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THESIS

**TRAINING FOR FAILURE IN THE UNITED STATES
FIRE SERVICE**

by

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December 2019

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TRAINING FOR FAILURE IN THE UNITED STATES FIRE SERVICE

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

In 2017, the United States fire service documented 87 firefighter deaths and an estimated 58,835 firefighter injuries. To reduce these risks, the fire service invests hours of training in personnel to keep them as safe as possible. Unfortunately, these fatalities and injuries continue to happen despite the number of training hours conducted to master department standard operating procedures (SOPs) and maintain state continuing education requirements. Although training will never prevent 100% of fire-related deaths, it is a critical component in decision-making in a high risk/low frequency occupation. Based on NIOSH findings, it can impact response to improve firefighter safety. This thesis presents various training models currently used in the fire service, how cognitive processes and panic and stress impact firefighter response, other challenges and impacts on training, as well as best practices for training in other organizations. The evaluation of these factors assists in developing a better understanding of how we learn and retain information and how these lessons can be applied to improve training in the fire service.

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TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	PROBLEM STATEMENT	1
B.	RESEARCH QUESTION	3
C.	RESEARCH DESIGN	3
II.	TRAINING IN THE FIRE SERVICE.....	5
A.	TRAINING STANDARDS IN THE FIRE SERVICE	5
B.	NEED FOR TRAINING.....	8
1.	High Risk/Low Frequency Events.....	8
2.	Job-Related Experience.....	10
3.	NIOSH LODD Reports.....	12
C.	TRAINING MODELS AND METHOD OF DELIVERY	14
1.	Online Learning Management Systems	15
2.	Seminar/Lecture.....	16
3.	Tabletop//Functional.....	17
4.	Full-scale Exercises	18
5.	Hands-on/Kinetic/Live Fire Training	18
6.	Technology/Virtual Reality/Serious Gaming	21
7.	Design Method for Effectiveness	22
III.	COGNITIVE PROCESSES AND THE PSYCHOLOGY OF TRAINING	25
A.	DEVELOPING EXPERTISE.....	25
B.	RECOGNITION PRIMED DECISION MAKING.....	26
C.	WORKING MEMORY MODEL.....	28
D.	THE IMPACT OF PANIC AND STRESS.....	31
1.	Inverted U-shaped Relationship	34
2.	Cue Utilization Theory	36
E.	FLOW STATES.....	37
IV.	OTHER CHALLENGES AND IMPACTS ON TRAINING.....	39
A.	LEADERSHIP.....	40
B.	FIREFIGHTER CULTURE	41
C.	ENVIRONMENT.....	43
V.	IMPLEMENTING BEST PRACTICES.....	45
A.	MILITARY.....	45

B.	PRIVATE SECTOR/SPORTS	48
C.	OTHER FIRE SERVICE ORGANIZATIONS	49
VI.	DISCUSSION AND CONCLUSION	53
	LIST OF REFERENCES.....	59
	INITIAL DISTRIBUTION LIST	69

LIST OF FIGURES

Figure 1.	Annual Fires vs. Number of Career Firefighters in the United States.	9
Figure 2.	Risk vs. Frequency.....	9
Figure 3.	Fire Departments Types of Responses 1990–2014.....	11
Figure 4.	The Working Memory Model.....	30
Figure 5.	Yerkes-Dodson Inverted U-shaped Relationship.....	35

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LIST OF ACRONYMS AND ABBREVIATIONS

AFD	Akron Fire Department
AHJ	authority having jurisdiction
ALIVE	Advanced Learning through Interactive Visual Environments
CE	continuing education
DT	decision time
EB	episodic buffer
EMS	emergency medical services
FE	functional exercise
FFFIPP	Firefighter Fatality Investigation Prevention Program
FSX	full-scale exercise
GSD	Georgia Smoke Divers
HLT	high-level training
IAFC	International Association of Fire Chiefs
KSA	knowledge, skills, ability
LCDT	lowest common denominator training
LMS	learning management system
LODD	line of duty death
LTM	long-term memory
NDT	no decision time
NFL	National Football League
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NYU	New York University
PFC	prefrontal cortex
RPD	recognition primed decision making
SIT	stress inoculation training
SOP	standard operating procedure
STM	short-term memory
TT	table top
UL	Underwriters Laboratories

USFA	U.S. Fire Administration
VR	virtual reality
WM	working memory

EXECUTIVE SUMMARY

Each year in the United States, fire departments are faced with the challenge of preparing firefighters to respond safely and effectively while the fire service landscape continues to change. The addition of new responsibilities like emergency medical services and other all-hazards responses has deeply impacted the time available for training. Furthermore, the fire service has seen a significant decrease in structure fires. For example, fire departments nationwide responded to 2,326,500 fires in 1983, but only responded to 1,240,000 fires in 2014.¹ This decrease of over a million fires, combined with the added responsibilities, directly impacts the amount of hands-on experience firefighters are receiving.

These circumstances are further impacted by changes in fire dynamics and building construction. While firefighters gain general knowledge of these components through the broader based training models like lectures or videos, they are at a tremendous disadvantage if they do not experience kinetic training in these areas. Observing the effect of fire on current construction and structure contents can be valuable to firefighters, especially considering recent tests by Underwriters Laboratories (UL), which confirm significantly faster burn rates in structures. It is estimated that occupants today have three minutes to exit a structure, compared to 17 minutes 30 years ago.² Failure to train in this type of live environment to gain first-hand knowledge could put firefighters at a significant risk.

The U.S. fire service currently lacks any type of enforceable national standards on firefighter training. Individual states establish the number of continuing educational hours required to maintain state firefighter certifications. Some states do not have any set training

¹ “NFPA Statistics—Fire Department Calls,” National Fire Protection Association, May 2018, <https://www.nfpa.org/News-and-Research/Data-research-and-tools/Emergency-Responders/Fire-department-calls>.

² Elisabeth Leamy, “House Fires Burn Much Faster than They Used to. Here’s How to Survive,” *Washington Post*, November 21, 2017, https://www.washingtonpost.com/lifestyle/home/house-fires-burn-much-faster-than-they-used-to-heres-how-to-survive/2017/11/20/1c1eb7f8-c890-11e7-aa96-54417592cf72_story.html.

requirements for firefighters. Furthermore, individual fire departments have control over the content and delivery method of training for their department. The National Fire Protection Association (NFPA) does offer recommendations that provide minimum job performance and safety guidelines for firefighters. However, the NFPA is a civilian-run organization with no authority or enforcement power.

When a firefighter dies in the line of duty, it is felt by firefighters nationwide. Most line of duty deaths (LODDs) are investigated by the National Institute for Occupational Safety and Health (NIOSH). The reason for the investigation is not to determine blame, but rather to understand why the death occurred. The investigation will also provide recommendations for fire departments so others do not repeat the actions that resulted in the firefighter's death. Every NIOSH LODD investigation has resulted in identifying deficiencies in training as a root cause for the death. Despite attempts by NIOSH to educate fire departments, LODDs continue to happen as departments fail to learn from other's mistakes.³

In an attempt to meet current challenges, fire departments employ various training methods. This thesis examines different training models currently used, such as learning management systems (LMS), large-group lectures, and tabletop exercises, which have all gained popularity because they are cost effective, user friendly, and can be delivered to large groups. However, these methods lack the ability for students to create muscle memory through repetition, a foundation that helps firefighters develop frames of reference to encourage rapid recall when making life-or-death decisions on a fire ground. Studies have shown this type of kinetic training is also preferred by firefighters as the standard method of training.⁴

To appreciate the importance of training in the fire service, it must first be understood how cognitive processes affect learning and performance in a dynamic

³ Mike Hendricks and Matt Campbell, "Fatal Echoes: In a Tragic Loop, Firefighters Continue to Die from Preventable Mistakes," *Kansas City Star*, accessed January 26, 2019, <https://www.kansascity.com/news/nation-world/national/article118921298.html>.

⁴ John Petrakis, "Firefighter Learning Styles and Training: Beyond the Slide Presentation," *Fire Engineering* 156, no. 10 (October 1, 2003), <https://www.fireengineering.com/articles/print/volume-156/issue-10/features/firefighter-learning-styles-and-training-beyond-the-slide-presentation.html>.

environment that demands the ability to make decisions instantaneously. This thesis explores several concepts that impact cognitive ability, including the recognition primed decision making and the importance of expertise and how it affects the development of foundational knowledge through realistic training and job-related experience. Another theory, working memory model, explains how information needed in the moment is held and manipulated in memory, in particular how memory and recall are significantly impacted by stress and anxiety.⁵ Finally, the inverted U-relationship and cue utilization theory offer answers on how stress and anxiety affect overall human performance.

Decision making under stress offers a unique challenge to firefighters. People do not typically need to train for an environment in which they will be required to make immediate, life or death decisions under stressful conditions. For a firefighter, however, this skill is essential. Adding stress to training, to make circumstances more realistic, is believed to make training more impactful. The research considers how other organizations, such as the U.S. Army and Air Force, recognize the value of conducting realistic training to prepare their members for engagement. Professional sports also provide an argument for realistic training. The National Football League continues to conduct full-pad, full-contact practices to prepare for games, because it recognizes the importance of duplicating game conditions for maximum preparation. Finally, an elite fire training organization known as the Georgia Smoke Divers (GSD) provides insight into how to train firefighters more effectively. The GSD promotes stress inoculation by exposing students to physical and mental exhaustion in an attempt to impact the psychological state of participants for them to develop successful responses under these types of conditions.

Finally, this thesis looks at other training challenges faced by fire departments, including individual ability, organizational leadership, organizational culture, and unpredictable circumstances. As individuals learn and retain information differently, firefighters operate at various levels of cognitive ability, which makes repetitive training even more important for some. An individual who performs tasks well during training will

⁵ Alan Baddeley, "Working Memory: Theories, Models, and Controversies," *Annual Review of Psychology* 63, no. 1 (2012): 1–29, <https://doi.org/10.1146/annurev-psych-120710-100422>.

most likely do the same during an actual crisis.⁶ Leadership and fire department culture also factors into the challenges fire departments face. Training requires the support of formal and informal leaders of fire departments to add validity, and make the training effective. Certainly, the potential always exists for unpredictable circumstances to occur that exceed the capabilities of firefighters and fire departments. The ultimate goal is to avoid creating an unpredictable situation as a result of poor decisions made by firefighters.

⁶ Billy Schmidt, "Observing Firefighter Performance," *Fire Rescue* 2, no. 2 (March 20, 2009), <https://www.firerescuemagazine.com/articles/print/volume-2/issue-2/news/observing-firefighter-performance.html>.

I. INTRODUCTION

Failing to prepare is preparing for failure

~ John Wooden

A. PROBLEM STATEMENT

In 2016, the United States Fire Service responded to over 35 million incidents nationwide, more than three times the number of incidents in 1981.¹ During this same period, the number of incidents involving structure fires dropped in half, yet the number of fire-related deaths remained steady. Ironically, the decrease in fires has led to a significant reduction in the amount of experience firefighters gain while operating at actual fire emergencies. This decrease in turn puts a greater burden on training to compensate for lost experience.

With the decrease in the number of structure fires, fire departments have taken on other responsibilities in the emergency management and first response domain. Many of today's fire departments engage in emergency medical services (EMS) and other all-hazards response. These additional responsibilities, combined with the required training to learn and maintain them, have reduced the time available for fire training. While this reduction in available training time cannot be specifically quantified, in today's fire service, firefighters concur that departments nationwide have more responsibilities while time and financial resources continue to diminish. One example is the Akron Fire Department (AFD). While staffing on the AFD has remained relatively consistent over the past 20 years, emergency call volume has increased. In 1998, the AFD responded to 29,566 emergency responses; by 2018, this number had increased to 49,700 emergency responses.²

¹ "NFPA Statistics—Fire Department Calls," National Fire Protection Association, May 2018, <https://www.nfpa.org/News-and-Research/Data-research-and-tools/Emergency-Responders/Fire-department-calls>.

² Akron Fire Department, *2018 Annual Report* (Akron, OH: City of Akron Fire Department, 2018), 37; Akron Fire Department, *1998 Annual Report* (Akron, OH: City of Akron Fire Department, 1998), 39.

Budget concerns also factor into this equation, as fire departments are unwilling or unable to pay overtime to conduct training off-duty. In other words, this training must take place on-duty, which is never guaranteed with the added number of incidents to which fire departments are now responding. Typically, more than 90 percent of a fire department's budget covers personnel costs, while another 5–7 percent covers standard operating costs. Less than five percent is available for unexpected expenses, which leaves little remaining budget to spend on training.³

In an attempt to remedy the time and budget constraints, fire departments have developed training platforms designed to be delivered to the largest number of people in the shortest amount of time. These methods include lectures, learning management systems (LMS) delivered via internet, video, and tabletop (TT) scenarios. Together, these approaches allow fire departments to be compliant technically with state requirements and the recommendations of the National Fire Protection Association (NFPA), but it can be argued they fail to prepare firefighters properly to respond during a crisis.

Recent research in cognitive science on how humans learn, retain, and use information suggests that hands-on, kinetic modalities are more effective than others are. To understand the potential benefits of these dynamic training methods, the experiences and lessons of organizations that have embraced kinetic training and learning should be investigated. This research examines the ways the human brain learns and considers the differences between the efficacies of various training models to support investing in the kind of training that will save firefighter lives, with a focus on the kinetic, hands-on methods of learning. Lastly, this research explores other organizations that have had success with kinetic training, such as the military, sports teams, and the Georgia Smoke Divers (GSD). Each of these organizations emphasizes or values actual hands-on training as part of its preparation.

³ Steven Knight, "Doing More with Less: Fire Department Budgets, Fiscal Responsibility," FireRescue1, August 14, 2018, <https://www.firerescue1.com/fire-chief/articles/doing-more-with-less-fire-department-budgets-fiscal-responsibility-GTj33j3axJ2tfshe/>.

B. RESEARCH QUESTION

How can a better understanding of how people learn and retain information lead to improvements in training in the fire service?

C. RESEARCH DESIGN

This research investigates failure points in firefighter training and identifies reasons for deficiencies, such as how often firefighters train and what methods of training delivery are currently used, ranging from lectures to more advanced uses of technology-involved training. It also assesses the usefulness of these delivery models based on cognitive processes and other internal and external factors influencing training and response. Finally, the research compares training in the fire service to methods used by the military, sports teams, and an elite fire organization because of the common physical demands and limited time for decision making.

While the amount of information available regarding measurable and successful training in the fire service is quite lacking, this research identifies validated effective training models that can build a better crisis response and provides an analysis of the following. What models are being utilized? Are they efficient and effective based on the limited resources departments have available? And what role do cognitive processes and other human factors play into the overall effectiveness of training? By deconstructing the various training methods and other considerations, this research develops recommendations for training models to improve firefighters' responses to dynamic events and to increase performance and safety.

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II. TRAINING IN THE FIRE SERVICE

You won't rise to the occasion—you'll default to your level of training

~ Barrett Tillman

In the fire service, training requirements are set at the state level and follow the recommendations of the National Fire Protection Association (NFPA). Exact content and method of delivery are controlled by the fire departments themselves, however, and can be affected by the time available for training. One thing is certain; as fire departments evolve and take on added responsibilities, like EMS and other all-hazard skills, the time available for fire training is decreasing, as are the opportunities for firefighters to obtain real-life experience.

The National Institute of Occupational Safety and Health (NIOSH) frequently investigates when a firefighter is involved in a line of duty death (LODD). Its reports are intended to educate fire departments, so the actions identified as being a part of the LODD are not repeated. This chapter identifies recommendations from these reports that directly identify training deficiencies as a factor in firefighter deaths.

Finally, this chapter examines training delivery models currently being employed in the fire service. These models include LMS, seminar/lecture, TT/functional, full-scale exercise (FSX), hands-on/kinetic, and virtual reality/serious games. This analysis lays the foundation for identifying which model or models should be used to prepare firefighters to perform their duties safely and effectively.

A. TRAINING STANDARDS IN THE FIRE SERVICE

In 2017, the U.S. Fire Administration (USFA) documented 87 firefighter deaths and an estimated 58,835 firefighter injuries.⁴ To reduce these risks, the fire service invests hours of training in personnel to keep them as safe as possible. Unfortunately, these

⁴ Ben Evarts and Joseph Molis, "U.S. Firefighter Injuries 2017," *National Fire Protection Association Journal*, November 1, 2018, <https://www.nfpa.org/News-and-Research/Publications-and-media/NFPA-Journal/2018/November-December-2018/Features/US-Firefighter-Injuries-2017>.

fatalities and injuries continue to happen despite the number of training hours conducted to master department standard operating procedures (SOPs) and maintain state continuing education (CE) requirements. Although training will never prevent 100% of fire-related deaths, but based on NIOSH findings, it can impact responses to improve firefighter safety. This paper does not examine other potential causes of injury or death in fire response situations, such as unforeseeable events, equipment failure, or other variables.

NFPA Sections 1001: Standard for Firefighter Professional Qualifications and 1500: Standard on Fire Department Occupational Safety, Health and Wellness Program provide minimum job performance and safety guidelines for firefighters.⁵ NFPA 1500–Chapter 5: Training, Education, and Professional Development offers guidance regarding how fire departments are expected to establish and maintain training programs and curricula.⁶ Specifically, NFPA 1500 5.1.1 requires fire departments to “establish and maintain a training, education, and professional development program with a goal of preventing occupational deaths, injuries, and illnesses” and “provide training, education, and professional development for all department members commensurate with the duties and functions that they are expected to perform.”⁷

Using NFPA guidelines, each state establishes its own set of standards and requirements for career and volunteer firefighters. For example, in Ohio, aspiring career firefighters must complete a 256-hour Firefighter II course.⁸ In Texas, the requirement for the Basic Fire Suppression Curriculum is 468 hours.⁹ States like Missouri and Kansas do not have any set training requirements for career or volunteer firefighters and require no

⁵ National Fire Codes, “NFPA 1500: Standard on Fire Department Occupational Safety, Health and Wellness,” National Fire Protection Association, 15, 2018, <https://codesonline.nfpa.org/code>.

⁶ National Fire Codes, 15.

⁷ National Fire Codes, 15.

⁸ EMS & Fire Certifications, “Fire Service Certificates to Practice,” Ohio Emergency Medical Services, accessed January 21, 2019, <https://www.ems.ohio.gov/certifications-fire-certificates.aspx>.

⁹ “Basic Fire Suppression Certification—Step 1,” Texas Commission on Fire Protection, accessed February 16, 2019, https://www.tcfp.texas.gov/certification/basic_certification/basic_certification-step_1.asp.

yearly refresher training.¹⁰ In all cases, the training of firefighters should continue throughout their careers in the fire service, as departments strive to achieve their missions. As the authority having jurisdiction (AHJ), each department controls its training topics and decides what is necessary for personnel to be ready to respond.¹¹ While *NFPA 1041: Standard for Fire Service Instructor Professional Qualifications* suggest all training be conducted by an instructor meeting specific requirements, but no recommendations specify what knowledge, skills and abilities (KSAs) should be covered during training.¹² Moreover, due to the limited amount of resources available to meet these requirements, departments are oftentimes compelled to utilize less effective training methods. Any combination of these issues can create a lack of consistency and standards and lead to failures when firefighters are faced with dynamic situations.

Furthermore, the manner in which training is provided can have a significant impact on the overall effectiveness of the training. For example, in Ohio, *Revised Code Sections 3737.66* and *4765.55* establish the fire service qualifications and training programs, respectively. These sections dictate the minimum prerequisites an individual must meet to be a certified firefighter. Beyond this foundational criterion, the AHJ must only provide 54 hours of CE related to the fire service and approved by the AHJ's fire chief, every three years. However, the method of delivery does not factor into the requirement, which allows each AHJ to determine what constitutes training. In other words, in terms of meeting training hour requirements, a two-hour video is the equivalent of two-hours of hands-on training, or simulated computer training can replace live-fire training. Improving training practices is paramount in helping to create a safe and organized response. However, as long as NFPA standards lack legal authority and no oversight from the U.S. government exists,

¹⁰ Mike Hendricks and Matt Campbell, "Fatal Echoes: In a Tragic Loop, Firefighters Continue to Die from Preventable Mistakes," *Kansas City Star*, 6, accessed January 26, 2019, <https://www.kansascity.com/news/nation-world/national/article118921298.html>.

¹¹ EMS & Fire Certifications, "Fire Service Certificates to Practice."

¹² National Volunteer Fire Council and National Fire Protection Association, *Understanding & Implementing Standards*, NFPA 1407 and 1021, vol. 2 (Greenbelt, MD: National Volunteer Fire Council and Quincy, MA: National Fire Protection Association, 2014), 11, https://www.nfpa.org/Assets/files/AboutTheCodes/1021/Standards%20Guide_1021_1407.pdf.

individual departments will continue to exercise discretion in how they implement training curricula.¹³

B. NEED FOR TRAINING

Despite the increase in the number of professional firefighters and the decrease in actual fires, the ratio of firefighter fatalities per incident continues to rise. For example, in 1983, fires numbered 2,326,500 with 114 fatalities, or one for every 20,407 fires. In 2014, fires numbered 1,240,000 with 98 fatalities, or one for every 12,653 fires.¹⁴ According to reports by the NIOSH, the lack of experience and training firefighters are receiving is one variable that has been implicated in contributing to the higher ratio in fatalities. This statement applies not only to how much training, but also to the type of training being conducted. Since fires on a national level have continued to decline the past two decades, firefighters lack the opportunity to gain valuable hands-on experience while operating at an incident. Figure 1 demonstrates the national decline in actual fires in the period 1985 to 2015.

1. High Risk/Low Frequency Events

Gordon Graham argues firefighters respond to four types of incidents: low risk–high frequency, low risk–low frequency, high risk–high frequency, and high risk–low frequency. As shown in Figure 2, Graham explains the two types of high risk–low frequency events, those with decision time (DT), and those with no decision time (NDT). While both are problematic, the high risk–low frequency incident with NDT offers the biggest challenge to firefighters.¹⁵ Most firefighter injuries and fatalities occur or are initiated during high risk–low frequency NDT events.¹⁶ As a result of the potential of a

¹³ Douglas Krantz, “Is the NFPA Code the Law or a Recommendation?,” Technician’s Corner, accessed July 6, 2019, <https://www.douglaskrantz.com/SCNFPACode.html>.

¹⁴ National Fire Protection Association, “NFPA Statistics—Fire Department Calls.”

¹⁵ Gordon Graham, “High Risk/Low Frequency in the Fire Service,” accessed August 31, 2019, video, 15:17, <https://www.youtube.com/watch?v=Og9Usv82CdU>.

¹⁶ Graham, “High Risk/Low Frequency in the Fire Service.”

high risk, NDT event, training must be focused on preparing firefighters to react quickly and appropriately during an incident.

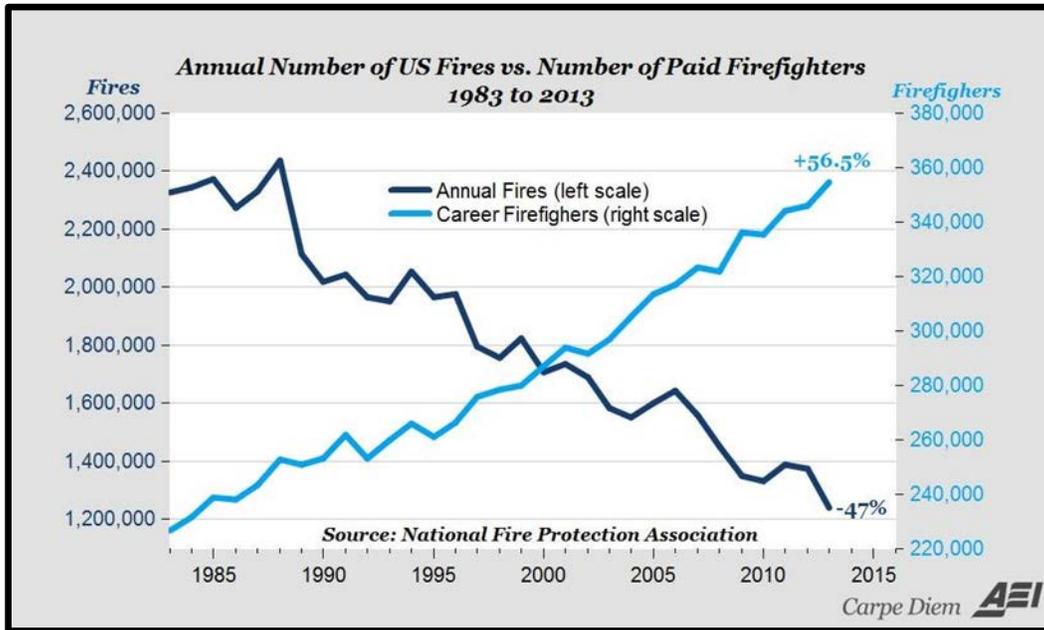


Figure 1. Annual Fires vs. Number of Career Firefighters in the United States.¹⁷

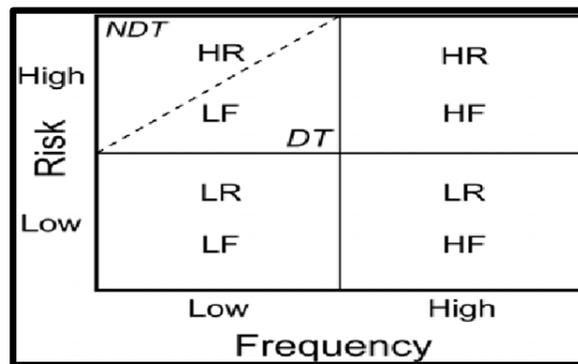


Figure 2. Risk vs. Frequency.¹⁸

¹⁷ Source: Mark Perry, “Over Last 20 Years, Annual Fires in the U.S. Declined by about 50% While Career Firefighters Increased More than 50%?” *American Enterprise Institute*, September 8, 2015, <https://www.aei.org/carpe-diem/over-last-20-years-annual-fires-in-the-us-declined-by-about-50-while-career-firefighters-increased-more-than-50/>.

¹⁸ Source: Joseph V. Henderson, “The Virtual Terrorism Response Academy: Training for High-Risk, Low-Frequency Threats,” *Studies in Health Technology and Informatics* 111 (2005): 186.

2. Job-Related Experience

The *Fire Chief's Handbook* states, “many fire departments miss the chance to receive some of the most valuable training if they fail to learn from operations at actual events.”¹⁹ Learning from these events occurs at the actual incident but can then be expanded during the post-incident critique, when the learning situation can be identified.²⁰ This type of on-the-job training is essential in creating points of reference for firefighters to recall during similar type situations they may face in the future.

However, throughout the years, as seen in Figure 3, fire service organizations have taken on additional response duties, most notably EMS, which reduce the amount of on-the-job firefighting experience available to personnel. In 2015, U.S. fire departments responded to over 21.5 million EMS incidents.²¹ EMS, which is now a part of many fire departments, account for 68 percent of the incident increase.²² The added responsibility has a direct impact on the amount of actual real experience gained while operating at fires.²³

The addition of EMS helps explain the need for fire departments nationwide to add firefighters while the actual number of fires continues to decrease. During a period that has seen the number of fires cut in half, there are nearly 50 percent more paid professional firefighters nationwide.²⁴ This increase is directly related to the significant increase in emergency medical calls. The need for EMS is only going to increase over the next 15 years as America’s “baby boomer” generation reaches the age of 65. According to the U.S.

¹⁹ Joseph Bachtler and Thomas Brennan, *Fire Chief's Handbook* (Tulsa, OK: Fire Engineering Books & Videos, 1995), 342.

²⁰ Bachtler and Brennan, 342.

²¹ National Fire Protection Association, “NFPA Statistics—Fire Department Calls.”

²² Daniel C. Vock, “New Day in the Firehouse: The Job of Firefighter Has Changed Almost beyond Recognition,” *Governing*, September 2018, <https://www.governing.com/topics/public-justice-safety/gov-firefighters-firehouse.html>.

²³ Kenneth Morgan, “Mentoring Advances the Quality of Future Fire Service Leaders,” *FireFighterNation*, accessed July 12, 2019, <https://www.firefighternation.com/articles/2011/04/mentoring-advances-the-quality-of-future-fire-service-leaders.html>.

²⁴ Fred S. McChesney, “Fewer Fires, So Why Are there Far More Firefighters?,” *Washington Post*, September 4, 2015, https://www.washingtonpost.com/opinions/2015/09/04/05316abe-517c-11e5-933e-7d06c647a395_story.html.

Census Bureau, the year 2035 will be a watermark year in the United States, as the number of senior citizens will peak at 78 million and surpass those aged 18 by 1.5 million. This situation will mark the first time in American history the elderly will outnumber children.²⁵ For fire departments nationwide, this elder bulge will add to the number of EMS responses each year, which further decreases opportunities for firefighting experience and training, while significantly increasing the number of firefighters who will need training.

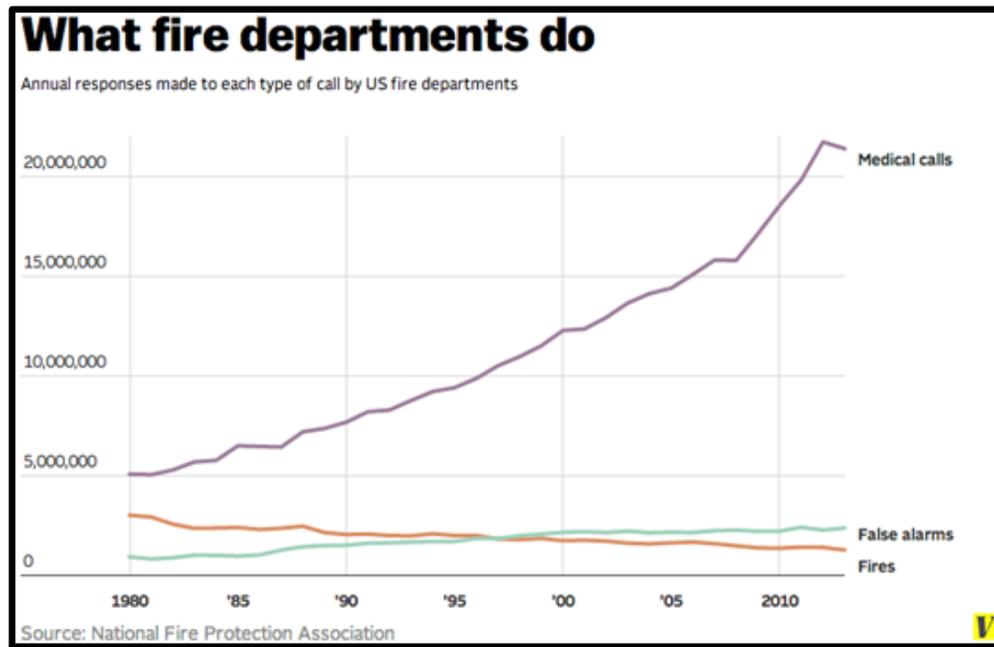


Figure 3. Fire Departments Types of Responses 1990–2014.²⁶

Moreover, many fire departments have also adopted an all-hazards model. In addition to fire and EMS calls for service, they also respond to hazardous materials, water rescue and technical rescue incidents. When firefighters are busy managing EMS or other

²⁵ “Seniors Will Soon Outnumber Children, but the U.S. Isn’t Ready,” USC News, June 21, 2018, <https://news.usc.edu/143675/aging-u-s-population-unique-health-challenges/>.

²⁶ Source: Ben Evarts and Gary Stein, *U.S. Fire Department Profile 2017* (Quincy, MA: National Fire Protection Association, 2019), 4, <https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Emergency-responders/osfdprofile.pdf>.

all-hazards incidents, the chance of them being available for a fire incident significantly decreases.

3. NIOSH LODD Reports

To understand the circumstances behind incidents resulting in a firefighter fatality better, the NIOSH, a branch of the Center for Disease and Control and Prevention, investigates firefighter LODDs in the United States.²⁷ NIOSH is a public health program, but is not involved in the enforcement of state or federal job safety health standards, nor does it determine direct fault or blame for a firefighter's death.²⁸ Since its inception, the NIOSH Fire Fighter Fatality Investigation Prevention Program (FFFIPP) has investigated approximately 40 percent of firefighter deaths in the United States.²⁹ The FFFIPP provides a thorough understanding of contributing factors for a LODD and offers recommendations to help educate the fire service community in hopes of preventing similar deaths. For example, an investigation into a firefighter's LODD in a Hartford, Connecticut house fire found many deficiencies, including a lack of training in hose streams, mayday procedures, and ventilation.³⁰ All these skills are considered essential functions required at most house fires.

NIOSH investigations over the years have demonstrated a pattern in firefighter deaths. Kumar Kunadharaju, Todd Smith, and David DeJoy analyzed NIOSH reports between 2004 and 2009 and identified a total of 1,167 recommendations, which were narrowed down to 35 high frequency recommendations.³¹ The root causes of firefighter fatalities were ranked based on how often a particular deficiency was identified in the

²⁷ "Fire Fighter Fatality Investigation and Prevention Program," National Institute for Occupational Safety and Health, June 6, 2019, <https://www.cdc.gov/niosh/fire/default.html>.

²⁸ National Institute for Occupational Safety and Health.

²⁹ National Institute for Occupational Safety and Health.

³⁰ Steven Goode and Dave Altimari, "Probe of Hartford Firefighter Death Reveals Tactical Mistakes; Lack of Training; Equipment Failures," Hartford Courant, August 7, 2015. <https://www.courant.com/news/connecticut/hc-hartford-firefighter-death-inquiry-report-20150807-story.html>.

³¹ D. M. DeJoy, K. Kunadharaju, and T. D. Smith, "Line of Duty Deaths among U.S. Firefighters: An Analysis of Fatality Investigations," *Injury Prevention* 16, Suppl 1 (September 2010): A95–96, <https://doi.org/10.1136/ip.2010.029215.345>.

reports. Deficiencies in preparation, and an inability to anticipate dynamic events during the incident, ranked as the second leading contributing factor in firefighter deaths. Based on these recommendations, the information was further reduced to four root causes that were putting the lives of firefighters at risk, including two directly related to training:

- Inadequate preparation for/anticipation of adverse events during operations
- Sub-optimal personnel readiness, or the failure of firefighters to be ready to respond to all hazards when requested³²

The terms “train” or “training” appear repeatedly throughout the various NIOSH reports. In Wilmington, North Carolina, firefighters were killed while fighting a fire in Canby Park. The NIOSH report cited a lack of training among the factors contributing to all three of their deaths.³³ Recommendations from NIOSH included an increase in the amount of live fire training conducted by the Wilmington Fire Department, and increases in the quality and frequency of training.³⁴ The Wilmington incident is even more tragic considering that 19 years before the Canby Park incident, Wilmington had an incident where 15 members of its department were injured and a federal investigation cited similar deficiencies in training.³⁵

Despite NIOSH attempts to educate fire departments by investigating LODDs, authors Mike Hendricks and Matt Campbell note, “tragedy after tragedy, firefighters paid the price when fire departments didn’t learn from others’ mistakes.”³⁶ For example, in December 2014, the Philadelphia Fire Department lost a veteran firefighter while battling a house fire. The NIOSH report from this incident also detailed deficiencies in performance

³² DeJoy, Kunadharaju, and Smith, A96.

³³ Christine Jedra and Esteban Parra, “Wilmington Warned about Lack of Fire Training 17 Years before Fatal Canby Park Blaze,” Delaware Online, 2, January 16, 2019, <https://www.delawareonline.com/story/news/2019/01/16/wilmington-warned-lack-training-17-years-before-fatal-blaze/2475747002/>.

³⁴ Jedra and Parra, 3.

³⁵ Jedra and Parra, 2.

³⁶ Hendricks and Campbell, “Fatal Echoes.”

directly related to training. Among the recommendations made were fire departments should ensure that (a) officers and firefighters are trained in the latest fire behavior research affecting fire ground tactics, and (b) all firefighters and officers are trained in Mayday techniques and communications.³⁷ It is imperative for fire departments to take the information from each report and incorporate them into department training to help avoid similar type incidents in the future.

Training is the best way for firefighters to compensate for the decrease in actual firefighting experience. However, experience alone in today's fire service is not enough to maintain the skills needed to respond efficiently and effectively to dynamic incidents. An anonymous writer once stated, "experience gives you the test first and the lesson afterwards." The more frames of reference that individuals store in their heads, the more effective and efficient decision making will be.³⁸ In the fire service, repetition is key to making good decisions while under stress or in extreme conditions. The right kind of training is a significant piece of creating an effective and safe response to any emergency. Fire Chief John Buckman III asserts that repetition in firefighting is key, since the ability to condition one's self to replicate skills during highly stressful situations directly impacts the individual's performance, which can possibly mean the difference between life and death.³⁹

C. TRAINING MODELS AND METHOD OF DELIVERY

Instructors have a variety of training models and methods of delivery available to them when developing a training plan for the fire service. However, the delivery method is dependent upon a variety of factors, including the information being presented, the

³⁷ "NIOSH LODD Report: Philadelphia Firefighter Dies in Structure Fire," *Fire Rescue*, 24–29, April 18, 2017, <https://www.firerescuemagazine.com/articles/2017/04/niosh-lodd-report-philadelphia-firefighter-dies-in-structure-fire.html>.

³⁸ David Greene, "Firefighters, Which Is Most Important? Training, Education or Experience?," *Carolina Fire Rescue EMS Journal*, April 23, 2012, <https://www.carolinafirejournal.com/Articles/Article-Detail/ArticleId/2088/Firefighters-which-is-most-important-Training-education-or-experience>.

³⁹ John Buckman III, "Why Firefighter Training Depends on Repetition," *FireRescue1*, 1, September 23, 2019, <https://www.firerescue1.com/firefighter-training/articles/141970018-Why-firefighter-training-depends-on-repetition/>.

audience receiving the information, and the intended outcome of the training. For example, author Ken J Good proposes that two kinds of training exist, high-level training (HLT), and lowest common denominator training (LCDT).⁴⁰ HLT involves difficult tasks that are challenging and possibly exceed the trainees' capabilities. HLT training pushes individuals to perform, sometimes to the point of failure. LCDT involves training designed to be simple so that all individuals succeed and feel good about the training. LCDT is very generic and lacks depth, but since people believe they have the training mastered, a false belief is created that the mission can be accomplished.⁴¹ These considerations, and others, such as available time, financial and human resources, go into training curriculum development.

1. Online Learning Management Systems

In the past 20 years, LMS have been developed to give fire departments the ability to create, track, manage, and distribute fire and EMS-based learning materials.⁴² An LMS caters to fire departments, and assists them with managing and documenting required fire and EMS training and can reach large groups of firefighters at a lower cost.⁴³ Since the AHJ controls training through its training charter, the lessons learned from an LMS are acceptable trainings for state CE. Although a computer-based LMS training platform can be a valuable tool for fire departments, it should be used collaboratively to enhance actual hands-on training and not to replace it.⁴⁴ When it comes to learning a new skill or process, listening to an instructor discuss a topic via a computer-based video is not effective.⁴⁵ Learning and development consultant, Deb Peterson explains that adults learn better by

⁴⁰ Ken J. Wood, *Who-Is-Training-Whom* (San Diego: Progressive Combat Solutions, n.d.), 1, accessed July 11, 2019, <http://progressivecombat.com/pdfs/Who-is-Training-Whom.pdf>.

⁴¹ Wood, 1.

⁴² "What Is an LMS?," Mindflash, accessed September 13, 2019, <https://www.mindflash.com/learning-management-systems/what-is-an-lms>.

⁴³ "How to Meet Fire Rescue Training Requirements and Decrease Risk with Online Learning," Fire Chief, June 12, 2018, <https://www.firechief.com/fire-products/online-training/articles/how-to-meet-fire-rescue-training-requirements-and-decrease-risk-with-online-learning-gPThqdwZ6tg6oOZj/>.

⁴⁴ "Industry Insights: Why Technology Is Meant to Supplement Hands-On Firefighter Training, Not Replace It," Firehouse, March 1, 2016, <https://www.firehouse.com/tech-comm/learning-management-systems/blog/12174856/supplementing-handson-firefighter-training-with-targetsolutions-firehouse>.

⁴⁵ "Benefits of Hands-on Training," Caron Business Solutions, September 28, 2016, <https://www.caronbusiness.com/sage-accpac-classroom-training/benefits-of-hands-on-training/>.

experiencing what they are learning. Hands-on learning has a direct impact on the student's mindset.⁴⁶

2. Seminar/Lecture

Seminars provide a learning environment through the presentation and discussion of information, like plans, policies and procedures. Research scholar, Gurpreet Kaur cites Kauchak and Eggen's conclusions as to why this traditional format remains popular.

- They are efficient and planning time is devoted to organizing context. Less attention is devoted to teaching strategy.
- They are flexible and can be adapted to a wide range of subjects.
- Lectures are easier to learn than most other instructional strategies.
- They are easier for the teacher due to simply "telling" students about the subject.⁴⁷

In addition to the aforementioned conveniences, Dr. Bruce Charlton, a scholar in evolutionary psychiatry, identified additional benefits to using a lecture model by citing, "it is easier for most people to learn conceptual information from spoken communications than from reading" and "real-time, human-presence, social context of a formal lecture makes it easier for most students to focus attention and remember what is said then when students are required to work alone."⁴⁸

The disadvantage to a lecture or seminar format is that the learners are more passive than active, which can significantly impact the synergy between what is studied in the classroom and the practical application in the field. Dr. Charlton asserts, "Lectures will

⁴⁶ Deb Peterson, "Overview and Definition of Experiential Learning," ThoughtCo, May 9, 2019, <https://www.thoughtco.com/what-is-experiential-learning-31324>.

⁴⁷ Gurpreet Kaur, "Study and Analysis of Lecture Model of Teaching," *International Journal of Educational Planning & Administration* 1, no. 1 (2011): 9.

⁴⁸ Bruce G. Charlton, "Lectures Are an Effective Teaching Method because They Exploit Human Evolved 'Human Nature' to Improve Learning," accessed March 2, 2019, <https://www.hedweb.com/bgcharlton/ed-lect.html>.

only get you so far, and individual teaching by ‘apprenticeship’ supported by self-directed study remain necessary for learning specialized and high-level skills.”⁴⁹

3. Tabletop//Functional

TT exercises go a step beyond lectures by putting plans, policies, and procedures into simulated scenarios and assessing them through discussion. Carol Lehtola, an associate professor at the University of Florida, explains that TT exercises offer safe, controlled, yet effective training when hands-on training may be impractical. TT trainings are designed to be delivered in a controlled environment, which makes them safe and manageable for large groups. Lehtola claims, “Table-tops allow for a business to identify and examine their areas of vulnerability.”⁵⁰ TT exercises are designed to include key organizational individuals focusing on situations common to the organization and can be used to evaluate department policies, plans, and procedures.⁵¹

Functional exercises (FEs) test coordination between the various operational components. FEs are conducted in a simulated, real-time environment focused on validating and evaluating department capabilities and functions. Command staff and management are typically involved in FE, although it can involve any member of the department.⁵² Controllers and evaluators oversee the exercises and offer feedback at the conclusion. Like TT exercises, FEs are conducted in controlled environments designed to generate discussion on the training topic. Neither involves any type of hands-on involvement to develop the skills that are the focus of the training.

⁴⁹ Charlton.

⁵⁰ Carol J. Lehtola, “Developing and Using Table-Top Simulations as a Teaching Tool,” *Journal of Extension* 45, no. 4 (August 2007), <https://www.joe.org/joe/2007august/tt4.php>.

⁵¹ “What Is the Difference between a Tabletop Exercise, a Drill, a Functional Exercise, and a Full-Scale Exercise?,” Emergency Preparedness, accessed October 9, 2019, <https://www.calhospitalprepare.org/post/what-difference-between-tabletop-exercise-drill-functional-exercise-and-full-scale-exercise>.

⁵² “Operations-Based Exercises—Types, Goals, and Conduct,” Federal Emergency Management Administration, accessed October 9, 2019, <https://emilms.fema.gov/IS0120c/groups/44.html>.

4. Full-scale Exercises

Full-scale exercises (FSXs) were designed to achieve a variety of outcomes during training. The most important is the ability to detect problems in executing organizational strategy and tactics.⁵³ Authors Brian Jackson and Shawn McKay point out in their article, “Preparedness Exercises 2.0: Alternative Approaches to Exercise Design that Could Make Them More Useful for Evaluating and Strengthening Preparedness,” “It is intuitive that exactly how a test is designed drives what information it can provide. Tests that cause failures directly can tell you nothing about the probability that a failure will occur but may provide very good information on what happens when it does.”⁵⁴ Perry goes on to point out that FSXs encourage participation and collaboration from multiple jurisdiction and agencies that allow them to develop an advanced working relationship.⁵⁵ The ability for participants to engage in relationship building as they work through the exercise can be an invaluable tool and provide a foundation of trust and understanding, when firefighters are faced with real events. FSX’s scenarios lack the ingredients necessary to prepare firefighters for a dynamic event because the scenario is typically controlled; it lacks the stress factors commonly found at an actual crisis. An FSX is essentially a dress rehearsal for an actual emergency.⁵⁶

5. Hands-on/Kinetic/Live Fire Training

Aristotle observed that “for things we learn before we can do, we learn by doing: for instance, men become builders by building and lyre-players by playing the lyre.”⁵⁷

⁵³ Ronald W. Perry, “Disaster Exercise Outcomes for Professional Emergency Personnel and Citizen Volunteers,” *Journal of Contingencies and Crisis Management* 12, no. 2 (June 2004): 65, <https://doi.org/10.1111/j.0966-0879.2004.00436.x>.

⁵⁴ Brian A. Jackson and McKay, Shawn, “Preparedness Exercises 2.0: Alternative Approaches to Exercise Design that Could Make Them More Useful for Evaluating—and Strengthening—Preparedness,” *Homeland Security Affairs*, April 2011, <https://www.hsaj.org/articles/46>.

⁵⁵ Perry, “Disaster Exercise Outcomes for Professional Emergency Personnel and Citizen Volunteers,” 65.

⁵⁶ Michael J. Reilly and David S. Markenson, eds., *Health Care Emergency Management: Principles and Practice* (Sudbury, MA: Jones & Bartlett Learning Publishers, 2010), 126.

⁵⁷ Johnathan Barnes and Anthony Kenny, *Aristotle’s Ethics: Writings from the Complete Works* (Princeton, NJ: Princeton University Press, 2014), 238.

Training through hand-on experience is called “kinetic training” and is often the least practiced type of training as it is the most resource intensive. This situation is especially true if the training is being done while firefighters are on-duty due to the limited availability of time. The lack of time is the result of numerous things: an increase in emergency medical calls, additional responsibilities like fire inspections, public education, community services, all-hazards responsibilities, minimum staffing, budgetary restraints, etc. In the article, “The Importance of Live-Fire Training,” author Keith Padgett argues that performing tasks consistent with those performed at the scene of an incident creates muscle-memory that helps firefighters in dynamic events.⁵⁸ The decline of available time for kinetic training directly impacts the ability of firefighters to create the muscle memory required for an adequate response during an incident.

Live-fire training is considered the best substitute for actual experience gained from real events. A static environment like a classroom cannot replace the conditions encountered during a real crisis. Things like heat, smoke, lack of visibility, confusion, chaos, and fatigue all factor into a firefighter’s decision-making process during a dynamic event. Firefighters who have not encountered these types of scenarios through experience or training, are suddenly thrust into dangerous environments and expected to respond appropriately. However, several major problems arise with using live-fire training, such as the significant potential for injury or death of a firefighter during a training exercise. This risk creates a predicament for fire departments in deciding whether to introduce dangerous risk during controlled training designed to prepare firefighters, or risk firefighter and civilian lives during an actual dynamic event with potentially under-trained firefighters.

Safe and effective firefighting requires knowledge of tactics, fire dynamics, and skills related to fire mitigation.⁵⁹ Conducting live fire training in a realistic manner offers

⁵⁸ Keith Padgett, “The Importance of Live-Fire Training,” *Fire Rescue* 3, no. 8 (July 31, 2008), <https://www.firerescuemagazine.com/articles/print/volume-3/issue-8/training-0/the-importance-of-live-fire-training.html>.

⁵⁹ Edward Hartin, “Live Fire Training as Simulation” (paper presented at the International Structural Fire Conference, June 9–10, 2014), 1.

another set of challenges. Training buildings are designed for multiple uses and have obvious differences from a structure used for regular human habitation.

These differences include:

- Training structures are more durable than a normal inhabitable structure.
- Thermal conductivity and heat are different in a training structure, which then impacts fire behavior.
- Floor plans are generic in a training building and lack open modern floor plans.
- Window failure is common in most structure fires, which then impacts the ventilation flow of the structure. Windows are seldom used in training structures for durability.
- The fuels used to burn training fires have major differences in quantity, type, and configuration.⁶⁰

Furthermore, recommendations regarding fuel use and requirements found in *NFPA 1403: Standard on Live Fire Training* prohibit using flammable liquids, plastic, rubber, and treated wood.⁶¹ These prohibited items are the fuels found in a majority of U.S. structure fires. Excluding them from live-fire training denies the firefighters the opportunity to observe how they would react during the free-burning phase of a fire.

Research indicates that individuals will generally rely on training and experience to develop a response to incidents or events. Along with environmental factors, acute stress and emotion affect the overall decision-making process of firefighters. A study conducted by the Hanover, MD Fire Department compared perceptual learning styles via a department-wide survey. The study compared auditory, visual, and kinesthetic (hands-on)

⁶⁰ Hartin, 2–3.

⁶¹ National Fire Protection Association, *NFPA 1403: Standard for Live Fire Evolutions* (Quincy, MA: National Fire Protection Association, 2018), 1403–9.

learning styles.⁶² The final results found that 59% of the department preferred kinesthetic learning, followed by 22% for visual, and 19% for auditory.⁶³ Since firefighting is a hands-on profession requiring physical skills to complete the task being faced, training should be as realistic as possible to prepare firefighters for actual events. Despite the many platforms used for delivering firefighter training, none makes more impact than actual hands-on training.

6. Technology/Virtual Reality/Serious Gaming

A relatively new platform for delivering firefighter training is the use of virtual simulation and serious games. The goal is to deliver realistic training without exposing firefighters to possible injury or death. Simulation offers more true-to-life training through the use of virtual environments.⁶⁴ Serious games offer a platform for training and education that provides users with an interactive experience designed to be immersive and engaging.⁶⁵ Both training platforms offer safe and cost-effective options to kinetic training that is more realistic than current classroom training models.⁶⁶

Simulation fire training has made recent major advances. One of the most significant achievements involves collaboration between the USFA and the New York University (NYU) Fire Research Group. Through this partnership, they created a scenario-based interactive firefighter-training program called Advanced Learning through Interactive Visual Environments (ALIVE).⁶⁷ The USFA acknowledges, “fire departments face many challenges creating good training programs...repetition is important with

⁶² John Petrakis, “Firefighter Learning Styles and Training: Beyond the Slide Presentation,” *Fire Engineering* 156, no. 10 (October 1, 2003), <https://www.fireengineering.com/articles/print/volume-156/issue-10/features/firefighter-learning-styles-and-training-beyond-the-slide-presentation.html>.

⁶³ Petrakis.

⁶⁴ “Disaster Management Training and Incident Command Training,” Simulation Training Systems, accessed August 4, 2019, <http://www.trainingfordisastermanagement.com/>.

⁶⁵ F. M. Williams-Bell et al., “Using Serious Games and Virtual Simulation for Training in the Fire Service: A Review,” *Fire Technology* 51, no. 3 (May 2015): 553–84, <https://doi.org/10.1007/s10694-014-0398-1>.

⁶⁶ Williams-Bell et al., 553–584.

⁶⁷ “Scenario-Based Interactive Firefighter Training,” U.S. Fire Administration, August 16, 2018, <https://www.usfa.fema.gov/operations/infograms/081618.html>.

training so these criteria must be met over and over.”⁶⁸ NYU’s program meets these criteria by offering simulations that have the characteristics of modern fire dynamics.

The creators of the ALIVE program argue traditional methods of training and information dissemination fail to prepare firefighters for the certain challenges they will face engaging modern fires and disasters. A need also exists to close the distance between current fire department practices and science-based interventions.⁶⁹ They also recognized a need for a platform to help fire departments distribute information within their organizations. In an attempt to test the value of the ALIVE program versus traditional classroom training, researchers worked with 599 firefighters belonging to large professional and volunteer departments. Subject matter experts developed three tests that were administered after ALIVE training and classroom training.⁷⁰ The data confirmed the ALIVE candidates demonstrated higher post-test knowledge levels in all areas.

7. Design Method for Effectiveness

To determine whether training is effective and worthwhile requires a way to evaluate and measure the results of training. Unfortunately, the fire service appears to have no formal evaluation platform to measure the actual effectiveness of training. Measuring performance of any government agency is a substantial task when done correctly. Typically, the measurement of fire department performance is centered on data-driven components of the department, such as response times, operation costs, customer satisfaction, or increases or decreases in fire incidents.⁷¹ When it comes to training, certification and training are intended to keep firefighters current on skills and techniques. Researcher Jennifer Flynn points out, “It is assumed that a high percentage of responders with completed training and certification are providing high quality service when

⁶⁸ U.S. Fire Administration.

⁶⁹ “Advanced Learning through Interactive Visual Environments (ALIVE),” New York University—School of Engineering, accessed August 4, 2019, <http://fire.engineering.nyu.edu/home/alive.html>.

⁷⁰ New York University—School of Engineering.

⁷¹ Jennifer D. Flynn, *Fire Service Performance Measures* (Quincy, MA: National Fire Protection Association, 2009), 23, <http://tkolb.net/FireReports/FireServicePerformanceMeasures2008.pdf>.

responding to calls.”⁷² However, without a national training requirement, fire departments set their own requirements for training, which means two separate departments with 100% completed training may not be providing the same service since one department may have more required training than the other does.⁷³

The real answer to measuring training in the fire service lies in the numerous NIOSH reports on firefighter LODDs. As previously stated, each report reviewed listed some deficiency in training as a factor contributing to firefighter deaths. Using the NIOSH reports as the measuring stick of effective training, effective firefighter training would reasonably be reflected by a decrease in firefighter LODDs, or by NIOSH no longer citing deficiencies in training as a contributing factor in fatalities. This reduction should be a goal every fire department strives to achieve with training. We owe it to every firefighter, and their families to assure they are fully prepared when they respond to a crisis.

With the addition of new services and the significant increases in requests for service outside of a standard fire call, fire departments nationwide have undergone a transformation in the way they do business. These additional responsibilities have minimized the time available for fire training, while at the same time, decreased exposure to real-life fire experience. However, even with these changes, coupled with the steady decrease in structure fires over the last 30 years, firefighter LODDs remain unaffected during this same period. So, while fire departments adjust operationally to meet changing demands for response, they also need to examine how they can provide the most efficient and effective training with the decline in opportunities to prepare this nation’s firefighters to respond safely to the dynamic events they may face during their careers.

⁷² Flynn, 23.

⁷³ Flynn, 24.

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III. COGNITIVE PROCESSES AND THE PSYCHOLOGY OF TRAINING

I am always doing that which I cannot do, in order that I may learn how to do it

~ Pablo Picasso

To appreciate the importance of training in the fire service, it first must be understood how cognitive processes affect learning and performance in a dynamic environment demanding the ability to make decisions instantaneously. This chapter demonstrates the need for fire departments to provide training involving repetition, muscle memory, and frames of reference for future events. While no scientific research focuses solely on fire department training, the cognitive principles discussed in this chapter can be easily applied to make training more effective.

A. DEVELOPING EXPERTISE

The importance of accurate intuition relies on repeated exposure to skills, which allows individuals to develop recognition of cues to a situation.⁷⁴ Psychologist Herbert Simon explained, “The situation has provided a cue. This cue has given the expert access to information stored in memory, and the information provides the answer. Intuition is nothing more and nothing less than recognition.”⁷⁵ Simon contends that conditions must be met for skilled intuition to develop; namely, a substantial opportunity to master skills along with a valid and realistic environment for learning. Numerous factors influence learning and the development of skills, which directly affect individual responses. These factors include the type of training an individual receives, individual motivation, and level of engagement.⁷⁶ Furthermore, individuals develop skills at different levels; as Kahneman

⁷⁴ Daniel Kahneman and Gary Klein, “Conditions for Intuitive Expertise: A Failure to Disagree,” *American Psychologist* 64, no. 6 (September 2009): 520, <http://dx.doi.org/10.1037/a0016755>.

⁷⁵ Herbert A. Simon, “What Is an ‘Explanation’ of Behavior?” *Psychological Science* 3, no. 3 (1992): 155, <https://doi.org/10.1111/j.1467-9280.1992.tb00017.x>.

⁷⁶ Kahneman and Klein, “Conditions for Intuitive Expertise,” 521.

and Klein state, “talent surely matters.”⁷⁷ Simon explains that a chess master’s expertise is a part of his recognition capabilities, which significantly rely on indexed knowledge accumulated from experience and training.⁷⁸

Authors Richard Larrick and Daniel Feiler define expertise as knowledge related to a specific profession that individuals acquire through actual experience or training. The end result of experience and training is a performance that is superior and repeatable by individuals in their particular profession.⁷⁹ Building this expertise is achieved through developing schema; a cognitive structure linking different bits of information together to form a relationship.⁸⁰ For example, in the fire service, an expert firefighter looks at fire in terms of what caused the fire and can then predict what will happen next. A non-expert is more concerned about the fire itself and observes characteristics like color and heat.⁸¹ With regular training that is impactful, firefighters can begin to organize information and develop robust schemas that allow for the building of expertise. This process leads to the development of an expert who can produce instantaneous, successful strategies in response to a crisis.

B. RECOGNITION PRIMED DECISION MAKING

Most theories regarding successful training models rely heavily on providing substantial foundational knowledge, combined with repetitive actions, to build an almost automatic response. Repetition of a task creates muscle memory and contributes to better decision-making skills during a dynamic incident, without too much deliberative thinking.⁸² According to Gary Klein et al.’s recognition primed decision making model

⁷⁷ Kahneman and Klein, “Conditions for Intuitive Expertise,” 515.

⁷⁸ Simon, “What Is an ‘Explanation’ of Behavior?” 155.

⁷⁹ Richard P. Larrick and Daniel C. Feiler, “Expertise in Decision Making,” in *The Wiley Blackwell Handbook of Judgment and Decision Making*, ed. Gideon Keren and George Wu (Chichester, UK: John Wiley & Sons, Ltd, 2015), 696–697, <https://doi.org/10.1002/9781118468333.ch24>.

⁸⁰ Larrick and Feiler, 699.

⁸¹ Larrick and Feiler, 699.

⁸² Ed Ballam, “Microprocessors Provide the Fire Service with the Ultimate ‘Muscle Memory,’” *Firehouse*, May 22, 2015, <https://www.firehouse.com/apparatus/components/12075919/firefighting-technology-microprocessors-provide-essential-high-tech-operations>.

(RPD), individuals deciding on a course of action will refer to past experiences of similar situations to decide on a course of action.⁸³ Decisions on a fire ground are made quickly, often without any debate. Thus, Klein investigated how fire commanders at a fire scene could make appropriate decisions without comparing options. Initially, Klein hypothesized fireground officers would restrict their analysis to a pair of options but found this assumption to be incorrect.⁸⁴ In fact, by referencing years' worth of experience and training, the officer pulls from the repertoire of patterns from memory to determine quickly the single best course of action.⁸⁵

This theory is further supported by Simon, who proposed the idea *bounded rationality*, which examines the cognitive limitations of the individual making the decision. Simon suggests individuals only consider as many alternatives as needed in determining which choice they believe is an acceptable, available option.⁸⁶ Fireground officers and firefighters should be able to draw on their past experiences and training to determine an immediate course of action from a limited number of alternatives, which will lead to the best possible outcome. Rehearsing an activity until it becomes so routine to firefighters that when they are challenged by an incident, they will rely on their past experiences to function at an optimal level.⁸⁷ Without this familiarity, firefighters might consider an alternative, substandard response that could result in injury or death.

⁸³ Kahneman and Klein, "Conditions for Intuitive Expertise," 515.

⁸⁴ Kahneman and Klein, 516.

⁸⁵ Kahneman and Klein, 516.

⁸⁶ Herbert A. Simon, "Bounded Rationality," in *Utility and Probability*, ed. John Eatwell, Murray Milgate, and Peter Newman (London: Palgrave Macmillan UK, 1990), 16, https://doi.org/10.1007/978-1-349-20568-4_5.

⁸⁷ Judith Glick-Smith, *Flow-Based Leadership: What the Best Firefighters Can Teach You about Leadership and Making Hard Decisions* (Basking Ridge, NJ: Technics Publications, 2016), 60.

C. WORKING MEMORY MODEL

Cognitive psychologists Alan Baddeley and Graham Hitch introduced a model of working memory (WM) to explain how information needed in the moment is held and manipulated in memory. WM evolved from short-term memory (STM), which is the temporary storage of simple, limited information. WM involves a combination of storing and controlling temporary information.⁸⁸ Baddeley and Hitch explain that the WM is broken down into different systems with specific functions. The *central executive* serves as the director of the whole system. At this point, information is combined and manipulated to inform thinking and decision making. The information comes from the subsystems responsible for the short-term storage of information. The *phonological loop* is the area responsible for the short-term storage of written and spoken information. The *visuospatial sketchpad* is the area responsible for the short-term storage of visual or spatial information.⁸⁹ These two subsystems store information for a very brief time, approximately two seconds unless it is updated and repeated through rehearsal.⁹⁰

Baddeley introduced a fourth component known as the *episodic buffer* (EB). The EB is believed to hold integrated events in a multi-dimensional code, which serves as a buffer between WM components. The EB also links WM to long-term memory (LTM), but this buffer has a limited storage capacity.⁹¹ The WM model explains that individuals have only a limited amount of mental storage space at any given time, although researchers have debated about the amount of storage available.⁹²

⁸⁸ Alan Baddeley, "Working Memory: Theories, Models, and Controversies," *Annual Review of Psychology* 63, no. 1 (2012): 1–29, <https://doi.org/10.1146/annurev-psych-120710-100422>.

⁸⁹ Baddeley, 12.

⁹⁰ Baddeley, 8.

⁹¹ Baddeley, 15.

⁹² Alex Burmester, "Working Memory: How You Keep Things 'in Mind' over the Short Term," *Scientific American*, June 5, 2017.

The prefrontal cortex (PFC) is the region of the brain tasked with conducting complex cognitive behavior, expression, and decision making.⁹³ Higher cognitive functions originate in the PFC. It has been argued that many of the functions of working memory depend on the PFC. Alex Burmester contends, “Planning and decision-making require us to already have in mind the relevant information to formulate a course of action.”⁹⁴ Burmester points out that increases and decreases in the WM during an individual’s lifetime are directly tied to the normal development and degradations of the PFC. Furthermore, the WM is directly affected by any type of damage to the PFC.⁹⁵

According to Baddeley’s WM model, through the EB, LTM can be directly accessed by WM. The LTM is the area of the brain where an individual’s past experiences and knowledge are stored.⁹⁶ LTM is divided into two major subdivisions, the explicit (declarative) and the implicit (non-declarative) memory. Explicit memory requires the use of conscious thought when trying to remember things like the names of people and places. Implicit memory, however, does not require conscious thought. Instead, individuals accomplish tasks by rote, or recall information ingrained through repetition learning.⁹⁷ Figure 4 demonstrates the flow of information from input to LTM. Baddeley contends that WM serves as an activator of brain function related to LTM. He adds that previously developed and stored information in the LTM acts as a booster to WM performance.⁹⁸

⁹³ “Prefrontal Cortex,” *The Science of Psychotherapy*, January 4, 2017, <https://www.thescienceofpsychotherapy.com/prefrontal-cortex/>.

⁹⁴ Burmester, “Working Memory.”

⁹⁵ Burmester.

⁹⁶ Isao Hasegawa, Toshihiro Hayashi, and Yasushi Miyashita, “Memory Retrieval under the Control of the Prefrontal Cortex,” *Annals of Medicine* 31, no. 6 (December 1999): 380–87, <https://doi.org/10.3109/07853899908998795>.

⁹⁷ Richard H. Hall, *Explicit and Implicit Memory* (Rollo: MO: Missouri S&T University, 1998), 1.

⁹⁸ Baddeley, “Working Memory,” 12.

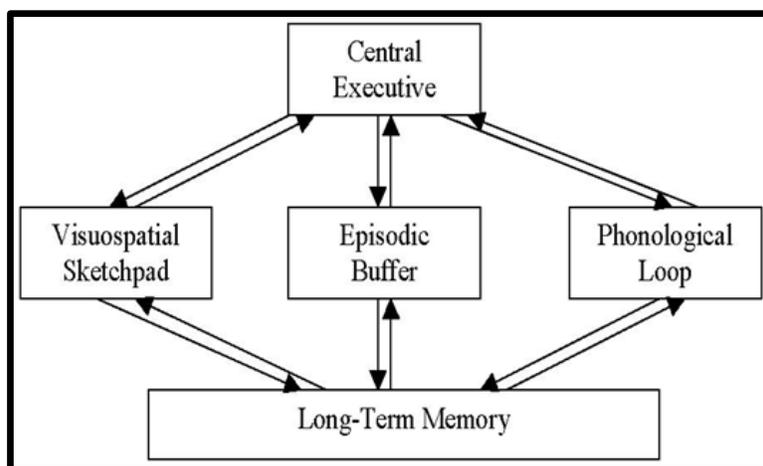


Figure 4. The Working Memory Model.⁹⁹

To understand how WM applies to firefighter performance, it is important to separate the skills associated with WM from those that are not. Furley and Memmert explain how WM is applied to sports. Successfully shooting a basketball into a hoop is a physical, talent-based skill and therefore does not need a lot of engagement on behalf of WM.¹⁰⁰ However, deciding on the best shot to take in an instant requires a quick assessment of the situation resulting in an optimal decision, and therefore requires engagement of WM. In the example of firefighting, when approaching a building fire, a firefighter needs to rely on training and experience regarding building construction, smoke activity, and fire conditions to make a spontaneous decision whether it is safe to enter. In addition, they must depend on their knowledge of proper search techniques to find the fire and victims under challenging conditions.

⁹⁹ Source: "Baddeley's Model of Working Memory," *Mercercognitivepsychology*, accessed November 9, 2019, <http://mercercognitivepsychology.pbworks.com/w/page/61198759/Baddeley%27s%20Model%20of%20Working%20Memory>.

¹⁰⁰ Philip Alexander Furley and Daniel Memmert, "The Role of Working Memory in Sport," *International Review of Sport and Exercise Psychology* 3, no. 2 (September 2010): 181, <https://doi.org/10.1080/1750984X.2010.526238>.

Researchers Sian Beilock and Thomas Carr suggest that WM capacity devoted to performance can be reduced by anxiety and stress.¹⁰¹ Moreover, psychologists Schmader and Johns believe that performance during a stressful situation reduces the WM of individuals who suffer from an anxiety disorder.¹⁰² Every firefighter will experience anxiety and stress at some point, so it is important to understand the relationship between the two. Stress is something felt by an individual during a threatening situation. Anxiety is a response to the stress, or previous stress, and is used to describe feelings that occur when the source of harm is uncertain or is distal in space or time.¹⁰³ People who are experiencing anxiety will have less WM because they will dedicate a portion of their mental resources to the stressor to suppress any negative feelings or thoughts. However, if those individuals have conditioned their WM through repetitive training, it is likely that the anxiety will have less of an impact on their response.

D. THE IMPACT OF PANIC AND STRESS

Understanding the human body's fight-or-flight response offers further understanding on how individuals respond to stress during a crisis. The stress response experienced by firefighters originates in the body's sympathetic nervous system. The release of the hormone glucocorticoid (cortisol in humans), along with catecholamines, epinephrine (i.e., adrenaline), norepinephrine, and dopamine, travel to the brain via blood vessels and prepare the body to act.¹⁰⁴ This fight-or-flight response inside the body is part of the sudden adrenaline rush that most firefighters feel when faced with danger or any other type of perceived threat. During these types of situations, cognitive resources in the

¹⁰¹ Sian L. Beilock and Thomas H. Carr, "When High-Powered People Fail: Working Memory and 'Choking under Pressure' in Math," *Psychological Science* 16, no. 2 (2005): 101, <https://doi.org/10.1111/j.0956-7976.2005.00789.x>.

¹⁰² Toni Schmader and Michael Johns, "Converging Evidence that Stereotype Threat Reduces Working Memory Capacity," *Journal of Personality and Social Psychology* 85, no. 3 (September 2003): 441–42, <http://dx.doi.org/10.1037/0022-3514.85.3.440>.

¹⁰³ "Stress," Anxiety and Depression Association of America, accessed November 9, 2019, <https://adaa.org/understanding-anxiety/related-illnesses/stress>; Joseph LeDoux and Daniel Pine, "Using Neuroscience to Help Understand Fear and Anxiety: A Two-System Framework," *American Journal of Psychiatry* 173, no. 11 (September 2016): 1084.

¹⁰⁴ Stephen Paravat, and Steven Warrington, "Physiology, Catecholamines—StatPearls—Bookshelf," NCBI, accessed November 25, 2019, <https://www.ncbi.nlm.nih.gov/books/NBK507716/>.

brain are also depleted as a result of stress.¹⁰⁵ This physiological response of catecholamines and glucocorticoids allows the body to respond to the threat and then reconcile when the threat is over to reestablish homeostasis.¹⁰⁶

The hippocampus and amygdala reside deep inside the brain, and their functions and proximity to each other are vital in understanding the stress response. The hippocampus plays an important role in learning, memory, and determines whether something is safe or unsafe.¹⁰⁷ Luksys and Sandi describe the importance of the hippocampus and prefrontal cortex areas during complex reasoning, while the amygdala has more of a role in emotional and automatic processes. Sandi found overwhelming stress could weaken explicit memory and impair decision making when performing a function an individual has not well rehearsed.¹⁰⁸ Sandi's review noted the impact of acute stress on well-rehearsed tasks was not as severe. Training and repeating tasks are needed to alleviate the negative effects of acute stress through individual preparedness.¹⁰⁹

Training occurs within fire departments nationwide on a regular basis, but are these training models accounting for the various factors that may impact rational decision making under immediate and demanding conditions? Despite all attempts to deliver training in the fire service, achieving and maintaining a level of proficiency is often impractical. Despite a lack of formal measurements of the effectiveness of training, the ability to perform safely and proficiently is arguably the most important outcome. Retired fire Chief Richard Gasaway suggests that training a firefighter to fail is quite possible.¹¹⁰

¹⁰⁵ Laurie Kelly McCorry, "Physiology of the Autonomic Nervous System," *American Journal of Pharmaceutical Education* 71, no. 4, art. 78 (September 1, 2007): 1, <https://doi.org/10.5688/aj710478>.

¹⁰⁶ "Stress: The Role of Glucocorticoids," Brain Facts, April 1, 2012, <https://www.brainfacts.org:443/thinking-sensing-and-behaving/emotions-stress-and-anxiety/2012/stress-the-role-of-glucocorticoids>.

¹⁰⁷ Amanda Ripley, *The Unthinkable: Who Survives When Disaster Strikes—And Why* (Crown, NY: Three Rivers Press, 2009), 99.

¹⁰⁸ Gediminas Luksys and Carmen Sandi, "Neural Mechanisms and Computations Underlying Stress Effects on Learning and Memory," *Current Opinion in Neurobiology* 21, no. 3 (June 2011): 502–8, <https://doi.org/10.1016/j.conb.2011.03.003>.

¹⁰⁹ Luksys and Sandi, 502–8.

¹¹⁰ Richard B. Gasaway, "Is It Possible to Train a Firefighter to Fail?," *Target Solutions*, April 17, 2012, <https://www.targetolutions.com/featured-contributors/training-for-failureall/>.

Gasaway argues that generally a non-stressed brain is calm, able to process information, and figure out possible solutions, whereas the stressed brain is less rational.¹¹¹ Gasaway contends a stressed brain is intuitive and resorts to lessons learned during repeated training as its fallback when forced to make immediate decisions under pressure and it runs automatic scripts when it is under stress.¹¹² If a correct explanation of the situation exists, then the training firefighters receive becomes quite significant. A lack of training, or training that fails to prepare firefighters adequately for dynamic events, can jeopardize their safety.

Psychologists Katrin Starcke and Matthias Brand assert that decision making and stress are intricately connected.¹¹³ Uncontrollability and unpredictability are conditions that elicit stress, and under these conditions, individuals experience physiological and endocrine reactions. Starcke and Brand explain, “if the decision-making process is affected by not only external stress but also stress reactions related to the decision itself, then many difficult situations could result in suboptimal decisions.”¹¹⁴ People are not trained to make the best decisions while being exposed to stress, but adding stress to training to make the circumstances seem more realistic is believed to make training more impactful. Gasaway argues firefighters are being trained to fail. He believes the training being done nationwide is ineffective because it lacks the ingredients needed to make the training realistic.¹¹⁵ A brain under stress does not make decisions the same way a non-stressed brain will, which makes the addition of stress in training necessary to reflect a dynamic incident better.¹¹⁶ Furthermore, repetition of training teaches the body muscle-memory, which is the fallback

¹¹¹ Gasaway

¹¹² Gasaway.

¹¹³ Katrin Starcke and Matthias Brand, “Decision Making under Stress: A Selective Review,” *Neuroscience & Biobehavioral Reviews* 36, no. 4 (April 2012): 1228, <https://doi.org/10.1016/j.neubiorev.2012.02.003>.

¹¹⁴ Starcke and Brand, 1242.

¹¹⁵ Gasaway, “Is It Possible to Train a Firefighter to Fail?”

¹¹⁶ Gasaway.

when high stress events are encountered.¹¹⁷ Having the KSAs to perform and make good decisions at an actual event are fostered by training in a more realistic environment.

1. Inverted U-shaped Relationship

Psychologists Robert M. Yerkes and John D. Dodson are credited with the first observation of the inverted U-shaped relationship between stress and performance.¹¹⁸ The inverted U-shaped relationship depicts human stress on the x-axis, and human performance of assigned tasks on the y-axis.¹¹⁹ As individual experiences increase arousal (stress), performance of cognitive activities will actually improve up to a certain point. This peak level, where arousal and performance combine to make an optimal response, is demonstrated at the top of the inverted U (Figure 5).

An incident may exceed the amount of stress an individual can handle, which then results in a breakdown in an individual's response.¹²⁰ In his book, *Sharpening the Warrior's Edge—The Psychology and Science of Training*, author Bruce Siddle explains the inverted U-shaped relationship of stress and performance in relation to individual performance during combat training. Siddle describes how increased stress results in increased performance, but only up to a certain threshold, at which point additional stress will lead to deterioration and poor performance.¹²¹ Once the human response reaches the peak of the inverted U-shaped relationship, individuals enter the period of diminishing performance.

¹¹⁷ Gasaway.

¹¹⁸ Karl Teigen, "Yerkes-Dodson: A Law for All Seasons," *Theory & Psychology* 4 (November 1, 1994): 527, <https://doi.org/10.1177/0959354394044004>.

¹¹⁹ Martin Corbett, "From Law to Folklore: Work Stress and the Yerkes-Dodson Law," *Journal of Managerial Psychology* 30, no. 6 (2015): 741–52, <https://doi.org/10.1108/JMP-03-2013-0085>.

¹²⁰ Bruce Siddle, *Sharpening the Warriors Edge: The Psychology & Science of Training* (Belleville, IL: PPCT Research Publications, 1995), 45.

¹²¹ Siddle, 38.

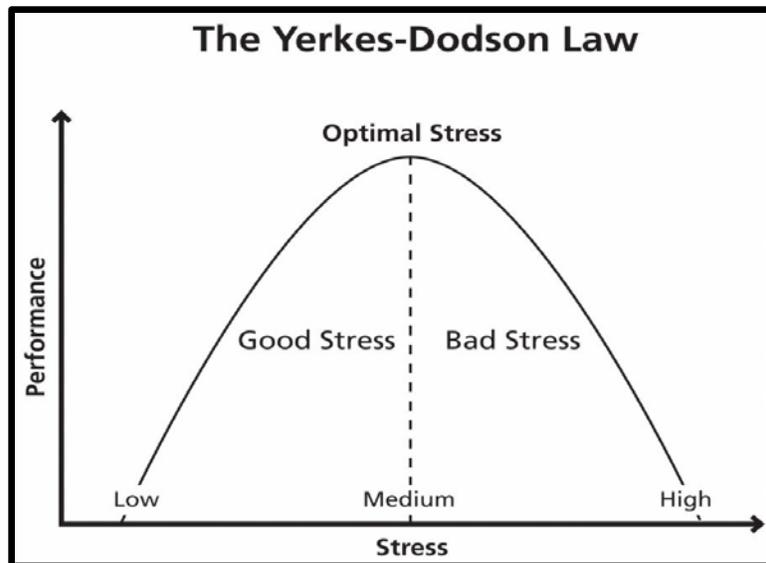


Figure 5. Yerkes-Dodson Inverted U-shaped Relationship.¹²²

Lauren Chaby et al. conducted studies using the Yerkes-Dodson law as their supporting framework. Their findings have been applied and replicated using various contexts, such as athletic training and workplace conditions. Yerkes-Dodson law argues “for more challenging tasks...moderate arousal can enhance performance in part by modulating motivation, but high levels of arousal can decrease performance through processes such as a reduction in the amount of information that can be processed.”¹²³ As relating to firefighters, small amounts of stress, or routine incidents, cause little arousal. As an incident becomes larger and more complex, performance will increase up to a certain level before deteriorating. The more knowledge individuals possess prior to a stressful event, the more likely they are to give an organized and impactful response. Having knowledge can help establish confidence, which naturally reduces the level of stress felt about a situation that then shifts optimal stress further into the inverted U-shaped response.

¹²² Source: Stephen J. Meyer, “Why the U.S. Keeps Losing the Ryder Cup: Research on Stress Provides Answer,” *Forbes*, October 22, 2014, <https://www.forbes.com/sites/stevemeyer/2014/10/22/why-the-u-s-keeps-losing-the-ryder-cup-the-s-word/>.

¹²³ Lauren E. Chaby et al., “Can We Understand How Developmental Stress Enhances Performance under Future Threat with the Yerkes-Dodson Law?,” *Communicative & Integrative Biology* 8, no. 3 (2015): e1029689-2, <https://doi.org/10.1080/19420889.2015.1029689>.

In addition, knowledge may increase situational awareness to allow individuals to be able to assess various options and outcomes quickly.

2. Cue Utilization Theory

The Easterbrook cue utilization theory also factors into how stress effects decision making in firefighters. Developed by J. A. Easterbrook from the Institute of Psychiatry at the University of London, Easterbrook argues when arousal is low, the perceptual field of individuals is still wide.¹²⁴ As stress increases, the perceptual field narrows and the individuals begin to focus on the most relevant cues.¹²⁵ As individuals experience more stress, their focus will zero in on relevant information regarding the immediate threat, while attention is directed away from less relevant information.¹²⁶ Simply stated, firefighters will focus on what they know to help them properly respond during a crisis. Without appropriate training and experience, the perceptual field could narrow to poor choices. This theory makes training even more relevant for firefighters to have the knowledge and situational awareness to survive the crisis.

Both the Yerkes-Dodson inverted U-shaped response and Easterbrook's cue utilization make even more sense when combined to apply to measure how firefighters perform during a crisis. During a stressful event, firefighters are going to refer to things learned during training. As stress increases, firefighters will focus on what they know to respond and survive. Yerkes-Dodson law and Easterbrook's theory will intersect up to the point the firefighters become overwhelmed and fall victim to the dynamic situation. Kinetic training involving repetition will allow firefighters to perform longer in the effective plane of the inverted-U because as Easterbrook explains, humans will resort to what they know well during cue utilization.

¹²⁴ J. A. Easterbrook, "The Effect of Emotion on Cue Utilization and the Organization of Behavior," *Psychological Review* 66, no. 3 (1959): 183–201, <https://psycnet.apa.org/doi/10.1037/h0047707>.

¹²⁵ Easterbrook, 185.

¹²⁶ Easterbrook, 185.

E. FLOW STATES

Psychologists Mihaly Csikszentmihalyi and Martin Seligman investigated the concept of flow, or optimal experience in the 1970s. Flow is a “feeling of complete and infinite emersion in an activity. You are unaware of conflict or contradictions. You are working toward goals, but you are also feeling challenged. The work feels effortless.”¹²⁷ To operate in flow, the task must be challenging; however, a task that exceeds someone’s capabilities will result in frustration. Being in a state of flow occurs when an individual’s skillset is so developed “that a level of unconscious competence has been reached.”¹²⁸ Flow happens when individual skill matches the challenge the individual is facing.

Judith L. Glick-Smith applied the theory of flow while observing the GSD. Dr. Glick-Smith was given an opportunity to observe live-burn training from inside the structure. She describes the moments after entering the fire as terrifying, panicky, with a complete loss of senses. Glick-Smith described her 15 minutes in the fire as an eternity, and the entire event as traumatizing.¹²⁹ This scenario is common for firefighters, who must remain situationally aware of their surroundings, which can change instantly. Glick-Smith recalls being immersed in fear and wanting to run. She argues, “the only thing that facilitates success in this scenario is training, preparation, and the ability to operate in the present.”¹³⁰ Flow is described as having eight specific characteristics:

- You have clear goals and are receiving immediate feedback within the activity.
- There are many opportunities for decisive actions.
- Awareness and action emerge.

¹²⁷ Rob Elkington et al., eds., *Visionary Leadership in a Turbulent World: Thriving in the New VUCA Context* (Bingley, UK: Emerald Group Publishing, 2017), 61.

¹²⁸ Elkington et al., 63.

¹²⁹ Elkington et al., 65.

¹³⁰ Elkington et al., 65.

- You focus on the task at hand.
- You feel in control of your actions.
- Awareness of self disappears during the task and feels stronger following task completion.
- The concept of time has no meaning.
- The experience is autotelic.¹³¹

Flow requires preparation to help firefighters visualize and achieve positive outcomes. To operate in flow, individuals must invest the time to prepare. Elkington points out, “Preparation refers to training and experience...it refers to rehearsing- repeating the activity until it is ingrained at a level you can do it without thinking.”¹³² Firefighters want their training to help them master their skills so when they face a dynamic crisis that falls outside of what is ordinarily experienced, they continue to function with an optimal level of confidence.¹³³

¹³¹ Glick-Smith, *Flow-Based Leadership*, 23.

¹³² Elkington et al., *Visionary Leadership in a Turbulent World*, 65.

¹³³ Elkington et al., 65.

IV. OTHER CHALLENGES AND IMPACTS ON TRAINING

Tell me and I forget, teach me and I may remember, involve me and I learn

~ Benjamin Franklin

This chapter explores other challenges faced by fire departments nationwide to train their members. Despite the type or amount of training, individuals comprehend and retain information differently. In addition, firefighting is no different from other professions that have good and bad employees. Leadership and culture within the fire service also experience other issues. While initiatives are currently in place to help overcome these hurdles, it is a monumental task to change the mindset of firefighters. Furthermore, the fire service is faced with constantly changing standards in building construction and the contents of buildings involved in structure fires.

Unpredictable circumstances can also certainly factor into the results of NIOSH LODD reports. Firefighters cannot train for every crisis they may face during their careers, but often, what is considered an arbitrary event is something that was avoidable upon closer examination. Andrew Beck, a training officer and staff member for the International Association of Fire Chiefs (IAFC) argues, firefighters like to tell themselves an injured or deceased firefighter did everything possible, and the events were totally unpredictable. This thought makes survivors feel better about the situation, who falsely believe they typically have more control over a crisis, but Beck argues it is not the best way to look at these events.¹³⁴ A mistake that is made following a LODD is to analyze the firefighters' actions taken during a crisis involving a chaotic environment. In the moments right before a fatal mistake is made, firefighters are down to few options and must react in an extremely stressful situation. The chances of making the wrong decision at this point are very high, with the potential of resulting in injury or death.¹³⁵ A closer investigation of the LODD's

¹³⁴ Andrew Beck, "Analyze and Share Underlying Factors to Prevent Firefighter LODDs," FireRescue1, accessed August 9, 2019, <https://www.firerescue1.com/fire-chief/articles/393612018-Analyze-and-share-underlying-factors-to-prevent-firefighter-LODDs/>.

¹³⁵ Beck.

root causes can show an accident was not as unpredictable as first thought.¹³⁶ Circumstances were made unpredictable through a series of potentially bad decisions made by the firefighter, or firefighters, which led to the final outcome.

Decision making during extreme or dynamic circumstances can mean the difference between injury, death, or getting out unharmed. Battalion Chief Billy Schmidt argues, “firefighters who display excellence during training and normal fire ground operations will most likely demonstrate similar behavior during an actual emergency.”¹³⁷ Schmidt goes on to say, “lacking important information, especially the understanding of basic operational and safety procedures and techniques, can result in disaster. In the fire service knowledge is not just power—it’s safety.”¹³⁸ Like many other professions, the fire service is no different when it comes to having good and bad employees. Knowing that even good firefighters can make mistakes further supports the fact that dynamic fire training for all is needed to enhance the capabilities of all.

A. LEADERSHIP

A key component to training and safety within a fire department revolves around the leadership of the organization. Leadership must maintain any current policies, and is even more important to the implementation of any new policies.¹³⁹ Leadership is often mentioned as a key component in implementing safety policies and programs. However, change is not likely to occur unless the leaders of fire departments demonstrate a commitment to the membership. For change to occur, both the formal and informal leadership of the organization must buy in completely. Leadership in the fire service is more than just issuing directives for the boots on the ground to follow. An organization

¹³⁶ Beck.

¹³⁷ Billy Schmidt, “Observing Firefighter Performance,” *Fire Rescue* 2, no. 2 (March 20, 2009): 1, <https://www.firerescuemagazine.com/articles/print/volume-2/issue-2/news/observing-firefighter-performance.html>.

¹³⁸ Schmidt, 2.

¹³⁹ U.S. Fire Administration, *National Safety Culture Change Initiative: Study of Behavioral Motivation on Reduction of Risk-Taking Behaviors in the Fire and Emergency Service*, FA-342 (Emmitsburg, MD: U.S. Fire Administration, 2015), 16, https://www.usfa.fema.gov/downloads/pdf/publications/fa_342.pdf.

must have commitment from the top down, so that the lines are very clear as to what is expected. Moreover, policies that fade away quickly do so because they were not needed in the first place, or the organization was not committed to them. Either case is unacceptable because it will take away from the legitimacy of future policies.

Training is considered an essential piece of any type of positive change occurring in firefighter behavior. Using the same logic, training considered inappropriate can lead to negative changes that then encourage behavior considered high risk.¹⁴⁰ The importance of providing firefighters training designed to be adequate and that reinforces appropriate attitudes, beliefs, behavior, and actions is paramount. The National Culture Change Initiative emphasizes, “Fire and emergency service training organizations must be conscious of the behavioral influences that are incorporated within the content of their training programs, as well as the manner in which training is being delivered.”¹⁴¹ Fire department leadership must provide instructors who operate under these same attitudes, beliefs, behavior, and actions to ensure the training is in line with the desired behavioral influence. Furthermore, a high degree of safety built-in to all fire department training must exist to ensure the safety of both the student and the instructor.

B. FIREFIGHTER CULTURE

Every individual member of the fire service is liable to maintain two key aspects that apply to professional firefighters, accountability, and personal responsibility.¹⁴² From the fire chief to an entry-level firefighter, individuals are responsible to meet the expectations associated with the positions they hold. Individuals are also accountable for maintaining their own health, training, and safety, as well as anyone falling under their supervision. Being held accountable is an inherent piece of supervision, leadership, and management that expands with every promotion in the fire service.¹⁴³ The fire chiefs of any professional fire department hold the ultimate responsibility for their department,

¹⁴⁰ U.S. Fire Administration, 17.

¹⁴¹ U.S. Fire Administration, 17.

¹⁴² U.S. Fire Administration, 15.

¹⁴³ U.S. Fire Administration, 15.

whether the outcomes are positive or negative. Although accountability should never be ignored, it often is until an incident with a negative outcome occurs, such as a firefighter injury or death. A culture of positive accountability within an organization can help assure training is being completed to help prevent this type of occurrence.¹⁴⁴

The culture of the fire service is decades in the making, which adds to the difficulty of making changes. Brian Brauer, of the Illinois Fire Service Institute argues, “fire department history and traditions can create a culture that is either difficult or impossible to change, and fire departments may need to give up some freedom and better adhere to national standards to reduce line-of-duty deaths.”¹⁴⁵ Long-standing traditions can add to the difficulty of training department members. For example, it is not uncommon for the more senior firefighters to take more of an observatory role at trainings, yet they are still expected to perform during a crisis. These traditions are introduced to new recruit firefighters as part of their initial training.¹⁴⁶

How departments train and prepare to execute their daily duties varies when moving around the United States. However, numerous commonalities exist between fire departments when it comes to training. Of course, exceptions always occur, but training in the fire service is not preparing firefighters for the dynamic events they may encounter. Training fails to meet firefighter needs, but this failure ranges from the type of training being conducted, the cultural impact of seniority on training, down to training just not being done.

Senior firefighters are the informal leaders of the fire department. The senior firefighters can impact younger firefighters that will often last an entire career.¹⁴⁷ Senior firefighters must lead by example; during training, the senior men should not sit back and

¹⁴⁴ U.S. Fire Administration, 16.

¹⁴⁵ Brian Brauer, “The Fire and Emergency Services Culture: Can It Be Changed?” *Fire Engineering* 169, no. 8 (August 1, 2016), <https://www.fireengineering.com/2016/08/01/320173/the-fire-and-emergency-services-culture-can-it-be-changed/>.

¹⁴⁶ Brauer.

¹⁴⁷ Anthony Rowett Jr., “The Senior Man,” *Fire Engineering*, February 16, 2017, <https://www.fireengineering.com/articles/2017/02/senior-firefighter.html>.

watch. This situation creates a culture identifying the senior firefighters as exempt from training, which can be detrimental to a fire department. Furthermore, when operating at a dynamic scene, it will take every person at that location to help produce a positive outcome; fire does not respect seniority. When senior firefighters jump in and participate in training, others in the group notice, and it encourages them to do the same also; more importantly, it helps all firefighters maintain a level of preparedness, which increases safety.

C. ENVIRONMENT

Changes in the environment firefighters operate in offers another challenge that demonstrates the need to remain up to date and diligent with training. Firefighters are facing constantly changing conditions at fire incidents related to materials found inside today's structure and differences in the way these structures are constructed. While firefighters can gain general knowledge of the construction and contents found in today's fires through the broader-based training models like lectures or online, they will be at a great disadvantage if they do not experience kinetic training in these areas. The content and construction of structures are different than they were 20 years ago; these factors need to be considered when trying to understand why training is even more important despite fewer fires. Carla Williams declares, "Modern materials and construction trends make smoke and fire more difficult to contain...more recent changes include flammable textiles, plastics with high burn rates and less practical building layouts."¹⁴⁸ Faster burn rates increase the chances of a flashover; the temperature in a room where all contents ignite simultaneously. Furthermore, because a fire burns hotter and faster, survival time inside has decreased substantially. Underwriters Laboratories (UL) estimates occupants had up to 17 minutes to exit a house fire 30 years ago; today that number is three minutes.¹⁴⁹ Without allowing

¹⁴⁸ Carla Williams, "Smoked Out: Are Firefighters in More Danger than Ever Before?" EHS Today, September 7, 2016, <https://www.ehstoday.com/emergency-management/smoked-out-are-firefighters-more-danger-ever>.

¹⁴⁹ Elisabeth Leamy, "House Fires Burn Much Faster Than They Used to. Here's How to Survive," *Washington Post*, November 21, 2017, https://www.washingtonpost.com/lifestyle/home/house-fires-burn-much-faster-than-they-used-to-heres-how-to-survive/2017/11/20/1c1eb7f8-c890-11e7-aa96-54417592cf72_story.html.

firefighters to train in these environments and gain valuable first-hand knowledge, fire service personnel are being put at risk.

Firefighters must have aptitude for the profession, and more importantly, they must be continuously challenged. Michael Morse insists, “There is a word for what needs to be done to ensure competence: training...training never ends...when a skill is learned, it needs to be re-learned at every available moment.”¹⁵⁰ Firefighters unwilling to make this commitment are doing a disservice to the organizations they represent and the citizens they are sworn to protect. Lieutenant/Paramedic Chris Battlo contends, “next to safety, there is nothing more important a firefighter can do than take responsibility for their training.”¹⁵¹

As Kahneman and Klein, stated, “talent surely matters,” which supports the proposition that as a profession that handles life and death situations, fire departments should hire the best candidates, but for various reasons are unable to do so.¹⁵² Some individuals lack cognitive capacity or the ability to learn; therefore, regardless of the type or extent of training provided, it is unlikely they will develop into skilled firefighters. Leadership and fire department culture also factor into the challenges fire departments face. Without the support and enforcement of fire departments’ formal and informal leaders, many training mandates are ineffective. Finally, due to the variable and unpredictable nature of fire, response situations exist where no amount of training will suffice.

A variety of factors have a direct impact on cognitive processes of firefighter decision making, including theories of developing expertise, RPD, working memory model, the effects of panic and stress, an inverted U-shaped relationship, flow states, and cue utilization. While these theories vary to different degrees, an argument can be made that when each is applied to firefighter training, preparedness to achieving positive outcomes exponentially increases.

¹⁵⁰ Michael Morse, “5 Stresses Firefighters Deal with That Others Don’t Know About,” FireRescue1, July 15, 2019, <https://www.firerescue1.com/fire-careers/articles/134791018-5-stresses-firefighters-deal-with-that-others-dont-know-about/>.

¹⁵¹ Chris Battlo, “Don’t Just Be a Firefighter: Take Responsibility for Your Training,” Firehouse, March 8, 2013, <https://www.firehouse.com/careers-education/blog/10891027/dont-just-be-a-firefighter-take-responsibility-for-your-training>.

¹⁵² Kahneman and Klein, “Conditions for Intuitive Expertise,” 515.

V. IMPLEMENTING BEST PRACTICES

Practice does not make perfect. Practice makes permanent

~ Sarah Kay

At the heart of almost every NIOSH report is a recommendation for improvements in training. However, these recommendations offer no suggestions on the training model or method of delivery. To identify best practices, this chapter explores training in similarly situated occupations, those that typically rely on an immediate, physical response, including the U.S. military, professional sports, and the fire training organization GSD.

A. MILITARY

In an article in the November–December 2016 edition of the *Military Review*, Capt. Andrew P. Jenkins discusses a new initiative combining the science of learning with unit training. The Army realized that to provide training that gave soldiers the skill set to win confrontation in today’s world, applying the science of learning and instructional design would create realistic, motivational training.¹⁵³ Like firefighting, the Army’s training goal is to improve the skills of the trainees so they will be able to respond appropriately and effectively when needed. Furthermore, the Army wants to deliver training that will have long-lasting effects and will allow officers to rely on their own recall regardless of the conditions.¹⁵⁴ Jenkins believes the best way to accomplish this training is by developing a doctrine centered on cognitive learning theories to give Army commanders the ability to design specific trainings that can be delivered to personnel as deliberate learning experiences.¹⁵⁵ By combining instructional design with the science of learning, commanders will have the ability to conduct effective and realistic training.

¹⁵³ Andrew P. Jenkins, “Transforming Unit Training with the Science of Learning,” *Military Review* 96, no. 6 (December 2016): 100.

¹⁵⁴ Jenkins, 102.

¹⁵⁵ Jenkins, 100.

Another approach by the Army is how it defines the difference between training and education, as a focus on the known versus the unknown.¹⁵⁶ The Army definition of training is “a structured process designed to increase the capability of individuals or units to perform specified tasks or skills in known situations.”¹⁵⁷ The definition of education according to Army Regulation 350–1 is “an individual’s ability to perform in unknown situations.”¹⁵⁸ As this definition applies to the fire service, hands-on training is needed to enhance and ingrain newly acquired skills learned in the classroom. Army Regulation 350–1 supports this standard, which goes on to state that education contrasts with training, “where a task or performance basis is used, and standards are used to assess individual and unit proficiency.”¹⁵⁹

The Army also published a white paper titled *The Enhancing Realistic Training White Paper: Delivering Training Capabilities for Operations Training in a Complex World*. The paper identifies the hurdles the Army must clear in today’s world when faced with an ever-changing landscape. The Army realized the need to enhance training and make it more realistic to win in a complex world.¹⁶⁰ Lieutenant General Robert B. Brown stated, “current training is not realistic, demanding, nor challenging enough to properly prepare our forces to improve and thrive in ambiguity and chaos.”¹⁶¹ This conundrum is faced by today’s fire service, which either by failing to train, or not training at all, delivers a chaotic and unsafe response, especially when faced with dynamic events.

The problems faced by the Army are not unlike those faced by fire departments nationwide in that the current training models are not meeting the needs of their personnel.

¹⁵⁶ Jenkins, 102.

¹⁵⁷ Department of the Army, *Army Training and Leader Development*, Army Regulations 350-1 (Washington, DC: Department of the Army, 2017), 253.

¹⁵⁸ Department of the Army, 16.

¹⁵⁹ Department of the Army, 2.

¹⁶⁰ United States Army Combined Arms Center, *The Enhancing Realistic Training White Paper: Delivering Training Capabilities for Operations in a Complex World* (Fort Leavenworth, KS: United States Army Combined Arms Center, 2016), 3, [https://usacac.army.mil/sites/default/files/documents/cact/ERT%20White%20Paper%20-%20Signed%20\(26%20JAN%202016\).pdf](https://usacac.army.mil/sites/default/files/documents/cact/ERT%20White%20Paper%20-%20Signed%20(26%20JAN%202016).pdf).

¹⁶¹ United States Army Combined Arms Center, 2.

Veteran soldiers returning from Iraq and Afghanistan brought back the understanding that legacy training conducted by the army did not duplicate the conditions and challenges they faced while deployed. The result was an overhaul of Army training to include what Lieutenant General Robert Brown called:

an operational design for how the Army will evolve and adapt current training capabilities to enhance realism in training. It provides the conceptual foundation for a capabilities-based assessment that will identify key required capabilities, assess critical capability gaps, and propose potential solutions needed to support physically and intellectually challenging training.¹⁶²

Having the ability to advance and evolve training is mission critical to the success of both the U.S. Army and fire departments nationwide.

Members of the United States Air Force, like firefighters, must perform in stressful and life-threatening environments. The Air Force strives to guarantee all members receive training designed to help fulfill mission requirements.¹⁶³ Part of the Air Force model is to include stress inoculation training (SIT) as a tactic for alleviating the adverse effects of stress on decision making and other performance areas are attributed to a change in cognitive processes.¹⁶⁴ The goal of SIT is to make individuals aware of stressors, the human body's physical and psychological responses to stress, and how stress affects performance. SIT is broken down into three phases that gradually build upon each other:

- Phase 1 is an awareness phase designed to inform individuals of likely stressors and the probable effect on performance.
- Phase 2 is designed to develop cognitive skills to facilitate the enhancement of performance under stress.

¹⁶² Unites States Army Combined Arms Center, ii.

¹⁶³ Sean Robson and Thomas Manacapilli, *Enhancing Performance under Stress: Stress Inoculation Training in Battlefield Airmen* (Santa Monica, CA: RAND, 2014), 16.

¹⁶⁴ Robson and Manacapilli, 16.

- Phase 3 involves the implementation of training under the conditions that simulate an operational environment to learn how to perform effectively under stress.¹⁶⁵

During training, increasing the level and intensity of stressors is recommended only after a successful demonstration of proficiency is obtained at the current training level.¹⁶⁶

Researchers confirm it has been difficult to quantify the success of SIT training. A study by RAND suggests proof exists that SIT works. The report stated that SIT had a moderate impact on improving performance, but a strong effect on decreasing performance anxiety. SIT also had a significant impact on individuals who came from an already high-anxiety population.¹⁶⁷ This research however did have limitations; most notably was the fact SIT training effectiveness is limited because the training only incorporates known stressors. However, even in these novel stress situations, the individual was still shown to have a more effective response.¹⁶⁸

B. PRIVATE SECTOR/SPORTS

A recent trend in sports, more specifically football, has been to eliminate full-contact drills in practice, which include hitting and tackling for two reasons, to prevent injuries and reduce the number of concussions that plague the sport of football. Some college and Canadian Professional teams have already eliminated full-contact from their practices. The National Football League (NFL), however, believes this removal has serious implications in preparing a team to play games on the weekend. The NFL players are considered the best football players in the world, yet they believe in the need for full-contact practice to perform at peak levels. Numerous similarities appear between the NFL's decision to continue its full-contact practice and the fire service's approach to hands-on

¹⁶⁵ Robson and Manacapilli, 7–10.

¹⁶⁶ Giora Keinan and Nehemia Friedland, "Training Effective Performance under Stress: Queries, Dilemmas, and Possible Solutions," in *Stress and Human Performance*, ed. James E. Driskell and Eduardo Salas (Hillsdale, NJ: Lawrence Erlbaum Associates, Inc., 1996), 257–77.

¹⁶⁷ Robson and Manacapilli, *Enhancing Performance under Stress*, 11.

¹⁶⁸ Robson and Manacapilli, 12.

training. New Orleans Saints Head Coach Sean Payton summed it up this way, “I think you are more at risk if you don’t practice some of the things you need to.”¹⁶⁹ Jacksonville Jaguar Linebacker Paul Posluszny added, “I know the health issues involved...but if you want to play this game and play it physical, you have to practice that.”¹⁷⁰

Additionally, full-contact drills provide players with the mental preparation for the full-contact sport they will experience on game day. By exposing players to contact in practice, teams are able to build experience of game-like conditions, which helps to control anxiety during a live game that can lead to improved performance. Firefighters are also confronted with anxiety during a crisis. However, that anxiety can be reduced for those who have faced same or similar conditions through participating in live, hands-on training.

The question of whether to use full-contact in practice can also be applied to how fire departments conduct training. The best football players and coaches in the world rely on game preparation using real conditions and hands-on drills in practice. Teams do this preparation despite the immediate risk for injury. Although athletes do not die in the line of duty, the parallel for live training conditions can still be made with firefighters, as both professions require preparation to respond properly to achieve a successful outcome. For firefighters, this preparation includes being able to manage situations to avoid injury and death.

C. OTHER FIRE SERVICE ORGANIZATIONS

The GSD is one group focused on conducting extreme experience-based training. Founded in 1978, the GSD course is designed to be an experiential training program that focuses on structural firefighting with the goal of enhancing the skills of firefighters during critical incidents.¹⁷¹ The GSD trainers stress the importance of mental and physical preparedness for firefighters, while also stressing the need for candidates to share the

¹⁶⁹ “What NFL Coaches and Players Are Saying about CFL Eliminating Padded Practices,” ESPN, September 14, 2017, https://www.espn.com/nflnation/post/_id/248397.

¹⁷⁰ ESPN.

¹⁷¹ Judith L. Glick-Smith, “Leading Georgia Smoke Divers,” *Fire Rescue*, 2, October 1, 2015, <https://www.firerescuemagazine.com/articles/print/volume-10/issue-10/special-operations/leading-georgia-smoke-divers.html>.

knowledge and skills gained during the course with their home agencies. Current program leader David Rhodes emphasized the need to make sure all are proficiently trained in his statement, “our customers don’t have a choice when they call 911. They get whoever is on call. How dare you be anything but the best we can be.”¹⁷²

The GSD course is designed to improve firefighter decision making in high stress environments. The course is taught in smaller increments that build upon each other, with the intention of building muscle memory along the way.¹⁷³ It also emphasizes the physical conditioning of a firefighter. While it is not intended to be a physical fitness course, gains in fitness are a byproduct of the GSD course.¹⁷⁴ Every morning during the six-day course, firefighters are reminded of the mission and objectives of the GSD training, “to prevent death and injury by training firefighters to be adaptable and to develop critical decision-making skills in high stress environments.”¹⁷⁵ The GCD course tries to promote stress inoculation by using physical training to wear individuals down and create an impact on the psychological state of participants. Once students reach a state of physical and mental exhaustion, they are put through a 45-minute long obstacle course of firefighting related functions. This process is repeated daily for six days with the belief that repetition is the mother of skill.¹⁷⁶

The GSD course was initially intended for firefighters in the state of Georgia. Eventually, the course allowed firefighters from other states to attend. As a result, other smoke diver programs have emerged. Operating under the identical mission as the GSD, the Indiana Smoke Divers were started in 2013.¹⁷⁷ Additionally, the program will add

¹⁷² Glick-Smith, 2.

¹⁷³ Glick-Smith, 3.

¹⁷⁴ “Georgia Smoke Diver Training,” Georgia Smoke Diver, accessed August 30, 2019, http://georgiasmokediver.com/gsd_training.html.

¹⁷⁵ Glick-Smith, “Leading Georgia Smoke Divers,” 5.

¹⁷⁶ David Rhodes, “Fitness and Skills,” FireRescue, accessed November 26, 2019, <https://www.firerescuemagazinedigital.com/firerescue/201806/MobilePagedArticle.action?articleId=1403520#articleId1403520>.

¹⁷⁷ “History of the Georgia Smoke Diver and Indiana Smoke Diver Programs,” Indiana Smoke Diver, accessed August 30, 2019, http://www.indianasmokediver.com/about_history.html.

another decedent in March 2020 when the Oklahoma Smoke Divers will hold their first class.¹⁷⁸ Like the other Smoke Diver programs, the Oklahoma version will have a mission of preventing death and injury by training firefighters. All three chapters of Smoke Divers recognize the importance of performing under stress by training the same way. To help maintain the skills learned during the six-day course, graduates have an open invitation to come back and help instruct future classes.

This chapter identified organizations that have placed a priority on training to be prepared for challenges they may face in situations in which an immediate physical response may be required to achieve a successful outcome. One example is the U.S. military, which recognized the need for and implemented realistic training environments to prepare soldiers to respond under the stress of combat. Additionally, the NFL is an organization willing to risk individual health by conducting live, full-contact practices to prepare teams. Finally, the GSD conduct high impact fire training designed to improve decision making in high stress environments. Each organization's model has components that can be adapted to develop relevant and impactful firefighter training.

¹⁷⁸ "Home," Oklahoma Smoke Diver, accessed August 30, 2019, <http://www.oklahomasmokediver.com/index.html>.

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VI. DISCUSSION AND CONCLUSION

Each year in the United States, fire departments nationwide are impacted LODDs. The effects reach far beyond the department suffering the loss, as the nation's firefighting family mourns as well. One constant finding in LODD investigations conducted by NIOSH is a deficiency in training. Firefighters need to be capable of making rapid decisions and performing habit-based tasks on a fireground in response to a crisis. However, the fire service does not have an established set of requirements; therefore, training can vary significantly from department to department. In addition, several factors influence the effectiveness of the training available, including the model of delivery and the individual's cognitive processes. External influences also impact training, such as leadership, culture, and environment. Due to the significant impact of training on keeping firefighters safe, it is important to explore these issues through the research question of this thesis. How could a better understanding of how people learn and retain information lead to improvements in training in the U.S. fire service?

In the United States, no national standards currently exist for fire department training. Each individual state can establish the amount of training hours required; however, the content and delivery of the training is determined at a local level by each fire department. In other words, a fire department may be conducting hands-on drills on forcible entry, while a neighboring department is watching a video on the same subject. Both of these trainings hold the same value when calculating completed fire-training hours. The NFPA does have written standards on what is acceptable fire training, but since it is a civilian operated organization, the NFPA standards are merely recommendations and not enforceable.

It is well documented that fire departments have undergone a transformation in the last 30 years in business processes, particularly with the addition of EMS and other all-hazards responsibilities. These new job-related functions call for even more firefighter training, while simultaneously decreasing the opportunities for job-related experience. In addition, changes in building construction and items found inside a structure present another set of problems. Survival time has seen an enormous decrease, as today's fire burn

faster and hotter, while the structures themselves are less tolerant to fire conditions. These elements have added additional considerations to firefighting that requires training and preparation.

The current training practices used by fire departments are designed to be as efficient as possible. The use of a LMS and lecture style instruction can be delivered to large groups, which makes the most of available training time. These types of training models are inexpensive, and in the case of LMSs, can be delivered when it is convenient for the student. It is debatable, however, whether these passive training practices are appropriately preparing firefighters to respond actively. In an attempt to make classroom trainings more realistic, fire departments also conduct TT-scenario training and full-scale exercises. These trainings are considered dress rehearsals for an actual emergency, but lack the stress and anxiety of an actual crisis.

This research also considered the cognitive processes and the psychology of training that factor into how individuals learn and retain information. Firefighting is a unique occupation that requires firefighters to make split second decisions directly impacting the outcome. It is imperative for firefighters to react appropriately for their safety and the citizens they serve. This thesis explored RPD and the importance of expertise and how it affects the development of foundational knowledge through realistic training and job-related experience. Another concept, WM, explains how information needed in the moment is held and manipulated in memory, and in particular, how memory and recall are significantly impacted by stress and anxiety. Finally, the inverted U-relationship and cue utilization theory were examined to offer answers on how stress and anxiety affect overall human performance.

CD also influences training. Introduced by American social psychologist Leon Festinger, CD is the uncomfortable feelings that arise when someone's behavior conflicts with someone's beliefs. These feelings cause individuals to have strong motivations to eliminate the inconsistency.¹⁷⁹ Festinger states, "when dissonance is present, in addition

¹⁷⁹ Leon Festinger, *A Theory of Cognitive Dissonance* (Stanford, CA: Stanford University Press, 1962), 3.

to trying to reduce it, the person will actively avoid situations and information which would likely increase the dissonance.”¹⁸⁰ Andrew Beck, a subject matter expert for the International Association of Fire Chiefs National Near Miss Program, notes that firefighters are quick to point out the frequently described factors in NIOSH LODD reports, such as a lack of training, poor communications, and a loss of situational awareness. Ironically, the same group of people would describe events leading up to a firefighter’s death as unpredictable.¹⁸¹ Firefighters know what problems arise but rationalize conflicting thoughts to justify firefighters’ actions during a crisis, instead of taking a critical look at their institutional shortfalls.

Throughout the cognitive research, a common theme was that through repetitious kinetic training, firefighters could build muscle memory and frames of reference, which allowed them to make better decisions during a crisis. As firefighters develop expertise through training, their ability to respond develops, which creates a better overall response. So how much training does it take to perfect a skill? Malcolm Gladwell argues it takes 10,000 hours of deliberate practice to master a particular skill.¹⁸² Using this number, it would take firefighters almost five years, training eight hours a day, seven days a week, to reach mastery. A distinct need exists for training to occur in the fire service so firefighters can operate safely and effectively when thrust into dangerous situations. While it is impossible to dedicate the 10,000 hours Gladwell believes is needed to master skills, time is certainly available for effective training. Fire departments must evaluate how they are training and make certain they are using the available time to conduct training that impacts firefighters the most.

As the author considers the impacts of training on his own organization, he realized that the training practices used were likely falling short. Throughout his career, he has seen the evolution of training to more internet-based platforms and away from kinetic training. For example, the AFD responds to 89% EMS-related incidents and only 11% fire related

¹⁸⁰ Festinger, 3.

¹⁸¹ Beck, “Analyze and Share Underlying Factors to Prevent Firefighter LODDs.”

¹⁸² Malcom Gladwell, *Outliers: The Story of Success* (New York: Back Bay Books, 2011), 35–68.

incidents. The decrease in live fire experience has made the need for hands-on training more important than ever. However, time constraints combined with a limited budget have made LMS the training model of choice for the AFD. Furthermore, a false sense of security exists that comes with LMS learning. Firefighters who have completed LMS training may develop a false belief that they are ready to face challenges presented at a fire scene, which puts them in danger of being overwhelmed when responding to a real-world incident.

It is up to the leadership of each fire department to oversee training and make certain it is being done. Fire departments are historically reactive rather than proactive, oftentimes needing a tragedy to motivate change. This part of the firefighter culture needs to change. As fire departments often operate within the confines of tight budgets, the primary driver is the availability of funds. But how much is a firefighter's life worth? Perhaps the answer is to change the way fire departments operate, which may be to move away from aggressive interior operations unless a victim is inside. Phoenix Fire Chief Alan Brunacini once said firefighters should, "risk a lot to save a lot, risk a little to save a little, and risk nothing for what was already lost."¹⁸³ The risk Chief Brunacini mentions is magnified if firefighters are not properly trained.

Despite the level of training a firefighter receives, during dynamic events, the unpredictable can happen. On a larger scale, the towers of the World Trade Center collapsing were certainly a novel and random event at the time. It was not at all possible to train and prepare for an event of that magnitude. The impact Hurricane Katrina had on New Orleans and the entire Gulf Coast was unanticipated, which resulted in an extremely unorganized and ineffective response. On a smaller scale, events at fires are also unpredictable, be it accelerants feeding a fire, or the number of occupants trapped in a structure during a fire. Irregularities of events make them nearly impossible to be 100 percent prepared. While it can be argued the response will be more impactful, it does not guarantee a positive outcome at these types of events.

¹⁸³ Timothy E. Sendelbach, "Honoring 'America's Fire Chief,'" Firehouse, December 1, 2017, <https://www.firehouse.com/leadership/article/12379908/tribute-to-chief-alan-v-brunacini-firehouse-magazine-tim-sendelbach>.

Investigating how other organizations use realistic training to prepare for events they may encounter can influence fire departments to reevaluate training practices. The best example comes from the U.S. military, which realized through actual engagement that their training methods were not adequately preparing them for combat. The Army concept of combining instructional design with the science of learning is something fire departments can mimic. Using the LMS and lecture platforms, and reinforcing them with kinetic learning, would be a valuable training model.

All the other organizations had facets of training fire departments could consider when developing and conducting their own training. The overarching theme in all was the need for realism, combined with a physical element to make individuals work under stress and anxiety. Each organization believed that by incorporating these ingredients during training, it would prepare their individuals to respond, make better decisions, and perform effectively during the actual events.

This research has demonstrated a need for changes in how the firefighting profession is currently training this nation's firefighters. The author proposes the following recommendations:

- Establish national training standards that create a universal foundational core of knowledge and experience for all firefighters. The current model of allowing states to control training requirements lacks consistency. An enforceable national model would make training more uniform while creating an added urgency for fire departments to actually fulfil the requirements. Individual states can remain in the process by becoming the enforcement branch to confirm departments are meeting these standards.
- Incorporate realistic, kinetic training. The research has shown a definite need for training in real-world scenarios to compensate for the loss of on-the-job experience firefighters are missing because of other responsibilities and a decrease in structure fires. Time and budget friendly training, such as LMS and lecture-style models, are failing to prepare firefighters fully for the dangers they will face. By adding the element of

hands-on training to compliment these platforms, firefighters will develop the confidence, and muscle memory to perform better during dynamic incidents where stress and anxiety levels are high.

- Change current business models due to increasing limitations on resources and access to experience. The growth of EMS and an increase in all-hazards response has completely changed how fire departments operate. This change is demonstrated in the numbers, which show a 50% decrease in structure fires, yet firefighting related deaths are stagnant. With the limit placed on real-world experience, as well as other time and financial constraints, fire department leaders need to develop innovative ways to ensure they are adequately training personnel and factor that in with the amount of risk they should be willing to allow their firefighters to take. Fire department SOPs should reflect these findings.
- Incorporate virtual reality (VR) to enhance training. While VR does not replace kinetic training, it does offer some elements not found in typical lecture, functional, or TT exercises. Programs like the ALIVE model developed by NYU in collaboration with the USFA appear to offer an element of stress through visual enticement. This type of training would meet the needs of fire department administration, which desires safe training, while meeting a portion of firefighting needs by creating scenes that feel partially realistic.

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