we must master for one reason or another, but which require little or no skills based interaction" (p. 93).

The former director of the NIMS Integration Center, Bourne (2005), described the inconsistency responders encountered in the response to hurricanes that struck the Gulf Coast of the United States in 2005. "Many other emergency departments and government agencies did not [understand the NRP], with painfully apparent ramifications. Reports from the region revealed a series of questions as to who was in charge, what actions were being taken, and what the response should have been" (p. 47).

The transition from a response mindset to a preparedness mindset was referenced in the literature. Buckman (2005) articulates a paradigm shift the fire service is facing, "Everybody thinks of 'response' just as the red lights and sirens part, but in today's world response is really awareness, preparation, response, and recovery. That's what the NRP is all about" (p. 96). Giuliani (2002), the Mayor of New York City during the terrorist attacks of September 11th, 2001 stated, "Creating reasons for those who work for you to establish their own culture of preparedness is part of being a good leader" (p. 65).

Bevelacqua & Stilp (2002) discuss the importance of the NRP and NIMS for responders. "Understanding the complex interdependence between all agencies is an essential part of the response equation. Working together for a systematic multilayered response system, local, state, and federal agencies can make great strides" (pp. 8-9). Quinn, the executive director of Ottersurf Labs, an e-learning consulting firm in Walnut Creek, California, describes a phenomenon that occurs during critiques of interdisciplinary response. C. Quinn (personal communication, September 29. 2006) stated, "Yet in many cultures it is not OK to fail. You can't get them to talk about their mistakes."

In a comparison of state mandated training for emergency responders in the southeastern United States, Poulin eluded to a potential response problem. When presenting a paper at the annual meeting of the Southern Political Science Association in New Orleans, the year prior to Hurricane Katrina, Poulin (2004) stated, "Based on the identified discrepancies in mandated training requirements for firefighters, it seems clear that there will be difficulties in developing standardized federal and state emergency response plans that are applicable to all areas of the nation" (p. 12).

In conclusion, Poulin discussed the basic problem with one-size fits all approaches to emergency response. Poulin (2004) stated, "If state and federal planners fail to realistically appreciate the capabilities of local first responders, their plans may include unrealistic performance expectations" (p. 20). Poulin (2004) continued:

> If there is a perceived need for an operational capability, the training, funding, and support to develop that capability must be available, or that capability should not be counted upon….When it comes to the training of emergency responders, the federal and state governments must either mandate training requirements to develop the consistency

they seek, or re-tool their plans to control for inconsistency in response capabilities in differing localities. (pp. 21-22)

In summary, the literature review of the NRP focused first on the City of Golden, Colorado plan to instruct first responders; the review of literature influenced this researcher to investigate the integration of this local plan into a national template. Miderhoff identified the potential for Golden to spawn an incident of national significance. Leaders in the City of Golden articulated the reasons for NRP training, and discussed the unique aspects of response with a fire department comprised of volunteer and career staffing. The importance of an all hazards, all discipline approach was reviewed, with an emphasis on preparedness.

Electronic Student Response Technology

To paraphrase Shakespeare, a rose by any other name is still a rose. The ESRT technology discussed in this ARP, has a variety of nomenclature in the academic and training industries. For the purpose of this ARP, this researcher used Beatty (2004) for an operational definition of ESRT as the "combination of hardware and software – designed to support communication and interactivity in classes" (p. 2). In a review of the literature, the technology was referred to as Classroom Communication Systems (CCS), Student Response Technology (SRT), Group Response Systems, Clickers, and an Electronic Voting System.

Beatty (2004) described the historical trends of ESRT. In 1992-1999 the original system, Classtalk which was developed by a NASA engineer, used graphing calculators as student input devices in conjunction with a hard wired network. Beatty (2004) explained this expensive and cumbersome system was pushed out of the market by the current generation of technology that, "employs proprietary 'clickers' resembling a TV remote control to send infrared (IR) to receptors at the front of a classroom" (p. 3). Educause (2005), a nonprofit association which

promotes the intelligent use of information technology in education, reports that with ESRT the instructor can instantly display a histogram of class responses that "allows for active participation by all students and provides immediate feedback to the instructor, and the students, about any confusion or misunderstandings of the material being presented"(¶ 6). Beatty (2004) foreshadows the future of ESRT explaining:

> A third generation has now begun to appear. These systems are built from stock internet hardware, software, and protocols. They use laptop and tablet PCs and PDAs [personal digital assistants] as student input devices, Ethernet and 802.11 'wi-fi' wireless networks for connectivity, and Web browsers, HTTP, Java, and Microsoft .NET as a software base. (¶ 7)

Greer & Heaney (2004) discuss a benefit of teaching with ESRT stating the systems are "capable of assessing teaching and learning methods in real time, and they offer an exceptional means of introducing active learning protocols" (¶ 1). A more specific concept discussed by Greer & Heaney (2004) is:

> The instructor can gauge instantaneously what concepts students understand, and more important, which concepts they are failing to grasp. This feedback allows the teacher to spend less time on material that already has been processed in favor of focusing on the problem areas. (¶ 3)

Greer & Heaney (2004) summarize that ESRT, "allows the instructor to gauge student perception and understanding of a given topic in real time and to alter the lecture content accordingly" (¶ 9).

In two previous applied research projects, this researcher investigated ESRT in the context of training Golden, Colorado firefighters. Attitudes towards this technology were researched in *Investigation of the Classroom Communication System for the Golden Fire*

Department (2004). Twenty four student firefighters were surveyed after a 13 week recruit academy, during which the ESRT technology was used. Milan (2004) stated, "Less than 4% of those surveyed stated it interfered with learning, and 83% reported after using the system that the CCS [ESRT] helped them learn" (p. 64). This survey influenced and prompted this researcher to conduct evaluative research into the effectiveness of ESRT as an instructional methodology. Although the firefighters believed the technology helped them learn, there was no empirical evidence to support this belief.

A subsequent ARP entitled *Evaluation of Electronic Student Response Technology in an Introductory National Incident Management System Course* (2005) provided empirical evidence. A true experiment with the entire population of firefighters serving Golden, Colorado was conducted. Using the Solomon Four-Group Experiment Design, it was reported by Milan (2005), "There were significant differences in total achievement test scores observed between the experimental group which received the ESRT training program and the DI control group which did not. (F=38.56, which is significant at the <.0001 level)" (pp. 44-45).

The operational definition of Direct Instruction (DI) used for this ARP is described by Chick (1999) as:

> Mastery Learning, often called the direct instruction method, is highly structured through lesson designs. Direct Instruction materials are based on effective principles of instructional design and include explicit teaching of rules and strategies; sequencing of examples and nonexamples so that students learn concepts more quickly; and immediate correction and feedback-all of which have been researched and validated. (p. 86)

The training materials suggested for course delivery by the Colorado Division of Fire Safety clearly follow the DI model. *Adult Learning and Instructor Competencies,* published by

the Office of Domestic Preparedness (2004) and used in the train the trainer course for NRP instructors, recommends, “presenting single concepts and focusing on application of concepts to relevant practical situations” (p. AIC 23). T. Staples (personal communication, May 17, 2006), the Colorado Director of Fire Certification, stated, “The State of Colorado trains instructors to utilize a mastery learning model, and this model is evident in the NRP training materials handed down from DHS. ”

However, Hertelendy (2003) cautions:

> Traditional delivery methods, such as lectures, discussions, and demonstrations, often prove to be nothing more than informational sessions that present hollow facts. Students can often become bored or miss key information because they get too wrapped up in trying to feverishly copy down every word an instructor says. Most learning that occurs with lecture activities is based on memorizing facts and being able to recite them for a test. This is considered, by experts in learning theory, to be an inefficient method that doesn’t fit well with the adult learning model. (p. 42)

Gughelmino (as cited in Dolezalek, 2004) discusses the changing role of an instructor; “It is an awareness of how they can provide more choices to the learner and serve as a resource for learning as opposed to an information giver” (p. 34). In Take Time for Effective Learning, an article in *Training Magazine*, Albrecht (2006) concurs stating, “People don’t want theory, they want practical information they can use. Forget the lectures. People learn by doing. Throw the sage off stage. Make it fun” (p. 39). Rachel (2002) discusses assessment of adult learners; “The desirable assessment measure is demonstration of the ability to perform the learned material through a direct means, such as actually taking and printing a photograph, rather than an indirect means, such as taking a paper-pencil test on how to take and print a photograph” (p. 221).

None of the literature reviewed to this point addressed instructional efficiency, which prompted this researcher to look into the findings of others on this concept. In a US Department of Education study, Slavin (n.d.) stated, "Frequent assessment of student learning is critical for teachers to establish the most rapid instructional pace consistent with the preparedness and learning rate of all students" (¶12). Slavin continues, "Instructional efficiency can be conceptualized as the amount of learning per time. For example, students will learn more in a ten-minute lesson high in instructional efficiency than in a lesson of similar length low in instructional efficiency" (¶ 29).

In summary, ESRT is a technology that supports interactive learning. Classtalk, the original system put into use in 1992, used hardwired connections, was expensive, and was cumbersome. The system has evolved to the use of proprietary clickers, and the evolution of ESRT technology is predicted to continue. The use of ESRT has shown promise, and through previous research has been evaluated with Golden firefighters. The results showed a belief on the part of learners that ESRT improved learning, and this was validated through evaluative research by this author. The shift in role of instructor from disseminator of knowledge to facilitator of learning was cited in several sources, and influenced this researcher to select the ESRT interactive instructional strategy for this study.

Evaluative Research

This researcher investigated the three true experimental designs outlined in *Educational Research: Competencies for Analysis and Applications*. Gay and Airasian (2003) stated, "True experimental designs control for nearly all sources of internal and external validity…[and] have one characteristic in common, random assignment of participants to treatment groups…Notice too that all true designs have a control group" (p. 374).

A review of Gay and Airasian influenced this researcher to further investigate random assignment of subjects to control and treatment groups. Becker (2001) stated:

> If truly randomized experiments could be designed and conducted in education, then a researcher interested in assessing cognitive, or affective, domain outcomes of a given classroom treatment need only administer an achievement test or attitudinal survey at the end of the program to those randomly assigned to the treatment and the alternative. There would be no need for pre-treatment measures. (¶ 36)

Becker (2001) continues:

> Unfortunately no one has ever designed a perfect experiment; randomization is an idea better thought of in degree than absolute. The best we can do in social science research is to select the treatment and control groups so they are sharply distinct and yet could happen to anyone. (¶ 37)

A previous experiment by this researcher with GFD firefighters was completed in 2005 using the Solomon Four-Group Experiment Design, in which one half of the participants in the control and experimental groups were pre-tested. The reason for the random assignment to a pretest and the subsequent statistical analysis in this experiment design was suggested by Gay & Airasian (2003) to, "tell the researcher whether the treatment was effective and whether there is an interaction between the treatment and the pretest" (p. 376). The statistical analysis in this previous ARP showed the ESRT treatment was more effective and there was no interaction between the treatment and the pretest. Milan (2005) stated, "There were no significant differences in total achievement test scores observed between the experimental group that was pre-tested and the experimental group that was not pre-tested. (F= 0.42, which is insignificant at the .05 level.)" (p. 45).

The second experimental design considered was the Posttest Only Control Group Design. Gay & Airasian (2003) stated a caution for this design; "If there is any chance that the groups may be different with respect to pretreatment knowledge related to the dependent variable, the Pretest-Posttest Control Group Design should be used" (p. 377). This caution influenced this researcher to investigate possible differences in knowledge of the NRP. When asked about previous training, J.E. Bales (personal communication, May 22, 2006) stated, "GFD sent six firefighters to the Gulf Coast in 2005, all who were trained in NIMS and the NRP by FEMA. Additionally, approximately 20 percent of our firefighters are affiliated with wildland, USAR [Urban Search and Rescue], or incident management teams. The level of NRP training completed by these individuals is not part of the department records, and I suspect we have great variation in NRP training." Based on an inability to ensure homogeneity of the random samples, the Posttest Only Control Group Design was rejected by this researcher.

The Pretest-Posttest Control Group Design was selected for this Applied Research Project for important and relevant reasons. Primarily, the experiment is a true experimental design, rather than a quasi-experimental design. Miller (2004) reports, "Evidence of causality from quasi-experimental studies is weaker than evidence from randomized experiments" (p. 37). This researcher was in the position to randomly assign participants to a control and treatment group and manipulate the independent variables, namely the length of instruction time, i.e. two-hour ESRT or four-hour DI.

Secondly, the Pretest-Posttest Control Group Design controls for all sources of internal and external validity except pretest treatment interaction. The sources of invalidity are shown in Table 1.

Table 1

Sources of Invalidity

	Internal							External		
Designs	H	M	T	I	R	S	Mo	SI	PI	MI
	True Experimental Designs									
Pretest-Posttest	+	+	+	+	+	+	+	+	-	(+)
Posttest Only	+	+	(+)	(+)	(+)	+	-	-	(+)	(+)
Solomon 4-Group	+	+	+	+	+	+	+	+	+	(+)

Note: H=History, M=Maturation, T=Testing, I=Instrumentation, R=Regression, S=Selection, Mo=Mortality, SI= Selection Interaction, PI= Pretest-X Interaction, MI= Multiple-X Interaction, += factor controlled for, (+)= factor controlled for because not relevant, - = factor not controlled for. From *Educational Research; Competencies for Analysis and Applications* (p.375) by L.R. Gay and P Airasian, 2003, Upper Saddle River New Jersey: Prentice Hall. Copyright 2003 by Gay & Airasian, reprinted with permission.

The fact that a previous experiment, with similar content and virtually the same population, showed no pretest treatment interaction strongly influenced this researcher to select the Pretest-Posttest Control Group Design.

Rachel (2002), discussing the technical quandary of educational research comparing two distinct instructional methods, reported:

> The issue of whether a single facilitator conducts both treatments, as in Anaemena (1986), or separate facilitators each conduct one treatment, as in Clark (1991), is vexing. One facilitator for both treatments helps assure that personality variables do not confound the outcome since presumably the educator does not present herself as Dr. Jekyll in one setting and Ms. Hyde in another. However, a single facilitator for both treatments may exhibit some bias in favor of one treatment. By contrast, the use of two facilitators, one

> for each treatment, invites inevitable differences in personality, rigor or experience which might easily be more important than the facilitators teaching methods when it comes to outcome measures such as achievement. (p. 223)

This researcher was influenced by Rachel's findings to design an experiment where the same instructor is used for both control and treatment groups.

The definition of evaluative research is, "The systematic process of collecting and analyzing data in order to facilitate decision making" (Department of Homeland Security, 2003, II-26). Grossen (1996) provided the bottom line to evaluating new instructional techniques and technology in the statement, "Until an instructional practice has been implemented, evaluated, and found to produce better results than its alternatives, there is no research basis for recommending it" (p. 8).

A three level system for evaluating the evidence behind the statement "the research says" is summarized by Grossen (1996):

> Level I research is 'basic research' and theory building. Research at this level is comprised of correlations, descriptive data and qualitative case studies…At Level II, a theory of instructional practice is tested in the classroom to see if it is more effective than the alternatives. Do randomly assigned students actually perform at higher levels in classrooms that use the experimental teaching procedure? Using statistics, researchers analyze the data to determine if the results are accidental or can be predicted to occur again…Level III research evaluates the effects of the recommended teaching intervention using large-scale and school-and district-wide implementations. Research at this level is important because it examines the new intervention in full context. (p. 22)

Grossen's three level research classification system is shown in Figure 1.

Figure 1: The three level research classification system.

Education	Scientific method
Level I. Theory building	1. Develop a hypothesis
Level II. Test the theory	2. Test the hypothesis by formal experiment 3. Analyze data to determine the truth of the hypothesis
Level III. Replicate results in large scale studies and school/district wide implementations	4. Peer review, replication of the experiment, large scale and/or long term follow up studies

Note: From "Making Research Serve the Profession" by B. Grossen, 1996, *American Educator 20(3)* p.25.

The research classification system influenced this researcher to experimentally compare two identified instructional strategies, i.e. ESRT and DI, using Level II research.

In summary, regarding evaluative research for this ARP, three true experimental designs were investigated. This researcher was influenced to select the Pretest-Posttest Control Group Design based on the literature review. Techniques for comparing two instructional methods were discussed, and a three level classification for research was cited. Conducting Level II research was determined as an appropriate level for this research, based on the three level research classification system.

Procedures

This procedures section contains research methodology, including subtitles; the 13 step process; limitations and assumptions; and definition of terms for ambiguous concepts. The

subtitles for the research methodology are experimental design, definition of variables, data analyses, and null hypotheses.

Research Methodology

The desired outcome of this applied research project was to determine if two-hour ESRT instruction is more efficient than four-hour DI for teaching an introductory National Response Plan (NRP) course to Golden firefighters. A true experimental design was selected to determine whether any significant differences, in the means (averages) of groups receiving two different instructional strategies, were caused by the treatment or by other factors. If in fact there were significant differences found, the ESRT treatment could be recommended for implementation of future NRP courses.

The subject matter to be taught to both groups was based on the FEMA IS-800 Course. The State of Colorado issued content materials for teaching this course to groups. This researcher decided to teach one group using Direct Instruction strategies for the recommended four-hour delivery, and the second group using ESRT in a two-hour course. The goal was to determine whether or not randomly assigned subjects would perform equally, or at a significantly higher level, when they were taught in a shorter time period using ESRT. Analyzing data from posttest scores, after adjusting for differences in the pretest scores of subjects, would determine if the results were the result of chance, or if they could be predicted to occur again. The assumption was that if the ESRT experimental group scored equally or significantly higher than the DI group, they had learned the subject matter more efficiently than the control (DI) group.

The experimental design

This researcher relied heavily upon *Educational Research: Competencies for Analysis and Application* (2003) by Gay and Airasian to conceive and design the experiment for this ARP.

The Pretest-Posttest Control Group Design, previously described in the literature review, was selected to be the most logical true experimental design for this ARP. Theoretically, this design would show a cause-effect relationship because: the researcher was in a position of manipulating instructional time of the independent variables; randomization of both groups would control for non experimental variables; the ESRT group would receive the two-hour treatment and the DI group would not (DI was in effect a control group); randomization would occur at the same point in time for both groups; and measurement of both groups would be part of pre-established testing procedures for teaching this course.

According to Gay and Airasian (2003), the Pretest-Posttest Control Group Design controls for all sources of internal validity, and for one of the two sources of external invalidity. For internal validity, this design controls for history, maturation, testing, instrumentation, regression, selection, mortality, and selection interactions. For external validity, this design controls for multiple X (note: X=Treatment) interaction, but not for pretest X interaction. Randomization of both groups controls for non-experimental variables. The results from this experiment would have limits for external exportability due to two major reasons; the GFD is not representative of the total firefighter population, and the sample size is small (N=58).

Variables defined

Variables selected for this experimental design were the independent, dependent, and covariate variables. See Table 2 for the definition of the variables and their values.

Table 2

Definitions and Values of Variables

Variable	Definition	Value
Independent	1) Two-Hour ESRT	ESRT No DI
	2) Four-Hour Direct Instruction	DI No ESRT
Dependent	1) Posttest	Raw Scores on FEMA IS-800 Test (2006)
Covariate	1) Pretest	Raw Scores on FEMA IS-800 Test (2006)

Independent Variables: ESRT and DI.

There are two independent variables, ESRT and DI. The operational definition of the experimental group is a two-hour class for pre-tested firefighters. ESRT is used as the instructional strategy for the experimental group of firefighters. The operational definition of the control group is a four-hour class for pre-tested firefighters. DI is the instructional strategy used for the control group. Therefore, the values of the first independent variable are those who had ESRT and had no DI. The values for the second independent variable are those who had DI and no ESRT.

Dependent Variable: Standardized Posttest.

The value of the dependent variable is raw scores on the posttest. The operational definition of the dependent variable is the FEMA IS-800 test (2006). This researcher assumes that due to the wide intended use of this assessment for millions of responders by FEMA, this

test is indeed a valid assessment instrument.

Covariate Variable: Standardized Pretest.

The value of the covariate is raw scores on the pretest. The operational definition of the covariate variable is the FEMA IS-800 test (2006). This researcher hypothesizes that there may be potential preexisting differences among firefighters. Therefore along with random sampling, a study of covariance would provide a more accurate comparison of treatments by analyzing the pretest data.

Data Analysis

A one way analysis of variance (ANOVA) was selected for initial data analysis. This statistical analysis is widely used for testing hypotheses. As the name implies, this is a procedure that allows the researcher to examine the effect of an independent variable. The ANOVA procedure is a statistical approach to determine whether or not the means of the two groups are equal. Gay & Airasian (2003) stated, “Simple, or one way analysis of variance (ANOVA) is used to determine whether there is a significant difference between two or more means at a selected probability level” (p. 467). The F statistic is used to reject, or to fail to reject, the null hypothesis presented. A level of .05 or less is generally selected to determine the level of significance of the F statistic. Computations of sums of squares, degrees of freedom, and mean squares are made; the F ratio is calculated, and its level of significance is determined. A computer program may be used to calculate this information as well as a hand calculation. F statistics are useful for testing the level of significance of any differences found between the means, such as the means of the posttest scores of the two groups.

A one way analysis of covariance (ANCOVA) was selected for a secondary analysis. ANCOVA was selected to remove any preexisting variability that was due to preexisting

differences of the covariate pretest, and to adjust the means of the posttest to compensate for starting out with different means on the pretests. ANCOVA removes the total variability of the pretest scores from the posttest scores. The ANCOVA procedure is a statistical approach to determine whether or not the means of the two groups are equal after adjustments are made. Gay & Airasian (2003) stated, "The concept underlying ANOVA is that the total variation, or variance, of scores can be divided into two sources-variance between groups (variance caused by the treatment groups) and variance within groups (error variance)" (p. 467). As with ANOVA, the F statistic is used to reject, or to fail to reject, the null hypothesis presented. A level of .05 or less is generally selected to determine the level of significance of the F statistic. The basic one way ANCOVA which requires four sets of calculations is shown in Table 3.

Table 3

Analysis of Covariance (ANCOVA) Calculation

Step	Process
1	Calculates the ANOVA aspect of ANCOVA i.e. sum of squares values of posttests, variability of total group, within groups, and between groups sum of squares.
2	Calculates the covariate aspect of pretests i.e. sum of squares values of pretests-variability of total group and within (inside) groups sum of squares.
3	Calculates the measures of covariance for pretests and posttests i.e. the sum of co-deviates, which are the raw measure of covariance between pre and posttests by a) calculating the covariance of pre and posttests within the total array of data, and b) calculating the covariance within the groups.
4	The final set of calculations ties step 2 and step 3 together and removes from the posttests the portion of its variability due to the covariance with the pretests by a) calculating the adjustment of the sum of squares of the total posttests, b) calculating the adjustment of the sum of squares of the within groups of posttests, c) calculating the adjustment of the sum of squares of the between groups of posttests and d) calculating the adjustment of the means of the posttests for the ERST and DI groups. These calculations bring the pretest effects on the posttests under statistical control.

Note: From Concepts and Applications of Inferential Statistics by. R. Lowry, [Electronic version] Chapter 17, ¶4.

The F ratio is then calculated, and its level of significance is determined. A computer program may be used to calculate this information as well as a hand calculation.

The test for homogeneity of regressions was selected as the third and final data analysis procedure. A basic assumption of ANCOVA is that the slope of the two separate group's regression lines must not differ significantly from each other. If they do vary, the results of ANCOVA are not valid; therefore, this test must be conducted to satisfy the assumption of homogeneity of regression. Gay & Airasian (2003) explained, "Covariate analysis statistically adjusts the scores of method Y to remove the initial advantage so that the results at the end of the study can be fairly compared as if the two groups started equally" (p. 343). The sum of squares between regressions, remainder, and adjusted error are calculated; an F ratio is calculated; and a level of significance is determined. If any value of F is equal to or smaller than 1.0, the differences are not significant and the assumption of homogeneity is satisfied. A computer program may be used to calculate this information as well as a hand calculation.

Null Hypotheses

Null hypotheses stated for the purpose of this ARP data analysis are shown in Table 4:

Table 4

Null Hypotheses

Number	Null Hypothesis
One	There is no significant difference in the means of posttest scores, of randomly assigned firefighters, on a standardized National Response Plan assessment between a two-hour Electronic Student Response Technology and a four-hour Direct Instruction course.
Two	There is no significant difference in the means of posttest scores, of randomly assigned firefighters, on a standardized National Response Plan assessment between a two-hour Electronic Student Response Technology and a four-hour Direct Instruction course after adjusting for differences in the pretest scores of subjects.
Three	There is no significant difference between the slopes of the regression lines for each of the two groups (a two-hour Electronic Student Response Technology and a four-hour Direct Instruction course) considered separately, and the slope of the overall within groups regression.

The null hypotheses in this ARP are used to test whether there is a significant difference in the means (averages) of the two groups, i.e. two-hour ESRT and four-hour DI, on a posttest instrument, or a significant difference between the slopes of regression lines. If a null hypothesis is true, the difference between the means is due to random variability, not the treatment. In that case, the likelihood of ending up with an F ratio larger than critical F would be less than 5% (p=.05) (Rumsey, 2003).

13 Step Process

After a true experimental design was selected, the variables for the experiment were defined, appropriate statistical analyses were selected, and the null hypotheses were stated. A 13-step process was used to conduct this applied research project. The steps were generally sequential.

The first step was for this researcher to attend the State of Colorado train the trainer course and secure training materials for classroom delivery of the FEMA IS-800 course.

The second step was to randomly assign all Golden firefighters into two groups, one to receive four-hour DI and the other to receive two-hour ESRT instruction.

The third step was to administer a pretest to both of the groups one week prior to the classroom sessions to minimize a practice effect on the final test. All scores were tabulated and recorded.

The fourth step was to deliver the four-hour DI instruction to the control group and administer the posttest. The DI was delivered as prescribed by the State of Colorado, and this group served as the control group.

The fifth step was to deliver the two-hour ESRT classroom presentation to the experimental group and administer the posttest. The same materials used for DI were utilized; the time dedicated to each of the five modules of the course was modified based on the pre test results. For example, the lowest mean performance per module on the pretest received the highest amount of instructional time. Instruction was based on need versus. a predetermined instructional time. The ESRT group served as the experimental group.

The sixth step was to collect and format the data so appropriate analyses could be implemented. Table 5 shows the experimental design for the Pretest-Posttest Control Group design.

Table 5

The Pretest-Posttest Control Group Design

Random Group	Pretest	Treatment	Posttest
R	0	X1	0
R	0	X2	0

Note. *O = Outcome on test, X = Treatment.*

The seventh step was to compute a one way ANOVA, with the aid of a computer program and by hand, to verify the accuracy of the computer program. Basically this data analysis was done to determine whether there was a statistically significant difference between the means of the two treatment groups i.e. DI and ESRT on the posttests. The one way ANOVA design used is shown in Table 6.

Table 6:
One Way Analysis of Variance (ANOVA)

Source of Variance	*SS*	*df*	*MS*	*F*	*p*
Treatment [bg]					
Error [wg]					
Total					

Note: SS=sum of squares, *df*=degrees of freedom, *MS*=mean square, *F*=F Statistic, *p*=level of significance, *bg* = between groups, *wg*= within groups.

The customary significance level of .05 was selected to reject, or fail to reject the null hypothesis. The data was calculated using the Vassar Stats Computer Program (Lowry, 2006b).

The formulas for calculating the ANOVA by hand can be found in *Introduction to Statistics* (Anderson, Sweeney & Williams, 1991).

The eighth step was to analyze the data in order to determine the results for null hypothesis number one.

The ninth step was to compute the one way ANCOVA in order to remove the total variability of the pretest scores from the posttests, and then to focus on the remainder (the residual variance) following this removal. The data was calculated with the aid of a computer program and by hand. Basically this data analysis was done to determine whether there was a statistically significant difference (not due to chance) between the means of the two treatment groups i.e. DI and ESRT on the posttests after they were adjusted for the effects of the pretest. The one way ANCOVA design used is shown in Table 7.

Table 7:
One Way Analysis of Covariance (ANCOVA)

Source of Variance	*SS*	*df*	*MS*	*F*	*p*
Adjusted means					
Adjusted error					
Adjusted total					

Note: *SS*=sum of squares, *df*=degrees of freedom, *MS*=mean square, *F*=F Statistic, *p*=level of significance.

The customary level of significance of .05 was selected to reject or fail to reject the null hypothesis. This ANCOVA was calculated using the VassarStats Computer Program. The computational formulas for hand calculations can be found on the VassarStats website (Lowry, 2006b).

The tenth step was to analyze the data in order to determine the results for null hypothesis number two.

The eleventh step was to calculate the aggregate correlation within the DI and ESRT samples and test for the homogeneity of regressions. Basically this data analysis was necessary to determine whether there was a statistically significant difference between the slopes of the regression lines for each of the two groups (a four-hour Direct Instruction and a two-hour Electronic Student Response Technology course) considered separately, and the slope of the overall within groups regression. According to Lowry (2006a):

> The analysis of covariance assumes that the slopes of the regression lines for each of the groups considered separately do not significantly differ from the slope of the overall within-groups regression. If they do significantly differ, then the analysis of covariance is invalid and any positive conclusion drawn from it is potentially false and misleading. (¶ 20)

The test for homogeneity of regressions used is shown in Table 8. According to Lowry (2006a), "The procedure for rigorously determining whether this 'homogeneity of regression' assumption is satisfied involves yet another variation on the theme of analysis of variance. As in all versions of ANOVA, the end result is an F-ratio" (¶ 22).

Table 8:
Test for Homogeneity of Regressions

Source of Variance	*SS*	*df*	*MS*	*F*	*p*
Between regressions					
Remainder					
Adjusted error					

Note: SS=sum of squares, *df*=degrees of freedom, *MS*=mean square, *F*=F Statistic, *p*=level of significance.

The customary level of significance of .05 was selected to reject or fail to reject the null hypothesis. This test for homogeneity of regression was calculated along with the one way ANCOVA printout. The computational formulas for these calculations can be found on the VassarStats website (Lowry, 2006b).

The twelfth step was to analyze the data in order to determine the results for null hypothesis number three.

The thirteenth step was to report the results of the data analyses.

Limitations and Assumptions

The results of this applied research project were limited by several factors that should be noted. There were individuals assigned to each group who did not attend portions of the experiment, which caused an inequity in the size of the groups. Ideally, more valid conclusions could have been reached if this experimental mortality had not occurred.

Another limitation that must also be considered is an instructor cannot be without a preference in teaching style. It is possible the trainer's enthusiasm for one of the instructional methods could affect the instruction, and subsequently student performance on the posttest.

This experiment has limits on external exportability due to two major reasons; the GFD is not representative of the total firefighter population, and the sample size is small. This limitation is based on a Kahane and Cavender (2002) statement:

> When we accept a conclusion based on a sample that is too small to be a reliable measure of a population from which it was drawn, we are guilty of the fallacy of small sample, a variety of the fallacy of hasty conclusion. (p. 92)

Therefore, the results cannot be generalized to other groups of firefighters. This study was undertaken to find whether or not it was feasible to explore the ESRT instructional strategy further in future larger studies for the GFD.

Definition of terms

Analysis of covariance: "ANCOVA is a merger of ANOVA and regression for continuous variables. ANCOVA tests whether certain factors have an effect after controlling for quantitative predictors. The inclusion of covariates increases statistical power because it accounts for some of the variability" (Wikepedia, 2006a, ¶ 1).

Analysis of variance: "A statistical comparison for making simultaneous comparisons between two or more means; a statistical method that yields values that can be tested to determine whether a significant relation exists between variables" (Wordreference, 2006, ¶ 1).

Correlation:

> In probability theory and statistics, correlation, also called correlation coefficient, indicates the strength and direction of a linear relationship between two random variables. In general statistical usage, correlation or co-relation refers to the departure of two variables from independence, although correlation does not imply causality. (Wikepedia, 2006b, ¶ 1)

Critical Values of F: These values are found in F Distribution Tables in most statistics textbooks. These tables typically list only the values for the .05 and the .01 levels of significance (Gay & Airasian, 2003, pp.562-563).

Effective: "Effectiveness means the capability of producing an effect. The word is sometimes used in a quantitative way, 'being very or not much effective' " (Wikepedia, 2006c, ¶ 1).

Efficient: "The production of the desired effects or results with the minimum waste of time, effort, or skill" (Answers.com, 2006 , ¶1).

F-Ratio: "A computation used in the analyses of variance to determine whether variances among sample means are significant" (Gay & Airasian 2003, p.587).

Hypothesis testing:

> Hypothesis testing is a method of inferential statistics. An experimenter starts with a hypothesis about a population parameter called the null hypothesis. Data are then collected and the viability of the null hypothesis is determined in light of the data. If the data are very different from what would be expected under the assumption that the null hypothesis is true, then the null hypothesis is rejected. If the data are not greatly at variance with what would be expected under the assumption that the null hypothesis is true, then the null hypothesis is not rejected. Failure to reject the null hypothesis is not the same thing as accepting the null hypothesis. (Lane, n.d., ¶1)

p-value:

> A number between 0 and 1 that reflects the strength of the data that are being used to evaluate the null hypothesis. If the p-value is small, you have strong evidence against the null hypothesis. A large p-value indicates weak evidence against the null hypothesis. (Rumsey, 2003, p. 56)

Regression: "In statistics, regression analysis is used to model relationships between random variables, determine the magnitude of the relationships between variables, and can be used to make predictions based on the models" (Wikepedia, 2006d, ¶ 1).

Results

The results of this experiment were determined by analyzing data from the pretests and posttests. The assessment tool used for testing both groups was the FEMA IS-800 test (2006). This tool is a standardized test used by FEMA as an assessment for everyone taking the online IS-800 course, and all Colorado Division of Fire Safety classroom deliveries of the course sponsored by the State of Colorado. This researcher selected this test as the assessment tool for this ARP because of the general acceptance of this assessment as a standard for evaluation. The pretest and posttest used in this experimental research were identical, and the FEMA IS-800 test (2006) is reproduced with permission in Appendix A. Specifically, raw scores from the assessments were compared. Test scores, that is the raw data from the pre and posttests, are included as Appendix B.

The initial number of subjects in this ARP was 64, i.e. the total population of firefighters serving Golden, Colorado. They were randomly assigned to one of two groups, either the DI control group or the ESRT experimental group. Of these, 28 received instruction in the four-hour DI group, and 30 received instruction in the two-hour ESRT group. A change in sample size was due to experimental mortality. The total number of participants in this study was 58 (N=58). The number of participants lost due to experimental mortality (those that did not take both the pretest and posttest) was 6 (n=6). Originally the size of both random groups was equal, but due to the experimental mortality factor, the DI group had two fewer subjects than the ESRT group. Table 9 shows the experimental mortality for the participants.

Table 9:
Experimental Mortality

Group	Original Sample	Mortality	Final Sample
DI	32	4	28
ESRT	32	2	30
Total N=	64	6	58

Each null hypothesis required a different type of analysis of the data. The results of the data analysis for null hypothesis number one are displayed in Table 10.

Table 10:
One Way Analysis of Variance (ANOVA) Results

Source of Variance	*SS*	*df*	*MS*	*F*	*p*
Treatment [bg]	333.3518	1	333.3518	33.4768	<.0001
Error	557.631	56	9.9577		
Total	890.9828	57			

Note: SS=sum of squares, df=degrees of freedom, MS=mean square, F=F Statistic, p=level of significance, bg = between groups.

Null hypothesis number one: The ESRT posttest scores were higher than the DI posttest scores. The data in Table 10 shows that there was a significant difference in the means of posttest scores on a standardized National Response Plan assessment between a four-hour Direct Instruction and a two-hour Electronic Student Response Technology course. (F=33.4768, which is significant at the <.0001 level). Therefore, this researcher rejected null hypothesis number one. The VassarStats computer printout for the ANOVA is included as Appendix C.

The results of the ANCOVA data analysis for null hypothesis number two are displayed in Table 11.

Table 11:

One Way Analysis of Covariance (ANCOVA) Results

Source of Variance	*SS*	*df*	*MS*	*F*	*p*
Adjusted means	223.41	1	223.41	25.02	<0.000006
Adjusted error	491.1	55	8.93		
Adjusted total	714.5	56			

Note: SS=sum of squares, *df*=degrees of freedom, *MS*=mean square, *F*=F Statistic, *p*=level of significance.

Null hypothesis number two: The data in Table 11 shows that there was a significant difference in the means of posttest scores on a standardized National Response Plan assessment between a four-hour Direct Instruction and a two-hour Electronic Student Response Technology course, after adjusting for differences in the pretest scores of subjects. (F=25.02, which is significant at the <.000006 level). Therefore, this researcher rejected null hypothesis number two. The VassarStats computer printout for the ANCOVA is included as Appendix D.

The results of the test for homogeneity of regressions data analysis for null hypothesis number three are displayed in Table 12.

Table 12:

Test for Homogeneity of Regressions Results

Source of Variance	*SS*	*df*	*MS*	*F*	*p*
Between regressions	8.55	1	8.55	0.96	0.331556
Remainder	482.55	54	8.94		
Adjusted error	491.1	55			

Note: SS=sum of squares, *df*=degrees of freedom, *MS*=mean square, *F*=F Statistic, *p*=level of significance.

Null hypothesis number three: The data in Table 12 shows that there was no significant difference between the slopes of the regression lines for each of the two groups, a four-hour Direct Instruction and a two-hour Electronic Student Response Technology course, considered separately, and the slope of the overall within groups regression. (F=0.96, which is not significant at the .05 level.) Therefore, this researcher failed to reject null hypothesis number 3. If the slopes had differed significantly, the ANCOVA results would have been invalid. The test for homogeneity of regressions is included in the VassarStats computer printout for the ANCOVA, which is included as Appendix E.

Discussion

Prior to this study, there had been little analysis by the GFD of the problem of finding the most efficient way to instruct first responders on the NRP, even with the mandate to teach all courses in the most effective and efficient manner. The results of this study showed that using ESRT, rather than the recommended DI, significantly increased the efficiency of instruction. A previous similar study by this researcher showed that using ESRT was also a more effective instructional approach for training of entry-level firefighters.

The results of this study suggest to this researcher that the firefighters in the two-hour ESRT group, who performed significantly higher on a valid test, actually did learn more efficiently than their counterparts in the four-hour DI group. This discussion focuses on the relationship between the results of this study and the NRP, ESRT, and evaluative research. These topics were also the focus of the literature review. In addition, this author's interpretation of the results of this ARP, and their implications for the GFD are discussed.

The National Response Plan

The primary results of this study, namely that the firefighters in the two-hour ESRT group learned more efficiently than their counterparts in the four-hour DI group, suggests that an in-depth understanding of the NRP can occur more efficiently when using an interactive instructional strategy. This study also reflects a proactive approach by the GFD regarding the NRP.

Bevelacqua & Stilp (2002) stated, "Understanding the complex interdependence between all agencies is an essential part of the response equation. Working together for a systematic multilayered response system, local, state and federal agencies can make great strides" (pp. 8-9). This author agrees and sees the effectiveness and efficiency of training first responders on the NRP as basic elements for understanding that interdependence. This understanding is essential for operational success on incidents of national significance. The content of this ARP addresses this issue. Buckman (2005) articulates a paradigm shift the fire service is facing. "Everybody thinks of 'response' just as the red lights and sirens part, but in today's world response is really awareness, preparation, response and recovery. That's what the NRP is all about" (p. 96).

The interpretation of this author is the City of Golden is proactive in addressing the awareness of, and preparation for working within, the NRP. This is demonstrated by the

motivation to conduct the threat assessment for *Operation Liberty Shield,* and actions such as those exemplified by the following J.E. Bales (personal communication, May 18, 2006) statement, "Training our firefighters, and all City of Golden responders, in the NRP is an extension of this commitment." These local actions speak to the commitment from local government the Federal Government seeks in the NRP. The GFD is taking a leadership role by training 20 additional individuals from a non-governmental organization; this action is in line with Giuliani's (2002) statement, "Creating reasons for those who work for you to establish their own culture of preparedness is part of being a good leader" (p. 65).

The ability for the City of Golden to follow through on the commitment made to NRP training depends on the effective and efficient performance of the GFD training division. Innovations, such as the new instructional approach discussed in this ARP, are necessary to meet this commitment. The research suggests performance of local responders and local government is the foundation for an effective response to incidents of national significance, and successful performance depends on the training they have received. The performance of first responders during the less than effective multilayered response to Hurricane Katrina, is an example of less than desirable NIMS and NRP training. This is a representation of over expectation of performance by those involved in response planning. Poulin (2004) stated, "If state and federal planners fail to realistically appreciate the capabilities of local first responders, their plans may include unrealistic performance expectations" (p. 20). These findings suggest performing up to expectations will be facilitated by adequate preparation, such as NRP training citywide in Golden, Colorado. This author views the understanding of the NRP by all responders as essential for operational success on incidents of national significance; the focus of this study on the NRP

reflects the value placed on awareness and preparedness exhibited by the City of Golden, Colorado.

Quinn, the executive director of Ottersurf Labs, an e-learning consulting firm in Walnut Creek, California, describes a phenomenon observed by this author as prevalent in the emergency response community. C. Quinn (personal communication, September 29, 2006) states, “Yet in many cultures it is not OK to fail. You can’t get them to talk about their mistakes.” This is an area that must see improvements for the NRP to be effective. The interpretation of this researcher is the use of ESRT to make training more interactive, cooperative, effective, and efficient may make inroads into this cultural problem.

Electronic Student Response Technology

The results of this study, namely that the firefighters in the two-hour ESRT group, learned more efficiently than their counterparts in the four-hour DI group, suggest that the issue of the current instructional strategy of DI may not adequately address the NRP training mandate for GFD. Providing instruction in the most efficient and effective manner possible is required for the GFD training division to complete a greater amount of training without increasing overall training time. Instructional strategies in the GFD training division may need to be updated.

The implementation of this ARP depended on technology. Beatty (2004) described a “combination of hardware and software – designed to support communication and interactivity in classes” (p. 2). This was the operational definition of ESRT identified for this ARP. The technology has evolved from a cumbersome hard-wired network to the current systems which “employ proprietary ‘clickers’” (Beatty, 2004, p.3). This researcher sees the future of the systems heading towards cell phone or PDA input devices and Internet based software programs. As Beatty has predicted, they are beginning to emerge.

The belief, by 83% of GFD student firefighters, that ESRT helped them learn (Milan, 2004) in itself is enough to justify pursuing ESRT as a learning strategy. The experimental data supporting this belief as to effectiveness (Milan, 2005), and efficiency shown by this ARP, confirms the use of ESRT is an appropriate instructional strategy. Over 25 years ago McCormack (1979) identified the importance of fire training efficiency stating, "Making our instructors more efficient makes the entire fire service more efficient" (p. 26). This researcher interprets the efficiency of instruction using ESRT technology as a necessary innovation to meet the ever-expanding training agenda at GFD.

ESRT is more than a gadget; it supports a new way of instructing. Gughelmino (as cited in Dolezalek, 2004) says this transition is necessary so the instructor "can provide more choices to the learner and serve as a resource for learning as opposed to an information giver" (p. 34). Albrecht (2006) is more direct in the message stating, "People don't want theory, they want practical information they can use. Forget the lectures. People learn by doing. Throw the sage off stage. Make it fun" (p. 39). A shift in the role of GFD instructors is a major challenge that must be faced if ESRT is to be incorporated into training.

Evaluative Research

The results of this study, namely that the firefighters in the two-hour ESRT group, learned more efficiently than their counterparts in the four-hour DI group, should be an incentive for the GFD to continue conducting evaluative research at a Level II and Level III, rather than merely continue instructing using DI, which in this situation is a less effective and efficient instructional strategy for the GFD.

By using true experimental design, the results of this ARP suggest that the outcomes were due to the ESRT instructional strategy, and not due to chance. The level of significance set

at the 0.05 level was the probability value this researcher selected to reject the null hypotheses of no differences between outcomes from the two instructional strategies. The results showed that there was a less than five percent chance that the results obtained were due to chance alone. Since sources of internal and external invalidity were controlled in this study, the results suggested the differences were due to the ESRT instructional strategy used in the experiment.

In this study, the efficiency of ESRT as compared to DI was judged in terms of the criterion of FEMA IS-800 (2006) posttest scores of Golden firefighters. The mean of posttest scores clearly showed that firefighters taught with ESRT performed better on the posttest. Gay & Airasian (2003) stated, "Simple, or one way analysis of variance (ANOVA) is used to determine whether there is a significant difference between two or more means at a selected probability level" (p. 467). When the ANOVA was completed, the data showed the increase in performance of the ESRT group was statistically significant. It may be of interest to note that this researcher had envisioned that only equal performance on the posttests would have suggested ESRT was more efficient than DI, since it required less instructor time to achieve similar results.

The data analysis (ANOVA) strongly suggested the increase in performance was due to the ESRT treatment, and not a result of chance. Gay & Airasian (2003) also stated, "The concept underlying ANOVA is that the total variation, or variance, of scores can be divided into two sources-variance between groups (variance caused by the treatment groups) and variance within groups (error variance)" (p. 467). The F of 33.4768 was significant at the <.0001 level. Another way of viewing this result is this result would occur less than once in 10,000 times as a result of chance due to random sampling. This far exceeds the confidence level of 95 percent (level of significance of .05) set prior to the experiment to reject the null hypothesis.

A great strength of the covariance analysis (ANCOVA) used in this Pretest-Posttest Control Group Design is the adjustment of posttest scores to account for pre-course knowledge of the NRP. As Chief J.E. Bales of the GFD (personal communication, May 22, 2006) previously stated:

> GFD sent six firefighters to the Gulf Coast in 2005, all who were trained in NIMS and the NRP by FEMA. Additionally, approximately 20 percent of our firefighters are affiliated with wild land, USAR [Urban Search and Rescue], or incident management teams. The level of NRP training completed by these individuals is not part of the department records, and I suspect we have great variation in NRP training.

The covariant in this Pretest-Posttest Control Group Design was performance on a standardized pretest; ANCOVA was calculated and showed the difference in means were still significant after adjusting for pretest differences. Gay & Airasian (2003) explained, "Covariate analysis statistically adjusts the scores of method Y to remove the initial advantage so that the results at the end of the study can be fairly compared as if the two groups started equally" (p. 343). This finding has implications that ESRT is the most effective and efficient instructional strategy for the GFD Training Division to implement when instructing first respondents with varying levels of understanding of the NRP.

For the results of ANCOVA to be accepted as accurate, the slope of regression lines for the two groups when considered separately, and the slope of the overall within groups regression must not vary significantly. The level of significance set for this test was also set at .05. The resulting F of 0.96 represents an F factor of 0.331556, which is clearly not significant at the .05 level. Based on this result, null hypothesis number 3 was not rejected. This, in effect, confirms the homogeneity of regressions, and implies that the results from the ANCOVA are valid.

Grossen (1996) provided the bottom line to evaluating new instructional techniques and technology in the statement, “Until an instructional practice has been implemented, evaluated, and found to produce better results than its alternatives, there is no research basis for recommending it” (p. 8). This suggests, only evaluative research and conducting true experiments will accomplish this goal for the fire service. It appears to this researcher that in fire service training one of two schools of thought prevails. Either the training division uses the tried and true Direct Instruction model, or they suffer from implementing the latest instructional fad without first investigating its true effectiveness or efficiency. Each of these approaches has inherent pitfalls. Given this limited choice, it is encouraging the overwhelming majority of fire service instructors stick to DI. However this ARP and others like it, raise the question of whether there is better way to train firefighters.

The Pretest-Posttest Control Group Design was selected for many reasons; first and foremost it is a true experimental design. Additionally, this researcher conducted a previous experiment with essentially the same group of learners and a similar subject that showed no pretest treatment interaction. The fact that the only external variable not controlled by the Pretest-Posttest Control Group Design was the pretest treatment interaction, it was in the determination of this researcher prudent to use this design. Bales made a convincing argument that the level of pre-treatment knowledge of the NRP was extremely variable. This influenced this researcher to heed the advice of Gay & Airasian (2003) that, “If there is any chance that the groups may be different with respect to pretreatment knowledge related to the dependent variable, the Pretest-Posttest Control Group Design should be used” (p. 377).

Rachel (2002) discussed the merits of using a single instructor to present two different treatments versus using different instructors, “The use of two facilitators, one for each treatment,

invites inevitable differences in personality, rigor or experience" (p. 223) strongly influenced this researcher to use a single instructor. An important limitation cited must also be considered. The instructor cannot be without a preference in teaching style, and it is possible the enthusiasm in one of the treatment groups could affect the outcome. Though this is a near certainty, this researcher suggests the preferential teaching style factor was minimal due to the duplication of content, facility, and time of day for both treatment groups.

Rachel (2002) discusses assessment of adult learners:

> The desirable assessment measure is demonstration of the ability to perform the learned material through a direct means, such as actually taking and printing a photograph, rather than an indirect means, such as taking a paper-pencil test on how to take and print a photograph. (p. 221)

This researcher is motivated to study, in a future ARP, how performance on actual or simulated incidents would compare to their scores on a standardized assessment.

Author's Interpretation of Study Results

The results in favor of using ESRT were highly significant. This ARP was a short-term study; one does not substantially add to a body of data with a single study. Further, this study was not a definitive study for major policy decisions. However, the results of this study can serve to guide and motivate future investigations regarding the most effective and efficient instructional strategies to train local first responders to be better prepared in the event of a national emergency. This study, if conducted with larger more diverse groups and more intensive treatments, might produce notable results. Evaluative research can and should be done. The result from this true experimental design shows evidence of causality, and serves as a research basis for informed recommendations. The results of this study came from Level II research,

which tests theories suggested by Level I research.

The measured results of this study showed significant differences in favor of ESRT. In addition, this study may have had effects not measured. For example, the instructor may have become more conscious of the importance of focusing instruction on what the students do not already know when using the ESRT. The instructor can immediately ascertain whether the NRP students are aware of such things as which organizational element is responsible for directing on-scene emergency management, by displaying their immediate responses from the input devices. The instructor may have become more aware of the value of an interactive instructional strategy. The students, on the other hand, may have learned that they are responsible for actively interacting, and thus have some control over their learning. They also learn that it is acceptable to make mistakes, to talk about them, and learn from them. It's better to learn from their mistakes at this level than to learn the lessons during an actual emergency.

Implications of the Results for the GFD

From the results of this author's ARP, if ESRT were to be accepted as an instructional approach to be fully implemented by the GFD training division, it would have several major implications. A challenge for GFD would be the timing of an ESRT system purchase. Whether to purchase the current technology with proprietary clickers, or wait for technological advancements evidenced by the next generation of ESRT is a quandary. Waiting would delay the implementation of a learning strategy that has demonstrated effectiveness and efficiency. The next generation of ESRT presents a local challenge for GFD, namely to overcome the logistics of a system that accepts variation in input devices, and has an element of acceptance for those in the department who are less technologically savvy and who only are comfortable using DI. Based on these realities, this researcher suggests the purchase of an ESRT system, which uses current

technology, would be a wise use of department training funds. As with all technology, the leadership of the GFD must accept the reality that this current generation of ESRT technology has a limited lifespan, and be willing to walk away from this equipment when newer student response systems are found to be more effective and efficient.

Second, there would need to be a shift in mindset of GFD instructors who are using DI as their primary instructional strategy. Extensive instructor training impacting their overloaded schedules is a factor of instituting ESRT that must be considered; staff development would require an additional workload. A training program should be developed so the instructors would understand the mechanics of ESRT as well as how to use it interactively. However, this researcher believes each hour invested in this type of instructor training would pay dividends in improved efficiency and effectiveness of instruction.

In summary, this discussion focused on the results of this study as it relates to the NRP, ESRT, and evaluative research. This author discussed the role of the instructor for future NRP training, and stressed the value of using an interactive instructional approach. A change in instructional strategy would have associated equipment and instructor training costs, yet it would be more efficient. The transition could not take place quickly; however the response success of local government to an incident of national significance depends on improved understanding of NRP, through more effective and efficient instruction.

Recommendations

The problem addressed in this ARP was that the efficiency of using two-hour ESRT had not been compared to four-hour DI for teaching GFD firefighters in an introductory NRP course. The purpose of this ARP was to compare instructional efficiency of two-hour ESRT and four-hour D.I. using evaluative research. The two-hour ESRT, at the level of intensity (2 hours)

established in this experiment, not only equaled, but significantly improved achievement assessment scores on the FEMA IS-800 test (2006). The recommendation resulting from this data analysis is that further evaluative research should be conducted by the GFD on the use of ESRT for NRP instruction of other populations. The future training by GFD, required for additional City of Golden personnel, provides an ideal opportunity to replicate the experiment conducted in this ARP.

The results of this ARP and other information gleaned from this project should be communicated to others. The State of Colorado, through the Colorado Division of Fire Safety, may decide to replicate this research to determine whether the results of this ARP generalize to a larger population. Similarly FEMA should be made aware of this ARP, and may decide to replicate it on a national level. This recommendation for replication should also apply to any subsequent evaluative research conducted by the GFD.

These previous two recommendations led to this researcher's final and most important recommendation, which is to elevate the Level II research completed in this ARP to Level III research, using a larger scale study or long term follow up study. As Grossen (1996) stated, "Research at this level is important because it examines the new intervention in full context" (p. 22).

In summary, the recommendations to the GFD from this ARP are to conduct further research on instructional strategies, to communicate the results of this study to others, and to elevate this study to Level III research.

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Appendix A

FEMA IS-800 Test (2006), Reproduced with Permission.

1. The National Incident Management System (NIMS) provides:

A. The specific guidance needed for the Federal Government to respond to domestic incidents that are catastrophic in magnitude.
B. The automated systems needed to collect and manage national information about incident response.
C. A nationwide template enabling government and nongovernmental responders to respond to all domestic incidents.
D. An alternative to the Incident Command System in planning for and responding to National Special Security Events.

2. Select the TRUE Statement from below:

A. The NRP focus is solely on establishing a standardized framework for preventing and responding to potential and actual domestic terrorism incidents.
B. The NRP supersedes existing agency authorities and statutes related to incident response and management during Presidentially declared disasters.
C. The NRP requires that agencies fully implement all of the system's components to ensure standardization across every Incident of National Significance.
D. The NRP is an all-hazards plan that provides flexible mechanisms for national-level operational coordination for domestic incident management.

3. Select the incident below that is likely to meet the criteria for an Incident of National Significance.

A. Hazardous materials spill that has contaminated a creek.
B. Severe storm damage resulting in a Presidentially declared disaster.
C. Coast Guard boarding of a vessel suspected of alien smuggling.
D. Combined FBI and local investigation of the kidnapping of a child.

4. Which of the following officials has been directed by the President to assume responsibility for managing domestic incidents?

A. Secretary of Defense
B. Attorney General
C. Secretary of Homeland Security
D. National Security Advisor

5. The NRP is based on the premise that:

A. Incidents are typically managed at the lowest possible geographic, organizational, and jurisdictional level.
B. Federal-to-Federal support will not be required unless an incident is covered under a Stafford Act declaration.
C. Governmental agencies are in the best position to respond to incidents and should not encourage citizen involvement.
D. Supplemental operations and hazard-specific contingency plans are not necessary.

6. In Accordance with HSPD-5 and other relevant statutes and directives, who has lead responsibility for criminal investigations of terrorist threats?

A. Attorney General
B. Secretary of Defense
C. Secretary of Homeland Security
D. National Security Advisor

7. An ESF is a:

A. Center that serves as the national hub for terrorism-related analysis, collecting information from all members of the U.S. Government's intelligence community.
B. Physical location where public affairs professionals from organizations involved in incident management activities work together to provide critical emergency information.
C. Grouping of Government and certain private-sector capabilities in an organizational structure that provides support, resources, program implementation, and services.
D. Specialized advanced team that provides technical assistance to assess the situation, identify critical and unmet needs, and establish incident support facilities.

8. Which organizational element is a temporary Federal facility established locally to coordinate operational Federal assistance activities to the affected jurisdiction(s) during Incidents of National Significance?

A. Incident Command Post (ICP)
B. Regional Resource Coordination Center (RRCC)
C. State Emergency Operations Center (EOC)
D. Joint Field Office (JFO)

9. Owners/operators of certain regulated facilities or hazardous operations:

A. May bear responsibilities under the law for preparing for and preventing incidents from occurring, and responding to an incident once it occurs.
B. Must take actions to prepare for and prevent incidents from occurring, but do not participate in response activities if an incident does occur.
C. Use plans developed by Federal and State emergency managers to ensure that their facilities are prepared.
D. Assume the role of Incident Commander when an incident occurs on private-property areas associated with their facilities.

10. What organizational element is responsible for directing on-scene emergency management and maintaining command and control of on-scene incident operations?

A. Emergency Support Functions (ESF)
B. Incident Command Post (ICP)
C. Local Emergency Operations Center (EOC)
D. Joint Operations Center (JOC)

11. The Homeland Security Operations Center (HS)C) is:

A. The primary national hub for domestic incident management, operational coordination, and situational awareness.
B. The focal point and operational control center for all Federal law enforcement activities related to domestic terrorist incidents.
C. The coordination point for the deployment of Federal response resources and support for the efforts of regional and field components.

D. The temporary Federal facility established to coordinate operational Federal assistance activities to the affected jurisdiction(s) during Incidents of National Significance.

12. What NRP element is a Federal headquarters-level multi-agency coordination entity that facilitates strategic Federal domestic incident of National Significance?

A. Joint Field Office (JFO) Coordination Group
B. Homeland Security Council/National Security Council (HSC/NSC)
C. Interagency Incident Management Group (IIMG)
D. Policy Coordination Committees (PCCs)

13. What NRP element coordinates the deployment of the Emergency Response Team-Advance Element (ERT-A) to field locations?

A. Homeland Security Operations Center (HSOC)
B. Regional Response Coordination Center (RRCC)
C. State Emergency Operations Center (EOC)
D. Joint Operations Center (JOC)

14. Select the TRUE statement from below:

A. The PFO directs the incident command structure established at the incident and has directive authority over the Senior Federal Law Enforcement Officer.
B. Once formally designated, the PFO may continue to conduct his or her normal duties and functions.
C. The PFO may not delegate duties to the FCO or other designated Federal official even after an event transitions to long-term recovery.
D. The PFO provides a primary point of contact and situational awareness locally for the Secretary of Homeland Security.

15. Who manages and coordinates Federal resource support activities related to Stafford Act disasters and emergencies?

A. The designated Senior Federal Officials (SFOs)
B. The Governor's Authorized Representative (GAR)
C. The Federal Coordinating Officer (FCO)
D. The State Coordinating Officer (SCO)

16. Figure Caption: Missing reporting level for three Incident Command Posts in the field

A. Central Authority
B. Area Command
C. Control Point
D. Resource Allocation

17. Which branch manages unique tactical issues inherent to a crisis situation, such as a hostage situation or terrorist threat, and includes the Joint Operations Center (JOC)?

A. Law Enforcement Investigative Operations Branch
B. Response and Recovery Branch
C. Security Operations Branch
D. Emergency Services Branch

18. Which JFO section is responsible for providing current information to the JFO Coordination Group to ensure situational awareness?

A. Operations Section
B. Planning Section
C. Logistics Section
D. Finance and Administration Section

19. Select the TRUE statement from below:

A. The JFO uses an Incident Command System (ICS) structure to manage on-scene operations.
B. Regardless of size or number of States affected, each incident has only one JFO.
C. Disaster Recovery Centers are collocated with the JFO whenever feasible.
D. Utilizing Unified Command principles, the JFO Coordination Group directs activities within the JFO.

20. When the Secretary of Homeland Security declares an Incident of National Significance, who notifies affected States and Federal agencies?

A. National infrastructure Coordination Center (NICC)
B. Homeland Security Operations Center (HSOC)
C. Strategic Information and Operations Center (SIOC)
D. Interagency Incident Management Group (IIMG)

21. Who directs the following functions: Public Affairs, Community Relations, Congressional Affairs, State and Local Coordination, Tribal Affairs, and International Affairs?

A. Liaison Administrator
B. External Affairs Officer
C. Chief of Staff
D. Federal Resource Coordinator (FRC)

22. Who manages the Federal resource support activities related to non-Stafford Act Incidents of National Significance when Federal-to-Federal support is requested from DHS?

A. Federal Coordinating Officer (FCO)
B. Comptroller
C. Chief of Staff
D. Federal Resource Coordinator (FRC)

23. Hazard mitigation involves:

A. Preventing the immediate loss of life after a disaster strikes.
B. Lessening the paperwork associated with applying for hazard grants.
C. Reducing or eliminating long-term risk to people and property from hazards.
D. Clearing contaminants from an area following the release of a chemical agent.

24. Which of the following statements about reporting requirements is correct?

A. State, local, and tribal governments report threats, incidents, and potential incidents using specialized communications and reporting channels established for NRP events.
B. Typically, first responders report information directly to the HSOC, which in turn notifies State or local emergency operations centers.
C. Credible information regarding terrorist threats is reported from a local FBI agent to the national FBI Strategic Information and Operations Center and then to the HSOC.

D. Federal emergency operations centers are encouraged but not required to use established reporting mechanisms to report incident information to the HSOC.

25. Select the TRUE statement from below:

A. Standard procedures regarding requests for assistance may be expedited or, under extreme circumstances, suspended in the immediate aftermath of an event of catastrophic magnitude.
B. Under the Stafford Act, the HSOC designates the types of assistance to be made available and the counties eligible to receive assistance.
C. In a terrorist event, law enforcement officials must wait to plan evidence collection and preservation until after the lifesaving response operations are completed.
D. The majority of initial response actions in the local threat or hazard area are taken by Federal responders.

26. Under the Stafford Act, who requests assistance from the Federal Government?

A. The designated Senior Federal Officials (SFOs)
B. The Principal Federal Official (PFO)
C. The State Coordinating Officer (SCO)
D. The Governor

Appendix B

FEMA IS-800 Test (2006) Scores – Raw Data

Student #	Direct Instruction DI-Pretest	DI-Posttest
d1	13	19
d2	14	19
d3	12	13
d4	8	13
d5	8	12
d6	10	15
d7	14	17
d8	no show	
d9	no show	
d10	no show	
d11	13	15
d12	8	16
d13	10	14
d14	6	10
d15	12	13
d16	13	12
d17	15	15
d18	14	12
d19	11	15
d20	13	16
d21	14	16
d22	12	19
d23	8	22
d24	10	18
d25	14	17
d26	13	12
d27	9	16
d28	15	14
d29	15	no show
d30	15	19
d31	14	18
d32	13	18

Student #	ESRT Instruction Pretest	Posttest
e1	15	18
e2	16	21
e3	14	22
e4	11	22
e5	10	19
e6	12	21
e7	9	21
e8	15	21
e9	9	21
e10	12	21
e11	13	22
e12	13	21
e13	14	23
e14	9	20
e15	10	9
e16	12	14
e17	15	25
e18	15	21
e19	11	14
e20	14	22
e21	17	no show
e22	17	22
e23	16	19
e24	15	24
e25	17	24
e26	10	19
e27	14	15
e28	17	23
e29	18	22
e30	13	21
e31	9	no show
e32	19	23

Appendix C

One Way ANOVA Data

standard weighted-means analysis

ANOVA Summary 2

Source	SS	df	MS	F	P
Treatment [between groups]	333.3518	1	333.3518	33.476	<.0001
Error	557.631	56	9.9577		
Ss/Bl					
Total	890.9828	57			

Data Summary

	Samples					
	1	2	3	4	5	Total
N	28	30				58
-ΣX	435	610				1045
-Mean	15.5357	20.3333				18.0172
-ΣX^2	6977	12742				19719
Variance	8.1098	11.6782				15.6313
Std.Dev.	2.8478	3.4173				3.9536
Std.Err.	0.5382	0.6239				0.5191

Appendix D

One Way ANCOVA Data

ANCOVA SUMMARY

Source	SS	df	MS	F	P
adjusted means	223.41	1	223.41	25.02	0.000006
adjusted error	491.1	55	8.93		
adjusted total	714.5	56			

Appendix E

Test for Homogeneity of Regressions

Test for homogeneity of regressions:

Source	SS	df	MS	F	P
between regressions	8.55	1	8.55	0.96	0.331556
remainder	482.55	54	8.94		
adjusted error	491.1	55			