

Paper:

A Proposal for Effective Emergency Training and Exercise Program to Improve Competence for Disaster Response of Disaster Responders

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This paper develops a training and exercise program to improve the competence of disaster responders in emergency situations. The concept of instructional design, one of the theories of learning in the field of education, is used to set learning goals and develop the overall training and exercise program. The learning program developed in the study includes three stages of learning: “learning,” “drilling,” and “exercising.” The program has been improved through three implementations. As a result, evaluations of the effectiveness of the program of training and practice show that it effectively improves one’s disaster response competencies.

Keywords: disaster responders, training and exercise program, competence for disaster response

1. Introduction

1.1. Needs for Effective Emergency Training and Exercise : Current Situation

In a disaster, disaster responders are required to gather and send information, make decisions, and coordinate with other sections, departments, and relevant organizations, etc. rapidly and appropriately under extraordinary circumstances. Those responses greatly rely on manpower, so the type and degree of the responses tend to vary with the experience and ability of the responders. In addition, it is important for organizations to maintain their disaster response competence considering the fact that disaster responders in public administrations or similar organizations usually relocate every couple of years. Therefore, between disasters, which are by nature unpredictable, disaster response organizations must systematically and effectively develop human resources that have the requisite abilities for disaster response so that they can utilize the resources effectively when disaster strikes.

The ability of organizations and their members to respond to emergencies is effectively improved by training and exercise which target disasters, accidents, and incidents, and various organizations, such as the national gov-

ernment, local governments and public authorities, private companies, and local communities, have been doing just that. However, these training programs and exercise sessions have not encouraged disaster responders in public administrations to achieve their goals appropriately, i.e., to improve their disaster response competence.

Exercises conducted by public administrations tend to be perfunctory rituals following set schedules and performed for their public relations appeal. From the point of view of public administration staff, Saito (2006) voices the criticism that most of exercises conducted by local authorities are scripted. The exercises are actually based on scenarios which direct the participants: when the staff salutes, what they report, and how the governors reply to them. Whether they actually foster autonomous disaster response abilities is questionable.

There is a local authority that conducts an annual map simulation exercise in which disaster responders practice a part of their emergency manual. The exercise updates its program in ways such as by targeting different disasters each year and adding press conferences and various other situations. However, it has not been established as an effective emergency exercise.

1.2. Need for Effective Training and Exercise Program

An awareness of emergency training and exercise programs is growing in Japan. Many studies target the improvement of disaster responders’ disaster response competence or the development of human resources. There has been progress in studies on disaster response exercises and map simulation exercises [2] to [4]. In an effort to widely introduce map emergency exercises led by municipal governments, in 2005, the People Protection and Emergency Response Office of the Fire and Disaster Management Agency provided local authorities with a report including types and characteristics of map exercises, examples of past exercises, and a model for conducting map exercises for municipal governments of cities with populations below 100,000 [5].

However, although those studies and efforts give actual procedures for single exercise programs, none of them has

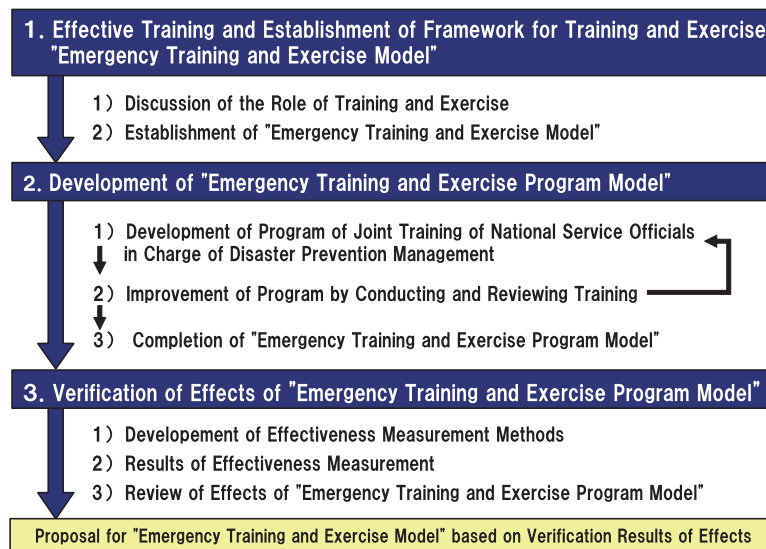


Fig. 1. Flow of the study.

ever shown the structure of programs to comprehensively improve the abilities necessary for disaster response. It can therefore be said that effective emergency training exercises and programs have not actually been established. What is more, there is no method of evaluating their effectiveness. Therefore, for the effective development of human resources, it is urged that a training and exercise program be developed that comprehensively improves the abilities disaster responders need.

2. Purpose of Development of Effective Exercise Program and Approach

2.1. Purpose of Study

The study intends to develop a training and exercise program that appropriately and effectively improves the emergency response competencies of disaster responders. More specifically, the study intends to develop a program to effectively improve the competency of disaster responders and a method of evaluation, similar to the training and a program at the Joint Training of National Service Officials in Charge of Disaster Prevention Management, directed by the Cabinet Office of the Japanese National Government.

2.2. Method of Study

The training and exercise program was developed following this four-step procedure: (1) reviewing the role of training and exercise, building the "emergency training and exercise model" as a basic framework for the program, and, based on the model built, designing the emergency training and exercise program model as an actual program, (2) developing a specific curriculum and teaching materials based on the emergency training and exercise program model, conducting the program in training, improving the program based on reviews of training, and

developing the emergency training and exercise program model, (3) measuring and examining the effectiveness of the emergency training and exercise program model to demonstrate the efficacy of learning, and (4) proposing a training and exercise program that effectively improves the disaster response competencies of disaster responders based on the concept of learning goals of instructional design established in the field of education (Fig. 1).

3. Building a Framework for Effective Emergency Training and Exercise

3.1. Reviewing the Role of Training and Exercise

Learning is a process of imitation and emulation to acquire certain knowledge, skills, and attitudes. Training and exercise are opportunities to learn how to acquire necessary abilities. It is important to focus on and review the learning process from the point of view of learners when we review the role of training and exercise that provide learners with opportunities to acquire knowledge and skills effectively. As a learning process of learners, the study focuses on a learning process that combines three elements of development of human resources: "learning," "drilling," and "exercising" (Hayashi, Maki, et al., 2009) [6] to [8] (Fig. 2).

Figure 2 shows that the three elements, "learning," "drilling," and "exercising," are not separated but related to one another as a learning process that emphasizes steps by which learners acquire abilities. First, in the "learning" step learners understand basic theories and rules as knowledge. Next, based on the knowledge understood in the "learning" step, they proceed to the next step, "drilling," where they improve their proficiency in the skills based on the knowledge they have.

Then, based on the knowledge and skills they acquired in the steps of "learning" and "drilling," they proceed to

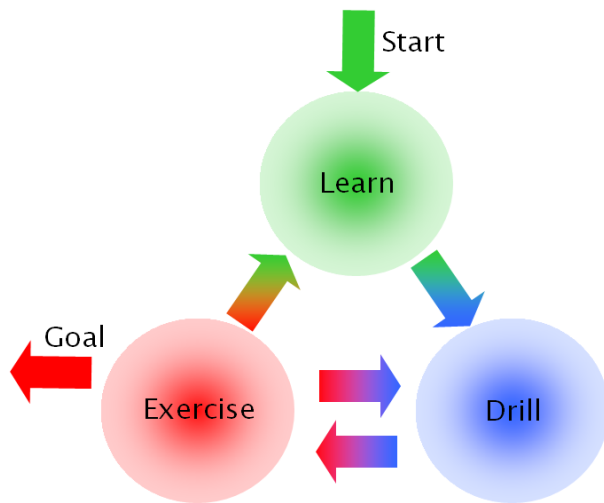


Fig. 2. Learning process model.

the “exercising” step to make sure they have really acquired the target knowledge and skills and if they can make full use of them according to the situation. That is, through the process of “learning,” “drilling,” and “exercising,” those who do not know what to do will learn what to do, and those who are unable to do something even though they know what to do will be able to do it if they try. Then, they can use the knowledge and skills that they have acquired so as to appropriately make a decision and carry it out appropriately in various situations. The study uses the learning process model with a combination of the three elements, “learning,” “drilling,” and “exercising,” to build the “emergency training and exercise model” and effectively foster disaster responders.

3.2. Building an Emergency Training and Exercise Model

We built an actual emergency training and exercise model with the learning process of “learning,” “drilling,” and “exercising” in terms of “learning goal” and “learning method.”

3.2.1. Learning Goal

A learning goal means a competency that a learner is supposed to acquire in the training and exercise program (competency: performance ability), i.e., “knowledge,” “skills,” and “attitudes” (KSA: Knowledge, Skill, Attitude) necessary for each learner to improve his competency [9].

The three elements of “learning,” “drilling,” and “exercising” correspond to “knowledge,” “skills,” and “attitudes,” respectively, which are abilities that learners acquire through training and exercise. A learner “learns knowledge,” or understands distinctions, concepts, rules, and problem solving as knowledge. A learner “drills skills,” or masters motor skills and performances. A learner “tries things out” to acquire “attitudes,” and he appropriately and safely makes full use of acquired “knowledge” and “skills” according to situations. That is, the

three elements of “learning,” “drilling,” and “exercising” are understood as learning goals in the acquisition of “knowledge,” “skills,” and “attitudes.”

3.2.2. Learning Method

Next, we discuss a learning method to acquire the three competencies – the “knowledge,” “skills,” and “attitudes” needed by disaster responders – in view of their correspondence to “learning,” “drilling,” and “exercising.” We define “learning” as getting knowledge of the target matter by studying it. We define “drilling” as rehearsing to acquire the necessary skills to perform the target behavior. We define “exercising” as making sure they have acquired “attitudes” to appropriately make full use of “knowledge” and “skills” that they have acquired by “putting into practice.” That is, the three elements of “learning,” “drilling,” and “exercising,” respectively.

3.2.3. Designing an Emergency Training and Exercise Model

In view of “learning goals” and “learning methods” 3.2.1. and 3.2.2., we design the “emergency training and exercise model,” which improves the abilities of learners in the process of “learning,” “drilling,” and “exercising” in stages as follows.

The goal of “learning” is to acquire the “knowledge” of the information and ways of thinking to which disaster responders conform when they make decisions for disaster response. Specific knowledge” includes basic types and characteristics of disastrous events, terms and ways of thinking unique to disaster prevention to be shared with disaster responders, rules and regulations of organizations for smooth disaster responses, and procedures to solve problems that disaster responders face. “Learning methods” to understand those things include lectures given by the instructor, “disaster ethnography [10] learning” to learn a lesson and find disaster responses through listening to those who were present on the spot of a disasters or through written materials, and “mental training” to picture the situation in which the learner handles disaster responses and deepens his understanding of what to do in a disaster.

We define the “learning goal” of a “drill” as the mastering of response procedures, handling procedures, and operation methods of secure, speedy disaster response in any disastrous situation as “skills.” Specific skills include procedures to follow in the planning and carrying out of measures against disasters; procedures to follow in the gathering, summarizing, and transmitting of information such as disaster information, damage information, and response information; and operation procedures for equipment used in disaster response. Appropriate “learning methods” to acquire those skills include “lecture,” i.e., oral explanation given by an instructor who has acquired the skills; “demonstration,” i.e., the actual performance of a skill by an instructor; and “functional exercise (drill),” i.e., the repetition of skills in an area of disaster response, such as information handling.

Table 1. Disaster prevention training and exercise model.

	Learning Process		
	Stepwise, Short-term Improvement of Abilities through a Combination of "Learning," "Drilling," and "Exercising"		
Learning Action	Learn	Drill	Exercise
	Those who do not know what to do will learn what to do.	Those who are unable to do something, even though they know what to do, will become able to do it.	Those who can carry something out but do not do it routinely will carry it out routinely.
Learning Goal	Knowledge	Skills	Attitudes
	Understand distinctions, concepts, rules, and problem solving as knowledge.	Master skills of natural, secure, and speedy disaster response in any situation of disasters.	Select safe, appropriate actions.
	<ul style="list-style-type: none"> ● Understand information, get knowledge, and learn ways of thinking on which individual disaster responders base their disaster responses, as "knowledge." 	<ul style="list-style-type: none"> ● Master response procedure ● Master handling procedure ● Master method of operation 	<ul style="list-style-type: none"> ● Appropriately select and utilize acquired knowledge and skills so as to smoothly respond to disasters in cooperation with relevant sections in one's own organization or other relevant organizations ● Ascertain if relevant organizations can work together (including confirmation of ability to transmit information and ability to build mutual understanding and relationships of trust among individuals and organizations)
Learning Methods	Learning	Rehearsal	Practice
	<ul style="list-style-type: none"> ● Lectures ● Listening Sessions ● Mental Training ● Disaster Ethnography Learning 	<ul style="list-style-type: none"> ● Lectures ● Demonstrations ● Function Exercise (Drills) 	<ul style="list-style-type: none"> ● Desk Practice ● Function Practice ● Comprehensive Practice ● Hands-on Practice (Exercising)

We define the "learning goal" of an exercise as the acquisition of "attitudes" requisite to the selection of optimal and safe actions appropriate to the situation and using the knowledge and skills acquired through "learning" and "exercising." More specifically, the "learning goal" includes the ability to smoothly respond to disasters by appropriately taking the optimal action using acquired knowledge and skills and working together with relevant sections and organizations. Appropriate "learning methods" to acquire those attitudes include "practice" ("desk practice," "function practice," "comprehensive practice," "hands-on practice," etc.) for rehearsal and exercise performance on the assumption of actual duties.

4. Design of Program Model for Joint Training of National Service Officials in Charge of Disaster Prevention Management

Based on **Table 1** of the previous section, "Emergency Training and Exercise Model," we designed a specific emergency training and exercise program for "Joint Training of National Service Officials in Charge of Disaster Prevention Management."

4.1. Joint Training of National Service Officials in Charge of Disaster Prevention Management

Joint Training of National Service Officials in Charge of Disaster Prevention Management is an emergency training program for service officials in charge of disaster prevention who engage in disaster emergency operations in national organizations (the Cabinet Secretariat and 13 government Ministries). The first purpose is the devel-

opment of skills to cope with situations that require quick decisions and actions in unexpected situations, in addition to the acquisition of knowledge of emergency disaster response and the ability to coordinate with various organizations in times of disaster. The second purpose is the fostering of participants' sense of unity and solidarity so that the government as a whole takes measures. This sense is believed to be fostered by assembling working-level officials in charge of disaster response (personnel who work in the government headquarters when it is set up) for training. The two-day training session is held annually in order to provide training for around 50 participants. The authors have been involved in the planning and operation of the training sessions since 2007 as researchers, and the study includes training sessions conducted in 2007, 2008, and 2009.

4.2. Development of Emergency Training and Exercise Program Model

Table 2 shows a program developed for the Joint Training of National Service Officials in Charge of Disaster Prevention Management, with the emergency training and exercise model as a basic framework.

4.2.1. Learning

(1) Learning 1 : To Obtain Knowledge at "Lectures"

They "learn" information and learn from experiences related to problems in disaster response. They also learn of areas to be strengthened, such as basic knowledge of disaster response, status of the activities, and status of response in affected local authorities. More specifically, instructors give lectures on the subject, and after the lec-

Table 2. Disaster prevention training and exercise program.

	Learning Process		
	Stepwise, Short Term Improvement of Abilities through Combination of "Learning," "Drilling," and "Exercising"		
Learning Action	Learn	Drill	Exercise
	Those who do not know what to do will learn what to do.	Those who are unable to do something even though they know what to do will become able.	Those who can carry out something but do not routinely do it will carry it out routinely.
Learning Goal	Knowledge	Skills	Attitudes
	<ul style="list-style-type: none"> ●Acquire Knowledge Related to Emergency Disaster Response. ●Deepen Understanding of Activity Outlines during Emergency Response. 	<ul style="list-style-type: none"> ●Understand Role and Work of the Cabinet Office of the Japanese National Government (Disaster Management) and the Cabinet Secretariat. ●Drill the Skills Related to the Ability to Coordinate with Various Organizations Necessary when Disaster Strikes. ●Drill the Skills Needed for Coping with Situations that Require Quick Decisions and Actions in Unexpected Situations. 	<ul style="list-style-type: none"> ●Acquire the Ability to Coordinate with Various Organizations Necessary when Disaster Strikes. ●Acquire the Ability to Cope with Situations that Require Quick Decisions and Actions in Unexpected Situations.
Learning Methods	Learning	Rehearsal	Practice
	<p>①Listening Sessions Attend listening sessions on issues in disaster response and issues to be strengthened which fit the goals of Joint Training of National Service Officials in Charge of Disaster Prevention Management. Hold a question and answer session after the listening session.</p> <p>②Disaster Ethnography Use disaster ethnography and write down questions and new information related to disaster response on cards for verbalization to deepen the understanding of activity outlines used in the course of emergency response and the knowledge of disaster response. In the latter half of the training, each group discusses and presents lessons they learned in the training process and shares their acquired understanding and knowledge with others to further deepen their understanding.</p> <p>Rehearsal</p>	<p>③ Lectures on Effective Information Handling Procedures in Emergency Response Drill the techniques of experts conveyed through lectures on the role of the Cabinet Office of the Japanese National Government (Disaster Management) and the Cabinet Secretariat (Safety and Crisis Management), which is the government's center of information operations for disaster response. The lectures are entitled "Goal of Information Handling," "Information Handling Function and Information Handling Procedure," and "Information Gathering and Organizing."</p>	<p>④Initial Response and Information Handling Exercise in the Government Deepen understanding of the role and the work of information handling operations carried out by the Cabinet Office of the Japanese National Government (Disaster Management) and the Cabinet Secretariat through simulating desk exercises of practical operations, taking specific cues to establish cooperation guidelines, and "Exercising" disaster response through information handling.</p>

tures they have question and answer sessions to deepen the trainees' understanding of the content of the lectures.

- (2) Learning 2 : To Deepen Knowledge and Understanding through "Learning about Disaster Ethnography"

The learning focuses on the systematic understanding of experiences and implicit knowledge of actual disaster responses through interviews which people who have engaged in emergency response. It also focuses on the utilization of "disaster ethnography" [8] prepared for future lessons in disaster response. More specifically, participants are divided into groups to read disaster ethnographies and then write down questions and new findings related to disaster response on cards for verbalization. Thus, they "learn" disaster response and activity outlines for disaster response. In the last half of the training, the groups each discuss and present lessons they have learned in the training process and share their understanding and knowledge with other participants to deepen their understanding. As teaching materials, we use "Disaster Ethnography Teaching Materials" (A1) which presents the results of ethnography research (A2) on findings by responders to the South Hyogo Prefecture Earthquake of 1995, the Central Niigata Prefecture Earthquake of 2004, the Niigataken Chuetsu-oki Earthquake of 2007, and the Iwate-Miyagi Nairiku Earthquake of 2008, among others.

4.2.2. Drill

- (1) Drill : To Rehearse "Effective Information Handling Procedure in Emergency Response"

Participants learn "standard emergency response systems" from experts. They learn them through lectures, such as "workflow of government emergency response" and "response procedure of each disaster responder." They then drill them to learn the basic thinking behind government disaster response and basic rules and principles of disaster response. After that, they "drill" basic rules and processes of disaster response by confirming the actual procedures in groups and rehearsing them together.

Experts have created a textbook entitled the "Standard Textbook on Disaster Prevention and Knowledge," which includes the "Standard Emergency Response System," "Emergency Response System of Japan," "Workflow in Emergency Response," and "Information Handling and Response Procedure."

4.2.3. Exercise

- (1) Exercise : To Practice Disaster Response with "Initial Response and Information Handling Exercise in the Government"

Participants foster what they have learned through information handling simulations (information handling exercises) at the disaster headquarters of the government

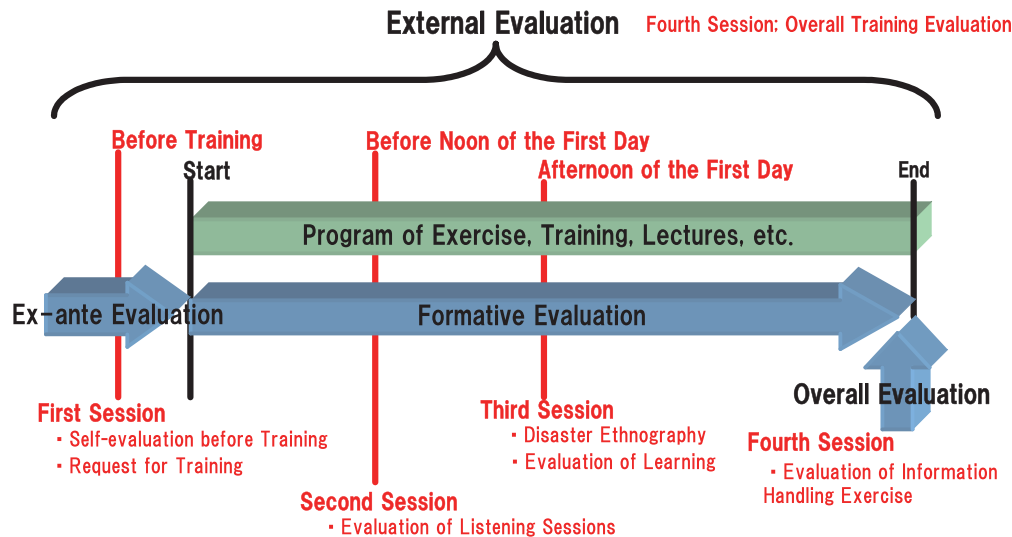


Fig. 3. Timing of effectiveness measurement.

as competencies for disaster response and “exercise” it. More specifically, they deepen their understanding of the role and the work of information handling and take specific cues to establish cooperation guidelines through information handling simulations conducted by the Cabinet Office of the Japanese National Government and the Cabinet Secretariat. Thus, they practice disaster response through information handling.

The teaching materials used are actual records of information handling at disaster headquarters during the Central Niigata Prefecture Earthquake of 2004, the Niigataken Chuetsu-oki Earthquake of 2007, and the Iwate-Miyagi Nairiku Earthquake of 2008, records from immediately after the earthquake struck. Information handling in disaster response intends to illustrate the “big picture” of disaster situations and responses at a certain point of time to combine present activity plans based on information gathered. Therefore, in the exercise, they practice a program of information gathering and summarizing which includes the process of using information actually utilized in the handling of actual disasters as teaching material to practice the execution of information handling, issuing “reports” to inform those involved of the details of the damage, state of the government’s response, and briefing the Prime Minister on the relevant information (one of the researchers plays the role of the Prime Minister).

4.3. Improvement of Program Content by Conducting and Reviewing Training

The program was designed based on the emergency training and exercise model. The efficacy and validity of the program are reviewed by training planners and those involved, based on attitudes and presentations of the participants, so as to improve the emergency training and exercise program for the next time. We evaluated the program twice, in 2007 and 2008, and we found most of improvements to be related to time changes, progressions, equipment preparation, etc. There have been no major modifications. Therefore, we set the emergency training

and practice program on completion of the 2008 session as the final version of our program for the improvement of disaster response skills.

5. Validation of Effects of National Service Officials’ Emergency Training Program

In order to verify the effects of the completed emergency training and exercise program model, we surveyed all of the participants in the 2009 Joint Training of National Service Officials in Charge of Disaster Prevention Management to measure the effectiveness of the program.

5.1. Development of Effectiveness Measurement

We set measurement targets, measurement procedures, measurement timing, and evaluation scales to measure the effectiveness of the training.

5.1.1. Measurement Targets and Means

We surveyed all participants to measure the effectiveness of the program. Since it was a good opportunity to gather a great amount of data from a great number of people at a time, we conducted a survey to measure the participants’ self evaluation.

5.1.2. Evaluation Timing

According to Nakahara, et al. (2006), there are four means evaluating the learning goals of training and exercise programs: an ex ante evaluation done before the activity, a formative evaluation done in the middle of the program, an overall evaluation done after the program, and an external evaluation to see the program objectively and to evaluate improvement in contents and environments [11]. Based on this, we surveyed all of the participants at four different times: before the training, before noon on the first day, after noon on the first day, and after the completion of the training (Fig. 3).

Verbal Information	Get Verbal Information(Verbal Info)	State	Say/Write Contents
Intellectual Skills	Discriminate	Describe	Describe Contents
	Identify	List	Itemize Contents
		Recognize	Recognize an Event as an Issue
		Define	Define an Issue
	Classify	Match	Match an Issue with a Frame
	Demonstrate	Classify	Classify a Situation and a Level
Cognitive Strategies	Adopt Strategies (Adopt)	Demonstrate	Give an Example
		Generate	Generate a New Rule
		Plan	Plan
		Establish	Establish a System
Attitudes	Choose Attitudes (Choose)	Maintain	Maintain a System
		Develop	Develop
		Discuss	Discuss
		Involve	Play a Role
Motor Skills	Execute Response (Execute)	Participate	Participate
		Complete	Complete One's Own Mission
		Implement	Take an Action
		Provide	Provide an Outcome
		Manage	Manage
		Coordinate	Coordinate with Other Individuals and Organizations

Fig. 4. Emergency training and exercise program model.

Table 3. Five classifications of learning outcomes by gagne.

Verbal Information	Knowledge that can be stated in words. Task to memorize designated items.
Intellectual Skills	Discrimination of things, application of rules and principles, and abilities to make full use of symbols such as problem solving. Learning of rules to apply a principle to unfamiliar instances.
Cognitive Strategies	Learners' ability to control learning, recollection, and thinking of themselves. Learn "how to learn" so as to learn effective learning, recollection, and thinking.
Attitudes	Inner state that affects learners' individual decision making.
Motor Skills	Combined movements of skeletal muscles to achieve an action with a goal.

5.1.3. Setting of Evaluation Scale

We adopted the concept of five classifications of learning outcomes, "Verbal Information," "Intellectual Skills," "Cognitive Strategies," "Attitudes," and "Motor Skills," by Robert M. Gagne (**Table 3**) [12] to measure whether disaster responders have acquired the necessary abilities, i.e., the instructional goals. This concept is positioned as a framework of basic learning goals of "instructional design," which promotes learning systematically, effectively, and efficiently. Thus, we set an evaluation scale to verify the effects of the National Service Officials Emergency Training Program. The concept of the five classifications is divided into nine instructional events and further classified into 21 specific actions. We reset those

21 items as those required for disaster response competence and reviewed the evaluation scale used to measure the learning effects of the emergency training and exercise program. From among the 21 items, we cut out four items that did not fit as abilities to be acquired in the training and settled on an evaluation scale comprised of 17 items (**Fig. 4**).

5.2. Effectiveness Measurement

We measured the effectiveness of the emergency training and practice program on the 17 items on the evaluation scale.

5.2.1. Intellectual Skills Measurement

Intellectual Skills were evaluated as shown in **Fig. 5**. (1) The score of "Recognize that the Event Requires Disaster Response" (Recognize) increased as the training progressed, although it was high even before the training. (2) The score of "Define Issues to Respond to According to the Situation" (Define) increased rapidly after the lecture and then increased in stages. (3) The score of "Match Issues to Respond to with Existing Rules and Knowledge" (Match) increased markedly due to ethnography. (4) The score of "Classify Disaster Situation and Damage Level" (Classify) was negative before the training but became positive after the lecture and increased with the exercise. (5) The score of "Generate New Rules in Difficulty in Responding" (Generate) was negative before the training but increased dramatically with the ethnography.

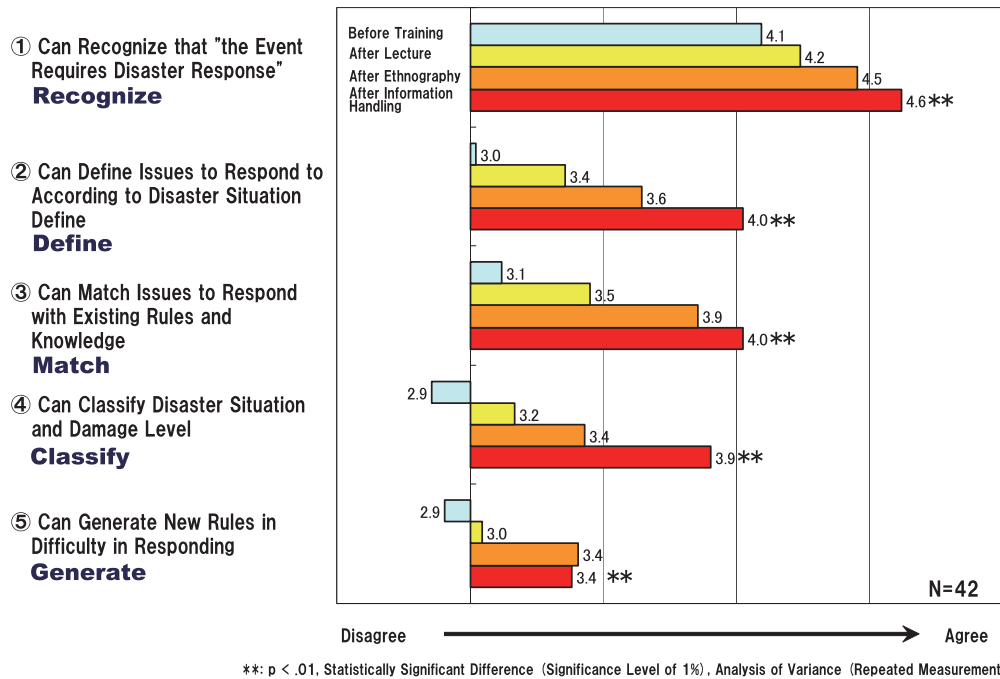


Fig. 5. Self-evaluation of disaster response ability (intellectual skills: identify, classify, and generate).

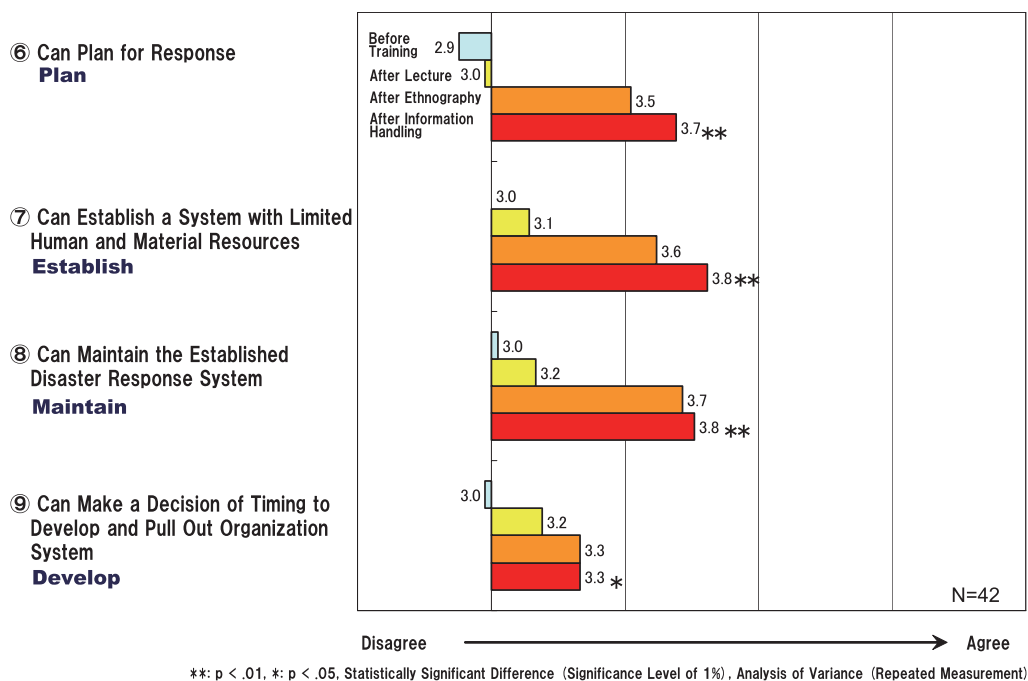


Fig. 6. Self-evaluation of disaster response ability (cognitive strategies: adapt strategies).

5.2.2. Cognitive Strategies Measurement

Figure 6 shows the results of Cognitive Strategies measurement. Any of the score of (6) "Plan for Response" (Plan), (7) "Establish a System with Limited Human and Material Resources" (Establish), (8) "Maintain the Established Disaster Response System" (Maintain), and (9) "Decide Timetable for System Development and Pull Out" (Develop) increases significantly after the disaster ethnography. Since the exercise did not include pullout in

(10) "Develop," the score did not change after the information handling exercise.

5.2.3. Attitude Measurement

Figure 7 shows the results of Attitude measurement. All four scores of (10) "Discuss with Those Relevant to Response" (Discuss), (11) "Be Involved in a Role in and between Response Organizations" (Involve), (12) "Participate in Disaster Response" (Participate), and (13) "Com-

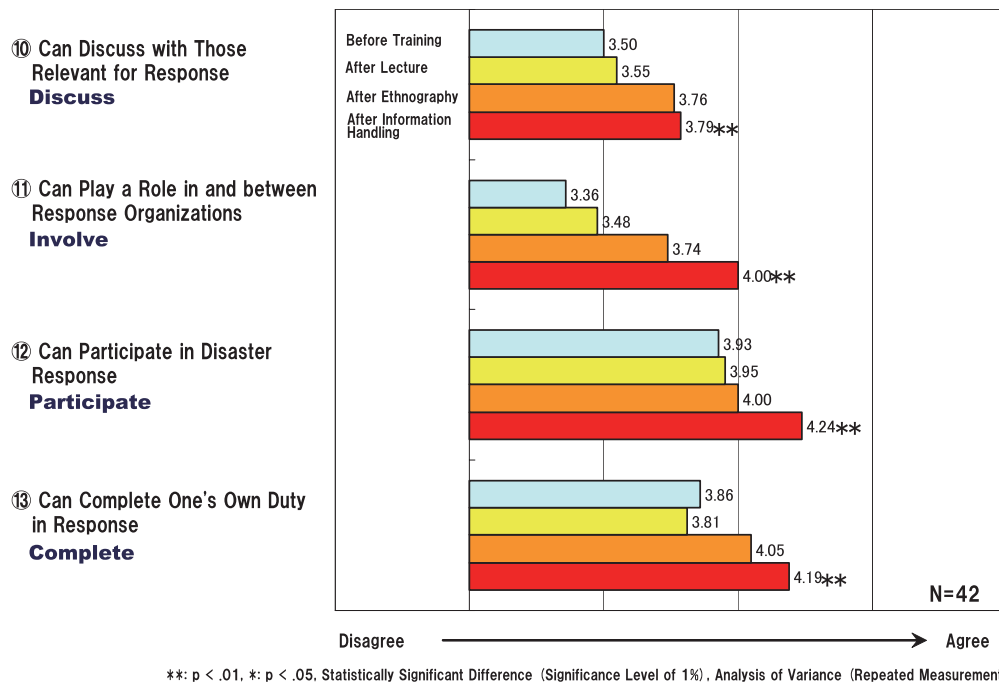


Fig. 7. Self-evaluation of disaster response ability (attitudes: choose attitudes).

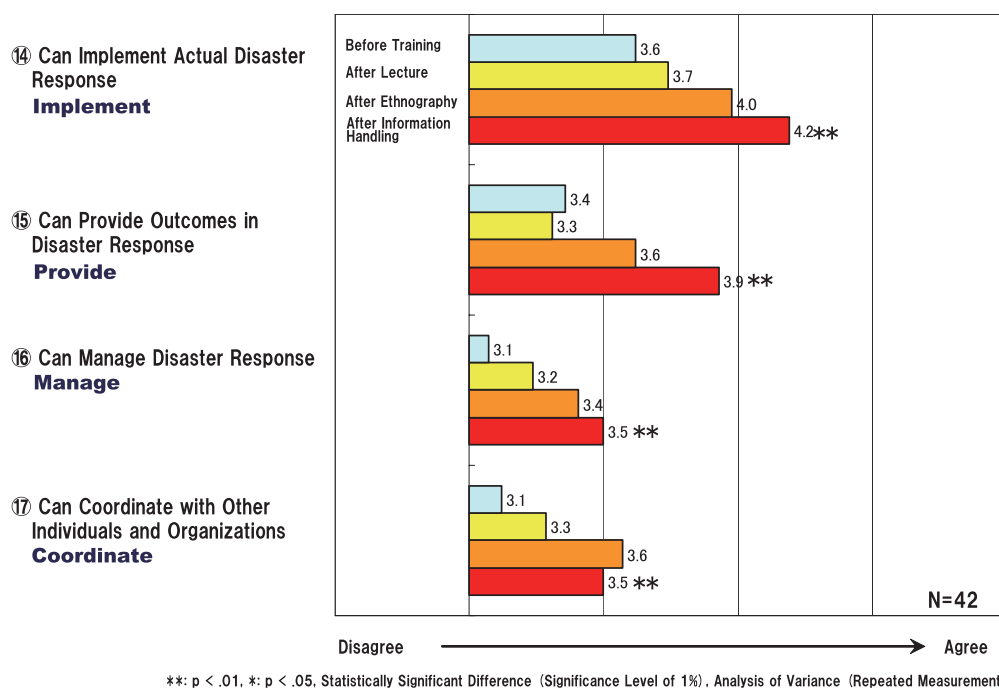


Fig. 8. Self-evaluation of disaster response ability (motor function: execute response).

plete One's Own Duty in Response" (Complete) were originally high in self-evaluation and increased steadily in training. The score of (11) "Involve" increased greatly by performing both disaster ethnography and through practice. The score of (12) "Participate" increased by actually participating in the physical exercise.

5.2.4. Motor Skills Measurement

Figure 8 shows the results of Motor Function measurement. All four of the scores of (14) "Implement

Actual Disaster Response" (Implement), (15) "Provide Outcomes in Disaster Response" (Provide), (16) "Manage Disaster Response" (Manage), and (17) "Coordinate with Other Individuals and Organizations" (Coordinate) increased steadily. The score of (15) "Provide" increased significantly as a result of the disaster ethnography. The score of (17) "Coordinate" exhibits an honest self-evaluation, which they recognized as high in the disaster ethnography but less so after the exercise.

5.3. Effects of Emergency Training and Exercise Program Model

We reviewed the effects of the emergency training and exercise program model from results of the survey and found the following three points.

- (1) We confirmed that their abilities improved in stages through the process of “learning,” “drilling,” and “exercising.”
- (2) We found that some points were learnable through lectures while others were not. For instance, “Recognize” can be sufficiently learned through lectures, while “Classify” had an outcome only after they actually physically exercise it. Although “Develop” can be understood in theory, “Plan,” “Establish,” and “Maintain” can not be acquired only through lectures. Although most elements related to Attitudes can be understood in theory, elements such as cooperation with other organizations can be realized through practice.
- (3) Disaster Ethnography and Information Handling Exercises are effective if they actually participate in them. The effects of exercises, unlike those of lectures, are seen in changes in what they “know but can not carry out.”

We have seen that a combination of attending lectures and participating in exercises is more effective than only attending lectures, and that the “emergency training and exercise program,” which is built based on the “emergency training and exercise model” with a framework of “learning,” “drilling,” and “exercising,” effectively improves participants’ disaster response competence. In addition, the verification method used for effectiveness measurement shows that participants’ disaster response competence has improved. Therefore, it has been shown that the method has validity to some extent as a method of evaluating the emergency training and exercise program.

6. Conclusions

The study discussed the framework of the training and exercise program and then built the “emergency training and exercise model” for an emergency training and exercise program to effectively improve disaster response competencies. Next, based on the model, we developed the “emergency training and exercise program model” through actual emergency training session, and we measured its effectiveness. As a result, we confirmed that the participants’ abilities have improved in stages through the process of “learning,” “drilling,” and “trying out.” Thus, we have successfully shown that the emergency training and exercise program model developed in the study is the basis of an emergency training and exercise program that effectively improves participants’ disaster response competencies.

Issues for the future include common use of the model developed in the study to verify if abilities have improved

in other training programs and exercise session and for other types of disaster. A separate emergency training and exercise program model for the improvement of other target abilities will be developed to compare programs in search of a prototype of an ideal emergency training and exercise program model.

The verification method used for effectiveness measurement in the study has turned out to be useful in the improvement of one’s abilities. In the future, we plan to further improve and develop evaluation items, answer methods, analysis methods, etc. to improve evaluation methods for highly reliable emergency training and exercise programs.

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Additional Notes

(A1) “Disaster Ethnography Teaching Materials”

Among disaster ethnography teaching materials used in the training, the teaching materials related to the South Hyogo Prefecture Earthquake of 1995 and the Central Niigata Prefecture Earthquake of 2004 were developed by Hayashi, Shigekawa, et al. [8]. The teaching materials related to the Niigataken Chuetsu-oki Earthquake of 2007 and the Iwate-Miyagi Nairiku Earthquake of 2008 were developed by the authors using the research method for disaster ethnography shown in Additional Note [1].

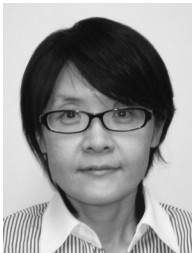
(A2) “Ethnography Research”

A disaster ethnography research is a research method of interviewing disaster responders to systematically get together and record findings, lessons, and implicit knowledge obtained through actual disaster responses. When interviewing, the researchers are supposed to let disaster responders talk about their experiences freely without interrupting or asking them questions in the middle of the interview. Their words are transcribed without any modification and systematically organized to become “disaster ethnography teaching material.” This type of teaching material is valuable particularly in the verbalization of implicit knowledge, such as intuitions, insights, and knacks only available in the course of actual disaster response.

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