Hearing Investigation Technique and Educational Program for Analysis of Background Factors of Accident

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Preventing accidents and incidents depends on gaining a maximum amount of information about the situations in which these events occurred and about what actions were taken by the people involved in these events. Therefore, we developed a hearing investigation technique. And as a result of having tried this technique, we confirmed that we could collect more the data about the background factors than before. Moreover, we developed an educational program that consists of a five-step of exercise and explanation. And we confirmed that the participant’s investigative attitude becomes proper.

Keywords: hearing investigation, education program, accident analysis

1. Introduction
Preventing accidents and incidents depends on gaining a maximum amount of information about the situations in which these events occurred and about what actions were taken by the people involved in these events. Therefore, we developed a hearing investigation technique and an educational program intended for assistant railway stationmasters. In addition, the effectiveness of developments was evaluated.

2. Hearing investigation technique
In studies in psychology and legal proceedings, it is regarded as a problem that a wrong investigation method forms a false memory. A cognitive interview method [1-5] was proposed as a method for obtaining more accurate information and free narratives. It is said that there is little influence to object’s memory for this method. Surveys were conducted using questionnaires and interviews among railway experts units to gather know-how about hearing investigation technique. Based on the expert’s know-how and psychological skills, an hearing investigation technique was developed to analyze background factors in accidents. Table 1 summarizes the main points in the technique.

The benefits of a hearing based on these main points include; information gathering made easier on the background of accidents; reduced rates of repeat investigation, analysis and reporting; and review and formation of more effective actions to mitigate factors contributing to accidents. The technique is broader expected to lessen the stress felt by those being investigated and to improve the impression of investigators. As a result, it becomes smooth interpersonal relationship at the workplaces and encouraging participation in future actions for safety and cooperation with future investigations.

3. Educational program
The developed educational program consists of a five-step course including exercises and explanatory sessions.
1) For motivating participants in the program, they are made to consider on their everyday behaviors and attitudes and are evaluated on their findings. Based on the evaluation, they are given the explanations of the areas which they should pay particular attention to. They are also given the explanations of the purpose and importance of the investigation.
2) Participants are given explanations of the basic points which they should pay attention to and its reason. Sample videos are shown to participants.
3) Participants take part in hearing exercises. After the recordings of sample hearing conversations are played, they are asked whether they have understood the conversations correctly and are given the explanations of the conversations.
4) Participants take part in roll-playing exercises. Participants all together listen to conversations of a pair for 10 to 15 minutes, then review and are given explanations. This is repeated twice or three times. When participants are getting used to the exercise, they are split into groups of 3 to 5 persons.
5) Participants are given the explanations of how to handle situations where the hearing investigation is not achieving expected results and how to end the hearing investigation. At the end of the course, participants are given opportunities to ask questions to resolve any uncertainty.

4. Effectiveness
4.1 Hearing investigation technique
4.1.1 Evaluation by the trial experience person
Sessions were held to explain the new technique and had participants experience the educational program. As
part of this activity, a questionnaire survey was conducted to evaluate the practicality and effectiveness of the new technique.

In terms of practicality of the new technique (“Do you feel you can use the technique yourself if it is adopted by the company as the standard technique?”), the survey found that 71.4% of the respondents answered positively while up to 5% answered negatively. Those who answered negatively expressed reservations about going forward with the technique out of lack of experience. They should be able to eliminate their concern by accumulating experience.

About the effectiveness of the new technique (“Do you think the technique is helpful in analyzing the background of handling mistakes and other events?”), 91.0% of the respondents answered affirmatively.

Table 1  Main points of the new hearing investigation technique

| Preparation after the occurrence of an event |
|---------------------------------------------|
| ○ Prepare so that an investigation may be begun early as far as it is possible after event occurrence. |
| ○ Interview those involved one by one. |

| In speaking to the interviewee |
|------------------------------|
| ○ Speak to the interviewee as you would do in everyday conversation at the workplace. |
| ○ Explain why you want to interview them. |
| × Before everything else, encourage them to consider on what they did in remorse. |

| At the start of the hearing |
|-----------------------------|
| ○ First of all, encourage the interviewee to remember how the event unfolded. |
| × Talk about any previous handling mistakes that the interviewee may have made. |
| × If the interviewee is not aware of any mistakes that they have made, make them aware that they made those mistakes. |
| × Assume an attitude of anger if the interviewee would not admit making a mistake or is telling a lie. |

| In questioning |
|----------------|
| ○ Ask questions only after letting the interviewee talk about the event. |
| ○ Tell the interviewee that they can say “I do not know” or “I do not understand” if that is true. |
| ○ Ask multiple questions about the same thing from various perspectives. |
| ○ Find out “what and how the interviewee normally does” by asking questions. |
| ○ Even if the event is clearly attributable to a careless mistake, ask the interviewee whether there is any other cause such as the equipment involved, the interviewee’s physical conditions and their worries. |
| × Ask questions and provide answers in short sentences and at a brisk pace. |
| × Only ask questions that can be answered easily, by simply saying “Yes” or “No.” |
| × Provide assumptions and ask for answers to the assumptions. |

| At the end of the hearing |
|--------------------------|
| ○ Thank the interviewee for cooperation. |

Note: ○ Desirable, × Undesirable
4.1.2 Comparison of the volume of words spoken during investigation sessions

A comparison was made of the volume of words spoken by investigators and interviewees during investigation sessions before (56 events) and after (40 events) the new technique was introduced. The results are shown in Fig.1.

After the new technique was introduced, the volume of words spoken by the investigators increased statistically significantly in both open questions that cannot be simply answered by “Yes” or “No” and are intended to prompt interviewees to speak freely and questions about the background. In addition, after the new technique was introduced, the volume of words spoken by interviewees, or those involved in the events being investigated, about the background increased statistically, namely more than twice as much as before.

The results described above indicated the effectiveness of the new hearing investigation technique as a tool for gathering information about the background of events.

4.2 Educational program

4.2.1 Evaluation of the new technique by participants in the trial

Questions in the survey described in 4.1.1, also asked participants to evaluate the materials used in the educational program and the program content.

To the question “Do you think you can explain to relevant staff if you are provided with just the materials?” only 36.5% of the respondents answered affirmatively, although it was higher than the rate of negative answers. About the effectiveness of the program materials and content, or whether they are “helpful in understanding the technique,” those who answered affirmatively among the respondents are 86.2% for the manual (descriptions of the technique), 91.5% for the video viewing, 88.4% for the listening to recorded interviews and 71.9% for role-playing exercises.

The results described above strongly indicated the effectiveness of the educational program while at the same time suggesting an issue in that not everyone is suited to be an instructor.

4.2.2 Comparative evaluation of awareness about the main points in the technique

The degree of comprehension of 122 items relating to the new technique was compared between those who “know nothing about the new technique,” those who “know the outline of the main points by word of mouth,” those who “had read the manual” and those who “had attended the explanation sessions during the educational program.” A comparative survey was conducted in 2013 from which 624 units of data were obtained (see Fig.2). Some of the key results are shown below (see Fig.3).

(a) “After the event, preparation must be initiated so that investigations can begin as early as possible.” The average from a statistical point of view was significantly higher among those who had read the manual or participated in the educational program than those who knew nothing about the new technique.

![Fig. 2 The respondent percentage about the recognition of the new technique](image)

![Fig. 1 Comparison of the volume of words spoken in the investigation situation](image)
The recognition of the new technique (see Fig.2)
(a) After the event, preparation must be initiated so that investigation can be started as early as possible.

The recognition of the new technique (see Fig.2)
(b) When speaking to the interviewee, encourage them to tell whatever they can remember.

The recognition of the new technique (see Fig.2)
(c) Even if the event is clearly attributable to a careless mistake, ask the interviewee whether there is any other cause such as the equipment involved, the interviewee’s physical conditions and their worries.

The recognition of the new technique (see Fig.2)
(d) At the end of the hearing, thank the interviewee for cooperation.

The recognition of the new technique (see Fig.2)
(e) When speaking to the interviewee, before everything else, encourage them to consider on what they did for remorse. (Undesirable)

The recognition of the new technique (see Fig.2)
(f) At the start of the hearing, “assume an attitude of anger if the interviewee would not admit making a mistake or is telling a lie.” (Undesirable)

Note1 An answer is 4-point scale: “1=It does not apply at all”, “2=It does not apply little”, “4= It applies little” and “5=It applies very much.”

Note2 ** mark indicates a significant case by the 5 % standard as a result of the official approval of the difference in the averages.

Note3 A low answer is desirable because the contents of the items of (c) and (f) are not desirable.

Fig. 3 Comparison of the degree of comprehension of the new technique’s main points

(b) When speaking to the interviewee, “encourage them to tell whatever they can remember.” The average from a statistical point of view was significantly higher among those who had participated in the educational program than those who knew nothing about the new technique.

(c) “Even if the event is clearly attributable to a careless mistake, ask the interviewee whether there is any other cause such as the equipment involved, the interviewee’s physical conditions and their worries.” The average from a statistical point of view was significantly higher among those who had read the manual or participated in the educational program than those who knew nothing...
about the new technique.

(d) “At the end of the hearing, thank the interviewee for cooperation.” The average from a statistical point of view was significantly higher among those who had participated in the educational program than those who knew nothing about the new technique.

(e) When speaking to the interviewee, “before everything else, encourage them to consider on what they did in remorse.” (Undesirable): The average from a statistical point of view was significantly lower among those who had participated in the educational program than in any of the other groups.

(f) At the start of the hearing, “assume an attitude of anger if the interviewee would not admit making a mistake or is telling a lie.” (Undesirable): The average from a statistical point of view was significantly lower among those who had participated in the educational program than in any of the other groups.

Nothing of the new technique was not understood by only once of practice, but it is confirmed that the main points can be understood sufficiently even by once of practice.

5. Conclusion

We developed a hearing technique for accident investigation and an educational program for frontline railway staff. In addition, these developments were found effective in the following respects.

(1) More than 90 % of those who received explanation regarded the new technique as effective.

(2) By the trial of the new technique conducted with frontline staff, it was found that the volume of words spoken by the investigators increased for both open questions intended to prompt interviewees to speak freely and for questions about the background. It was also found that the volume of words spoken by the interviewees, or those involved in the events being investigated, about the background increased significantly from a statistical point of view.

(3) 70 to 90 % of the participants regarded the educational program and materials as effective.

(4) By only once of practice, it was confirmed that the main points can be understood sufficiently.

Interpersonal relationship based on mutual trust in daily operation is important in achieving appropriate hearing investigations. This is an area that must be improved through future actions.

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