

# A Study on Key Factors Affecting the Effectiveness of Regular Trainings on Volunteer Firefighters With Miaoli County Fire Bureau as Example

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**Abstract-** To enrich the firefighting knowledge of volunteer firefighters, improve their rescuing skills and ensure their life safety, requirements for regular trainings on volunteer firefighters were stipulated in “Practice of organizing training exercises for volunteer fire fighting organizations” in 2001 and the “Implementation Regulations for Regular Training of Firefighters” in 1995. Along with technological development, due to such factors as changes in architecture types, climate and people’s living styles, the types of disasters have also dramatically changed, making rescue work even more difficult. As volunteer firefighters play an important role in protecting the safety of people’s life and property, they must receive perfect trainings to be able to stand out when disasters occur.

This study aims to explore the factors affecting the effectiveness of regular trainings on volunteer firefighters. Literature review was used to sum up the key factors. Then, survey analysis was made on 9 expert scholars who have participated in the regular trainings in the past three years with revised Delphi expert questionnaire method to sort out relatively objective indicators for the regular trainings on volunteer firefighters. Finally, hierarchical analysis method was used to obtain the weight value of each factor indicator. After consistency verification, the final relative weight value and its overall ranking were calculated.

The study results show that the main factors affecting the regular training effectiveness of the volunteer firefighters are "training plan", "training direction" and "training expectation" in sequence, while the impact factors that are highly valued are "adjusting teaching materials", "firefighting professional skills", "strengthening teaching resources", "teaching methods" and "to cope with the trend of the times" in sequence. The study results herein can serve as reference for the future fire departments to implement training to effectively enhance the effectiveness of regular training and increase the volunteer firefighters’ knowledge and survival chances.

**Keywords:** volunteer firefighters, regular training, training effectiveness, hierarchical analysis method

## I. INTRODUCTION

In recent years, global disasters have become increasingly huge, complex and normalized. Cooperation between government forces and non-governmental resources is a necessary means to tackle disasters. Governments around the world have been actively introducing non-governmental forces.

The quality of yearly training of volunteer firefighters has a great impact on the life safety of firefighters as well as the personal and property safety of general public. In response to the changes of urban patterns and environmental disasters, volunteer firefighters should continuously study through regular trainings to improve the quality of fire rescue and reduce the casualty rate. Therefore, the regular training of volunteer firefighters should be institutionalized, specialized and integrated in order to achieve the expected objectives.

## II. LITERATURE REVIEW

Literature review and analysis will be made in this chapter. By literature review with relevant theories as the evidence, studies will be made on the key factors affecting the effectiveness of the regular training of volunteer firefighters.

### 2.1 Overview of the meanings of training

“Training” refers to the education or coaching made on the specific pre-service or in-service objects’ thinking, behavior, knowledge, skills etc. to improve the performance of the organization. Its purpose is to improve the staff’s capability so as to achieve the policy targets of the organization or fulfill important tasks. Therefore, training is a purposeful activity, an intentional action and a systematic arrangement. Its objective is to make trainees obtain

specific knowledge, concepts and attitude through carefully designed teaching activities, so that themselves (or their group) can perform specific tasks at a certain level and achieve organizational expectations(Xuan,2001,12).

2.2 Planning and implementation of training

The implementation of training is the core work and the most tedious part of training. Whether the teaching methods used in training courses are in line with the actual needs and whether the assisting teaching environment is good or not will inevitably affect the training and its effectiveness. Organization of training is undoubtedly necessary. However, as the training requires manpower, time and funds, it is necessary to choose the appropriate time to do it, which may be subject to external or internal effects.

2.3 Investigation on current regular training of volunteer firefighters in Taiwan

Regular firefighting training may also encounter problems and difficulties as in the training of general public service organizations. Currently, most of the undertakers of education and training of fire departments in counties and cities lack professional ability of training planning and the training effectiveness and implementation evaluation. There is no further overall evaluation for the effectiveness of regular training, which is one of the major reasons for the lack of training effectiveness. Therefore, it is an important topic to train the professional ability of above-mentioned undertakers about training planning and evaluation of training effectiveness and implementation so as to improve the training effectiveness. The objective of training effectiveness evaluation is to evaluate whether the educational training has achieved the predesigned goal of training, i.e., whether the trainees have improved their work knowledge and transfer such knowledge to their work, which can serve as a reference for the overall training (Lai, 1998, 110).

III. RESEARCH METHOD

The purpose of this research is to investigate the key factors affecting the effectiveness of regular training of volunteer firefighters. The researcher collected relevant data and literatures in Taiwan as well as theoretical models of experts and scholars and then adopted the modified Delphi questionnaire analysis method and AHP hierarchical method to establish steps (as shown in Figure 1) for studying the key factors affecting the effectiveness of regular training of volunteer firefighters. Finally, the researcher integrated the indicator weight values of decision-making factors, which were ranked according to the proportion. The methods and steps of this study are as follows:

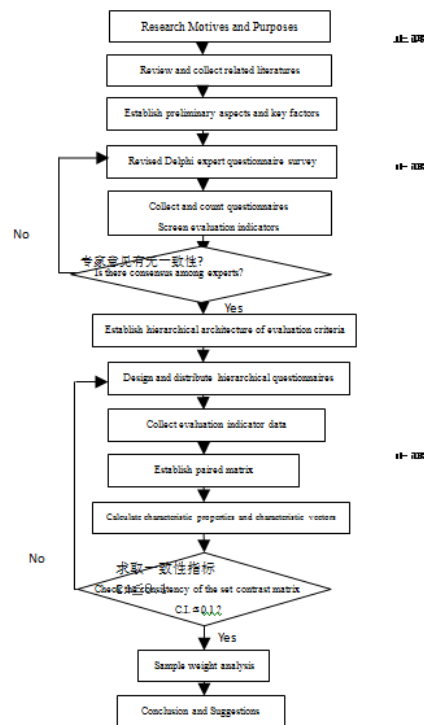


Figure 1 Research Step Diagram

Source: Compiled by this study

Step1: Formulate research topics through research motives and purposes

Step2: Literature review

Make induction and analysis through literature review to construct impact factor indicators for firefighters' regular training effectiveness; formulate aspects and impact evaluation criteria for preliminary hierarchical analysis; divide the obtained criteria into three aspects ("training planning", "training directions" and "training expectation") and 12 items of secondary criteria; determine the preliminary framework of evaluation criteria.

Step3: Design revised Delphi expert questionnaires

First, conduct two rounds of revised Delphi questionnaire survey by using the semi-open Likert five-point scale. The questionnaires are distributed to 9 expert scholars who have participated in regular trainings in the past three years. The related results are then summarized and integrated. At this stage, repeated questionnaire survey method is used to obtain the experts' opinions, and the results are integrated and analyzed until reaching the consensus degree of experts' opinions. Then the actual measurement process can be regarded as completed.

Step4: Revised Delphi questionnaire data analysis

Screen out the factors with average importance over 3.8 points as the final items of the questionnaire. After the expert opinions of the questionnaire are collected, the items with average value below 3.8 points are deleted.

Step5: Design, distribute and recover hierarchical questionnaires

Step6: Use decision analysis software to obtain the weight of each indicator and construct the impact factors selection table.

Step7: Put forward conclusions and suggestions based on study results

#### IV. RESULTS ANALYSIS AND DISCUSSION

This study selected the volunteer firefighters of Miaoli County Fire Bureau as the research objects to explore the key factors affecting the effectiveness of the regular training of volunteer firefighters. Data were collected, analyzed and discussed through questionnaire survey, and the importance and impact of dietary self-efficacy and learning self-efficacy were sorted out.

1) Results analysis of the first Delphi questionnaire survey

(1) Under the evaluation aspect of "training planning", "strengthen practical exercise" (Average mean 3.22, Standard deviation 1.20) and "make regular tests and fruit acceptance" (Average mean 3.44, Standard deviation 1.01) were deleted after expert discussion because the average mean of both items didn't reach 3.5 and their standard deviation values were more than 1.

(2) Under the evaluation aspect of "training direction", "personal interest orientation" (Average mean 2.67, Standard deviation 0.71) was deleted after expert discussion because its average mean didn't reach 3.5.

(3) Under the evaluation aspect of "training expectation", "get a certificate" (Average mean 3.33, Standard deviation 0.71) and "personal interest" (Average mean 3.22, Standard deviation 0.67) were deleted after expert discussion because their Average mean didn't reach 3.5.

(4) 5 out of the 15 items in the result evaluation criteria of the first questionnaire were deleted because their Average mean didn't reach 3.5, as shown in Table 1.

Table 1: Standard for Selecting the Evaluation Criteria of the First Round of Expert Questionnaire

Target layer	Principal criteria	Statistical results			Secondary criteria (evaluation criteria)	Statistical results			Screening Results
		Average mean	Percentage	Standard deviation		Average mean	Percentage	Standard deviation	
Study on key factors affecting the effectiveness of regular trainings on volunteer firefighters	training planning	4.78	95.6	0.44	Adjust teaching materials	4.22	84.4	0.67	Retain
					Strengthen teaching resources	4.42	88.4	0.73	Retain
					Strengthen practical exercises	3.22	64.4	1.20	Delete
					Teaching methods	4.11	82.2	0.78	Retain
					Pay attention to service requirements	4.33	86.6	0.50	Retain
					Make regular tests and fruit acceptance	3.44	68.8	1.01	Delete
	training direction	4.33	86.6	0.71	Firefighting professional skills	4.78	95.6	0.44	Retain
					Reaction at disaster relief site	4.11	82.2	0.78	Retain
					Safety during service implementation	4.44	8.88	0.53	Retain
					Personal skills	4.56	91.2	0.53	Retain
					Personal interest orientation	2.67	53.4	0.71	Delete
	training expectation	4.00	80	0.87	Applying to duty service	4.67	93.4	0.50	Retain
					Developing potentials	4.33	86.6	0.50	Retain
					Get a certificate	3.33	66.6	0.71	Delete
					Personal interest	3.22	64.4	0.67	Delete

Source: Compiled by this study.

2) Results analysis of the second Delphi questionnaire survey

he second Delphi questionnaire survey was made after integrating the two items of evaluation criteria “to cope with the trend of the times” and “Avoiding affecting original occupation” provided by the expert group in the first round of questionnaire. Statistics showed that the Average mean values of 12 items of evaluation criteria are all above 3.8 with consensus degree above 70%, representing constringent expert opinions as shown in Table 2.

Table 2: Standard for Selecting the Evaluation Criteria of the Second Round of Expert Questionnaire

Target layer	Principal criteria	Statistical results			Secondary criteria (evaluation criteria) Average mean	Statistical results			Statistical results
		Average mean	Percent age	Standard deviation		Percentag e	Standard deviation	Average mean	
Study on key factors affecting the effectiveness of regular trainings on volunteer firefighters	training planning	4.78	95.6	0.44	Adjust teaching materials	4.33	86.6	0.71	Retain
					Strengthen teaching resources	4.56	91.2	0.53	Retain
					Teaching methods	4.44	88.8	0.73	Retain
					Pay attention to service requirements	4.44	88.8	0.53	Retain
	training direction	4.33	86.6	0.71	Firefighting professional skills	4.67	93.4	0.50	Retain
					Reaction at disaster relief site	4.11	82.2	0.78	Retain
					Safety during service implementation	4.56	91.2	0.53	Retain
					Personal skills	4.67	93.4	0.50	Retain
					Coping with the trend of times	4.78	95.6	0.44	Retain
	training expectation	4.00	80	0.87	Applying to duty service	4.56	91.2	0.53	Retain
					Developing potentials	4.22	84.4	0.67	Retain
					Avoiding affecting original occupation	4.44	88.8	0.73	Retain

Source: Compiled by this study.

3) Establish layers of evaluation indicator for study on key factors affecting the effectiveness of regular trainings on volunteer firefighters

1. The first layer is the principal criteria

It is divided into three aspects, namely “training planning”, “training direction” and “training expectation”.

2. The second layer is the secondary criteria

The secondary criteria of the “training planning” aspect include “adjusting teaching materials”, “adjusting teaching materials”, “teaching methods” and “paying attention to service requirements”; the “training direction” aspect include “firefighting professional skills”, “reaction at disaster relief site”, “safety during service implementation”, “personal skills” and “coping with the trend of times”; the “training expectation” aspects include “applying to duty service”, “developing potentials” and “avoiding affecting original occupation”.

4) Analysis of principal criteria

As the number of principal criteria  $n=2$ , the comparison times  $2(2-1)/2=1$  can be regarded as constringency effect, and therefore it conforms to the consistency requirement.

5) Analysis of secondary criteria

Under importance analysis of the secondary criterial for the aspect of training planning aspect, the most significant impact is “adjusting teaching materials”(0.514), followed by “adjusting teaching materials”(0.268), “teaching methods”(0.125) and “paying attention to service requirements” (0.093).

Under importance analysis of the secondary criterial for the aspect of training direction, the most significant impact is “firefighting professional skills” (0.479), followed by “safety during service implementation” (0.186), followed by “reaction at disaster relief site” (0.158), “personal skills”(0.100) and “coping with the trend of times”(0.077).

Under importance analysis of the secondary criterial for the aspect of training expectation, the most significant impact is “Applying to duty service” (0.601), followed by “Avoiding affecting original occupation” (0.303) and “Developing potentials” (0.096).

6) Weight analysis of principal (secondary) criteria paired comparison matrix

The weight ranking was obtained after comprehensive scoring to further understand the relative importance of each impact factor, as shown in Table 3.

Table 3: Ranking of overall weight of principal (secondary) criteria

Weight Ranking	Overall Weight	Evaluation Criteria	Principal Aspect
1	0.289	adjusting teaching materials	Training Planning
2	0.161	Firefighting professional skills	Training Direction
3	0.151	Adjusting teaching materials	Training Planning
4	0.070	Teaching methods	Training Planning
5	0.063	Coping with the trend of times	Training Direction
6	0.053	Safety during service implementation	Training Direction
7	0.053	Paying attention to service requirements	Training Expectation
8	0.034	Personal skills	Training Direction
9	0.026	Reaction at disaster relief site	Training Direction
10	0.026	Applying to duty service	Training Expectation
11	0.018	Developing potentials	Training Expectation
12	0.017	Avoiding affecting original occupation	Training Expectation

Source: Compiled by this study.

## V. CONCLUSION

1. The diverse environment of Miaoli County causes many types of disasters, for which there are respective coping strategies, so the skills that require training are more complex. Unlike full-time firefighters, most volunteer firefighters have their own jobs and relatively less time to receiving professional firefighting knowledge, which highlights the importance of regular training. Therefore, a planned construction of teaching materials, teaching methods and teaching resources is needed in order to improve the training effectiveness, enhance the survival advantage of volunteer firefighters and reduce casualties.

2. With the development of science and technology and the climate change, the types of disasters have also changed. Regular training should also make progress in this direction by carrying out simulation and training in response to the trend to avoid the loss of life and property in case of new types of disasters.
3. Although the secondary criteria of the indicators in the middle and later part of the overall weight ranking is not considered by the volunteer firefighters as important criteria, it is still important to a certain extent for the key indicators identified by the expert group, and also has reference value for improving the effectiveness of the volunteer firefighters' regular training.
4. Limited by research funds, regional scope and time constraints, this study can only investigate the regular training of volunteer firefighters in Miaoli County, and select the impact factors emphasized by the volunteer firefighters in Miaoli County. Because the humanistic structure and environment are difficult to apply to other counties and municipalities, future scholars can further extend the study to the metropolitan areas.

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