EVALUATION OF ELECTRONIC STUDENT RESPONSE TECHNOLOGY IN AN INTRODUCTORY NATIONAL INCIDENT MANAGEMENT SYSTEM TRAINING COURSE

EXECUTIVE ANALYSIS OF FIRE SERVICE OPERATIONS IN EMERGENCY MANAGEMENT

BY: Kevin O. Milan
Golden Fire Department
Golden, Colorado

An applied research project submitted to the National Fire Academy
as part of the Executive Fire Officer Program

May 2005

CERTIFICATION STATEMENT

I hereby certify that 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: _____

ABSTRACT

Research on Electronic Student Response Technology (ESRT) supports its use as an instructional strategy. This applied research project (ARP) investigated the use of ESRT in an introductory National Incident Management System (NIMS) course. The problem was the effect on NIMS test scores of using ESRT had not been compared to the effect of using Direct Instruction (DI). The purpose of this evaluative research was to determine the effect on NIMS test scores of using ESRT, and compare it to DI using the Solomon Four-Group experiment design.

The following null hypotheses were tested:

1. There is no significant difference in total NIMS achievement test scores between firefighters randomly assigned to DI groups or ESRT groups.

2. There is no significant difference in total NIMS achievement test scores between firefighters taking the pre-test and firefighters not taking the pre-test who were randomly assigned to DI groups or ESRT groups.

3. There is no significant difference in total NIMS achievement test scores for the groups that resulted from the two way interactions, of ESRT and pre-test or DI and pre-test, between firefighters taking the pre-test and firefighters not taking the pre-test who were randomly assigned to DI groups or ESRT groups.

The study included 84 (N=84) firefighters, serving the City of Golden, Colorado, who were randomly assigned to control and treatment groups. The control group received DI only, and the experimental group received instruction supplemented with ESRT. A 2x2 factor analysis of variance (ANOVA) showed significant differences in mean scores on a standardized Federal Emergency Management Agency (FEMA) post-test. The ESRT group obtained significantly higher test scores. The recommendations were 1) to conduct further research on interactive instructional strategies, 2) to communicate the results of this ARP to others, and 3) to elevate this research to Level III in a larger scale study.

TABLE OF CONTENTS

List of Figures

List of Tables

INTRODUCTION

Homeland Security Presidential Directive 5 (HSPD-5) concerns adoption of the National Incident Management System (NIMS) by agencies seeking Federal support. In the 2003 directive, President George W. Bush stipulated "Beginning in fiscal year 2005, Federal departments and agencies shall make adoption of the NIMS a requirement, to the extent permitted by law, for providing Federal preparedness assistance through grants, contracts, or other activities" (White House, 2003, ¶20).

The State of Colorado has tasked the Colorado Division of Fire Safety (DFS) with implementing NIMS training for first responders in Colorado. In the DFS *National Incident Management System Training Implementation Strategy*, the Director of the Colorado DFS expressed: "This plan, developed in partnership with the Colorado Division of Emergency Management, identifies appropriate levels of training based on emergency scene responsibilities and identifies training courses that the DFS can offer to achieve the required level of training" (Colorado Department of Public Safety, 2005a, p.1). Director Cooke continues explaining the plan: "Identifies the strategy for DFS to deliver the training to Colorado's first responder community".

As a Colorado first response agency, Golden Fire Department (GFD) is going to comply with HSPD-5 to maintain eligibility for federal funding and improve response capabilities through adoption of NIMS. In addition the GFD has been charged with training executives, middle managers, and other departments within the City of Golden.

Previous investigations by this researcher have identified and compared instructional strategies for training GFD personnel. Each of these applied research projects (ARP's) recommended further evaluative research to determine if statistically significant differences in performance could be attributed to the use of different instructional methods. In an earlier ARP by this researcher, the direct instructional model (DI) was identified as the primary method of delivery being used for fire service instruction at GFD (Milan, 2003).

In a later ARP, a survey of GFD firefighter attitudes towards Electronic Student Response Technology (ESRT) showed a belief that supplementing DI with ESRT technology could improve their performance. ESRT is a wireless system that allows students, using small hand held devices, to electronically respond to queries by instructors. In the GFD survey 83 percent of GFD firefighters reported, after using the system, the ESRT helped them learn (Milan 2004).

Since the GFD is charged with training a large number of first responders, it is essential that the training be implemented in the most efficient and effective way possible. The City of Golden will commit significant resources and time to the training of personnel in the use of NIMS in order to comply with HSPD-5. Identifying the most successful method of instruction, prior to delivering the training, will be beneficial to the GFD and to the City of Golden. Even though GFD firefighters identified ESRT as a preferred learning enhancement in earlier descriptive research no data was generated to show if it would in fact improve performance.

This ARP is concerned with finding hard data on the effectiveness of ESRT by conducting evaluative research. The problem is the effect on NIMS test scores of using ESRT has not been compared to the effect of using DI. The purpose of this evaluative research is to determine the effect on NIMS test scores of using ESRT, and compare it to DI using the Solomon Four-Group experiment design.

This study is designed to use evaluative research, i.e. an experimental design, to determine if statistically significant differences occur between the two groups that were taught using different instructional strategies. This researcher's assumption is that in an introductory NIMS course, GFD firefighters taught using ESRT will have significantly higher scores on a standardized post-test than those taught using DI alone.

Null hypotheses were defined for the purpose of data analysis. For this experiment the following null hypotheses were tested:

1. There is no significant difference in total NIMS achievement test scores between firefighters randomly assigned to DI groups or ESRT groups.

2. There is no significant difference in total NIMS achievement test scores between firefighters taking the pre-test and firefighters not taking the pre-test who were randomly assigned to DI groups or ESRT groups.

3. There is no significant difference in total NIMS achievement test scores for the groups that resulted from the two way interactions, of ESRT and pre-test or DI and pre-test, between firefighters taking the pre-test and firefighters not taking the pre-test who were randomly assigned to DI groups or ESRT groups.

The Solomon Four-Group design will be used for the experiment, and a 2x2 factor analysis of variance (ANOVA) will be used for data analysis.

The results of this ARP will be of value to the GFD who has been charged with NIMS training of first responders serving the City of Golden, Colorado in the most effective and efficient way possible.

BACKGROUND AND SIGNIFICANCE

The Golden Fire Department is located 15 miles west of Denver and serves the City of Golden Colorado, as well as parts of unincorporated Jefferson County. The department, which has a combination of volunteer and paid staffing, provides fire, emergency medical, and technical rescue services. The U.S. Census Bureau, Census 2000, reports a total population of 17,159 residents. Approximately 2.5 million people visit the Golden area each year.

The GFD Training Division, in the past, has basically trained firefighters to respond to fires and other emergencies. Currently, the GFD Training Division has taken on the added responsibility for initial and ongoing training NIMS training. In 2005, the GFD Training

Division has been tasked not only with training firefighters in the NIMS, but all employees potentially involved in emergency preparation, mitigation, response, and recovery.

Over 175 individuals from police, public works, and parks as well as all the leadership of all departments and members of city government, have been identified to receive the training (M.E. Garza, personal communication, February 19, 2005). The training will be presented at one of five levels, as described by the DFS. The levels of response personnel are defined by the Colorado DFS *National Incident Management System Training Implementation Strategy* (Colorado Department of Public Safety [CDPS] 2005a) as Awareness Level, Operations Level, Supervisory Level, Command Level, and Executive Level. City personnel will be trained at one of these levels by October 1 2005, by the GFD Training Division, in order to comply with HSPD-5.

In the journal *Homeland Protection Professional* Nicholson (2004) interviewed Stephan, a special assistant to the Secretary of the Department of Homeland Security (DHS). The necessities of active roles of local jurisdictions, such as the City of Golden, are outlined in the statement: "The lion's share of what we're responsible for and what we are concerned about resides on the state and local jurisdictions. They have to be part of the solution, and they have to be part of the acceptance of whatever you're coming up with" (Nicholson, 2004, p.11).

For future NIMS training courses, considering the increasing scope of training services, it is timely for the GFD to consider evaluating instructional strategies that are the most effective and efficient methods to train a diverse population with varying skills and cognitive abilities, namely the employees of the City of Golden. Identifying instructional strategies that have the highest probability for improving learning is of primary importance.

Traditionally, the GFD Training Division has recommended a DI strategy for both recruit and regular member training. In *Identification and Comparison of Instructional Strategies for the GFD Recruit Academy* this researcher identified DI as the primary method of instruction used by GFD (Milan, 2003). This mainstay of most GFD cognitive training courses can be viewed as lecturing to students. Referring to Rosenshine's work with DI, Chick, (1999) reported: "Direct Instruction (DI) is a general term that refers to behavioral features that describe a highly structured system of teacher-student interactions, many of which correlate with student achievement, such as group responses, corrections, and engaged time" (p. 82).

In the past, the GFD regularly used a DI approach for training firefighters. Curriculum materials, from sources such as the International Fire Service Training Association (IFSTA), were presented to firefighters using the recommended DI model with the associated PowerPoint presentations. Currently, there is no change from the DI instructional approach at the GFD. Even though previous ARP's by this researcher suggested that using ESRT and/or other active instructional strategies would have a more positive effect on learning, no hard data existed to support this assumption.

One disadvantage of the DI teaching strategy is that students become passive, rather than active, recipients of instructor knowledge presented in a lecture format. Lawson (2000) notes this drawback, and describes the importance of gaining and maintaining interest because today's

learners: "want the learning experience to be both meaningful and enjoyable" (p. 42). The Golden City Manager has communicated a desire to truly incorporate NIMS citywide for mitigation, preparation, response, and recovery from emergencies. Bestor declared "For the City of Golden to function effectively during a large scale emergency it is important the key personnel actually learn NIMS rather than just log the seat time required to meet the training mandate" (M.C. Bestor, personal communication, June 2, 2005).

In the future, GFD training, including NIMS training, must not only be effective, it must be efficient. There is limited time available in the GFD for NIMS training because of revised requirements by the State of Colorado for firefighter certifications. Therefore, the instructional strategies must be those that have been proven to be most efficient for learning to occur, given the time available for training. The challenge of increased demands on training time is not new or unique to the GFD. In an ARP titled *Training for the 1990's*, Larson (1990) states: "All of us are being pressured to do more with less and training time is no exception" (p. 13).

Currently, the GFD training program has been impacted by the Colorado DFS revised requirements for renewal of firefighter certification. Basically, the requirements increase the time required for skills documentation. A direct effect of this revision is a decrease in the training time available for cognitive instruction, such as NIMS requires. Previous ARP's by this researcher (Milan 2003, 2004) identified the need for evaluative research to confirm or dispute the effect of using different instructional strategies for GFD firefighters on learning. ESRT was investigated as a method to address learning cognitive objectives more effectively and efficiently in the reduced amount of time.

This ARP is necessary to increase the effectiveness of the GFD in future NIMS training courses. To this end, this researcher will conduct evaluative research to determine if statistically significant differences appear on the means of test scores supplemented with the use of ESRT, as compared to DI strategies alone. If this researcher's assumption is correct, using ESRT could assure the stakeholders would actually learn NIMS more efficiently and effectively as reflected by their higher scores on standardized assessments. This ARP will provide valuable, verifiable information about two methods used to teach NIMS, and the effect of these two distinct instructional strategies on standardized test scores.

Investigation of the preferred methods for NIMS instruction supports the objectives of the *Executive Analysis of Fire Service Operations in Emergency Management* (EAFSOEM) course presented at the National Fire Academy (NFA), and the Operational Objectives of the United States Fire Administration (USFA). NIMS instruction is an essential element of the role of NIMS and is described in the EAFSOEM manual as a: "standardized method for managing events or emergencies of any size for federal, state, and local agencies" (DHS, 2004, SM 2-2). USFA Operational Objective number two states: "2,500 communities will have a comprehensive multi-hazard risk reduction plan led by or including the local fire service" (USFA, 2004, ¶1). This ARP will assist the community of Golden by assessing the most effective and efficient instructional strategies to accomplish baseline NIMS training in support of this goal.

In addition, this ARP is linked directly to the USFA operational objective number three: "To respond appropriately in a timely manner to emergent issues" (USFA, 2004, ¶1). The

emergence of evidence based instructional strategies is revolutionizing education in the twenty first century: "to maximize the possibility of enhancing student achievement" (Marzano, Pickering, & Pollock, 2001, p. 3). An added benefit from this ARP is that the results obtained from this evaluative research have the potential to improve the future effectiveness of the Golden Fire Department through improved instruction.

LITERATURE REVIEW

The review of literature included sources from the Learning Resource Center (LRC) at the NFA, universities in the Denver Metropolitan area, and the Internet. The review was directed to literature related to the title of this ARP, and this researcher focused on the findings of others regarding 1) introductory NIMS training, 2) ESRT, and 3) evaluative research.

Introductory National Institute Management System Training

NIMS is the incident management system directed in HSPD-5, and mandated by the Governor of the State of Colorado. In Executive Order No. D 011 04 (2004) Governor Owens resolved:

> It is necessary and desirable that all Federal, State, local and tribal emergency agencies and personnel coordinate their efforts to effectively and efficiently provide the highest level of incident management….The NIMS standardized procedures for managing personnel, communications, facilities and resources will improve Colorado's ability…to enhance local and state agency readiness, maintain first responder safety, and streamline incident management processes.

NIMS training will impact millions of responders. In a briefing on NIMS Training Jamieson, the director of the NIMS Integration Center stated "Currently a total of $8.5 billion is allocated for training first responders and state and local emergency management organizations" (Yamanaka, 2004, ¶7).

In February 2005, this researcher attended a 16-hour NIMS 'train the trainer' course presented by the Colorado DFS. During the course each module was presented, and the instructional delivery was demonstrated to the future trainers. DI was used to present information from the facilitator's guides, and DI was also used in the teaching demonstrations. The course materials included state issued PowerPoint® presentations to be implemented following a DI strategy.

In *Policies and Procedures for Contract Instructors,* DFS expressed that instructors will: "Deliver the courses…in a manner that reflects the highest standards of the adult education profession" (CDPS, 2005b, p. 1). The literature for teaching the content of the NIMS course focused on instruction in the cognitive domain of adult learners. A fire service instructor and author, Carter (2003), describes the cognitive domain, when he quotes from the *IFSTA Fire and*

Emergency Instructor text, as: "a general concept that refers to all forms of knowing including perceiving, imagining, reasoning, and judgment" (p.20). Carter continues: (2003)

> There are six stages of cognitive learning:
> Knowledge--Recalling and recognizing information
> Comprehension--Understanding the meaning of information
> Application--Using information learned in specific situations
> Analysis--Breaking information into parts to understand the whole
> Synthesis--Integrating the parts to invent a new whole, and
> Evaluation--Using standards and criteria to judge the value of information.

This definition of the general concept of the cognitive domain influenced this researcher to search for addition literature defining cognitive learning. The Association for Supervision and Curriculum Development (ASCD) was consulted for an additional definition. Cognitive learning is defined as: "The mental processes involved in learning, such as remembering and understanding facts and ideas" (ASCD, 2005a, ¶19).

In the context of pedagogical, an educational model for teaching children, and andragogical, a model for instructing adults, the strategies for training fire officers were reviewed. Egsegian (2002) citing Knowles, Holton, and Swanson, in an ARP titled, *Analysis of the Pedagogical Educational Model vs. the Andragogical Model in Fire Officer Education,* stated that in a pedagogical model "The role of the learner is by definition a dependent one. The teacher is expected by society to take full responsibility for determining what is to be learned, when it is to be learned, how it is to be learned, and if it has been learned" (p. 8). In discussing the andragogical model Egsegian (2002) stated: "It is a normal aspect of the process of maturation for a person to move from dependency toward increasing self directedness" (p. 9).

In the discussion and recommendations sections from Egsegian's ARP (p. 26), an improvement in student grades was cited when the andragogical model was employed while training fire officers. Egsegian's ARP was typical of many fire service ARP's, in that improvements were noted when instructional strategies were varied, or adult learning models were followed. This researcher noted that evaluative research was not conducted in Egsegian's ARP to determine whether these improvements could be attributed to adult learning strategies or were possibly a result of chance or variations in group (sample) assignments.

Egsegian's discussions of the importance of differentiating instruction for adult learners, from instruction for children ultimately led this researcher to review *The Adult Learner*. Knowles et al. (1998) professed:

> Andragogy is a core set of adult learning principles…The six principles of andragogy are 1) the learners need to know; 2) self-concept of the learner 3) prior experience of the learner, 4) readiness to learn 5) orientation to learning, and 6) motivation to learn… Another important principle in adult education is the importance of the learner as a decision maker in the process of learning.… Andragogy's core adult learning principles take the learner seriously. They go

> beyond basic respect for the learner and view the adult learner as the primary source of data for making sound decisions regarding the learning process (p. 183).

In summary, the introductory course for NIMS focuses on teaching large numbers of adult learners about the system. The cognitive domain was identified as the focus of materials given in the 'train the trainer' course. Primarily, the goal of this introductory course is for the learner to gain knowledge, comprehend, and understand the meaning of the information provided in order to be able to apply this knowledge in times of crisis. After reviewing the materials and literature received during the 'train the trainer' course, this researcher was influenced to gain further understanding of instructing adults in the cognitive domain. Principles of adult education were reviewed in the literature related to firefighter training. Methods of instructing adult learners, as compared to teaching children, were reviewed in various studies.

The 'train the trainer' course materials, specifically the facilitator's guide, contained structured DI lessons and PowerPoint® presentations for course delivery. No additional information was found in the literature review as to other suggested strategies for NIMS instruction. The lack of explicit data in the literature about NIMS instructional strategies for training adult learners was encouraging to this researcher, delineating the need to find the best possible effective strategy the GFD can employ for implementing an introductory NIMS course.

Electronic Student Response Technology

The literature on ESRT was reviewed in an effort to find an instructional strategy that would have the potential to generate a higher level of learning than that generated by the currently recommended DI strategy. Chick (1999) describes DI 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).

One objective of this literature review was to identify an instructional strategy that can effectively and efficiently improve the quality of instruction, and result in the improved performance of adult learners in the introductory NIMS course. This researcher investigated the possibility that this objective can be met by using instruction supplemented with ESRT.

The use of ESRT in the university setting has produced significant results. In a study involving over 6000 students, the use of ESRT increased scores on a standardized physics examination. Hake (1998), as reported in the *American Journal of Physics*, conducted research using over 6,000 (N=6542) introductory physics students enrolled in 62 separate and distinct courses at various universities and reported:

> Fourteen 'Traditional' courses (N=2048) which made little or no use of interactive-engagement (IE) achieved an average gain $\langle g \rangle_{T\text{-}ave} = 0.23 \pm 0.04$ (std

> dev). In sharp contrast, forty eight courses (N=4458) which made substantial use of IE methods achieved an average gain $\langle g \rangle_{IE\text{-}ave} = .48 \pm .014$ (std-dev), almost two standard deviations of $\langle g \rangle_{IE\text{-}ave}$ above that of traditional courses (¶1)

Interactive Engagement (IE) is defined by Hake (1998) as the use of the ESRT with: "activities which yield immediate feedback through discussion with peers and/or instructors" (¶7).

The term, Electronic Student Response Technology (ESRT), has found its way into recent literature about the systems formerly know as Classroom Communication Systems (CCS). The genesis of the technology is a National Science Foundation Grant, which in 1992 spawned the original interactive system 'Classtalk'. Abrahamson (1999) explained the beginnings of the CCS.

> In July 1992 the NSF [National Science Foundation] awarded a grant to a small startup company called Better Education Inc. to develop a new tool for teaching known as a classroom communication system (CCS). Collaborators on this work included some of the outstanding people in education research in the USA. The results of this grant have been far reaching (Abrahamson, 1999, ¶1).

The roots of ESRT are described further in the *Journal of Computing in Higher Education*. Dufresne, Gerace, Leonard, Mestre, and Wenk, reviewed Classtalk, a classroom communication system for active learning.

> In brief the system consists of a number of student input devices networked to a central computer under the instructor's control…From the central computer the instructor can present questions or tasks to the audience by displaying them on a monitor or projecting them onto a screen. The network is used to download tasks to the student input devices, return student responses to the instructor's computer, and if desired, provide response-specific feedback to the student. Programming contained in the central unit permits the instructor to examine the collected responses, display the results to the audience, and store them for future analysis (Dufresne et al, 1996, p.7).

Greer and Heaney (2004) explained ESRT by describing how:

> These wireless systems allow students to key in responses with remote control units to questions posed by an instructor in the classroom. Student responses then are displayed in real time, allowing both students and instructors to gauge student comprehension instantaneously….When an instructor can query and collect responses from every individual in his or her classroom, the instructor can gauge instantaneously what 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 'problem areas' (p. 345).

In conclusion Greer and Heaney (2004) stated:

> Our experiences with electronic student response systems at Penn State University have convinced us that the [E]SRT is capable of creating rapport between the professor and the student in large classroom environments. Both our quantitative and our qualitative assessments strongly support this conclusion. Further testing is required to gauge whether SRT is superior to the traditional lecture approach as a means of improving class comprehension (p. 350).

ESRT was a focus topic at the annual meeting of the Geological Society of America (GSA) held in Denver during 2004. Bennett (n.d.) who employs ESRT in large general education geoscience courses at Western Illinois University reported: "Students responded that it made the class more fun and forced them to both attend class and pay closer attention…These data suggest that electronic student response systems may provide an effective means for engaging students"(¶1). Disadvantages of ESRT are cited in a review of the conference on the GSA website (n.d.) "The biggest concern voiced was time--time needed to learn the system, to set it up, to develop the questions, to input the questions, and the time taken away from the lecture for the polling and the peer instruction" (¶6).

Considering the larger number of adult learners that will be attending the GFD introductory NIMS classes, the trainers will undoubtedly be required to teach to a larger size group than typically encountered in fire department training sessions. One researcher cites the advantages of using ESRT, previously called CCS, when teaching a larger class. The literature reviewed indicated that the mechanics of using the system are secondary to the philosophy of the instructional interaction strategy of the ESRT for adult learners. Beyond the mechanics of the system, Abrahamson (1999) links this current technology with an age old method of instruction stating:

> The reason the Socratic Method works in teaching is because a teacher through questioning can spotlight an area of knowledge, encourage students to think through the issues, establish positions, and commit to positions. It just so happens that this is exactly what the past twenty five years of cognitive science research has shown are things that you would like someone to do when you want them to learn something (¶5).

He cites the problem with the Socratic method of instruction when stating:

> It works well in a small group with perhaps three to five students. In a class of thirty, one hundred or three hundred most students get left out of the interaction. So if you interact well with five students in a class of thirty, the remainder don't get the full benefit of your teaching….This is the reason behind the CCS. We wanted to build a system that would enable teachers to teach interactively, even in the normal class sizes that are associated with common educational practice…(Abrahamson, 1999, ¶5).

This researcher found no literature on the use of ESRT for firefighter or other high-risk professional training. Yet, effective learning for the fire service is of high interest to the profession, as evidenced by the abundance of research discovered relating to training and

teaching firefighters. CBT was frequently mentioned, in the studies reviewed, as a motivational and interactional factor for learning content. A recurring theme was to extend classroom learning beyond lecture. Many of the articles, books, and ARP's dealt with the comparison of instructional strategies. A great deal has been written about the potential of technology to improve learning opportunities for professional firefighters.

The use of technology to support collaborative learning is discussed in *The Internet and Higher Education*. A review of the work of Lehtinen by Potter (2004) revealed:

> Lehtinen examines the theoretical rationale for Computer Supported Collaborative Learning (CSCL). Critical to Lehtinen's thinking is a distinction he makes between cooperation and collaboration. Cooperation is a division of labor whereas collaboration entails mutual engagement. For collaboration to flourish in a CSCL environment, thinking must be made visible among the collaborators. By encouraging students to provide explicit explanations with their contributions, CSCL technology induces high levels of cognitive activity less frequently found in noncollaborative environments (p. 155).

Potter (2004) cites possible negative aspects of CSCL and animation that influence learning in the statement: "While animation appears to support learning, the value of interactivity seems less than definitive. One possible explanation for this finding is that the students experienced cognitive overload resulting from the design characteristic of the tool itself" (p. 156).

A distinctly different instructional role for firefighter instructors is indicated when computers are integrated into Problem Based Learning (PBL). Goh and Lim (2004) stated:

> The instructor's role shifts from 'sage on stage' to guide by side…He or she will not be a source of information but a resource person….When students engage in open inquiry, teachers have to be prepared for the fact they do not 'know everything,' be open to discover new ways of looking at things, and to have a flexible approach to the solution of a problem (p. 51).

A term commonly used in the literature today is "soft skills" education, which refers to skills for dealing with people; they are differentiated from hard skills, which refer to the skills needed to complete tasks, such as raising a ladder. When discussing curricula for soft skills education for firefighters, Bainbridge (2001) explained: "Identification of an effective delivery method, incorporating lecture, written material and/or hands-on training, is necessary to promote this type of education….Many exercises that involve hands-on training should be part of the curricula to reinforce written material and lecture" (p. 65). As early as 1996 when the computer was engaged as a fire service learning tool Campbell (1996) professed: "People who participate learn more and remember what they learn" (p. 30).

Many studies were discovered comparing instructional strategies in fire service and emergency medical service (EMS) courses. Typical of these items were the writings of Lawson

who describes making training more active in *The ASTD Handbook of Training Design and Delivery*.

> Research shows that people understand concepts better and retain information longer when they are actively involved in the learning process; therefore, the most effective means of delivering training are active-training techniques….People learn by doing, not by being told. This basic principle of adult learning should be your guide in designing any training program, from the highly technical to the so-called soft skills addressed in human resource development programs (Lawson, 2000, pp. 42-44).

Lawson (2000) highlighted the challenge of large group instruction. "A big problem trainers face is getting people to respond to questions during a full class discussion. In many cases only a handful of people participate" (p. 48). Lawson suggested a low-tech solution. "To guarantee 100% audience response, use response cards. Hand each participant cards to use in responding to multiple choice (A,B,C,D) or true-false (T,F) questions".

Nutall, in an ARP entitled *Developing Fire Prevention Inspection Skills Using Computer Based Training* discussed attitudes towards Computer Based Training (CBT).

> Another identified difference between CBT and classroom instruction is improved instructional reception by the students….The effectiveness of CBT for adult learners is based upon the fact that students feel in control…It provides a privacy factor that reduces learners embarrassment about taking 'remedial' classes or making mistakes while answering questions in the training materials. The computer actively engages the trainee in the training process, providing increased trainee satisfaction (Nutall, 1998, p. 5).

In an ARP entitled *An Assessment of Computer Based Training for EMT Re-certification,* Somers conducted a survey to measure general attitudes toward CBT in the Phoenix Arizona Fire Department. "The results of the survey were personnel nearly universally were comfortable with using computers, with the caveat that the older and longer served personnel were less comfortable" (Somers, 2002, p iv). Somers discussed the correlation of attention to proficiency when referring to Brown.

> Research has shown that individuals who spend more time on-task while practicing become more proficient than those who focus on off task activities (Brown, 2001). Therefore, it is important for program designers to add elements that grab the attention of the user and challenge the user thus, holding their attention to the task of learning…. Motivation is often an overlooked aspect of CBT instruction design yet, may be the most critical for successful implementation (pp. 32-40).

In summary, the ESRT instructional strategy has been utilized over a large range of disciplines. ESRT makes a Socratic method of instruction easier to accomplish with large groups. Review of studies involving ESRT indicated that conceptual understandings increased

and gains in scores on tests were significant. ESRT research was not mentioned in the literature related to a high-risk profession such as firefighting. The majority of the studies reviewed recommended interactive hands on activities for training, and engaging firefighters in the learning process. ESRT is classified as an interactive instructional strategy by Hake (1998, ¶7).

Evaluative Research

The literature on evaluative research is extensive. The definition of evaluative research is "the systematic process of collecting and analyzing data in order to facilitate decision making" (DHS, 2003, p. II-26).

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).

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

The research classification system influenced this researcher to experimentally compare two identified instructional strategies, i.e., ESRT and DI, using Level II research. Grossen (1996), concluded: "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 clarification supports the purpose of this ARP.

This ARP essentially carries out an assessment rather than conducts an evaluation, yet it can be classified within evaluative research guidelines. Jalongo and Matuku (1999) define assessment and evaluation. "'Assessment' is a general term usually reserved for determination about people…'Evaluation' is another general term used in education when making judgments about things, such as lesson plans, learning experiences, curriculum models, and educational programs" (Jalongo & Matuku, 1999, p. 126).

This researcher found it prudent to note the difference between evaluation and assessment, but was not influenced by the literature review to change the title of this ARP to *Assessment of Electronic Student Response Technology in an Introductory National Institute Training Course*. This ARP will assess the effect of ESRT using a standardized Federal Emergency Management Agency (FEMA) IS-700 test, but more importantly it will also relate to the larger concept of evaluation. The ASCD (2005b) defines assessments as: "measuring the learning and performance of students or teachers. Different types of assessment instruments include but are not limited to achievement tests, minimum competency tests, screening tests, aptitude tests, observation instruments, performance tasks, and other authentic assessments" (¶29). Evaluation, in the educational context, is a much larger concept and deals with the overall effectiveness of a course or program.

A variety of statistical texts were reviewed to assist this researcher in determining an appropriate experiment design for the evaluative research envisioned for this ARP. The literature on true experimental designs in Campbell and Stanley (1963) *Experimental and Quasi-Experimental Design* as well as in Gay and Airasian (2003) *Educational Research* was reviewed for the purpose of selecting an experimental design model appropriate for the Level II Research planned for this ARP.

Gay and Airasian (2003) pointed out the feasibility of using the Solomon Four-Group Design for an experiment containing two independent variables; such a design was envisioned for this ARP. The Solomon Four-Group Design is explained by Gay and Airasian (2003) as a true experiment which:

> involves random assignment of participants into one of four groups. Two of the groups are pretested and two are not. One of the pretested groups and one of the unpretested groups receive the experimental treatment. All four groups are post-tested with the dependent variable….There are two independent variables in this design: treatment/control and pretest/no pretest….To put it simply, if the pretested experimental group performs differently on the post-test than the unpretested experimental group, there is probably a pretest-treatment interaction. If no pretest-treatment interaction is found, then the researcher can have more confidence in the generability of treatment differences across pretested and nonpretested treatments (p. 377).

In summary, statistical texts reviewed in the literature influenced this researcher's selection of a true experimental design for this ARP. Evaluative research was carefully examined by way of a review of the three level classification system of research described in the literature by Grossen (1996). The literature review was invaluable in the search for an appropriate design to be used as a model for this evaluative research. Solomon Four Group Design was reviewed in terms of the most feasible and practical true experimental design for this Level II research. Generally, this researcher was not able to discover research relating the effectiveness of the instructional strategies proposed for NIMS instruction in the first response community. The literature review focused on introductory NIMS training, the use of ESRT as an interactive instructional strategy, and evaluative research.

PROCEDURES

This procedures section contains research methodology, including subtitles; the 10 step process; limitations and assumptions; and definition of terms for ambiguous concepts. The subtitles for the research methodology are the experimental design, the definition of variables, data analysis, and null hypotheses.

Research Methodology

The desired outcome of this ARP was to determine the most effective and efficient instructional strategy to be utilized by the GFD for teaching the introductory NIMS course to Golden community first responders. A true experimental design was necessary to determine whether any differences in the scores 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 treatment could be recommended for implementation in future NIMS courses.

The subject matter to be taught to both groups was based on the FEMA IS-700 Course. The State of Colorado issued materials for teaching this course to groups. This researcher considered teaching one group using DI strategies, and the second group using a computerized classroom communication system called ESRT. The goal was to determine whether or not randomly assigned subjects would perform at a higher level when they were taught using ESRT. Analyzing data from post-test scores would determine if the results were accidental or if they could be predicted to occur again. The assumption was that the group who scored significantly higher had learned the subject matter more effectively than the other group.

The Experimental Design

This researcher relied heavily upon *Educational Research* by Gay and Airasian (2003)to conceive and design the experiment for this ARP. The Solomon Four Group Design, previously described in the literature review, was selected to be the most logical experimental design for this ARP. Theoretically, this design would show a cause-effect relationship because: 1) the researcher was in a position of manipulating the independent variable ESRT; 2) randomization

for two groups would control for non experimental variables; 3) the ESRT group would receive the treatment and the DI group would not (DI was in effect a control group); 4) randomization would occur at the same point in time for both groups; and 5) measuring of both groups would be at the same point in time and a natural part of pre-established testing procedures for teaching this course. Figure 2 shows the Solomon Four-Group Experiment Design.

Figure 2
The Solomon Four-Group Experiment

	DI	ESRT
Pre-Test	Post-Test Scores O,O,O,O,O,O,O,O,O,O, O,O,O,O,O,O,O,O,O,O, O,O,O,O	Post-Test Scores O,O,O,O,O,O,O,O,O,O, O,O,O,O,O,O,O,O,O,O, O,O,O,O
No Pre-Test	Post-Test Scores O,O,O,O,O,O,O,O,O,O, O,O,O,O,O,O,O,O,O,O, O,O,O,O	Post-Test Scores O,O,O,O,O,O,O,O,O,O, O,O,O,O,O,O,O,O,O,O, O,O,O,O

According to Campbell and Stanley (1963) the Solomon Four-Group design sources of internal and external invalidity are 1) history, testing, regression, selection, and interactions of these variables for internal validity and 2) interaction of testing and X, interaction of selection and X, and reactive arrangements for external validity. Randomization of both groups would control for non-experimental variables. This experiment would have limits on external validity due to two major reasons: 1) the GFD is not representative of the total firefighter population, and 2) the sample size is small.

Variables Defined

The variables selected for this experimental design were independent and dependent variables. See Table 1 for the definition of the variables and their values.

Table 1
Definitions and Values of Variables

Variable	Definition	Value
Independent	1) ESRT	ESRT
		No ESRT
No ESRT	2) Pre-Test	Pre-Test
		No Pre-Test
Dependant	1) Post-Test	Raw Scores on FEMA IS-700
		Test

Independent Variables

There are two independent variables, ESRT and Pre Test. The operational definition of ESRT is two three-hour classes of firefighters, some who have taken a pre-test and others who have not. ESRT is used as the instructional strategy for one group of firefighters, and DI is used for the control group. Therefore the values of this independent variable are those who had ESRT and those who had no ESRT. The operational definition of pre-test is raw scores on the FEMA IS-700 test for those who were randomly selected to take the pre-test. The values of the pre test variable are pretest and no pretest.

Dependent Variable: Standardized Test

The value of the dependent variable is raw scores on the post-test. The operational definition of the dependent variable is the FEMA IS-700 test. This researcher believes that due to the wide intended use of this assessment for millions of responders by FEMA this test is indeed a valid assessment instrument.

Data Analysis

A 2x2 factor ANOVA was selected for data analysis. This statistical analysis, called the two way analysis of variance (ANOVA), is widely used for testing hypotheses. As the name implies, this is a procedure that allows the researcher to examine the effect of two independent variables concurrently, and also tell the researcher whether the two variables interact.

The analysis of data for a two-factor analysis, such as for data gathered from the Solomon Four-Group design, produces F-Ratios to test the null hypotheses. The two factors for the design of this ARP are treatment and testing. The F statistic is used to reject or to fail to reject the null hypotheses 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 Ratios are useful for testing the level of significance of any differences found between the means, such as the means of the post-test scores of the two groups and their interaction. ESRT and pre-test are the two independent variables in this experiment. Gay and Airasian (2003) stated: "The correct way to analyze data resulting from application of this design is to use a 2x2 (two by two) factorial with treatment and control groups crossed with pretesting and non pretesting" (p. 377).

Null Hypotheses

Null hypotheses stated for the purpose of this ARP data analysis are:

1. There is no significant difference in total NIMS achievement test scores between firefighters randomly assigned to ESRT groups or DI groups.

2. There is no significant difference in total NIMS achievement test scores between firefighters taking the pre-test and firefighters not taking the pre-test who were randomly assigned to ESRT groups or DI groups.

3. There is no significant difference in total NIMS achievement test scores for the groups that resulted from the two-way interactions, of ESRT and pre-test or DI and pre-test, between firefighters taking the pre-test and firefighters not taking the pre-test who were randomly assigned to ESRT groups or DI groups.

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. DI and ESRT, on a post-test instrument. If a null hypothesis is true, the differences between the means was 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 percent (p=.05) (Rumsey, 2003).

Process

After a true experimental design was selected, the variables for the experiment were defined, an appropriate statistical analysis was selected, and the null hypotheses were discussed, a 10-step process was used to conduct this applied research project. The steps were generally sequential.

The first step was to attend the DFS train the trainer course and secure training materials for classroom delivery of the FEMA IS-700 course.

The second step was to randomly assign all Golden Firefighters into two groups, one to receive DI and the other to receive ESRT.

The third step was to randomly select half of each of these groups so a 4-Group Solomon experiment design could be utilized for this study. One half of each group was to be given a pre-test and one half of each group was not to be given the pre-test. The pre test groups were randomly selected. The pre-test used was the same instrument as the post-test.

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

The fifth step was to deliver the 3 hour DI instruction to the control group and administer the post-test. The DI was delivered as prescribed by the DFS and this group served as a control group.

The sixth step was to deliver the 3-hour ESRT classroom presentation to the experimental group and administer the post-test. The same DI was enriched with the interjection of 12 ESRT response slides. The questions were taken directly from the DFS instructional materials, and formatted for inclusion in the ESRT strategy. The ESRT group served as the experimental group.

The seventh step was to collect and format the data so a Solomon 4-group design could be implemented. Table 2 shows the experimental design for the Solomon four-group design.

Table 2
The Solomon Four-Group Experiment Design

Random Group	Pre-test	Treatment (ESRT)	Post-test
R	0_1	X	0_2
R	0_3		0_4
R		X	0_5
R			0_6

Note. O = Outcome on test, X = Treatment

The eighth step was to compute a 2x2 factor ANOVA of the data with the aid of a computer program, and by hand to verify the accuracy of the computer program. Basically the data analysis was done to determine whether there was a statistically significant difference between the means of the two groups, i.e., DI and ESRT. This was done using the 2x2 factor ANOVA design as shown in Table 3.

Table 3
2x2 Factor Analysis of Variance

	No X (DI)	**X (ESRT)**
Pretested	0_4	0_2
Unpretested	0_6	0_5

Note. Factor A=Treatment(X), Factor B= Testing

Campbell and Stanley (1963) state: "From the column means, one estimates the main effect of X, from row means, the main effect of pretesting, and from cell means, the interaction of testing with X (p. 25). In this study, the treatment X is ESRT.

Table 4
Analysis of Variance Table of the Two-Factor Experiment

Source of Variance	***SS***	***df***	***MS***	***F***	***p***
bg					
rows					
columns					
r x c					
wg					
total					

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 of .05 was selected to accept or fail to reject a null hypothesis. Calculating the data by hand was a five-step process to:

1. Compute the total sum of the squares.
2. Compute the sum squares for factor A.
3. Compute the sum of squares for factor B.
4. Compute the sum of squares for interaction.
5. Compute the sum of squares due to error.

The computation formulas for these five steps can be found in *Introduction to Statistics* (Anderson, Sweeney & Williams, 1991, p. 424).

The ninth step was to analyze the data in order to determine the results.

The tenth step was to report the results of the data analysis.

Limitations and Assumptions

The results of this ARP were limited by several factors that should be noted.

This experiment would have limits on external validity due to two major reasons: 1) the GFD is not representative of the total firefighter population, and 2) the sample is small. This limitation is based on a Kahane and Cavender statement as quoted by Martinette (2002) related to the "fallacy of bias statistics, or using a sample that insufficiently represents the total population" (p. 19). 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.

Ten firefighters were no shows for the pre-test groups and two were no shows for the groups not pre-tested, which caused an inequity in the size of the four groups. Ideally a more valid conclusion could have been reached if this experimental mortality had not occurred. Data on experimental mortality are included as Table 5.

Table 5
Experimental Mortality for GFD Firefighters

Group	Original Sample	Attrition	Final Sample
ESRT Pre-Tested	24	4	20
ESRT Non Pre-Tested	24	2	22
DI Pre-Tested	24	6	18
DI Non Pre-Tested	24	0	24
TOTAL N=	96	12	84

Definition of Terms

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, 2003, ¶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).

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 (Rice University Hyperstat, 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).

RESULTS

The results of this experiment were determined by analyzing the data from the pre-tests and post-tests. The assessment tool used for testing the groups was the FEMA IS-700 test. This tool is a standardized test used by FEMA as an assessment for everyone taking the online IS-700 course, and required by the DFS for the classroom deliveries of the course in the State of Colorado (Cooke, personal correspondence, March 16, 2005). Due to the general acceptance of this assessment as a 'standard' evaluation, this researcher selected this test as the tool for this ARP. The pre-test and post-test used in this experiment were identical and are included as Appendix F. Specifically raw scores from the assessments were compared. Test scores, i.e. the raw data, are included as Appendix A.

The initial number of participants in the study was 96. All firefighters serving Golden, the total population, were included in the study. They were randomly assigned to one of Four-Groups as prescribed in the Solomon 4-group experiment design. Of these, 42 received instruction supplemented with ESRT and 42 received DI. Of the ESRT participants, 20 were pre-tested and 22 were not. Of the DI participants, 18 were pre-tested and 24 were not. The final total number of participants in the study was 84 (N=84). Originally the size of all random groups was equal, but due to experimental mortality (non-participation due to non attendance), the pre-tested groups were smaller than the non pre-tested groups.

The results of the data analysis are displayed in Table 6 and Table 7. Table 6 reports the means of the groups. Factor A is the treatment and factor B is testing. Table 7 is a summary of the ANOVA data. Calculations were completed by hand, and with the assistance of a tool available online through Vassar University (n.d., ¶1) entitled 2x2 Factorial ANOVA. The results were calculated by hand to verify the accuracy of the computer analysis. Both the computer analysis and the hand calculations yielded the same results.

Table 6
Table of Means: Cells, Rows, Columns, and Totals

	B_1 (Pre-test)	B_2 (No Pre-test)	Rows
A_1 (DI)	12.4444	13.9583	13.3095
A_2 (ESRT)	18.05	18	18.0238
Columns	15.3947	15.8913	15.6667

Table 7
Analysis of Variance Table of the Two-Factor Experiment

Source of Variance	*SS*	*df*	*MS*	*F*	*p*
bg	490.3139	3			
rows	466.7143	1	466.714	38.56	<.0001
columns	5.1312	1	5.131	0.42	0.518793
r x c	18.4684	1	18.468	1.53	0.219731
wg	968.3528	80	12.104		
Total	1458.6667	83			

bg = between groups; rxc = rows times columns; wg = within groups

Null Hypothesis 1: The data in Table 7 shows that there were significant differences in total achievement test scores observed between the experimental group that received the ESRT training program and the DI control group which did not. (F=38.56, which is significant at the <.0001 level). Therefore, this researcher rejected null hypothesis number 1.

Null Hypothesis 2: The data in Table 7 shows that 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.). Therefore this researcher failed to reject null hypothesis number 2.

Null Hypothesis 3: The data in Table 7 shows that there were no significant differences in total achievement test scores between the two-way interaction, of ESRT and pre test or DI and pretest, between firefighters taking the pre-test and firefighters not taking the pre test who were randomly assigned to the ESRT group or DI group. (F= 1.53, which is insignificant at the .05 level.). Therefore this researcher failed to reject null hypothesis number 3.

DISCUSSION

ESRT effectiveness was judged in terms of the criterion of FEMA IS-700 post test scores of firefighters. The ESRT group scored significantly higher on the total achievement test scores. The primary conclusion drawn from the data analysis for this ARP was that there was a significant difference between the means of the ESRT group and the means of the DI group. This finding can be interpreted to denote the firefighters in the ESRT group, who performed significantly higher on a valid test, actually did learn more than their counterparts in the DI

group. This discussion focuses on instructional strategies as they relate to introductory NIMS training, studies on the effect of ESRT, and the importance of evaluative research; this was also the focus of the literature review.

Introductory National Incident Management System (NIMS) Training

The results using the andragogical model of instructing are in line with those of Egsegian; scores were significantly higher when using the ESRT model. When the same instructor employed DI alone for the control group, they were dependent on the instructor's lecture and DI materials to gain their knowledge. As Chick (1999) explained DI, it was designed to: "include explicit teaching of rules and strategies and sequencing of examples and nonexamples" (p. 86). For the DI group, all concepts were sequentially covered, whereas for the ESRT group all the NIMS concepts were covered, but in a way that focused on the concepts the firefighters needed to learn, not on all concepts whether they already knew them or not. The ESRT approach was more flexible than the DI strategy. This allowed instruction in a manner similar to that described by Greer and Heeney (2004): "to spend less time on material that has already been processed in favor of focusing on 'problem areas'" (p. 345). This researcher noted an improved interaction with the ESRT, much the same as Greer and Heeney. "Our experiences with electronic student response systems at Penn State University have convinced us that the [E]SRT is capable of creating rapport between the professor and the student in large classroom environments" (p. 350).

Firefighters trained with ESRT received immediate feedback as they were interacting with the instructor. The results of this ARP can be compared favorably with those of Egsegian's ARP (2002), where an improvement in student grades was noted when the andragogical model was employed while training fire officers. For example, Egsegian (2002) stated citing Knowles et al. "It is a normal aspect of the process of maturation for a person to move from dependency toward increasing self directedness" (p. 9). The firefighters in the ESRT group were stimulated to be more self-directed by taking more responsibility for their learning by using the hand held devices.

ESRT technology requires more of the instructor and a change in mindset from being a disseminator of information to becoming a facilitator of learning. The GSA (n.d.) states: "The biggest concern voiced was time--time needed to learn the system, to set it up, to develop the questions, to input the questions, and the time taken away from the lecture for the polling and the peer instruction" (¶6). Another, and in this researcher's opinion, greater challenge is cited by Goh and Lim (2004).

> The instructor's role shifts from 'sage on stage' to guide by side…He or she will not be a source of information but a resource person….When students engage in open inquiry, teachers have to be prepared for the fact they do not 'know everything,' be open to discover new ways of looking at things, and to have a flexible approach to the solution of a problem (p. 51).

This shift in mindset from expert to facilitator will probably meet substantial resistance from many GFD instructors. These are typically the less experienced instructors who in this researcher's opinion would be uncomfortable leaving the traditional role of disseminating information. It is this researcher's opinion that overcoming instructor resistance and only a slight increase in time to facilitate learning with ESRT is far offset by the improvements ESRT will provide for learning at the GFD.

Making training active rather than passive for firefighters is a recurring theme in the literature reviewed. Bainbridge (2001) explained: "Identification of an effective delivery method, incorporating lecture, written material and/or hands-on training, is necessary….Many exercises that involve hands-on training should be part of the curricula to reinforce written material and lecture" (p. 65). Lawson (2000) writes about making training active in *The ASTD Handbook of Training Design and Delivery*.

> Research shows that people understand concepts better and retain information longer when they are actively involved in the learning process; therefore, the most effective means of delivering training are active-training techniques….People learn by doing, not by being told. This basic principle of adult learning should be your guide in designing any training program, from the highly technical to the so-called soft skills addressed in human resource development programs (Lawson, 2000, pp. 42-44).

The old Chinese Proverb applies here: I hear--I forget; I see--I remember; I do--I understand.

Some non-experimental findings of others in the literature were related to this study, such as the motivational factor of the ESRT approach. In an ARP entitled *An Assessment of Computer Based Training for EMT Re-certification,* Somers (2002) discussed the correlation of attention to proficiency when referring to Brown. "Motivation is often an overlooked aspect of CBT instruction design yet, may be the most critical for successful implementation" (Somers, 2002, p. 40).

In this researcher's opinion, the presentation of NIMS instruction and integration of NIMS concepts into the City of Golden operations is a daunting task for the GFD. Over 175 employees, in addition to fire department personnel, are targeted to receive introductory training. This comes in a year when the Colorado Division of Fire Safety has revised certification renewal for firefighters, and in effect reduced the amount of time available for cognitive instruction for GFD (Milan, 2004). No additional staffing or budget increases have been allocated to the training division, however the responsibility of NIMS training for the City of Golden rests with the GFD Training Division.

Exploration of more effective and efficient instructional strategies is an appropriate response considering the added responsibilities of the GFD Training Division. The message from Homeland Security is clear "The lion's share of what we are responsible for and what we are concerned about resides on the state and local jurisdictions" (Nicholson, 2004, p. 11). Previous research by this researcher identified and compared instructional strategies used by GFD. DI was identified as the primary method of cognitive instruction. Preliminary investigations into ESRT

showed promising potential (Milan, 2003, 2004). There is a difference between a technology showing potential and actually improving learning. This applied research project explored the question of the effectiveness of instructional strategies raised by the two previous ARP's completed by this researcher. Decisions concerning instructional strategies for GFD must be based on sound research, such as these investigations.

Electronic Student Response Technology

ESRT was the treatment in this experiment. Many studies from academia related to the effectiveness of ESRT found in this study. The organizational implication from these results is that ESRT could be an effective tool for the GFD training division to utilize. The ESRT approach was shown to be a more effective way to teach the content of the NIMS course for this group of firefighters. The results should not be viewed as definitive for all firefighters or for varied subjects with this population. The ESRT group had higher scores than the DI group. The ESRT had a mean of 18.0238 whereas the DI group had a mean of 13.3095. This difference was found to be significant when analyzed using ANOVA. The results of this 2x2 ANOVA are shown in Table 7. Analyzing the means of those groups showed that those who had taken a pre test did not perform significantly better on the assessment. There were no significant differences between groups, nor between the two-way interactions of pre-test/no pre-test and ESRT/no ESRT of groups. Those groups who had taken the pre test had a mean of 15.3947 whereas those who had not taken the pre test had a mean of 15.8913.

True experimental research has been completed on ESRT in the academic setting. Hake (1998) conducted research with over 6000 introductory physics students and significant improvements were documented as "An average gain $\langle g \rangle_{IE\text{-}ave} = .48 \pm .014$ (std-dev), almost two standard deviations of $\langle g \rangle_{IE\text{-}ave}$ above that of traditional courses".

ESRT has distinct advantages to supporting collaborative learning. Potter (2004) suggested: "For collaboration to flourish in a CSCL [Computer Supported Collaborative Learning] environment, thinking must be made visible among the collaborators" (p. 155). Lawson highlights a challenge of large group instruction "A big problem trainers face is getting people to respond to questions during a full class discussion. In many cases only a handful of people participate" (2004, p. 48, as quoted by Potter).

ESRT also has a distinct advantage over the low tech solution suggested by Lawson: "To guarantee 100 percent audience response, use response cards. Hand each participant cards to use in responding to multiple choice (A,B,C,D) or true-false (T,F) questions". ESRT, on the other hand, puts the information in clear view of all instantaneously, as described by Greer and Heaney (2004).

> Student responses then are displayed in real time, allowing both students and instructors to gauge student comprehension instantaneously….When an instructor can query and collect responses from every individual in his or her classroom, the instructor can gauge instantaneously what 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 'problem areas' (p. 345).

Greer and Heeney (2004) are convinced the ESRT improves rapport between instructor and student but caution: "Further testing is required to gauge whether [E]SRT is superior to the traditional lecture approach as a means of improving class comprehension" (p. 350). Bennett (n.d.) stated: "Data suggest that electronic student response systems may provide an effective means for engaging students" (¶1).

Evaluative Research

The implication for the GFD is that more evaluative research should be conducted. The apparent lack of true experimental comparison of instructional strategies in the review of fire service literature was alarming to this researcher. Many studies cited improvements, however, improvements can be attributed to many factors beyond application of an instructional strategy. Only through controlled experimental procedures can there be confidence in results.

However, the GFD would have to conduct research on a larger scale with more intense treatments since the effectiveness of using ESRT was judged solely in terms of achievement on the NIMS post-test. This was a short-term study lasting for only one three-hour training session, for each instructional method, by the same instructor. If the study were more long term, perhaps the novelty of the technology would not be a motivating factor, and more definitive results could have been obtained. However, the results clearly indicate that using ESRT significantly improved the results on the post-test and it is assumed this effect would continue to be the case even in long term studies on a larger scale.

This study is not generalizable to all firefighters. It was exploratory to determine whether it would be of value to use ESRT instruction for the future training of firefighters and city employees in NIMS courses. This ARP paves the way for further exploration of ESRT by the GFD, since the results were highly significant. This study, if conducted with varied groups of subjects using longer term use of ESRT training, may produce results which are more generalizable. In the three level research classification system by Grossen (1996) this ARP was conducted at Level II i.e. to test hypotheses by formal experiment and analyze data to accept or reject the null hypotheses. More genereralizable results would require Level III research, including replication of the experiment and large scale, long term follow up studies.

An additional implication for the GFD regarding further research on ESRT is that it should be evaluative. As this study demonstrates, a controlled experimental study, including randomization, can occur in the instructional setting for firefighters. However, no evaluative research was found in the area of NIMS instruction in the search of the literature. Generally, surveys were used to study various instructional settings. It should be noted that just because there are gains on tests this does not denote that these gains are significant. Only through a controlled experimental study can the results be considered to be significant or not significant. Evaluative research is important for this reason.

This Solomon Four-Group design was selected for this experiment for extremely important reasons. Campbell and Stanley (1963) stated this design controls for many non-experimental as well as experimental variables. This researcher selected the strongest experimental design that could be conducted within time and financial constraints. Gay and Airasian established "If no pretest-treatment interaction is found, then the researcher can have more confidence in the generability of treatment differences across pretested and nonpretested treatments" (p. 377). The results of this study cannot be generalized due to the limitations cited as 1) the GFD is not representative of the total firefighter population, and 2) the sample is small. This researcher strongly suspects similar increases in test scores, as indicators of learning, would be present if the study were replicated on a larger scale.

The FEMA post-test was the tool chosen to assess performance. This researcher recognizes the importance of a valid instrument. The assumption is that the FEMA IS-700 post-test is indeed a valid assessment tool, due to the widespread use of the tool by both FEMA and the State of Colorado. It is incomprehensible to this researcher that a tool with this amount of use would be utilized if sufficient documentation of content validity did not exist. This tool is widely used by the first response community as a standard assessment and therefore was selected for use by this researcher.

The data in Table 7 showed there is a significant statistical difference in total achievement test scores between the experimental group that received the ESRT training, and the control group that did not. The F ratio calculated for this comparison was 38.56, which is clearly significant at the .05 level. There were no significant differences found in the other null hypotheses. The F-ratio for null hypothesis number two (pre-testing) was 0.42 ($P = 0.518793$), and for null hypothesis number three was 1.53 ($P = 0.219731$). Both of these F-ratios are clearly insignificant at the .05 level. The fact that the only significant difference found was produced by ESRT strengthens the argument ESRT is a direct cause for increases in scores on the post-test assessment. As established by Gay and Airasian (2003):

> To put it simply, if the pretested experimental group performs differently on the posttest than the unpretested experimental group, there is probably a pretest-treatment interaction. If no pretest-treatment interaction is found, then the researcher can have more confidence in the generability of treatment differences across pretested and nonpretested treatments (p. 377).

The organizational implications to be derived for the GFD are clear. The results of using ESRT showed highly significant results. Though ESRT has been explored extensively in the academic setting, this study shows further investigations for the emergency response and emergency preparedness communities should consider this as well as other interactive strategies for instruction. With estimates such as: "Currently a total of $8.5 billion is allocated for training first responders and state and local emergency management organizations" (Yamanaka, 2004, ¶7), it is this researcher's opinion exploration of instructional strategies for NIMS should be a priority. Investigations of effective and efficient instructional strategies should be conducted. The use of true evaluative research, which is severely lacking in fire service training, must be at the core of consideration of instructional strategies. This researcher agrees with Grossen's (1996) statement that "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). ESRT has been put to this test and has produced better results than the DI alternative for introductory NIMS training. This ARP, if conducted with larger groups, and more intense treatments, might produce remarkable results. This treatment may have had effects not measured in this study.

This discussion focused on the role of the instructor for the future NIMS training by the GFD, the value of using ESRT as an instructional strategy, and the importance of the GFD to use evaluative research in future studies. The clear implication for GFD is ESRT an effective instructional strategy for NIMS instruction. The bigger picture is national security can be improved with effective and efficient NIMS instruction, and evaluative research on instructional strategies will increase the knowledge base for cognitive instruction in the fire service.

RECOMMENDATIONS

The problem in this ARP was to address the effect, on standardized test scores, of using ESRT as compared to DI for GFD firefighters. The purpose of this ARP was to determine the effect, using evaluative research, of using ESRT vs. DI. ESRT, at the level of intensity established in this experiment, did significantly improve achievement test scores on the FEMA IS-700 assessment. The recommendation resulting from this data analysis is that further evaluative research should be conducted by the GFD on the use of ESRT for NIMS 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 Colorado DFS may want 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 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 1) to conduct further research on instructional strategies; 2) to communicate the results of this study to others; and 3) to elevate this study to Level III research.

REFERENCES

Abrahamson, A. L. (1999, May). *Teaching with classroom communication system--what it is and why it works*. Paper presented at the 7th international new trends in teaching physics workshop, Puebla, Mexico. Retrieved February 15, 2004, from http://www.bedu.com/Publications/PueblaFinal2.html

Anderson, D.R., Sweeney, D., & Williams. (1991). *Introduction to statistics: concepts and applications.* (2nd ed.) St. Paul, MN: West Publishing.

Association for Supervision and Curriculum Design. (2002a). *Lexicon of learning.* Retrieved May 22, 2005 from http://www.ascd.org/portal/site/ascd/menuitem.4247f922ca8c9ecc8c2a9410d3108a0c/template.article?articleMgmtId=fff4016620520010VgnVCM1000003d01a8c0RCRD

_____. (2002b). *Lexicon of learning.* Retrieved April 14, 2005 from http://www.ascd.org/portal/site/ascd/menuitem.4247f922ca8c9ecc8c2a9410d3108a0c/template.article?articleMgmtId=ee2a016620520010VgnVCM1000003d01a8c0RCRD

Bainbridge, L.L. (2001). *Determining components and delivery methods for "soft skill" education for the fire service*. Emmitsburg, MD: National Fire Academy.

Bennett, S. (n.d.). *Evaluation of electronic student response technology in a general education oceanography course*. Paper presented at the 2004 meeting of the Geological Society of America. Abstract retrieved May 11, 2005, from http://gsa.confex.com/gsa/2004AM/finalprogram/abstract_78082.htm

Campbell, D.T., & Stanley, J.C. (1963). *Experimental and quasi-experimental designs for research*. Boston: Houghton Mifflin.

Campbell, P. (1996, December). Interactive training = active learning. *Fire Chief, 40* (12), 30-33.

Carter, H.R. (2003, April). Another look at learning--part 1. *The Voice, 32* (4), 20-21.

Chick, K.A. (1999). Finding a place for inquiry methods and direct instruction. In M.R. Jalongo (Ed.), *Resisting the pendulum swing: Informed perspectives on educational controversies* (pp. 81-92). Olney, MD: Association for Childhood Education International.

Colorado Department of Public Safety. (2005a). *National incident management system training implementation strategy*. Centennial, CO: Author.

_____. (2005b). *Contract instructor policy and procedures*. Centennial, CO: Author.

Department of Homeland Security. (2004, December). *Executive analysis of fire service operations in emergency management student manual.* (Pilot 2 version). Emmitsburg, MD: Author.

_____. (2003, September 1). *Executive fire officer operational policies and procedures applied research project guidelines.* [Electronic Version]. Retrieved April 15, 2005, from http://www.usfa.fema.gov/downloads/pdf/efop-guidelines.pdf

Dufresne, R.J., Gerace, W.J., Leonard, W.J., Mestre, J.P. & Wenk, L. (1996). Classtalk: A classroom communication system for active learning. [Electronic version]. *Journal of computing in higher education, 7*, 3-47. Retrieved February 13, 2005, from http://umperg.physics.umass.edu/library/UMPERG-1995-13/entirePaper/

Egsegian, R. (2002). *Analysis of the pedagogical educational model vs. the andragical educational model in fire officer education*. Emmitsburg, MD: National Fire Academy.

Executive. Order No. D 011 04 (2004). [Electronic Version] Retrieved March 7, 2005 from http://www.colorado.gov/governor/eos/d01104.pdf

Gay, L.R., & Airasian, P. (2003). *Educational research: competencies for analysis and applications.* (7th ed.). Upper Saddle River, NJ: Merrill Prentice Hall.

Geological Society of America. (n.d.). *Electronic student response technology: Special session at 2004 annual meeting of the Geological Society of America*. Retrieved May 11, 2005 from http://serc.carleton.edu/introgeo/interactive/esr-gsa.html

Goh, A., & Lim, C. (2004, November-December). Teachers and students as investigators: the collaborative project in technology-based learning environments. *Educational Technology, XLIV* (6), 50-54.

Greer, L., & Heaney, P.J. (2004, September). Real-time analysis of student comprehension: an assessment of electronic student response technology in an introductory earth science course. *Journal of Geoscience Education, 52* (4), 345-351.

Grossen, B. (1996, Fall). Making research serve the profession. *American Educator, 20* (3), 7-8, 22-27.

Hake, R.R. (1998). Interactive-engagement vs. traditional methods: A six thousand student survey of mechanics test data for introductory physics courses. [Electronic version]. *American Journal of Physics, 66,* 64-74. Retrieved January 29, 2005 from http://www.bedu.com/Publications/ajpv3i.pdf

Jalongo, M.R., & Mutuku, M.M. (1999). Program evaluation: Monitoring quality without sacrificing substance. In M.R. Jalongo (Ed.), *Resisting the pendulum swing: Informed perspectives on educational controversies* (pp. 125-133). Olney, MD: Association for Childhood Education International.

Knowles, M.S., Holton, E.F., & Swanson, R.A. (1998). *The Adult Learner*. (5th ed.). Woburn, MA: Butterworth-Heinemann.

Larson, G.E. (1990). *Training for the 1990's.* Emmitsburg, MD: National Fire Academy.

Lawson, K. (2000). Making training active. In G.M. Piskurich, P. Beckschi, & B. Hall (Eds.) *The ASTD Handbook of Training Design and Delivery.* (pp. 42-94). New York: McGraw-Hill.

Martinette, C.V. (2002). *Learning organizations and leadership style*. Emmitsburg, MD: National Fire Academy.

Marzano, R.J., Pickering, D.J., & Pollock, J.E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Milan, K.O. (2003). *Identification and comparison of instructional strategies for the Golden Fire Department recruit academy*. Emmitsburg, MD: National Fire Academy.

_____. (2004). *Investigation of the classroom communication system for the Golden Fire Department*. Emmitsburg, MD: National Fire Academy.

Nicholson, W.C. (2004, April). An interview about NIMS and the NRP. *Homeland Protection Professional, 3*(3), 10-11.

Nutall, S.R. (1998). *Developing fire prevention skills using computer based training*. Emmitsburg, MD: National Fire Academy.

Potter, A.N. (2004). [Review of the book *Powerful learning environments: unraveling basic components and dimensions*]. *The internet and higher education, 7* (2), pp. 154-157.

Rice University Hyperstat. (n.d.). *Hypothesis testing*. Retrieved April 22, 2005 from http://www.ruf.rice.edu/-lane/hyperstat/A35243.html

Rumsey, D. (2003). *Statistics for dummies.* Hoboken, NJ: Wiley.

Somers, S.C. (2002). *An assessment of computer-based training for EMT re-certification.* Tempe, AZ: Arizona State University.

United States Fire Administration. (2004). *USFA 5-year operational objectives*. Retrieved June 1, 2005 from http://www.usfa.fema.gov/about/strategic/op-obj.shtm

White House. (2003). *Homeland security presidential directive/HSPD-5.* Retrieved May 30th, 2005 from http://www.whitehouse.gov/news/releases/2003/02/20030228-9.html

Wordreference. (2003). *Analysis of variance*. Retrieved June 24, 2005 from http://www.wordreference.com/definition/ANOVA

Vassar University. (n.d.). *Vassarstats*. Retrieved February 19, 2005 from http://faculty.vassar.edu/lowry/anova2x2.html

Yamanaka, Y. (2004, November 18). *Briefing on the National Incident Management System (NIMS) at the GWU/SAIC disaster and risk management forum.* Retrieved March 18, 2005 from http://www.fkassociates.com/NIMS%20Briefing.html

Appendix A
FEMA IS-700 Test Scores--Raw Data

Direct Instruction

ID Number	Pre-Test	Post-Test
DI-1		9
DI-2	9	11
DI-3	12	9
DI-4		13
DI-5		14
DI-6	13	15
DI-7		13
DI-8		16
DI-9		13
DI-10	12	17
DI-11		13
DI-12	15	12
DI-13		9
DI-14	11	16
DI-15	9	11
DI-16	9	11
DI-17		13
DI-18		10
DI-19		8
DI-20	9	13
DI-21		12
DI-22	12	11
DI-23		10
DI-24		14
DI-25	10	13
DI-26	5	9
DI-27		18
DI-28		15
DI-29	14	13
DI-30	6	17
DI-31		16
DI-32		21
DI-33		20
DI-34	11	13
DI-35	8	6
DI-36	12	16
DI-37		9
DI-38		17
DI-39		18
DI-40	10	11
DI-41		15
DI-42		19

DI Supplemented with ESRT

ID Number	Pre-Test	Post-Test
ESRT-1		22
ESRT-2		12
ESRT-3		17
ESRT-4		19
ESRT-5	9	23
ESRT-6		11
ESRT-7		20
ESRT-8	13	20
ESRT-9		20
ESRT-10		12
ESRT-11	12	16
ESRT-12		21
ESRT-13	10	23
ESRT-14	12	11
ESRT-15	6	13
ESRT-16	12	13
ESRT-17	8	13
ESRT-18		15
ESRT-19		14
ESRT-20		18
ESRT-21	13	18
ESRT-22	15	20
ESRT-23	16	17
ESRT-24		23
ESRT-25	13	15
ESRT-26		16
ESRT-27	12	21
ESRT-28	14	23
ESRT-29		19
ESRT-30		19
ESRT-31		20
ESRT-32		21
ESRT-33	9	19
ESRT-34		20
ESRT-35	15	20
ESRT-36		19
ESRT-37	11	22
ESRT-38	10	17
ESRT-39		15
ESRT-40		21
ESRT-41	15	20
ESRT-42		19

Appendix B
FEMA IS-700 DI Post-Test Scores

	B_1	B_2
A_1	11	9
	9	13
	15	14
	17	13
	12	16
	16	13
	11	13
	11	9
	13	13
	11	10
	13	8
	9	12
	13	10
	17	14
	13	18
	6	15
	16	16
	11	21
		20
		9
		17
		18
		15
		19

A_1 = Direct Instruction (DI)
B_1 = Pre-Test
B_2 = No Pre-Test

Appendix C
FEMA IS-700 ESRT Post-Test Scores

	B_1	B_2
A_2	17	22
	23	12
	20	19
	16	11
	23	20
	11	20
	13	12
	13	21
	13	15
	18	14
	20	18
	17	23
	15	16
	21	19
	23	19
	19	20
	20	21
	22	20
	17	19
	20	15
		21
		19

A_2 = Electronic Student Response Technology (ESRT)
B_1 = Pre-Test
B_2 = No Pre-Test

Appendix D
Table of Means: Cells, Rows, Columns, and Totals

	B_1	B_2		Rows
A_1	12.4444	13.9583		13.3095
A_2	18.05	18		18.0238
Columns	15.3947	15.8913		15.6667

A_1 = Direct Instruction (DI)
A_2 = Electronic Student Response Technology (ESRT)
B_1 = Pre-Test
B_2 = No Pre-Test

Appendix E
Analysis of Variance Data

Source	*SS*	*df*	*MS*	*F*	*p*
bg	490.3139	3			
rows	466.7143	1	466.714	38.56	<.0001
columns	5.1312	1	5.131	0.42	0.518793
r x c	18.4684	1	18.468	1.53	0.219731
wg	968.3528	80	12.104		
Total	1458.6667	83			

bg = between groups
wg = within groups (error)

SS = Sum of Squares
df = Degrees of Freedom
F = F Ratio
p = P-value

Appendix F
FEMA IS-700 Pre-Test/Post-Test
(Reproduced with Permission)

1. One of the chief benefits of NIMS is that it is:

a. Accompanied by Federal funding.
b. Applicable across jurisdictions and functions.
c. Based on an entirely new concept of response.

2. NIMS provides a _____ framework that applies to all phases of incident management regardless of cause, size, location, or complexity.

a. Rigid
b. Complicated
c. Straightforward
d. Flexible

3. The Incident Command System (ICS) is a proven incident management system that is based on organizational:

a. Best practices.
b. Strengths.
c. Structures.

4. Span of control may vary from

a. Two to eight.
b. Four to nine.
c. Three to seven.
d. Five to ten.

5. The use of common terminology for ICS position titles helps to reduce confusion between a person's position on an incident and his/her:

a. Day-to-day position.
b. Level of authority.
c. Chain of command.
d. On-scene responsibilities.

6. Incident Action Plans (IAP's) depend on _____ to accomplish response tactics.

a. Integrated communications
b. Organizational resources
c. Management by objectives
d. Common terminology

7. A hazardous materials spill in which more than one agency has responsibility for the response is a good use for a(n):

a. Emergency Operations Center (EOC).
b. Area Command.
c. Multiagency Coordination System.
d. Unified Command.

8. Public health emergencies that are not site specific are a good use for a(n):

a. Emergency Operations Center (EOC).
b. Area Command.
c. Multiagency Coordination System.
d. Unified Command.

9. An Area Command organization does not include an Operations Section because:

a. Operations are conducted on-scene.
b. Area Commands are not really commands.
c. Its authority is limited to obtaining resources.
d. The Planning Section handles operations in an Area Command.

10. One key responsibility of Multiagency Coordination Systems is to:

a. Direct tactical operations for the incident.
b. Make resource allocation decisions based on incident priorities.
c. Control large-scale incidents from a common location.
d. Facilitate operations at incidents where there is no incident site.

11. _____ may support multiagency coordination and joint information activities.

a. Incident Command structures
b. Area Commands
c. Unified Commands
d. Emergency Operations Centers

12. Public Information Officers operate within the parameters of a(n)_____--which establishes policies, procedures, and protocols for gathering and disseminating information.

a. Multiagency Coordination System
b. Incident Command structure
c. Joint Information System
d. Emergency Operations Center

13. When a Joint Information Center is established as part of a Unified Command, agencies or organizations contributing to joint public information management:

a. Work independently.
b. Clear all information with the Incident Commander.
c. Retain their organizational independence.
d. Report to the chief elected official.

14. When multiple JIC's are established, all JIC's must communicate and coordinate with each other on an ongoing basis using:

a. Joint Information System protocols.
b. Agency protocols.
c. Area Command protocols.
d. Multiagency Coordination System protocols.

15. National-level preparedness standards related to NIMS will be maintained and managed through the NIMS:

a. Integration Center.
b. Policy document.
c. Homeland Security Presidential Directive.
d. Presidential Decision Directive.

16. One responsibility of preparedness organizations at all levels is to:

a. Specify response requirements for every type of incident.
b. Determine the role and responsibilities of Incident Commanders.
c. Delegate preparedness to responsible agencies.
d. Establish guidelines and protocols for resource management.

17. A plan based on lessons learned from actual incidents is a(n):

a. Recovery Plan.
b. Corrective Action Plan.
c. Procedure.
d. Emergency Operations Plan.

18. One area of focus for the NIMS Integration Center is to:

a. Track all resources on a regional basis.
b. Ensure compliance with all NIMS requirements.
c. Facilitate the definition of general training requirements and approved courses.
d. Maintain a database of personnel meeting credentialing requirements.

19. To help ensure that equipment performs to certain standards and is interoperable with equipment used by other jurisdictions, the NIMS Integration Center will:

a. Review and approve lists of equipment meeting national standards.
b. Require jurisdictions to purchase equipment only if it meets established specifications.
c. Work directly with equipment suppliers to ensure interoperability.
d. Prescribe that all response equipment be interoperable.

20. Mutual aid agreements and Emergency Management Assistance Compacts help to:

a. Spread the costs of emergency response.
b. Facilitate the timely delivery of assistance during incidents.
c. Coordinate full documentation of incidents.
d. Establish the command structure for incidents.

21. Resource typing involves the categorizing of resources based on:

a. Availability.
b. Cost.
c. Performance.
d. Kind.

22. NIMS ensures that all personnel possess a minimum level of training, experience, fitness, capability, and currency by:

a. Maintaining a database of personnel who have been trained for specific positions.
b. Providing training to personnel who will be assigned to Command Staff positions.
c. Overseeing a national training and exercise program.
d. Establishing certification and credentialing standards for key personnel.

23. Requests for items that the Incident Commander cannot obtain locally must be submitted through the:

a. Multiagency Coordination Entity.
b. Area Commander.
c. NIMS Integration Center.
d. Department of Homeland Security.

24. Resource managers use established procedures to track resources continuously from _____ through demobilization.

a. Mobilization
b. Recovery
c. Typing
d. Purchase

25. NIMS standards for communications and information management are based on the principle that a common operating picture is required to:

a. Avoid duplication of effort.
b. Document the response fully.
c. Maintain the command structure.
d. Ensure consistency among all who respond.