

DOES EXPERIENTIAL LIVE-FIRE TRAINING
EXERCISE IMPROVE FIREFIGHTING READINESS?

By

CHEOLMIN JEONG

Bachelor of Science in Law

Pusan National University

Busan, South Korea

2007

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfilment of
the requirements for
the Degree of
MASTER OF SCIENCE
December, 2018

DOES EXPERIENTIAL LIVE-FIRE TRAINING
EXERCISE IMPROVE FIREFIGHTING READINESS?

Thesis Approved:

Dr. Tristan Wu

Thesis Adviser

Dr. Ray Chang

Dr. Alex Greer

ACKNOWLEDGEMENTS

To my family, I would like to thank my wife and children. Without their love and support, I cannot finish this daunting job.

To my thesis committee, I would like to thank and show my great respect to my advisor and chair Dr. Wu and other committee members Dr. Greer and Dr. Chang. Without their guidance and assistance, I cannot even think about starting this project and cannot complete this cumbersome job.

To Gyeonggi-do Fire Service Academy (GFSA), I would like to appreciate the support of all the staffs and firefighters in GFSA. Without their dedication, this thesis must have not been made. Especially, to the training instructors, Mr. Yonghui Lee, and Mr. Junhee Lee, I would like to express my greatest gratitude for their hard works.

To the Korn Ferry Hay Group, Incorporation (KFHG), I would like to thank the incorporation for allowing me to utilize the Kolb Learning Style Inventory. With the help of KFHG, this study can deliver fruitful outcome.

Name: CHEOLMIN JEONG

Date of Degree: DECEMBER, 2018

Title of Study: DOES EXPERIENTIAL LIVE-FIRE TRAINING EXERCISE IMPROVE
FIREFIGHTING READINESS?

Major Field: FIRE ADMINISTRATION AND EMERGENCY MANAGEMENT

Abstract: Firefighting is a demanding profession in South Korea requiring physiological strength, psychological soundness, skill, knowledge, and teamwork from firefighters. To raise and keep the qualified firefighter, fire service academies in the country have been providing them with from traditional skill mastering classes to recently introduced live-fire training (LFT), which simulates real fires. Since a couple of fire training institutes have installed the LFT facilities and been holding a few LFT classes, the in-depth effect of the training is still unknown. In order to better understand the effect of LFT and suggest effective training scenarios, this study implemented a quasi-experimental LFT with the help of 518 study participants from two recruit firefighter classes of a fire academy in South Korea. The academy utilized four LFT facilities: the Residential, the Industrial, the Special Phenomena, and the Self-Confined Breathing Apparatus (SCBA), which imitate specific fire types in each field. The participants answered to the training effect questionnaire before and after their LFT. With their answers, this study tested the significance of the participants' improvement and measured the effect size of the LFT based on Cohen's index (d) and Omega Squared (ω^2). The result shows that study participants' perception of their readiness of firefighting has improved after the LFT. In addition, the effects sizes of the training for the job requirements were mostly consistent across the LFT facilities. Specifically, their perception of knowledge acquirement about firefighting techniques has the biggest improvement whereas their perception of teamwork for safety has the smallest improvement. In addition, they have improved higher in psychology dimension than in physiology. The data shows inconsistent improvement in skill across the LFT facilities. Furthermore, some demographic factors such as sex, job position, and education level made difference in the perceptive readiness of firefighting between participant's categories. These findings will assist the Korean fire authorities to develop customized LFT sessions for trainees and to design effective training at each LFT facility.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
II. REVIEW OF LITERATURE.....	4
Theoretical Framework.....	4
The Variable.....	5
III. METHODOLOGY	13
Research Design.....	13
Sample.....	13
Measure.....	15
Descriptive Statistics.....	17
Indexes	18
Data Analysis	18
IV. FINDINGS.....	20
Results.....	20
Discussion.....	27
V. CONCLUSION.....	33
Conclusion	33

Chapter	Page
REFERENCES	36
APPENDICES	42

LIST OF TABLES

Table	Page
1. Skill Categories on the NFPA 1403 (2002)	10
2. Modes, Standard Deviations, and Sample Sizes LFT	18
3. The mean values of the participants' perception of readiness for firefighting before and after the Residential LFT	21
4. The effect of Sex on the participants' improvement at the Residential LFT	21
5 The effect of Job Position on the participants' improvement at the Residential LFT	22
6. The mean values of the participants' perception of readiness for firefighting before and after the Industrial LFT	23
7. The effect of Sex on the participants' improvement at the Industrial LFT	23
8. The effect of Job Position on the participants' improvement at the Industrial LFT	24
9. The effect of Education Level on the participants' improvement at the Industrial LFT	24
10. The mean values of the participants' perception of readiness for firefighting before and after the Special Phenomena LFT	25
11. The effect of Job Position on the participants' improvement at the Special Phenomena LFT	26
12. The mean values of the participants' perception of readiness for firefighting before and after the SCBA training	26
13. The effect of Job Position on the participants' improvement at the SCBA training	27

LIST OF FIGURES

Figure	Page
1. The Experiential Learning Theory and Learning Style Inventory (Kolb, 1984) ...	5

CHAPTER I

INTRODUCTION

The deaths of Firefighters on duty have been occurring not only in the U.S. but also in South Korea (Center for Disease Control and Prevention, 2006; Korea National Fire Agency, 2015). Firefighting is a highly demanding job requiring physical and psychological fitness, various techniques, and teamwork to save lives and protect properties. South Korean firefighters are also needed to meet these job requirements and they have been suffering from harsher working conditions. Lee, Bakri, Kim, Son, and Tochiara (2013) explain the high rate of firefighter fatality, which is noticeably higher in South Korea than in Japan and the U.S., due to the physical burden of hefty apparatuses that need to be worn. From their interviews with South Korean firefighters, Jeong et al. (2015) point out the significant correlation between the job environment of firefighting and psychological issues such as anxiety and obsession with their duty. Another study (Lee, Cha, Choi, & Kim, 2011) describes the new challenges in urban cities with high-rise buildings and recommends that the firefighters equip themselves with advanced teamwork and skills. To address these challenges, Korean fire academies constantly provide the Korean firefighters with various types of training (Kang, 2009).

South Korea Fire service provides not only fire suppression but also rescue to public and animals at risk, and emergency medical services (EMS) (Jeong, 2006). Regardless of their incumbent job position, all firefighters carry out fire suppression tasks from time to time because of the lack of workforce and a lot of fire incidents. That is why newly recruited Firefighters are sent

to a fire academy to train for all kinds of fire service activities before their deployment. Although the new-comers are recruited for a specific job position of fire suppression, rescue, or EMS; they receive the mandatory training of fire suppression irrespective of their job profile. In addition, after graduating from the mandatory class, they should receive periodical training, at various fire training centres, for maintaining and updating their fire suppression skills.

Firefighting training in South Korea has been changing from skill mastering at equipment-training yards to strategy acknowledgement of fire suppression, rescue, and EMS at live-fire training (LFT) facilities. LFT facilities simulate actual fire situations for training. Traditionally, Korean firefighters predominantly took skill lessons at their jurisdictional fire academy before being deployed to their station. However, the effectiveness of this training style has been doubted by the Korea Fire Service due to the change of social environment (KNFSA, 2006, p.2). To catch up with the changing environments like various hazardous materials and high-rise buildings, the KNFSA (Korea National Fire Service Academy) and local fire academies have been installing LFT facilities. Even though the academies follow the trend of LFT, they do not know the in-depth effects of the training.

As Rae (1997, p.15) mentions, the judge who decides the effectiveness of a training is not the trainer but the trainee, which means the improvement of the trainee after a training is the core of the effects. He also points out that the effect reflects on the need for the training and the need for training comes from the prerequisites for a profession (pp.13-14). To become a firefighter, a candidate needs to meet the criteria of five dimensions for fire suppression: physiological fitness, psychological soundness, skill mastery, knowledge acquisition, and teamwork. Firefighting is not only a physically demanding profession (Smith et al., 1997; Rossi, 2003; Elsner & Kolkhorst, 2008; & Soteriades et al., 2011), but is also psychologically stressful work (Bryant & Harvey, 1996; Smith & Petruzzello, 1998; & Smith et al., 2005). The vocation also requires a variety of skills, knowledge (Champagne, 2012; & Dunne, 2012) and teamwork (Douvillier, 2011).

Many scholars have examined the effects of training in two ways and sometimes combine the two to draw a holistic outcome. One is to examine by using measuring devices with an objective scale before and after training (Eglin, Coles, & Tipton, 2005; Smith et al., 1997; & Willi, Horn, & Madrzykowski, 2016), the other is to check by asking the perceptive status of their study participants (Baumann, Gohm, & Bonner, 2011; Peterson & Perry, 1999; & Perry, 2004). Whilst the former observes the physiological changes of the participants such as body temperature (D. L. Smith et al., 1997) and heart rate (Willi et al., 2016), the latter focuses on psychological change like anxiety (Baumann et al., 2011), the confidence in skills and knowledge (Peterson & Perry, 1999), and teamwork (Perry, 2004). In the meantime, other scholars (Smith & Petruzzello, 1998; & Petruzzello et al., 2016) examine the physical and the psychological effects at the same time. However, because the effect of a training depends on individual participants, the measurement should concentrate on the improvement of study participants in regards to the five dimensions (Rae, 1997, p.160).

The followings are the four main sections of this study. In the literature review section, a learning theory (Kolb, 1984) provides the fundamental base for this study. In addition, previous researchers address the propriety of personal backgrounds and present adequate variables for job dimensions. In the methodology section, this paper implemented a quasi-experiment with the help of the participation of firefighter trainees in The South Korea Fire Academy. They took a series of LFTs in several LFT facilities and responded to the same questionnaires before and after their training. In the following result section, the statistical analyses show the improvements of the participants numerically. In addition, this research also describes the findings from each research question and discusses the effects of each variable in the same section. In the conclusion section, this paper provides suggestions and an improvement proposal for the next LFT in South Korea.

CHAPTER II

LITERATURE REVIEW

Theoretical Framework

The Experiential Learning Theory: This study uses the Kolb's (1984) Experiential Learning Theory (ELT) to explicate the learning process of LFT because the hands-on based fire training mainly capitalizes on the experience of trainees. Although a myriad of studies has developed other static learning approaches like social interaction and instructional preference, learning is a changeable information processing through experience (McCarthy, 2010). Kolb (1984, p. 41) defines Experiential Learning as “The process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience.” In addition, Kolb (1984) explains the relationship between experience and the learning process by using a circular model by crossing the two axes of grasping and transforming experience (Figure 1). Whilst Concrete Experience (CE) and Abstract Conceptualization (AC) are relating to the grasping, Reflective Observation (RO) and Active Experimentation (AE) are relating to the transforming.

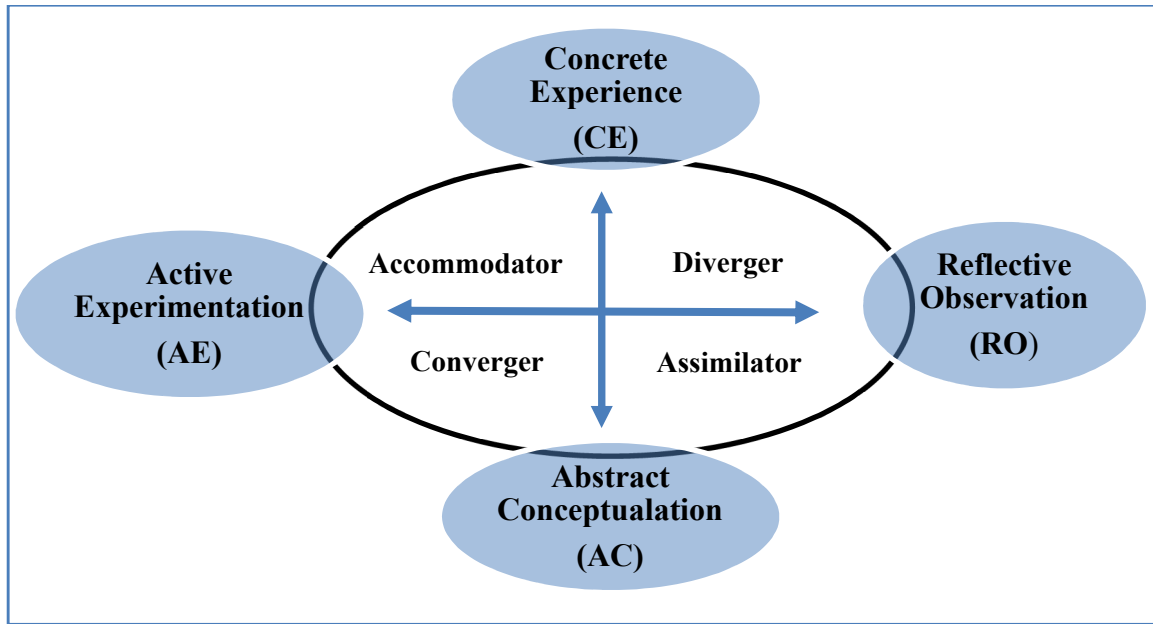


Figure 1. The Experiential Learning Theory and Learning Style Inventory (Kolb, 1984)

Kolb Learning Style Inventory: As seen in Figure 1, Kolb (1984) categorizes learning styles into four categories: Diverger, Assimilator, Converger, and Accommodator based on a personal approach to experience and the process of acknowledging it. He named it as the Kolb Learning Style Inventory (LSI). Kolb, Boyatzis, and Mainemelis (2001) explain the four types explicitly. According to them, the Diverger prefers to work in a group, listen to other opinions, and receive feedback from others. The Assimilator is likely to take a wide range of data and put it into an analytical form; the learner loves reading, lectures, and having time to contemplate on what the person learned. The Converger has strength in implementing theories and ideas to solve practical issues; this person shows an interest in obtaining technical skills for a special profession. The Accommodator prefers to act based on hands-on experience rather than logical analysis; the person puts more weight on duty fulfilment and completion than planning and meditating.

The Variables

Independent Variables: This study adopts three independent variables: demographics, the Kolb LSI, and training facilities.

Demographics: Demographic factors significantly affect the results of the exercise and training. The basic demographics like sex, age, marital status, education level, and income, and job-related factors such as working position and associated experience can have an impact on the learning outcomes. With respect to the basic demographics, sex is a typical factor that researchers include in their investigation. For instance, Khan, Davis, and Taylor (2017) found female firefighters learned more effectively than male firefighters in a risk identifying training. On the other hand, Punakallio, Lusa, and Luukkonen (2003) observed no difference between young males and females in fire training. Age is another classic factor of training studies but its impacts are not consistent (Bennett, Hanley, Buckle, & Bridger, 2011; & Punakallio et al., 2003). While one study (Punakallio et al., 2003) revealed the young participants surpass their old counterparts in physical strength, the other (Bennett et al., 2011) depicted no significant difference in heart rates among the differently aged participants after a bout of LFT. In regards to marital status and education level, Hayes and Allinson (1997) argue the two factors can influence personal learning style, which affects the outcome of learning. When it comes to income level, Eriksen and Prior (2011) observed that their study subjects learned environmental knowledge differently as per income, which implies the possible impact of income level on training.

In terms of job-related demographics, job position and antecedent job-related experience are key factors for composing personal learning style (Hayes & Allinson, 1997). With respect to job position, when participants come from different job positions what they learn from the training may differ. For instance, in Wynn & Hawdon's (2012) training experiment, the participants that are part-time firefighters denoted lower cardiorespiratory fitness than those of full-time firefighters. Furthermore, even though dissimilar organizations provide similar services, when they participate in the same training, the participants indicate unequal outcomes. For example, Prieto, González,

Del Valle, and Nistal (2013) witnessed that the three participating groups firefighters, lifeguards, and mine rescuers consumed oxygen unequally in the same training scenario. In other disaster exercise (Perry, 2004), the three groups of firefighters, police officers, and citizens delivered different tasks during the exercise according to a disaster plan. The participant groups showed different improvements in teamwork perception after their exercise.

With regard to previous job-related experience, the participants who had job-related experience showed less improvement of perceptive status compared to other inexperienced participants. Peterson and Perry (1999) implemented two quasi-experiments with the participants of professional fire service personnel who had job-related experience. They revealed their study participants had not improved or negatively improved their perception of teamwork after the exercise experiment. Perry (2004) also observed the higher improvement in knowledge acquirement of the volunteer group than those of the other fire and police personnel who had job experiences. In addition, according to Hayes and Allinson (1997), the more a training resembles the real work environment, the more benefit the participants achieve from the training. In other words, job-related experience influences the effect of the training on its participants.

Kolb LSI: As Hayes and Allinson (1997) insist, learning style is a significant factor for the educational achievement of a learner. In other words, when a training session accommodates trainees who indicate different learning types, the trainees show different outcomes according to their learning style. For instances, Eriksen and Prior (2011) verified that the residents in a wildfire-prone region learned the local environmental information in different levels as per their learning style. McCarthy (2010) describes the adoption of the LSI into the accounting field and mentions the difference in managerial capacity of the study participants according to their learning style. Even though Boyatzis and Kolb (1995) mention the possibility of change in learning style owing to personal background changes, the eventual goal of figuring out learning style is to induce the training participants to a proper style for their work. In this regard, as Kolb and Kolb (2005) depict,

the better balanced a person is between the four learning styles, the more adaptable the person is toward a proper learning style for an assigned task.

Training Facilities: Since the National Fire Protection Association (NFPA) standard 1403 (NFPA, 2002) does not define specific LFT facilities, fire training institutions can install the training facilities as per their objectives. In other words, fire service academy designs specific facilities for its indigenous needs and provides its trainees with specialized LFTs in the facilities. For instance, a fire department in an industrial area may build LFT props imitating a factory and a refinery facility, while another in a residential area will have residential fire LFT mock-ups. In addition, NFPA 1403 (NFPA, 2002) stipulates the importance of breathing gear for trainees which is called self-confined breathing apparatus (SCBA). Thus fire training institutions also install SCBA facilities. The standard also delineates guidelines for special fire phenomena such as flashover, backdraft, and fierce fires in a complex structure. Some institutions, like the academy in our study, have these special LFT facilities. With respect to the effect of each facility, as Willi et al. (2016) examined, a participant demonstrated different levels of outcome from different training facilities. In other words, each LFT can affect the training achievement of individuals differently.

Dependent Variables: This study draws the components of the effect of training from the Kolb LSI and antecedent researches. Firstly, the Kolb LSI does not directly depict the effect of learning but exemplify possible effect dimensions by matching the learning styles and educational specialities (A. Kolb & D. Kolb, 2005). For instance, students in physical science tend to indicate assimilating learning style, while psychology pupils have a tendency in diverging style. In the meantime, each learning style prefers certain learning skills across disciplines (e.g. decision skill for the converging type, and action skills for the accommodating type). In addition, A. Kolb and D. Kolb (2005) recognized the importance of teamwork from several educational specialities and adopted teamwork in the later version of LSI. Secondly, many researchers designed experimental training to measure the improvement of participants' physiological and psychological status. Some

of them showed the improvement in a numeric form for the physiological effect (Petruzzello et al., 2016; Willi et al., 2016; & Smith et al., 2001) while others (Ekkekakis, Hargreaves, & Parfitt, 2013; Peterson & Perry, 1999; & Borodzicz & Van Haperen, 2002) mentioned the participants' improvements psychologically and also in their skill, knowledge, and teamwork after training. To recap, the effects of the training are seen through the improvements in the following dimensions: physiological, psychological, skill, knowledge, and teamwork.

Physiological Effect: The physiological effect of an LFT consists of physical strength, metabolic soundness, and respiratory stability. Firstly with regard to physical strength, Smith et al. (1997) observed a significant increase in the lactate levels of their study participants in a simulated LFT, which contributed to understanding the physical stress of the participants. Eglin et al. (2005) argue that if an LFT has a close resemblance to a real fire scene, the participants calculate their physical preparedness more effectively after the training. Secondly, metabolic issues like heart rate and body temperature are not the target to decrease through LFT; several scholars (Petruzzello et al., 2016; & Horn, Blevins, Fernhall, & Smith, 2013) concentrate on revealing the degree of increase for participants to prepare them for real fire incidents. Finally, concerning respiratory stability, a number of researchers (Smith & Petruzzello, 1998; Smith, Manning, & Petruzzello, 2001; & Willi et al., 2016) revealed the respiratory effect of LFT's. The participants in their experiments experienced severe heat and breathing burden during the experiments and considered the experience as the opportunities to check themselves.

Psychological Effects: Training may address psychological concerns such as the obsession with duty, exertion, and anxiety. Due to the similar design of the real fire suppression incidents, participants in LFTs can experience a similar obsession with the duty to complete their operations. Smith et al. (2001) observed the improved level of obsession with duty after LFT scenarios, but several scholars (Baumann et al., 2011; & Smith et al., 2005) revealed the improvement was not statistically significant. In addition, training can address the anxiety of firefighting. Driskell and

Johnston (1998) witnessed a decrease in the anxiety levels of participants through stress mitigating training. However, when it comes to LFT, the anxiety relief level differs between experimental studies. One study (Baumann et al., 2011) observed the reduced anxiety levels of its participants through two different LFTs, whilst another (Smith et al., 2005) discovered no significant anxiety relief of its participants over the three LFTs.

Skill and Knowledge: LFT would provide firefighters with an opportunity to acquire and maintain necessary skills and knowledge to carry on their duty. The NFPA 1403 (NFPA, 2002) stipulates the 16 skill categories which firefighters can master in LFTs (Table 1). In addition, Willi et al. (2016) depict the possible skills above the 16 categories for trainees to master during the training. The NFPA 1403 (NFPA, 2002) also stipulates the responsibility of the fire authority to provide its firefighters with the chance to experience a realistic training to accrue knowledge. Taking LFT under fierce fire flames is a chance for the participants not only to understand the necessary skills and risks related to fire but also to develop the knowledge to eschew the related risks (Willi et al., 2016). However, all participant taking part in LFT do not achieve equal degrees of skills and knowledge. Burke et al. (2011) contend that highly proactive trainees are more effective in learning operational skills and safety knowledge than passive participants.

Table 1. Skill Categories on the NFPA 1403 (2002).

Mandatory	Recommendation		For Instructor
1. Radio Use	2. SCBA 3. Forcible Entry 4. Safety, Extinguishers Personal Accountability 5. Ground Ladders 6. Fire Extinguishment 7. Search and Rescue	8. Structural Fire Fighting 9. Horizontal Ventilation 10. Vertical Ventilation 11. Overhaul 12. Water Supply 13. Fire Extinguishers 14. Scene Illumination	15. Tool Maintenance 16. Fire hose care and Maintenance

Teamwork: Even though a study (Siassakos et al., 2010) describes that teamwork does not always guarantee better operation than individual team members do, A. Kolb and D. Kolb (2005)

argue that the ELT fits better for team learning regardless of the four learning styles. Furthermore, Borodicz and Van Haperen (2002) discern advanced teams from basic ones by estimating their operation, which comes from training for knowledge and experience acquirement. In addition, Perry (2004) insists that an exercise can improve the teamwork for the operation of participants, regardless of their occupational status: professional or volunteer. Another benefit from experiential learning is developing teamwork for safety, which consequently boosts trust among the team members (Kayes, Kayes, & Kolb, 2005). Douvillier (2011) also draws the importance of training for the safety of volunteers, who play a subsidiary role, incorporated into a team of professionals while responding to catastrophic events. In summary, the teamwork effect comes from the improvement of the attitude of team members after the training for their duty operation and safety.

The focus of this study is to examine the extent to which LFT affects firefighters on their perception of readiness for firefighting across their physiological fitness, psychological soundness, skills and knowledge, and teamwork. The firefighters have different demographic factors, such as age, gender, marital status, education level, job position, previous experience, and learning style. In addition, they have attended LFTs at four different facilities. Therefore, this study will test the following research hypotheses (RHs):

RH1: There are differences in the participants' perception of readiness for firefighting before and after LFTs at the Residential LFT facility.

RH2: There are differences in the participants' perception of readiness for firefighting before and after LFTs at the Industrial LFT facility.

RH3: There are differences in the participants' perception of readiness for firefighting before and after LFTs at the Special Phenomena LFT facility.

RH4: There are differences in the participants' perception of readiness for firefighting before and after training at the SCBA facility.

As Rae (1997, p.15) mentions, the core of training is to improve the training participant's confidence in his or her capacity. In other words, the effectiveness of a training is assessed by the extent to which the participant has improved, and the improvement comes from the participant's perceptive change. This means the positive improvement of the LFT represents the effectiveness of the training. In this regard, the following research questions (RQs) will be used to test the difference in improvements across the varied demographics and learning styles. These RQs will be tested separately for each LFT facility.

RQ1: How much does sex affect the improvement of the participants?

RQ2: How much does age affect the improvement of the participants?

RQ3: How much does marital status affect the improvement of the participants?

RQ4: How much does education level affect the improvement of the participants?

RQ5: How much does household income level affect the improvement of the participants?

RQ6: How much does a job position affect the improvement of the participants?

RQ7: How much does a previous job-related experience affect the improvement of the participants?

RQ8: How much does the Kolb LSI affect the improvement of the participants?

CHAPTER III

METHODOLOGY

Research Design

To examine the improvement of the participants' readiness of firefighting after the LFT in South Korea, this study employs a quasi-experiment. As the Educational Resources Information Centre (ERIC, 1997) describes an experimental design, it is a proper method to address the effectiveness issues in educational programs. Although a true-experiment with randomized groups is better to compare them, owing to the practical reasons such as few training facilities and schedules, this research employs real training classes for recruit firefighters. Furthermore, measuring the effects of an LFT in a realistic setting is more suitable to this study than a research with randomization (ERIC, 1997).

Sample

Participants: We sent our survey questionnaires to 535 subjects in two training classes for newly recruited firefighters at Gyeonggi-do Fire Service Academy (GFSA) in South Korea and retrieved answers from 531 participants. For personal issues, four participants had left the academy during their class. In addition, since several questions have categories with numbers too small to run statistical tests, this research excluded those categories. To be specific, only eight participants of rescue and two participants with other positions answered the question about the job position, and three participants who had a Master's Degree responded for the question about education level.

After eliminating those 13 participants, this study finally has 518 participants (96.8%).

The study participants in GFSA had to take their first training class that lasted 15 weeks before their deployment. During the 15 weeks, they took a mandatory 49-hour LFT session as per the institutional regulation of GFSA. Due to the huge number of participants, GFSA scheduled two identical classes for them. One was held from December 2017 to March 2018 and the other from March to May 2018. Subsequently, GFSA split the participants of each class into two groups for providing each of them with a full range of LFTs available at its facilities. This research targeted three groups, one in the first class taking LFT session from March 12th to 20th 2017, and the other two in the second class taking LFT from April 23rd to May 1st and May 8th to 16th 2018 respectively. Even though their training dates were different, they took identical lessons from each LFT facility at GFSA. Each group took ten different LFT scenarios and two respiration scenarios: three residential fires, four industrial fires, three special fire phenomena, and two respiration activities in a dark and complex structure. The participants started their training with the respiration activities and continued to the residential fires, the industrial fires, and the special fire phenomena consecutively. According to the internal regulation of GFSA, the participants took more than two hours of recovery between the scenarios.

Facilities: GFSA has installed five LFT facilities: the SCBA, the Residential, the Industrial, the Factory, and the Special Phenomena. However, the Factory facility was not available for the participants due to a maintenance issue. In regard of contents of each facility, the SCBA facility contains a maze with two stories and dozens of compartments, and ladder and stair machines. The Residential facility replicates a house, an apartment unit, and small business shops, which produce fires at sofas, gas stoves, closets, and rooms. The Industrial facility consists of an oil plant, oil storage, a tank truck, and several mock-ups of vehicles. Each replica produces flames from certain parts. The Special Phenomena has three structures: two for special fires – flashover and backdraft, and one for over 30 minutes lasting fierce fires and dense smoke. With respect to facility level, the

SCBA is the prerequisite course to make the participants familiar with adequate motions under fire and smoke. The Residential is the basic level to train fire suppression strategies such as ingress and egress, hose set-up, ventilation, and victim searching. The Industrial is the intermediate level to cut fuel supply to the fires rather than to quench them. The Special Phenomena is the advanced level to teach advanced skills and knowledge like detecting fire patterns under fierce fires.

Measure

The survey of this study consists of four questionnaires: two for demographics - personal background and personal learning style, and the other two for training effect - pre perceptive status and post perceptive status. Due to the geographical distance between the U.S and South Korea, the four questionnaires were delivered to two fire officials¹ at GFSA before the LFT sessions. With the help of these officials, the participants received personal background, Kolb LSI questionnaires, and pre perceptive status on the evening of the day before the session at their dormitory room and submitted them the next morning before the session started. On the evening of the last day of the session, the participants answered the post perceptive status questionnaire and submitted it the next morning. The collected questionnaires were delivered to the researcher's office in the U.S. by the end of June 2018.

Demographics (Independent Variables): The personal background consists of eight items: sex, age, job position, marital status, education level, income, fire service related experience, and personal learning style. In terms of answering categories, the questions have two categories for sex

1. The two officials (Mr. YUNGHUI LEE and Mr. JUNHEE LEE) received the questionnaires from the researcher by secured email and printed as many as the number of the respondents. The researcher discussed with them through an internet application about how to hand out, manage, retrieve, and send back the filled out questionnaires to the researcher's office in the US. After collecting all the responses, they returned the answered survey documents by airmail.

(1 = male, 2 = female), job position² (1 = fire suppression, 2 = EMS), marital status³ (1 = single, 2 = married), and fire service related experience⁴ (1 = yes, 2 = no); three for age⁵ (1 = under 30, 2 = 30 to 34, 3 = over 34), and education level⁶ (1 = high school graduate, 2 = college or associated program graduate, 3 = undergraduate); and four for income⁷ (1 = less than \$ 30,000, 2 = \$30,000 – 49,999, 3 = \$50,000 – 69,999, 4 = more than \$69,999). With respect to Kolb LSI, this study capitalized on the paper based Kolb LSI 3.1. (A. Kolb & D. Kolb, 2005) and assigned each participant to one of the four learning styles: Accommodator, Diverger, Converger, and Assimilator. The demographic questionnaires, saving for the Kolb LSI 3.1, are in the appendix section (Appendix A).

2. The survey question for job position has four categories (1 = fire suppression, 2 = rescue, 3 = EMS, 4 = others) but the respondents are eight for rescue and two for others, which are not statistically meaningful amounts. Hence, this study excludes these two categories and re-categorizes into two (1 = fire suppression, 2 = EMS) for statistical tests.

3. The survey question for marital status has four categories (1 = single, 2 = married, 3 = divorced, 4 = widowed), but no participant answered for divorced and widowed. Hence, this study eliminates these two categories.

4. The survey question for fire service related experience has a subordinate question to verify detail experiences but none of the categories of the subordinate question has enough number of respondents for statistical tests. Hence, this study excludes the subordinate question.

5. The survey question for age has five categories (1 = under 25, 2 = 25 to 29, 3 = 30 to 34, 4 = 35 to 39, 5 = over 39) but the numbers of respondents for under 25 and over 39 are too small to run statistical tests. Hence, this study re-groups the study participants into three categories (1 = under 30, 2 = 30 to 34, 3 = over 34).

6. The survey question for education level has five categories (1 = high school graduate, 2 = college or associated program graduate, 3 = undergraduate, 4 = master degree, 5 = doctoral degree) but only three participants have master degree, and no participants has doctoral degree. Hence, this study eliminates these two categories.

7. The survey question for income has six categories (1 = less than \$10,000, 2 = \$10,000 – 29,999, 3 = \$30,000 – 49,999, 4 = \$50,000 – 69,999, 5 = \$70,000 – 89,999, 6 = more than \$89,999) but not enough participants answered in less than \$10,000 and more than \$89,999 for statistical tests. Hence, this study re-categorizes the participants into four categories (1 = less than \$ 30,000, 2 = \$30,000 – 49,999, 3 = \$50,000 – 69,999, 4 = more than \$69,999).

Training Effect (Dependent Variables): Even though many studies measure training effect in objective ways such as time and distance, especially for physiological dimension (Eglin, Coles, & Tipton, 2005; & Wili, Horn, & Madrzykowski, 2016), the in-depth effect comes from the participant's perceptive change including physiological change (Rae, 1997, p.160). Therefore, this study measured the training effect of the LFT based on an effect questionnaire. The training effect questionnaire's purpose is to assess the differences between before and after the LFT; hence, the same questionnaires were distributed before and after the training. The training effect questionnaire consists of five sections – generic, residential, industrial, special phenomena, and SCBA – and a small comment box in the last part. All questions in the sections ask the participants to answer with five-point Likert scale (*1 = strongly disagree to 5 = strongly agree*). To be specific, all sections, except for the SCBA, have the same nine questions: three for physiology – confidence in stamina, metabolism, and respiration capacity; two for psychology – free from obsession with duty and free from anxiety; two for skill and knowledge – believe in own skill, and knowledge; and two for teamwork – helping team operation, and ready for rescuing team member. In addition, residential, industrial, and special phenomena sections have one more question of understanding the fires in those fields respectively. In the meantime, the SCBA section also has nine questions: one for understanding the function of the gear, two for psychology – free from obsession with duty and anxiety, four for skill – manipulate in dark areas, complex spaces, under physically exhausted conditions, and under stress, and two for teamwork – helping team member in dark areas, and complex spaces. The training effect questionnaires are in the appendix section (Appendix B and C).

Descriptive Statistics

Table 2 indicates mode (M), standard deviation (SD), and the number of responses (N) for each demographic variable. To be specific, this study has considerably more male participants than female, more unmarried participants than married ones. The number of participants who have not

experienced fire service is also significantly more than that of experienced participants. In addition, about two-fifth of participants are Convergers of Kolb LSI, and a half of these are university graduates. In the meantime, the number of participants of fire suppression is slightly more than that of EMS in the job position variable.

Table 2. Modes, Standard Deviations, and Sample Sizes

Variable	M	SD	N	Description
1. Sex	<i>Male</i>	.42	514	Participant's gender
2. Age	<i>Under 30</i>	.66	513	Participant's age
3. Job Position	<i>Fire Suppression</i>	.50	503	Participant's job position
4. Marital Status	<i>Single</i>	.31	513	Participant's marital status
5. Education Level	<i>Undergraduate</i>	.81	512	Participant's education level
6. Income	<i>\$ 30,000 - \$ 49,999</i>	1.04	473	Participant's household income
7. Fire Service Experience	<i>No</i>	.41	479	Participant's previous fire service related experience
8. Kolb LSI	<i>Converger</i>	1.10	506	The types of Kolb Learning Style Inventory 3.1

Indexes

To examine the overall improvement in each LFT facility as per the demographic factors, this study created indexes. The indexes are summed up by the discrepancies between the pre and post-perceptive status of demographic factors across the five effect dimensions. In the meantime, the index for the SCBA came from the eight questions; only excluding the first question of facility understanding. In detail, the Chrombach's Alpha was .876 for the Residential facility, .799 for the Industrial, .820 for the Special Phenomena, and .833 for the SCBA. With respect to the ranges of the created indexes, the ranges were between -14 and 24 for the Residential facility, between -14 and 21 for the Industrial, between -13 and 23 for the Special Phenomena and between -12 and 26 for the SCBA.

Data Analysis

This study utilised IBM SPSS Statistics Ver. 25 and implemented statistical tests for each LFT facility in GFSA respectively. With respect to the three LFT facilities: the Residential, the Industrial, and the Special Phenomena, the first test was commonly “Paired Samples T-Test” to scrutinize the ten variables in the questionnaires. Nine of them are for the improvements across physiology, psychology, skill, knowledge, and teamwork dimensions and one is for the improvement of understanding fire types in each facility. The next tests for them were “Independent Samples T-Test” or “One-Way ANOVA” depending on the number of groups in each of the eight demographic variables to examine the extent of its difference between pre and post-LFT. While the questionnaire for the SCBA facility examined three dimensions of effect – psychology, skill, and teamwork for operation, the first “Paired Samples T-Test” tested the three variables created by combining related questions in the survey. In addition, the T-Test also showed the difference in understanding the function of SCBA. The next tests for the facility were the same as the previous facilities – for examining the effects of the eight demographic variables.

Even though the statistical tests show a significant difference for a dependent variable before and after the LFT, the effect size of the training for the variable needs to be reported. In other words, statistical significance is the first step to know the existence of the effect, and the next step should be the measurement of the effect degree. In this regards, this study utilized the Cohen’s *d* index, which compares the standardized means of two independent groups (Sullivan & Feinn, 2012). The effect sizes of the index are *small* ($d = .2$), *medium* ($d = .5$), and *large* ($d \geq .8$). When it comes to comparing the means of three or more independent groups with consideration of an effect variable, this study used Omega Squared (ω^2) measure (Yigit & Mendes, 2018). The measure shows how much percentage the effect variable influence the observed difference between the groups

CHAPTER IV

FINDINGS

Results

RH1 (*There are differences in the participants' perception of readiness for firefighting before and after LFTs at the Residential LFT facility*): The results indicate that RH1 is confirmed (Table 3). The mean values of the participant's perception after the Residential LFTs are significantly different from those of before the LFTs based on the Paired Samples T-Test. In addition, the LFT has affected on each dependent variable with more than small effect size. The most significant improvements are on the skill dimension and the knowledge dimension, both of them showed .9 improvement respectively (Skill: $t_{(510)} = -21.63, p < .01, d = .96$; Knowledge: $t_{(511)} = -21.94, p < .01, d = .97$). In contrast, the least improvement is seen in the teamwork for safety, .23 ($t_{(511)} = -6.22, p < .01, d = .28$), while the teamwork for operation shows .58 improvement ($t_{(511)} = -13.70, p < .01, d = .61$). Meanwhile, the participants show significant improvement at understanding the fire types at the facility .77 ($t_{(511)} = -20.46, p < .01, d = .90$). In addition, both the physiology and the psychology dimensions have little improvements as compared to other dimensions, but the psychology items demonstrate some improvement as compared to the physiology ones. To be specific, the anxiety shows .59 ($t_{(512)} = -13.97, p < .01, d = .62$) and .57 for the obsession with duty ($t_{(512)} = -13.48, p < .01, d = .59$) while the stamina indicates .39 ($t_{(512)} = -9.99, p < .01, d = .44$), .35 for the respiration ($t_{(511)} = -8.80, p < .01, d = .39$), and .3 for the metabolism ($t_{(512)} = -7.54, p < .01, d = .33$).

Table 3. The mean values of participants' perception of readiness for firefighting before and after the Residential LFT

Perceptive Status		Pre	Post	Statistics
Understanding Fire Types		2.84	3.61	$t_{(511)} = -20.46, p < .01, d = .90$
Physiology	Stamina	3.24	3.63	$t_{(512)} = -9.99, p < .01, d = .44$
	Metabolism	3.41	3.71	$t_{(512)} = -7.54, p < .01, d = .33$
	Respiration	3.35	3.70	$t_{(511)} = -8.80, p < .01, d = .39$
Psychology	Obsession of duty ^a	3.26	3.83	$t_{(512)} = -13.48, p < .01, d = .59$
	Anxiety ^b	3.28	3.87	$t_{(512)} = -13.97, p < .01, d = .62$
Skill		2.68	3.58	$t_{(510)} = -21.63, p < .01, d = .96$
Knowledge		2.73	3.63	$t_{(511)} = -21.94, p < .01, d = .97$
Teamwork	Operation	3.30	3.88	$t_{(511)} = -13.70, p < .01, d = .61$
	Safety	4.00	4.23	$t_{(511)} = -6.22, p < .01, d = .28$

^a Obsession with duty: the participants' confidence in being free from the obsession with duty

^b Anxiety: the participants' confidence in being free from anxiety

With respect to the eight research questions about the overall improvement of the research subjects' perception at the Residential facility, only sex and job position significantly influenced the improvements. According to the results of the Independent Sample T-Test (as shown in Table 4), female participants demonstrate higher improvement than their male counterparts ($t_{(505)} = -3.75, p < .01, d = .40$), and the effect size of the factor is close to *medium*.

Table 4. The effect of Sex on the participants' improvement at the Residential LFT

Sex	Mean	SD	N
Male	4.44	5.92	390
Female	6.71	5.20	117

$t_{(505)} = -3.75, p < .01, d = .40$

In terms of job position, another Independent Samples T-Test indicates, as illustrated on Table 5, the participants of fire suppression have higher improvement than those of EMS ($t_{(494)} = -4.59, p < .01, d = .42$), and the effect size of the factor is near to *medium*.

Table 5. The effect of Job Position on the participants' improvement at the Residential LFT

Job Position	Mean	SD	N
Fire Suppression	4.00	5.68	280
EMS	3.67	5.70	216

$t_{(494)} = -4.59, p < .01, d = .42$

RH2 (*There are differences in the participants' perception of readiness for firefighting before and after LFTs at the Industrial LFT facility*): The results indicates that RH2 is also confirmed (Table 6). The Paired Samples T-Test for the items indicates a significant improvement in them, except for the skill variable. Furthermore, the effect size of the LFT is also higher than *small* for each item saving for the skill. While the knowledge variable shows the highest improvement with .97 ($t_{(513)} = -23.36, p < .01, d = 1.03$), the skill variable indicates decrease of -.2 ($t_{(512)} = 3.65, p < .01, d = .16$). The study participants show another significant improvement on understating fire types at the facility .93 ($t_{(512)} = -22.67, p < .01, d = 1.00$). Noticeably, the subjects also demonstrate higher improvement in psychology dimension than in physiology. To be specific, the improvements in the psychology variables are .71 for the anxiety variable ($t_{(513)} = -17.33, p < .01, d = .76$), and .69 for the obsession with duty ($t_{(513)} = -16.79, p < .01, d = .74$). Whilst, the improvements of physiology variable are .46 for the stamina ($t_{(513)} = -12.59, p < .01, d = .56$), .42 for the respiration ($t_{(513)} = -10.49, p < .01, d = .46$), and .37 for the metabolism ($t_{(512)} = -9.94, p < .01, d = .44$). In addition, the teamwork for operation shows relatively high improvement among the variables with .67 ($t_{(513)} = -15.44, p < .01, d = .68$) while the teamwork for safety indicates relatively small improvement among them with .28 ($t_{(513)} = -7.97, p < .01, d = .35$).

Table 6. The mean values of participants' perception of readiness for firefighting before and after the Industrial LFT

Perceptive Status		Pre	Post	Statistics
Understanding Fire Types		2.73	3.66	$t_{(512)} = -22.67, p < .01, d = 1.00$
Physiology	Stamina	3.23	3.69	$t_{(513)} = -12.59, p < .01, d = .56$
	Metabolism	3.40	3.77	$t_{(512)} = -9.94, p < .01, d = .44$
	Respiration	3.31	3.73	$t_{(513)} = -10.49, p < .01, d = .46$
Psychology	Obsession of duty ^a	3.18	3.87	$t_{(513)} = -16.79, p < .01, d = .74$
	Anxiety ^b	3.18	3.89	$t_{(513)} = -17.33, p < .01, d = .76$
Skill		2.61	2.41	$t_{(512)} = 3.65, p < .01, d = .16$
Knowledge		2.65	3.62	$t_{(513)} = -23.36, p < .01, d = 1.03$
Teamwork	Operation	3.23	3.90	$t_{(513)} = -15.44, p < .01, d = .68$
	Safety	3.96	4.24	$t_{(513)} = -7.97, p < .01, d = .35$

^a Obsession with duty: the participants' confidence in being free from the obsession with duty

^b Anxiety: the participants' confidence in being free from anxiety

In regards to the eight RQs for the Industrial LFT facility, only sex, job position, and education level have a statistically significant influence. Based on the Independent Samples T-Test for sex (as shown in Table 7), female participants show higher improvement than male subjects ($t_{(507)} = -5.29, p < .01, d = .56$), which is higher than *medium* effect size by the variable.

Table 7. The effect of Sex on the participants' improvement at the Industrial LFT

Sex	Mean	SD	N
Male	3.69	5.32	392
Female	6.56	4.54	117

$t_{(507)} = -5.29, p < .01, d = .56$

In terms of the job position, according to the Independent Samples T-Test for the variable (Table 8), EMS has higher improvement than fire suppression ($t_{(496)} = -4.61, p < .01, d = .42$), which is close to *medium* effect size by the variable.

Table 8. The effect of Job Position on the participants' improvement at the Industrial LFT

Job Position	Mean	SD	N
Fire Suppression	3.50	5.10	281
EMS	5.64	5.18	217

$t_{(496)} = -4.61, p < .01, d = .42$

With respect to educational level, as the One-Way ANOVA illustrates (Table 9), the participants who are university graduates show higher improvement than those of the other two categories ($F_{(2, 500)} = 4.47, p < .05, \omega^2 = .01$). However, the factor only explains 1 % of the variance between the groups.

Table 9. The effect of Education Level on the participants' improvement at the Industrial LFT

Education Level	Mean	SD	N
High School	3.10	4.56	116
College and Associate Program	4.45	5.37	143
University	4.86	5.47	244

$F_{(2, 500)} = 4.47, p < .05, \omega^2 = .01$

RH3 (*There are differences in the participants' perception of readiness for firefighting before and after LFTs at the Special Phenomena LFT facility*): The Paired Sample T-Test (Table 10) also confirms this hypothesis, and the effect size of the LFT on each variable is bigger than *small*. Among the significant improvements of the ten variables, the highest improvement is in knowledge variable with .93 ($t_{(512)} = -21.82, p < .01, d = .96$). The smallest improvement is in the teamwork for safety .25 ($t_{(512)} = -7.23, p < .01, d = .32$) while the second smallest improvement is

in the skill variable with .26 ($t_{(512)} = -4.66, p < .01, d = .21$). The participants show less improvement in the understanding fire types variable with .33 ($t_{(513)} = -9.30, p < .01, d = .41$) compared to the two previous facilities. However, they demonstrate the same pattern of higher improvement on the psychology dimension than the physiology. In detail, the improvements of the psychology variables are .67 in anxiety ($t_{(512)} = -15.54, p < .01, d = .69$) and .64 in obsession with duty ($t_{(512)} = -15.70, p < .01, d = .69$). In the meantime, the improvements of the physiology variables are .43 in stamina ($t_{(512)} = -10.97, p < .01, d = .48$), .39 in respiration ($t_{(512)} = -10.12, p < .01, d = .45$), and .33 in metabolism ($t_{(512)} = -10.97, p < .01, d = .38$). Lastly, the teamwork for operation variable indicates improvement with .64 ($t_{(512)} = -14.69, p < .01, d = .65$)

Table 10. The mean values of participants' perception of readiness for firefighting before and after the Special Phenomena LFT

Perceptive Status		Pre	Post	Statistics
Understanding Fire Types		3.72	4.05	$t_{(513)} = -9.30, p < .01, d = .41$
Physiology	Stamina	3.25	3.68	$t_{(512)} = -10.97, p < .01, d = .48$
	Metabolism	3.40	3.73	$t_{(512)} = -8.51, p < .01, d = .38$
	Respiration	3.34	3.73	$t_{(512)} = -10.12, p < .01, d = .45$
Psychology	Obsession of duty ^a	3.19	3.83	$t_{(512)} = -15.70, p < .01, d = .69$
	Anxiety ^b	3.20	3.87	$t_{(512)} = -15.54, p < .01, d = .69$
Skill		3.36	3.62	$t_{(512)} = -4.66, p < .01, d = .21$
Knowledge		2.71	3.64	$t_{(512)} = -21.82, p < .01, d = .96$
Teamwork	Operation	3.25	3.89	$t_{(512)} = -14.69, p < .01, d = .65$
	Safety	3.98	4.23	$t_{(512)} = -7.23, p < .01, d = .32$

^a Obsession with duty: the participants' confidence in being free from the obsession with duty

^b Anxiety: the participants' confidence in being free from anxiety

With respect to the eight RQs for the Special Phenomena LFT facility, only job position bears statistical significance. Based on the Independent Samples T-Test for the job position variable (as illustrated in Table 11), female participants show higher improvement than male counterparts ($t_{(497)} = -3.42, p < .01, d = .31$), which means close to *small* effect size of the variable.

Table 11. The effect of Job Position on the participants' improvement at the Special Phenomena LFT

Job Position	Mean	SD	N
Fire Suppression	3.85	5.50	281
EMS	5.54	5.50	218

$t_{(497)} = -3.42, p < .01, d = .31$

RH4 (*There are differences in the participants' perception of readiness for firefighting before and after training at the SCBA facility*): This hypothesis is confirmed based on the Paired Samples T-Test (Table 12). The test shows significant improvements in understanding the fire types, obsession with duty, skill, and teamwork for operation variables, and the effect size of the training for each variable is higher than *medium*. The highest improvement is in the skill variable at .82 improvement ($t_{(512)} = -21.03, p < .01, d = .93$) while the smallest improvement is in understanding the SCBA function at .47 improvement ($t_{(512)} = -11.78, p < .01, d = .52$). In the meantime, the obsession with duty variable shows .65 improvement ($t_{(509)} = -15.76, p < .01, d = .70$) and the teamwork for operation indicates .61 improvement ($t_{(512)} = -14.84, p < .01, d = .65$).

Table 12. The mean values of participants' perception of readiness for firefighting before and after the SCBA training

Perceptive Status	Pre	Post	Statistics
Understanding SCBA function	3.68	4.15	$t_{(512)} = -11.78, p < .01, d = .52$
Psychology: Obsession of duty ^a	3.29	3.94	$t_{(509)} = -15.76, p < .01, d = .70$
Skill	2.95	3.77	$t_{(512)} = -21.03, p < .01, d = .93$

Teamwork: Operation	3.31	3.92	$t(512) = -14.84, p < .01, d = .65$
---------------------	------	------	-------------------------------------

^a Obsession with duty: the participants' confidence in being free from the obsession with duty

In regards to the eight RQs for the SCBA facility, the only significant improvement came from the job position variable (Table 13). According to the Independent Samples T-Test for the variable, female group shows higher improvement than male group ($t_{(491)} = -2.78, p < .01, d = .25$), which shows close to *small* effect size.

Table 13. The effect of Job Position on the participants' improvement at the SCBA training

Job Position	Mean	SD	N
Fire Suppression	4.53	5.81	276
EMS	5.95	5.41	217

$t_{(491)} = -2.78, p < .01, d = .25$

Discussion

The Paired Samples T-Tests indicate the improvements of the study participants' perception of readiness for firefighting. In addition, the LFT had than small effect size across the dependent variables except for the skill at the Industrial facility. Meaningful improvement starts with the improvement in understanding the LFT, by the participants. The reason for the improvement can be the same to the studies (Smith et al., 2001; & Driskell & Johnston, 1998) of LFT experiment. The participants of those studies had improved their understanding of an LFT by taking the LFT repeatedly. The next meaningful point is the improvements are different between the five dimensions of LFT effect. To be specific, some effect dimensions have consistent improvement throughout the different LFT exercises, while others show a difference in improvement across the various exercises. Another meaningful result is on the LFT facilities. In other words, the participants showed different improvements of an effect dimension as per each LFT facility. Lastly, some demographic factors among the eight did not influence the improvement

of the participants while others showed significant impacts on them. The detailed discussions about each dimension, facility, and demographic factor are as follows.

Effect Dimensions: In general, the test results indicate that the physiology dimension had less improvement compared to other dimensions. The result may come from the measurement and the training period. With respect to the measurement, the participants may rate their physical capacity lower than their objective level. A study by Eglin et al. (2005) supports this; some participants of the study rated their capacity to drag an 85kg object close to impossible but dragged faster than others who marked that it was possible. In terms of the training period, the longer an LFT was, higher the improvement on heart rate was noted (Smith et al., 2001; & Smith et al., 2005). Namely, the participants may need a longer period of LFT to improve their physiological capacity than used in this study. When it comes to the constituents of the physiology dimension, the study participants showed higher confidence in their stamina than metabolism and respiration. One possible answer for this outcome is on the heftiness of firefighter's personal protective equipment (PPE). As seen in the experiment of Lee et al. (2013), wearing PPE during the LFT can be an opportunity for the participants to develop their stamina. In addition, the participants showed higher confidence in respiration than metabolism, which is analogous to the experiment of Petruzzello et al. (2016) since the participant became familiar with SCBA through LFT. Lastly, the participants demonstrated considerable improvement in metabolism, which may result from the repeated LFT. As Horn et al. (2013) revealed, the repeated working cycle could precipitate the increasing speed of metabolic factors such as body temperature and heart rate.

With respect to the psychology dimension, the participants have improved their confidence in the psychological variables. The possible reasons for this result are the repetition of the training and the training environment. As Baumann et al. (2011) argue, the repeated working cycle gave the participants a familiarity with the work that contributed to the improvements in the psychological variables. According to Borodzicz & Van Haperen (2002), the training environment of a simulated

crisis like LFT is more beneficial to the psychology dimension than other dimensions. When it comes to the components of the psychological dimension, same as the experiment of Baumann et al. (2011), the participants overcame anxiety relatively more than the obsession with duty exertion. As the scholars argue, the difference comes from the repetition of LFT. Importantly, in contrast to previous studies (Baumann et al., 2011; & Smith et al., 2005), the study participants show a significant improvement in the obsession with duty after LFT. Since this study capitalized on dozens of LFT scenarios over seven days, while the previous studies implemented two or three evolutions within several hours, the improvement in the obsession with duty may come from the long recovery time between scenarios.

In terms of skill dimension and knowledge dimension, this study observed high improvement of the participants in these dimensions. The mean values of the perceptive status of the dimensions in pre-LFT are below the intermediate point with an exception at the Special Phenomena facility. In contrast, their mean values of post-LFT go over the mid-point saving for an exception at the Industrial facility. These results may come from the lack of experience of the participants because the class was their first time in fire service. In other words, as Perry (2004) observed, the less experienced participants in an exercise can improve their skill and knowledge more than the experienced. In detail, the participants have the highest improvement in knowledge. The reason for the improvement can root from their experience, as Driskell, Sclafani, and Driskell (2014) argue, people become confident when they collect knowledge through experience. Compared to knowledge, the participants have less improvement or lost their confidence in skill, which can be interpreted in two ways. On the one hand, as seen in Perry's (2004) experiment, the participants mastered skills throughout on-going scenarios and had less to improve in the later scenarios. On the other hand, as NFPA 1403 (2002) could not demonstrate all skills in LFT, the participants felt daunted by the range of skills that they had to learn and lost their confidence. To verify the reason, more research is needed.

When it comes to teamwork dimension, the results also demonstrate the improvement of the participants in the dimension after LFT. This verifies the assertion of Kayes et al. (2005) that advocates the efficiency of team-based experiential learning. While the participants show improvements in both the components of teamwork dimension, they have less improved teamwork for safety than for operation. The possible reason is in their perceptive status of teamwork for safety before LFT, which is a relatively high value of four “*agree*”. As many scholars (Storer et al., 2014; & Bennett et al., 2011) agree with, firefighting is a physically and psychologically high-risk job. That is why the firefighter participants already have a high perception of safety, which leaves less room to improve as compared to operations. In contrast, the participants indicate relatively higher perceptive improvement in teamwork for operation than for safety and other dimensions such as physiology and skill. The reason for the higher improvement in safety may be the same as the study of Peterson and Perry (1999). The participants in their exercise recognized more importance of teamwork for operation than job risk. In addition, this result supports the postulation of Siassakos et al. (2010), who put more weight on teamwork than skill and knowledge for operation.

Effect of Facilities: Since GFSA provides the firefighter participants with sequential LFTs at the four facilities, scrutinizing the improvement in each facility will be meaningful for future LFTs. To start with, even though this study measured limited effect dimensions on the prerequisite course at the SCBA facility, the participants presented the highest improvement in skill acquirement. The reason can be at the aim of the facility, which focuses on SCBA manipulation under dark and complex environment. Next, when it comes to LFT facilities, the fires at the Residential facility are the first phase of the LFT, and all the effect dimensions present improvements. For the second phase in the Industrial facility, as seen in the LFT experiment of Smith et al. (2001), the participants showed great improvement throughout the effect factors as the LFT session continued. Another reason for the improvement is that the facility provides one more session than others do. As researchers (Horn et al., 2013; & Smith et al., 2001) revealed, the more

working cycles study participants have, the more improvement they present. Lastly, the Special Phenomena facility draws a high improvement from the participants in all dimensions because, as Borodzicz and Van Haperen (2002) claim, the facility provides a more realistic crisis than others do. Noticeably, the three LFT facilities, except for the SCBA, represent the same pattern of improvement. The highest improvement of the participants' perception is in the knowledge dimension and the physiological dimension has improved less than others have. In addition, the participants indicate high improvement on skill at the basic LFT facility but low improvement at the intermediate and the advanced LFT facilities.

Demographic Factors: The only three research questions of sex, job position, and education level present significant influence on overall improvement among the participant groups. In addition, effect sizes of the factors on the variance between their two independent groups are bigger than *small*, but the effect size of the education factor is too small. First, job position was the common factor causing different improvements across all the four LFT facilities. The participants of the EMS position have improved higher than those of the fire suppression at the Industrial, the Special Phenomena, and the SCBA facilities. The reason of this result can be found in Perry's (2004) experiment, in which the citizen volunteers, who had less or no experience in the emergency exercise, had higher perceptive improvement than the experienced participants had. Next, the female participants reported higher improvement in their overall perception than their male counterparts at the Residential and at the Industrial facilities. This result is different from the outcome of the study by Punakallio et al. (2003); hence, further research is needed to verify the effect of LFT based on gender. Lastly, only at the Industrial facility, the education level created a significant discrepancy between the participant groups. Although Hayes and Allinson (1997) argue that education level contributes to personal learning, additional LFT research is needed to clarify the influence of education.

Interestingly, the Kolb LSI did not affect significant effect on the variance between the four learning styles for the participants' improvement. This can be interpreted in two opposite ways. On the one hand, the majority of the styles is Converger who has interest in skill mastery. Unfortunately, the skill dimension was the least improved dimension across the LFT facilities. This may mean the variance between the learning styles is not statistically significant with the poor improvement. On the other hand, the participants have commonly improved in all the dimensions. This may indicate the LFT has holistic effect for the participants to improve their perception regardless of their learning styles. Needless to say, more researches are needed to verify the true effect of the Kolb LSI.

Even though this study revealed the positive effect of the LFT on the participants' improvement, the study needs to address four issues concerning with sample, measurement, validity, and counterbalance. First, owing to the empirical circumstances this study capitalizes on the newly recruited firefighters. Due to their lack of experience in real fire suppression scenes, the outcome of this study may not be generalized for all levels of career firefighters. In fact, the psychological and teamwork variables may draw different outcomes from other senior firefighters. Secondly, the researcher measured the subjective perception of the participants rather than objective measurement of their improvement. Even though this study aimed at the perceptive improvement of the participants, utilizing inventories or checklists such as the ones used by Smith et al. (2005), might have guaranteed a more objective outcome than this. Thirdly, concerning with validity, this study asked all the participants to answer the pre and the post LFT questionnaires to collect enough samples for statistical tests. This might give the participants familiarity with the questions and skewed their perceptive status after the LFT. Lastly, all the study participants took the LFT sessions in the order from the SCBA facility to the Residential, the Industrial, and the Special Phenomena as per the policy of GFSA. This may cause a counterbalancing issue and draw a skewed understanding of the LFT effect in each LFT facility of this study.

CHAPTER V

CONCLUSION

Firefighting is one of the most demanding professions in South Korea, requiring firefighters to be physiologically strong, psychologically sound, possess a varied skillset, broadly knowledgeable, and mutually cooperative. To meet these criteria, firefighters receive constant training from skill mastering and physical training at traditional training fields to strategy development at LFT facilities. GFSA in South Korea is one of the institutes that provide both traditional training and LFT to Korean firefighters. However, the in-depth effect of LFT is not clear because GFSA has only recently installed these LFT facilities: the Residential, the Industrial, the Special Phenomena, and the SCBA. Using the quasi-experiment with the help of two recruit classes at GFSA, this paper revealed the existence and the sizes of effect of LFT across the five job criteria. The most significant result is that all LFTs at the four facilities in GFSA helped the participants to improve positively their perception of readiness for firefighting across the physiology, psychology, skill, knowledge, and teamwork dimensions. Among the nine dependent variables, the study participants have improved their perception the highest in knowledge and the lowest in teamwork for safety. In addition, they have improved higher in psychological variables such as anxiety and obsession with duty than in physiological ones like stamina, metabolism, and respiration. Furthermore, the improvement of teamwork for the operation was consistent throughout the LFT

facilities with higher than *medium* effect size of the training, but improvement of skill fluctuated between the facilities.

Noticeably, among the eight demographic factors, only sex, job position, and education level have affected the improvement between the participant groups, but the effect size of each factor is lower than *medium*. In the meantime, age, marital status, household income, job related experience, and Kolb LSI factors have no significant impact. With respect to the significant factors, even though they affect the improvements, the impacts are not consistent between facilities (e.g. job position) or limited at certain facilities (e.g. sex and education level). Concerning the non-significant factors, since this study recruited a certain fire training class rather than a randomized sample, their impact may differ from the previous studies. In addition, the Kolb LSI did not affect the variance between the learning style groups. This may result from the majority of the style, Converger, who loves skill mastery, but the skill dimension is the least improved dimension in this study. Another possible reason for the result is the holistic effect of the LFT, which made the participants improved regardless of their learning styles.

Even though this study implemented a quasi-experiment, the results have several implications to fire service training for designing LFT scenarios. First, with respect to demographic factors, the participants of EMS and female gender take more advantage of LFT than their counterpart group. This implies that fire training institutes need not only maintain the effective LFT sessions for EMS and female participants but also to revise additional sessions for the other groups. Secondly, dissimilar to other multiple bouts of same LFT experiments (Smith et al., 2001; & Petruzzello et al., 2016), each level of LFTs at different facilities present high improvements respectively. This endorses that the GFSA should categorize its trainees into groups based on their level after initial LFTs at all the four facilities, and then provide them in-depth LFTs at specific facilities that commensurate with their level. Thirdly, as Horn et al. (2013) observed, the more work cycles the participants have, the higher the improvement they show, which requires training

agencies to extend LFT sessions. Lastly, as this study shows, the participants benefit more from the LFT in the psychological capacity rather than for physiology, skill, knowledge, and safety. Therefore, fire training authorities need to run LFT in parallel with the traditional training to complement each other for all the effect dimensions.

Based on this study, future researchers can draw a better outcome from LFT research by adopting several changes. Firstly, the participation of various career levels of firefighters from beginners to senior officials can describe in detail the effect of LFT on each career group of firefighters. Secondly, though this study capitalized on the perceptive improvement of the participants, some dimension like physiology will result in a different outcome with objective measurements. Thirdly, assigning a comparing group, who do not answer the pre training questions or do not take the LFT, will show an apparent effect of the training. Finally, to verify the true effect of each LFT facility, researchers need to utilize a counterbalanced LFT experiment.

REFERENCES

- Baumann, M. R., Gohm, C. L., & Bonner, B. L. (2011). Phased Training for High-Reliability Occupations. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 53(5), 548–557
- Bennett, A. I., Hanley, J., Buckle, P., & Bridger, R. S. (2011). Work demands during firefighting training: Does age matter? *Ergonomics*, 54(6), 555–564
- Borodzicz, E., & Van Haperen, K. (2002). Individual and Group Learning in Crisis Simulations. *Journal of Contingencies and Crisis Management*, 10(3), 139–147
- Boyatzis, R. E., & Kolb, D. A. (1995). From learning styles to learning skills: the executive skills profile. *Journal of Managerial Psychology*, 10(5), 3–17
- Bryant, R. A., & Harvey, A. G. (1996). Posttraumatic stress reactions in volunteer firefighters. *Journal of Traumatic Stress*, 9(1), 51–62
- Burke, M. J., Salvador, R. O., Smith-Crowe, K., Chan-Serafin, S., Smith, A., & Sonesh, S. (2011). The dread factor: How hazards and safety training influence learning and performance. *Journal of Applied Psychology*, 96(1), 46–70
- Champagne, P. J. (2012). Planning effective training drills. *Fire Engineerig*, 165(4), 91–96
- Douvillier, R. (2011). Teamwork in action. *Fire House*, 36(6), 92–94
- Driskell, J. E., & Johnston, J. H. (1998). Stress exposure training. *Making Decisions under Stress: Implications for Individual and Team Training*, 191–217

- Driskell, T., Sclafani, S., & Driskell, J. E. (2014). Reducing the Effects of Game Day Pressures through Stress Exposure Training. *Journal of Sport Psychology in Action*, 5(1), 28–43
- Dunne, T. (2012). Making “The Decision”: Transitioning to an exterior attack. *Fire Engineering*, 165(4), 81–90
- Eglin, C., Coles, S., & Tipton, M. (2005). Can fire-fighter instructors perform a simulated rescue after a hot fire training exercise? *Elsevier Ergonomics Book Series*, 3(C), 101–105
- Ekkekakis, P., Hargreaves, E. A., & Parfitt, G. (2013). Invited Guest Editorial: Envisioning the next fifty years of research on the exercise-affect relationship. *Psychology of Sport and Exercise*, 14(5), 751–758
- Elsner, K. L., & Kolkhorst, F. W. (2008). Metabolic demands of simulated firefighting tasks. *Ergonomics*, 51(9), 1418–1425
- ERIC. (1997). *True and Quasi-Experimental Designs*. <https://doi.org/ED421483>
- Eriksen, C., & Prior, T. (2011). The art of learning: Wildfire, amenity migration and local environmental knowledge. *International Journal of Wildland Fire*, 20(4), 612–624
- Hayes, J., & Allinson, C. W. (1997). Learning styles and training and development in work settings: lessons from educational research. *Educational Psychology*, 17(1–2), 185–193
- Horn, G. P., Blevins, S., Fernhall, B., & Smith, D. L. (2013). Core temperature and heart rate response to repeated bouts of firefighting activities. *Ergonomics*, 56(9), 1465–1473
- Jeong, H.-S. (2006). *A grounded analysis of the sensemaking process of Korean street-level fire service officials*. Reubin O'D. Retrieved from http://purl.flvc.org/fsu/fd/FSU_migr_etd-3527

- Jeong, H. S., Jeon, Y., Ma, J., Choi, Y., Ban, S., Lee, S., ... Lyoo, I. K. (2015). Validation of the Athens Insomnia Scale for screening insomnia in South Korean firefighters and rescue workers. *Quality of Life Research*, 24(10), 2391–2395
- Kang, S. (2009). *Enhancing the fire service education and training*. Donshin University. <https://doi.org/G901:A-0005481196>
- Kayes, A. B., Kayes, D. C., & Kolb, D. A. (2005). Experiential learning in teams. *Simulation & Gaming*, 36(3), 330–354
- Khan, Y. A., Davis, A. L., & Taylor, J. A. (2017). Ladders and lifting: How gender affects safety behaviors in the fire service. *Journal of Workplace Behavioral Health*, 0(0), 1–20
- KNFA. (2015). *Korea Fire Service Statistics 2015*. Seoul, Korea. Retrieved from <http://www.nfa.go.kr/nfa/policy/statisticsInfo/statisticsData/>
- KNFSA. (2006). The inovaton strategies for Fire Training 2010
- Kolb, A. Y., & Kolb, D. A. (2005). The Kolb Learning Style Inventory — Version 3 . 1 2005 Technical Specifi cations. *LSI Technical Manual*, 1–72
- Kolb, D. A. (1984). Experiential Learning: Experience as The Source of Learning and Development. *Prentice Hall, Inc.*, (1984), 20–38
- Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (2001). Experiential learning theory: Previous research and new directions. In R. J. Sternberg & L. Zhang (Eds.), *Perspectives on thinking, learning, and cognitive styles* (pp. 227–247). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

- Lee, J. J., Cha, M., Choi, B., & Kim, T. (2011). A team-based firefighter training simulator for complex buildings. *Korean Journal of Computational Design and Engineering*, 16(5), 370–379
- Lee, J. Y., Bakri, I., Kim, J. H., Son, S. Y., & Tochihara, Y. (2013). The impact of firefighter personal protective equipment and treadmill protocol on maximal oxygen uptake. *Journal of Occupational and Environmental Hygiene*, 10(7), 397–407
- Mccarthy, M. (2010). Experiential Learning Theory : From Theory to Practice. *Journal of Business & Economics Research*, 8(5), 1–10
- National Fire Protection Association (2002). *NFPA 1403 Standard on Live Fire Training Evolutions*. Quincy, MA, United States of America.
- Perry, R. W. (2004). Disaster exercise outcomes for professional emergency personnel and citizen volunteers. *Journal of Contingencies and Crisis Management*, 12(2), 64–75
- Peterson, D. M., & Perry, R. W. (1999). The impacts of disaster exercises on participants. *Disaster Prevention and Management: An International Journal*, 8(4), 241–255
- Petruzzello, S. J., Poh, P. Y. S., Greenlee, T. A., Goldstein, E., Horn, G. P., & Smith, D. L. (2016). Physiological, Perceptual and Psychological Responses of Career versus Volunteer Firefighters to Live-fire Training Drills. *Stress and Health*, 32(4), 328–336
- Prieto, J. A., González, V., Del Valle, M., & Nistal, P. (2013). The influence of age on aerobic capacity and health indicators of three rescue groups. *International Journal of Occupational Safety and Ergonomics*, 19(1), 19–27

- Punakallio, A., Lusa, S., & Luukkonen, R. (2003). Effects of protective equipment on the balance control among younger and older firefighters. *Aviation, Space, and Environmental Medicine*, 74(11), 1151–1156
- Rae, L. (1997). *How to measure training effectiveness* (3rd ed.). Brookfield, VT: Gower.
- Rossi, R. (2003). Fire fighting and its influence on the body. *Ergonomics*, 46(10), 1017–1033
- Siassakos, D., Draycott, T. J., Crofts, J. F., Hunt, L. P., Winter, C., & Fox, R. (2010). More to teamwork than knowledge, skill and attitude: General obstetrics. *BJOG: An International Journal of Obstetrics and Gynaecology*, 117(10), 1262–1269
- Smith, D. L., Manning, T. S., & Petruzzello, S. J. (2001). Effect of strenuous live-fire drills on cardiovascular and psychological responses of recruit firefighters. *Ergonomics*, 44(3), 244–254
- Smith, D. L., & Petruzzello, S. J. (1998). Selected physiological and psychological responses to live-fire drills in different configurations of firefighting gear. *Ergonomics*, 41(8), 1141–1154
- Smith, D. L., Petruzzello, S. J., Chludzinski, M. A., Reed, J. J., & Woods, J. A. (2001). Effect of strenuous live-fire fire fighting drills on hematological, blood chemistry and psychological measures. *Journal of Thermal Biology*, 26(4–5), 375–379
- Smith, D. L., Petruzzello, S. J., Chludzinski, M. a, Reed, J. J., & Woods, J. a. (2005). Selected hormonal and immunological responses to strenuous live-fire firefighting drills. *Ergonomics*, 48(1), 55–65
- Smith, D. L., Petruzzello, S. J., Kramer, J. M., & Misner, J. E. (1997). The effects of different thermal environments on the physiological and psychological responses of firefighters to a training drill. *Ergonomics*, 40(4), 500–510

- Soteriades, E. S., Smith, D. L., Tsismenakis, A. J., Baur, D. M., & Kales, S. N. (2011). Cardiovascular Disease in US Firefighters. *Cardiology in Review*, 19(4), 202–215
- Storer, T. W., Dlezal, B. A., Abrazado, M. L., Smith, D. L., Batalin, M. A., Txeng, C., & Cooper, C. B. (2014). Firefighter health and fitness assessment: a call to action. *Journal of Strength and Conditioning Research*, 28(3), 661–671
- Sullivan, G. M., & Feinn, R. (2012). Using effect size - or Why the p value is not enough. *Journal of Graduate Medical Education*, 4(3), 279–282
- Willi, J. M., Horn, G. P., & Madrzykowski, D. (2016). Characterizing a Firefighter's Immediate Thermal Environment in Live-Fire Training Scenarios. *Fire Technology*, 52(6), 1667–1696
- Wynn, P., & Hawdon, P. (2012). Cardiorespiratory fitness selection standard and occupational outcomes in trainee firefighters. *Occupational Medicine*, 62(2), 123–128
- Yigit, S., & Mendes, M. (2018). Which effect size measure is appropriate for one-way and two-way anova models? A Monte Carlo simulation study. *Revstat Statistical Journal*, 16(3), 295–313

APPENDICES

A. Personal Background Questionnaire

<h3>Personal Backgrounds Questionnaire</h3>

1. Would you please tell me what is your biological gender?

1) Male 2) Female

2. What is your age?

☐ Under 25 ☐ 25 to 29 ☐ 30 to 34 ☐ 35 to 39 ☐ over 39

3. What is your marital status?

☐ Single ☐ Married ☐ Divorced ☐ Widowed

4. What is your highest level of education?

☐ Graduated high school ☐ Graduated college or associate program (2 or 3 years)

☐ Bachelor's degree ☐ Master's degree ☐ Doctoral degree

5. What is your yearly household income?

- ☐ Less than \$10,000 ☐ \$10,000 – 29,999 ☐ \$30,000 – 49,999
☐ \$50,000 – 69,999 ☐ \$70,000 – 89,999 ☐ More than \$89,999

6. What is your job position?

- ☐ Fire Suppression ☐ Rescue ☐ EMS
☐ Others (_____)

7. Have you had experience of working at a fire department, being graduated from Fire Service related college, taking training at a fire academy, or other similar chances?

- ☐ Yes ☐ No

7-1. If you have experienced, which is/are your experience(s)?

(Please check all your experience)

- ☐ I have my Bachelor's degree in Fire Protection or Fire Science
☐ I finished military duty in Fire Service
☐ I have worked in Fire Service previously
☐ I have taken training in Fire Service
☐ Others (_____)

★ In regards to your personal learning style,
please fill out the following Learning Style Questionnaire.

B. Learning Effect Questionnaire

LFT Effect Questionnaire (Post-training)

Generic Questions					
Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Do you think you are prepared in terms of physical strength, such as muscular power and stamina, to deliver fire suppression activities?					
2. Do you think you are prepared in terms of metabolic fitness, such as stable heart rates and free of hyperthermia, to deliver fire suppression activities?					
3. Do you think you are prepared in terms of respiratory fitness, such as enough lung capacity and free of over-breathing, to deliver fire suppression activities?					
4. Do you think you are free from the obsession of exertion to deliver fire suppression activities?					
5. Do you think you are free from anxiety to deliver fire suppression activities?					
6. Do you think you have the proper skills to deliver fire suppression activities?					
7. Do you think you have the proper expertise about delivering fire suppression activities?					
8. Do you think you are ready to deliver team-based operations in fire suppression activities?					
9. Do you think you are ready to save your team members at risk in fire suppression activities?					

Specific Questions: Residential LFTs Building					
Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Do you think you understand the fire phenomena of residential buildings, such as house, apartment unit, and small shops?					
2. Do you think you have proper physical strength to suppress the residential building fires?					
3. Do you think you have proper metabolic fitness to suppress the residential building fires?					
4. Do you think you have proper respiratory fitness to suppress the residential building fires?					
5. Do you think you are free from the obsession of exertion of suppression activities in the residential building fires?					
6. Do you think you are free from anxiety for suppressing the residential building fires?					

7. Do you think you have the proper skills to suppress the residential building fires?					
8. Do you think you have the proper expertise to suppress the residential building fires?					
9. Do you think you are ready to deliver team-based operations in the residential building fires?					
10. Do you think you are ready to act as a team member for securing the safety of your team in the residential building fires?					

Specific Questions: Factory LFTs Building					
Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Do you think you understand the fire patterns of factory facilities, such as electricity generator fire, manufacturing machine, and material storage?					
2. Do you think you have proper physical strength to suppress the factory fires?					
3. Do you think you have proper metabolic fitness to suppress the factory fires?					
4. Do you think you have proper respiratory fitness to suppress the factory fires?					
5. Do you think you are free from the obsession of exertion of suppression activities in the factory fires?					
6. Do you think you are free from anxiety for suppressing the factory fires?					
7. Do you think you have the proper skills to suppress the factory fires?					
8. Do you think you have the proper expertise to suppress the factory fires?					
9. Do you think you are ready to deliver team-based operations in the factory fires?					
10. Do you think you are ready to act as a team member for securing the safety of your team in the factory fires?					
Specific Questions: Industrial area LFTs Facilities					
Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Do you think you understand the fire phenomena of the industrial facilities, tank lorry fire, oil storage fire, and oil refinery-tower fire?					
2. Do you think you have proper physical strength to suppress the industrial fires?					
3. Do you think you have proper metabolic fitness to suppress the industrial fires?					
4. Do you think you have proper respiratory fitness to suppress the industrial fires?					

5. Do you think you are free from the obsession of exertion of suppression activities in the industrial fires?					
6. Do you think you are free from anxiety for suppressing the industrial fires?					
7. Do you think you have the proper skills to suppress the industrial fires?					
8. Do you think you have the proper expertise to suppress the industrial fires?					
9. Do you think you are ready to deliver team-based operations in the industrial fires?					
10. Do you think you are ready to act as a team member for securing the safety of your team in the industrial fires?					

Specific Questions: Specific Fires LFTs Facilities					
Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Do you think you understand the specific fire phenomena such as flashover and backdraft?					
2. Do you think you have proper physical strength to cope with the specific fires?					
3. Do you think you have proper metabolic fitness to cope with the specific fires?					
4. Do you think you have proper respiratory fitness to cope with the specific fires?					
5. Do you think you are free from the obsession of exertion of suppression activities in the specific fires?					
6. Do you think you are free from anxiety for coping with the specific fires?					
7. Do you think you have the proper skills to cope with the specific fires?					
8. Do you think you have the proper expertise to cope with the specific fires?					
9. Do you think you are ready to deliver team-based operations in the specific fires?					
10. Do you think you are ready to act as a team member for securing the safety of your team in the specific fires?					

Specific Questions: SCBA Maze Training Facility					
Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

1. Do you think you understand the function of the respiratory device: the Self Contained Respiratory Apparatus (SCBA)?					
2. Do you think you can operate the SCBA in a dark environment?					
3. Do you think you can operate the SCBA in a complex structure inside a compartment space?					
4. Do you think you can operate the SCBA in a physically fatiguing situation?					
5. Do you think you can operate the SCBA in a mentally distressing situation?					
6. Do you think you can complete your assigned operation wearing the SCBA?					
7. Do you think you are free from anxiety when you wear the SCBA?					
8. Do you think you can help your team member to operate the SCBA in a dark environment?					
9. Do you think you can help your team member to operate the SCBA in a physically tight space?					

C. Live-Fire Training Facilities in GFSA

	<p>Overall Facilities</p> <ol style="list-style-type: none"> 1. Industrial LFT 2. Factory LFT 3. SCBA 4. Residential LFT 5. Special Phenomena LFT
	<p>SCBA</p> <ol style="list-style-type: none"> 1. SCBA manipulation in dark 2. SCBA manipulation in complex structure
	<p>Residential</p> <ol style="list-style-type: none"> 1. House LFT 2. Apartment Unit LFT 3. Small shop LFT
	<p>Industrial</p> <ol style="list-style-type: none"> 1. Oil plant LFT 2. Oil storage LFT 3. Oil spill LFT 4. Tank Rolly LFT
	<p>Special Phenomena</p> <ol style="list-style-type: none"> 1. Flashover LFT 2. Backdraft LFT 3. Multi-story LFT

VITA

CHEOLMIN JEONG

Candidate for the Degree of

Master of Science

Thesis: DOES EXPERIENTIAL LIVE-FIRE TRAINING EXERCISE IMPROVE
FIREFIGHTING READINESS?

Major Field: FIRE ADMINISTRATION AND EMERGENCY MANAGEMENT

Biographical:

Education:

Completed the requirements for the Master of Science in Fire Administration and Emergency Management at Oklahoma State University, Stillwater, Oklahoma in December 2018.

Completed the requirements for the Bachelor of Science in Law at Pusan National University, Busan, South Korea in 2007.

Experience:

Senior Safety Officer in Gyeonggi-do Disaster and Safety Headquarters
Senior Instructor at Gyeonggi-do Fire Service Academy