Development of human factors training tool

for rail operators

in emergencies or unusual situations

Ken KUSUKAMI

Safety Research Laboratory

Research and Development Center of JR East Group

East Japan Railway Company

In a situation where rail operators encounter unanticipated events such as an accident or other a trouble, he is required to deal with it appropriately and promptly. In order to enhance their ability to do so, operators need a deeper understanding of necessity of emergency procedures and reasons for them, as well as human weaknesses which cause so-called "human error" in emergencies or unusual situations (called "abnormal situations" below).

East Japan Railway Company (JR East) therefore developed "Human Factors Training Tool" for rail operators designed to help them understand possible human error which occur in abnormal situations, the causal factors of the errors, and countermeasures. The tool itself is software program working on a personal computer, and expected to be used in regular training at the operators' worksites. In this paper we will introduce the outline of this tool.

1. Introduction

Installation of train safety systems such as ATS (Automatic Train Stop system) and ATC (Automatic Train Control system) has reduced human error in normal situations. However, it is difficult to prevent errors in abnormal situations, since the above systems do not take them into account. Thus, we have shifted our focus to operating errors which are likely to occur in abnormal situations.

Education and training for abnormal situations is regularly conducted in worksites, in which knowledge of recovery procedures are confirmed and the training is conducted with actual rolling stock. Moreover, operators receive training using simulators with various scenarios at a training center.

The more the setting of training is similar to the actual job, the more trainees can acquire

knowledge and skill, thus, simulator training is quite effective. But it is only carried out once every two years. We therefore developed a training tool focusing on abnormal situations to be used in regular training in worksites.

2. Features of the Training Tool

2.1. Concept

We obtained the following opinions and request for the new tool through the interviews with staff operating.

① There are two kinds of training: routine training for all operators and "specialized training offered for specific situations such as newcomers, etc. Since the need to improve performance in abnormal situations is common to all operators, we should target the tool for routine training sessions.

② Since there is a company rule that regulates routine training sessions to ten times a year, training sessions in which the new tool can be utilized will amount to eight a year.

③ Routine training sessions generally take two hours, of which the tool can occupy about 30-90 minutes (according to the needs of each office).

Based on the above, we specify that the tool be used as follows:

- The tool is to be used for routine training sessions.
- Required time for one lesson is to be about 30 minutes.
- Training can be conducted either personally or in a group, using a personal computer.
- In a group session, a single coaching staff member can take the roll of tool instructor at operators' worksite.

2.2. Selection of important errors in abnormal situations

There are many different patterns of "abnormal situations". First of all, we conducted risk analysis of the operators' work through case studies and statistical analysis of incidents and interviews with coaching staff at operators' worksites. Based on these, we specified the types of accidents to be prevented, regardless of whether the type has actually occurred already or not. Next, we identified types of human error which could cause an accident, causal factors of the error, and possible scenarios leading from the error to the accident.

Table 1 shows five situations likely to cause errors that we should pay attention to and are to be made into scenarios as training programs.

As a way to provide a hint for preventing potential errors, we singled out one human weakness

related to each error based on type (right column of Table 1).

Table 1 Five scenarios of human weakness

	Situations prone to error occurrence	Human weakness related to error
1	Adjusting speed to prevent an accident in cases of natural emergencies	Risk in interrupted operation
2	Train safety procedure to prevent a secondary accident	general human behavior in emergency situations
3	Operation after safety system (ATS-P etc.) starts working	False presumptions
4	Dealing with signal failure	Ambiguous awareness
5	Dealing with brake failure	over-concentration of attention

2.3. Ideas to deepen operator's understanding of main point in error prevention

Next, through interviews with operators, we examined what type of composition would be most effective in deepening the operator's understanding of the main point in preventing error and how to make best use of training in actual situations.

As a result, we realized that the present routine training sessions do not sufficiently help operators understand the seriousness of human error, or the background and basis of rules to prevent it. This is the reason it can be difficult to perform quickly and succinctly in abnormal situations.

We then set up the three following objectives of our new training tool, since in training for abnormal situations, emphasis is generally placed on the memorizing of procedures.

- ・ That operator must understand that "doing" is different from merely "knowing".
- ・ That operator must understand how they should train to properly cope with abnormal situations (awareness, knowledge, skill, etc.).
- ・ That operator may maintain what they learn.

We adopted the following composition for training scenarios in order to achieve the above objectives: (Figure 1).

① To present an example of the error and understand the seriousness of the accident

First of all, to prime the trainee's learning attitude, the tool shows the seriousness of the accident caused by the operator's human error.

② To understand the background and basis of rules

Next, the tool shows that the procedure has been set up to prevent an accident, so each

point in the procedure is important.

③ To understand the relevant human factors

In addition, the tool presents human weaknesses which disturb the operators' behavior in an abnormal situation, even though they may understand the rules.

④ Coping with error countermeasures

Based on the above-mentioned remark, the tool discusses skill and technique important to cope with abnormal situations and the points that all operators must keep in mind.
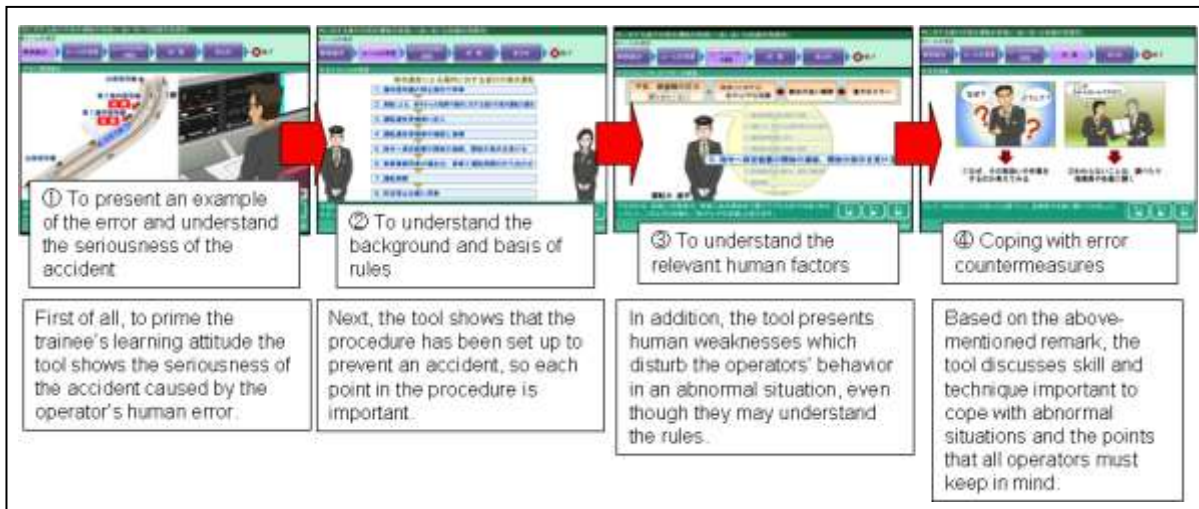

Fig.1 Basic composition of the training scenarios

2.4. Using coaching staff's capability and experience

The next way to increase the training's effectiveness is to make use of the coaching staff's capability and experience. They should be operators belonging to the worksite and their jobs are to teach and train operators both on real trains and at the worksite. Generally they should also conduct the routine training sessions. We examined what role the coaching staff should play for more effective training.

This tool is composed of effect of accidents, background and basis of rules, relevant human factors and countermeasures, using typical accident cases. However, the training effect is considerably limited if trainees only see at the flow of these contents on the screen. It is quite important for operators to take the contents seriously as their own problem and think about them carefully by themselves. Hence, we thought that this role should be allotted to the coaching staff.

We considered coaching staff not as an assistant to the tool, but as a leading instructor of the training who is expected to plan the whole training menu and procedure, making full use of the tool.

4

We made a simple guide for instructors to this end.

The guide does not consist of instructions to the coaching staff, but only exist as an exemplification or hint as to something they can refer to while planning the training. The hints are composed of examples of questions or explanations that instructors should give to operators, and subjects for group discussion, etc. We recommend them to tell operators about their experiences with close calls and techniques for preventing them which they learned through experience .We also ask them to have operators discuss places where errors tend to occur along their lines (Figure 2).
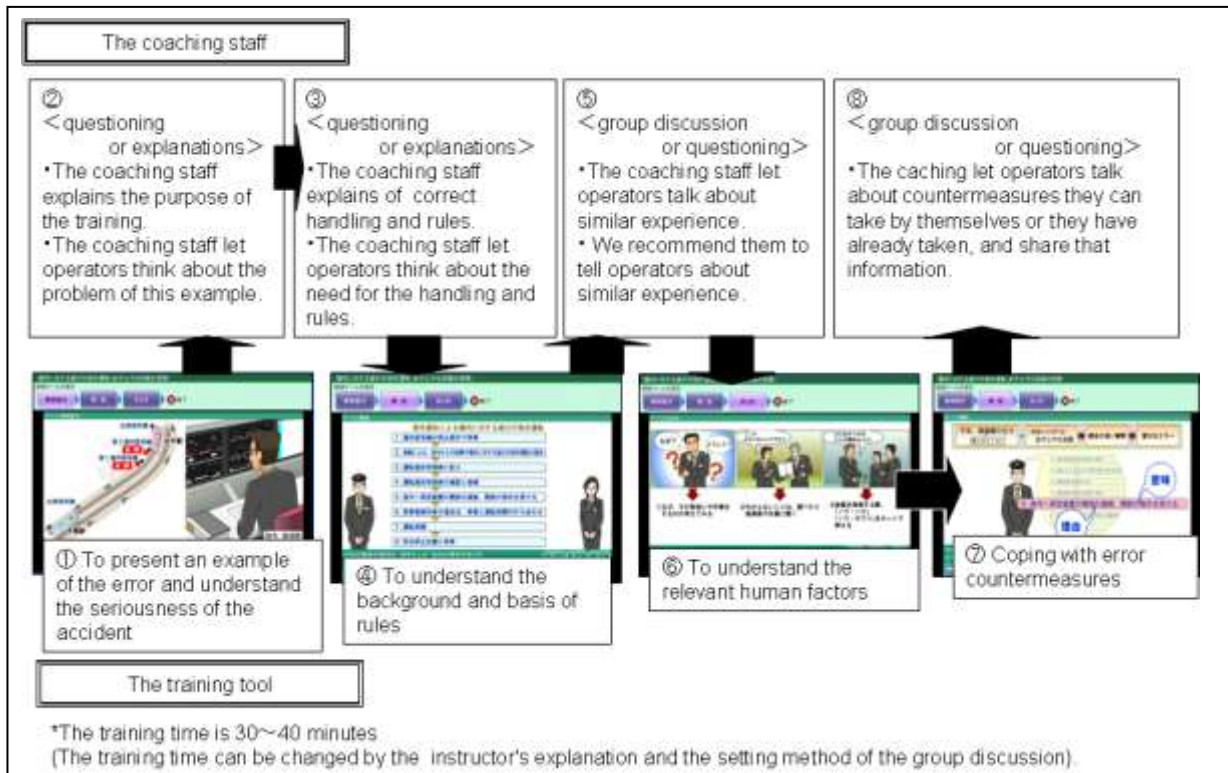

Figure 2　Example of training

3. Introduction of the tool to operator's worksites

3.1. A procedure of introduction

After being developed, the training tool was installed to a single CD-ROM and delivered to all the operator's worksites (104 places) in JR East.

But we thought that it would be difficult for tool users to understand our various ideas to make training more effective, only by distributing them by mail. Hence, we went to every branch office, explained the feature of the tool to the head of the coaching staff, and demonstrated it.

3.2. Evaluation of the Training Tool

At JR East General Education Center, we conducted a questionnaire survey to the coaching staff after an explanation and training sessions for the tool. Table 2 shows the results of the evaluation as the mean scores on a five-point scale (N=25). Important items such as "Ease in imagining the seriousness of human error in accidents." and "Ease in comprehending how human weakness causes error in abnormal situations." etc. were given high scores.

Table 2 Evaluation of training tool by coaching staff

Ability to project oneself with tool	4.5
Ease in imagining the seriousness of human error in accidents	4.9
Ease in comprehending reasons for rule and operation	4.5
Ease in comprehending how human weakness causes error in abnormal situations	4.7
The tool gives some hints about now to prevent a human error	4.3
Time of explanation in one scenario is appropriate	4.4
Ease for coaching staff to apply in training	4.3
The guide for instructors is easy to understand	4.1
Ease of training tool's operation	4.5

On the other hand, the score of "the guide for instructors is easy to understand" is rather low. It may mean that the coaching staff foals it a little hard to make a training plan, since the guide is merely an assembly of hints.

4. Conclusions

This training tool was introduced at the routine training sessions at operators' worksite and JR East General Education Center in April 2008.

JR East will make a steady and continuous effort to help all staff understand human factors more deeply and to raise awareness of the importance of safety.