Learning Method of Communication Error Prevention

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Preventing communication errors is essential for ensuring safety in the work place in railways. This study describes the construction of a “Causal model of communication errors in the railways” from the analyses of accident reports and feedback on experience of communication errors. Through this model, it was found that certain methods, such as “talk-back,” “confirmation talk” and “learning ambiguous expressions” were effective in preventing communication errors. A training method to teach these skills was proposed and its effectiveness was confirmed through experiments.

**Keywords:** communication error, miscommunication, talk-back, confirmation talk, accident prevention

1. Introduction

Communication errors in a railway systems are a serious threat to safety. While railway companies in Japan use various measures to prevent such errors, some accidents or incidents still occur as a result of communication errors.

The definition of a communication error differs between researchers or research fields [1]. In this study, the following definitions applied:

- Limited to verbal communication errors in the working place.
- Communication errors occurring at some stage in the message transmission process, i.e.: "deciding what information has to be sent – sending – receiving – understanding - and - confirming meaning if message is not clear."
- Excluding communication that failed because of defects in physical equipment.
- Excluding communication errors due to the particular relationship between the communicators.

2. Communication error factors and preventive measures

To elucidate the mechanisms leading to communication errors, 1706 accident reports and 97 communication error incidents were analyzed, from which 23 communication error factors were extracted. The relationship between these error factors was examined and a "Causal model of communication errors in railways" was constructed (Fig. 1).

In order to prevent communication errors, it is necessary to exclude these error factors. In reference to other communication error studies and communication error preventive measures used in the railways and other fields, "talk-back," “confirmation talk” and “learning to detect ambiguous expressions,” were considered to be effective in excluding these error factors.

2.1 “Talk-back” and “Confirmation talk”

The factors in the blue frame in Fig.1; “Information is incorrect,” “Over assumption,” and “Insufficient confirmation” can be eliminated by reinforcing the confirmation process. "Talk-back” is a well-known measure whereby the recipient of the information simply repeats the information they have heard to confirm that they have understood it correctly. “Confirmation talk” is also used for communication error prevention: the recipient of the information rephrases or summarizes what they have heard or responds by saying out loud how they will follow up the order, to confirm that they have understood the information or the order correctly.

2.2 Learning to detect ambiguous expressions

A number of different sub-factors contribute to insufficient confirmation. These include, "Not aware that information is inadequate," and "Communicator assumes that the recipient will understand.” Even if the communicator obtains confirmation of the information conveyed or that the message has been understood by using “talk-back” or “confirmation talk,” these sub-factors could still result in insufficient confirmation or superficial (form only) confirmation. Therefore, a method was devised to develop skills in detecting ambiguous expressions that could lead to ‘over assumption.’ In this method, the learner watches a video where two people in different rooms are communicating with each other via radio. The learner tries to detect the ambiguous expressions or words in their conversation. The factors in the red boxes in the chart can be eliminated using this training method.
3. Learning method of communication error prevention measures

Detailed procedures of “talk-back” and “confirmation talk” have not yet been clearly established. Therefore, in this study, a learning method was developed that consists of “learning to detect ambiguous expressions,” “talk-back technique learning” and “confirmation talk technique learning.”

3.1 Learning to detect ambiguous expressions procedure

In this method, the learner watches a video where a worker is building a toy car following instructions given via radio from an instructor in another room. While watching the video, the learner tries to detect out ambiguous expressions or words that may cause a communication error, and if any, writes down. This process aims to raise the learner’s awareness of expressions or words that contain ambiguity, thus helping them avoid these expressions themselves, or ensuring that they get confirmation of the meaning during an exchange. The structure of the training is shown in Fig. 2.

3.1.1 Evaluation of ‘learning to detect ambiguous expressions’

An experiment was conducted to confirm the effect of the method for learning to detect ambiguous expressions. 144 graduate and undergraduate students participated in the experiment, in pairs. They were put in one of the four learning conditions (Table 1).

Under conditions 2-4, after learning to detect ambiguous expressions, one of the pair instructs the other how to make the toy from the other room over the radio, while the listening participant makes the toy. Under condition 1, the participants just give the instructions or make the toy. The conversations and work were recorded on video. The work was left unfinished if the pair did not complete making the toy in 20 min.

3.1.2 Results

Data from pairs that did not follow the instructions given by the convener of the experiment, were excluded, therefore, finally 57 data sets in total were analyzed. The chi-square test was conducted on data both from pairs that finished building the toy and those who did not manage to
Table 1 Learning conditions

| Condition | Learning content |
|-----------|------------------|
| 1         | Neither instructor nor worker have learnt to detect ambiguous expressions. |
| 2         | Only instructor learns to detect ambiguous expressions. |
| 3         | Both instructor and worker learn to detect ambiguous expressions. |
| 4         | Both instructor and worker learn to detect ambiguous expressions. After learning to detect ambiguous expressions, they check the ambiguous words and expressions found in the video against a "list of ambiguous expressions." |

The results showed that there were statistically significant differences between the 4 conditions \( (\chi^2(3)=10.844, p<.05) \). Under condition 3, the number of the pairs that completed the task was statistically significantly larger, while under condition 4, the number of pairs unable to complete the task was statistically significantly larger. ANOVA was conducted on the mean number of ambiguous words used by the instructor showing that there was a significant difference between conditions \( (F(3, 53)=7.432, p<.05) \). Under condition 3, the number of the pairs that completed the task was statistically significantly larger, while under condition 4, communication was more time consuming than under the other conditions. From these results, it can be said that condition 3 was the most appropriate configuration.

3.2 “Talk-back” and “confirmation talk” learning

PowerPoint slides and videos were used to convey the purpose of each of these techniques and to conduct the training (Fig. 4).

Table 2 Number of the pair that finished the work and that of the pair who did not finish the work

| Condition | Finished | Not finished |
|-----------|----------|--------------|
| 1         | 9        | 6            |
| 2         | 8        | 5            |
| 3         | 13       | 1            |
| 4         | 5        | 10           |

Fig. 3 The number of ambiguous words and expressions

but there was no statistically significant difference among the conditions 2, 3 and 4 (Fig. 3).

All three learning scenarios contributed to raising the participants’ ability to avoid using ambiguous expressions. On the other hand, under condition 4, communication was more time consuming than under the other conditions. From these results, it can be said that condition 3 was the most appropriate configuration.

3.2.1 Evaluation of learning “talk-back” and “confirmation talk” technique

An experiment was conducted to confirm the effect of these learning techniques. From 144 graduate and undergraduate students participated in the experiment, in pairs. They were assigned to one of two groups: “talk-back” and “confirmation talk.” At first, the participants in each group learnt to detect ambiguous expressions. Next, they learned the “talk-back” or “confirmation talk” technique and practiced them. In the next step of the training, one of the pair instructed the other on how to make the toy from the other room via radio. The conversation and work of each pair was recorded on video.
3.2.2 Results

Data from pairs that did not follow the instructions given by the convener of the experiment were excluded producing a total of 45 data sets which were analyzed. Communication errors were counted and compared to results from pairs that only took part in the training to learn how to detect ambiguous expressions (condition 3 in Table 1). ANOVA was conducted on the number of communication errors in each condition and the results showed that there was a statistically significant difference ($F(2, 43)=7.915, p<.05$). Tukey’s HSD was used to compare the number of communication errors under each condition. The result showed that the number of communication errors were statistically significantly larger when participants had only been trained to “learn to detect ambiguous expressions,” than for those who had also had training in “talk-back” or “confirmation-talk” techniques (Fig. 5). These results confirmed the effectiveness of training in “talk-back” and “confirmation-talk” techniques.

4. Conclusions

This study analyzed accident reports and communication error feedback to construct a “Causal model of communication errors in railways.” By using this model, a learning method for communication error prevention was developed that consists of “learning to detect ambiguous expressions” and learning “talk-back” and “confirmation talk” techniques. Results from trials using the method confirmed its effectiveness.

References

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