

Discussion on Key Factors Affecting Rescue Ability of Field Service Staff in Design of Rescue Training Courses for Firefighting Staff- A Case Study of Miaoli County

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Abstract- Today, many complex disasters occur frequently with increasingly diversified types of disasters due to global warming, large changes in climate and rapid advancement in science and technology. Firefighters are an important human resource for firefighting agencies. When disaster strikes, the lives and property of the general public need to be protected by fully trained firefighters. Since 2008, the number of rescues in the country has increased from 750,000 to 1,100,000 per year. The dramatic year-on-year increase in the number of rescues has made rescue services the focus of the firefighting work, and the training quality and effectiveness of the rescue staffs as well as the treatment given to the people at the time of ambulance attendance are also closely related to the people's life support. This study defined the key factors of the design of the rescue training that influence the rescue ability of the field personnel, built a decision-making hierarchical structure based on literature, and finally discussed the weight of the impact of rescue training on the ability of a rescue technician via analytic hierarchy process (AHP).

This study found that in the primary criteria for decision-making factors that affect the quality of rescue training, the main emphasis for the ambulance technician is the training planning aspect, followed by the training method aspect, and finally the training expectation aspect; the training materials, teaching methods and professional skills are particularly important for influencing the quality of rescue training in the secondary criteria. It can be seen that the factors related to the training planning aspect have a certain influence, consistency and continuity on the results of ambulance technician training, and will affect the decision-making model of the rescue training design, so the training planning has become the most important factor in the training results of ambulance technicians.

Keywords: firefighters, rescue education and training, AHP (analytical hierarchy analysis)

I. INTRODUCTION

Emergency ambulance is one of the important social benefits in recent years. It provides timely rescue and treatment for urgent injuries and illnesses and the need for medical care with the most rapid efficiency. At present, emergency ambulance work accounts for more than 80% of all fire-fighting services.

The firefighters' ambulance and rescue capabilities have a great impact on the rights and interests of the people, as well as the safety of their lives and property. Firefighters must continue to learn through the rescue training of firefighters in response to changes in the time, improve the quality of firefighting and ambulance services, and provide people with more efficient services; therefore, firefighter training should be planned in a professional, integrated and institutionalized way to improve the quality of firefighters' ambulance service.

II. LITERATURE REVIEW

This chapter focuses on the preliminary analysis of the factors affecting the quality of rescue training through the literature, as well as the types of firefighters' rescue training courses suitable for Miaoli County. In addition, because this study used AHP (analytical hierarchy analysis) to explore the factors that affect the quality of firefighters' rescue training, understanding the theory of AHP is also the focus of this chapter.

A. Purpose and Function of Training

Training should be seen as an integral part of the core organizational strategy, rather than as an activity designed for a specific goal. Similarly, training should not be seen as a mere means. Instead, it can act as an incentive for employees. (Wu, 1994)

B. Purpose of Assessing Training Effectiveness

The most important purpose of training assessment is to organize training evaluations to understand the true results of employee training on their contribution to the organizations and to clarify the effectiveness and function of the training. The complete education and training should include the training evaluation aspect, which is to understand the time, manpower and capital cost put in the training, and the resulting benefits. (Roberts, 1990)

III. PROPOSED ALGORITHM

The purpose of this study was to explore the factors of the design of rescue training program that influence the ambulance technicians' ability. The relevant statistical data and literature from Taiwan were collected. The subjects were 45 staffs performing rescue service from Miaoli County. AHP was used to establish the decision-making hierarchical structure of factors with an impact on the training quality of ambulance technicians. The weights of each decision-making factor index were collected and ranked according to the proportion to write this paper.

Step 1: First use literature analysis to confirm the research topic.

Step 2: Design, send and recover hierarchical questionnaires.

Step 3: Analyze survey results with AHP

In the selection process, the proportions of all element criteria in the reference hierarchy were obtained and provided to the decision maker to analyze and select the optimal plan.

Step 4: Have a comprehensive analysis of the factors influencing the decision-making of the ambulance technicians' training quality.

After the hierarchical questionnaires were recovered, they were analyzed by analytical hierarchy process (AHP) and divided into three parts: the first part is the target layer, which is the goal that the study is expected to accomplish, "The decision-making factors of the rescue training course design that impact the rescue ability of the field staff". The second part is about primary criteria for the evaluation of the factors of the design of the rescue training courses that affect the rescue ability of the field staff, including three aspects: training planning, training methods and training expectations. The third part is the secondary criteria for impact: 10 items including training materials, teaching methods, regular exams, training of teachers, professional skills, updating rescue information, on-the-spot response, certifications, application to service and building self-confidence.

Step 5: Use decision-making analysis software to obtain the weight of each indicator and establish a selection table for the impact factors.

Saaty (1990) believes that when C.R. value is closer to 1, it means that the rating is randomly generated; when the C.R. value is closer to 0, the higher the consistency is. Therefore, in principle, when $C.R. \leq 0.1$, the consistency of the matrix is acceptable; if $C.R. > 0.1$, it means that the assessment results are inconsistent and need to be re-assessed.

Step 6: Propose conclusions and recommendations according to the results of the study.

IV. ANALYSIS AND DISCUSSION OF RESULTS

The subjects of this study were field personnel of the fire department of Miaoli County government. The decision-making factors of the rescue training design that affect the rescue ability of the field personnel were discussed in this study. Data collection, analysis and discussion were conducted through questionnaire surveys, and the importance and impact of training course design for field firefighters were sorted.

A. *Establish the criteria hierarchy of decision-making factors in designing rescue training that affect rescue ability*

(1)The first layer is the primary criteria.

There are three aspects, namely "training planning", "training methods" and "training expectations" respectively.

(2)The second layer is the secondary criteria

The secondary criteria of the training planning include 4 items such as “training materials”, “teaching methods”, “regular exams”, and “training of teachers”; the secondary criteria of the training methods include 3 items such as “professional skills”, “updating rescue information”, “on-the-spot response”; the secondary criteria for the training expectations include 3 items, “certification”, “application to service” and “building self-confidence”. There are 10 secondary criteria in total.

B. *Analysis on the primary criteria*

As the number of primary criteria $n = 3$, the number of comparisons was $3(3-2)/2 = 3$ times. It was learned that the most important indicator of factors affecting the quality of rescue training was the training planning with a weight of 0.538. The second most important person was the training methods with a weight of 0.346, the last was training expectations, with a weight of 0.116. This weight result showed that in the primary criteria for the rescue training factors affecting rescue training quality, the training planning was the most important, and the importance of which was more than 50% of the primary criteria. Due to the needs and characteristics of the task, the training method was also an important factor affecting the quality of rescue training; and the following factor was the training expectations.

Table 1: Paired Comparison Matrix of the Main Criteria of Decision-making Factors that Affect designing rescue training that affect rescue ability

Paired Comparison Matrix of the Main Criteria of Decision-making Factors that Affect designing rescue training that affect rescue ability					
	Training planning	training methods	training expectations	Weight	Ranking
Training planning	1	2.157	3.529	0.538	1
Training methods	0.464	1	4.165	0.346	2
Training expectations	0.283	0.240	1	0.116	3

C. *Analysis on the secondary criteria*

(1) Analysis of the importance of training planning aspect in the secondary criteria

The “training materials”had the greatest impact, reaching 0.187, followed by “training methods”, which accounted for 0.182. The next was “training of teachers”, accounting for 0.089, and finally “regular exams”, accounting for 0.080.

(2) Analysis of the importance of training method aspect in the secondary criteria

The AHP analysis results showed that the most important factor in the aspect of training method was the “professional skills”, which was 0.179, followed by “updating rescue information”, accounting for 0.096, and finally the “on-the-spot response”, accounting for 0.072.

(3) Analysis of the importance of training expectations aspect in the secondary criteria

The results of this aspect analysis showed the highest proportion in the “certification”, which is 0.050, followed by “application to service”, accounting for 0.045, and the last was “building self-confidence”, accounting for 0.021.

D. Primary (secondary) criteria pairwise comparison matrix weight analysis

After the comprehensive rating, the weight ranking is obtained, which can be used to further understand the relative importance of each influencing factor.

Overall, the two primary criteria and ten secondary criteria evaluation factors were combined to show that the first to third overall weights were ranked as follows: training materials (0.187), teaching methods (0.182) and professional skills (0.179). Those three assessment criteria also accounted for 54.8% of the total weight. This study classified the three assessment criteria as the [highly valued] factors that affect the field firefighters in Miaoli County; and the weights that ranked 4th to 6th were updating the rescue information (0.096), teacher training (0.089) and regular exams (0.080). These three assessment criteria also accounted for 26.5% of the total weight. This study classified these three assessment criteria as being [moderately valued] by field firefighters in Miaoli County. The remaining assessment criteria were the influencing factors of the [lowly valued] by the field firefighters in Miaoli County.

Table 2: Weight Analysis of Paired Comparison Matrix

Weight Analysis of Paired Comparison Matrix						
Main Norm level			Secondary Norm level		Multiplication level	
Main Norm	Weight of Main Norm	Ranking	Secondary Norm	Weight of Secondary Norm	Weight multiplication	Ranking
training planning	0.538	1	training materials	0.347	0.187	1
			teaching methods	0.338	0.182	2
			regular exams	0.149	0.080	6
			training of teachers	0.166	0.089	5
training methods	0.346	2	professional skills	0.517	0.179	3
			updating rescue information	0.276	0.096	4
			on-the-spot response	0.207	0.072	7
training expectations	0.116	3	certification	0.432	0.050	8
			application to service	0.390	0.045	9
			building self-confidence	0.177	0.021	10

V. CONCLUSIONS

(1) Training material is at the top of the weight: only when there are complete training materials, a good training environment can be provided to improve the results of training. Therefore, training material is the factor that is given priority by field firefighters for consideration.

(2) Teaching method is the second important weight: the teaching method varies. If the training method can be adjusted properly for the training course and the trainees, the effect will be very different.

(3) Professional skill is the third most important weight: with professional rescue skills, field colleagues are able to provide people with proper rescue service when facing the different rescue cases. This is also an important factor for the field firefighters to consider.

Over the past years, the number of rescue cases has risen dramatically, making rescue services a key item in firefighting. Through firefighting training, field firefighters have developed rescue ability and ambulance care ability in the rescue service. At this time, a sound and efficient training design shows its importance. Therefore, if the results of this study can be provided to the fire station and the Miaoli county government to be used as a reference for subsequent training in rescue training courses, so that training materials and teaching methods and professional skills should be given priority to consider in the design of a training course for Miaoli County firefighting field colleagues, it will effectively improve their ability in the rescue service.

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