Learning Probability Rules Using Feedbacks: What Kinds of Feedback and to Whom?

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Abstract

Two experiments on probability rule learning using feedback were conducted. In Experiment 1, of the five types of feedback (no feedback, right/wrong feedback, correct answer feedback, principle feedback, example feedback) tested, only the example feedback was found effective in learning probability rules. In Experiment 2, the relationship between the level of confidence prior to the learning (initial confidence) and the types of feedback was explored. The example feedback seemed to work only with participants having high level of initial confidence. Results of the two experiments suggested that the effective types of feedback are likely to be different depending on the task to be learned as well as on the initial level of learners' confidence on the task.

Keywords: feedback; probability rules; initial confidence.

Introduction

Learning a new category, a new rule, or a new tool without getting feedback for the learner's performance seems almost impossible to expect. However, the effects of giving feedback yields very complicated pictures.

When participants were tested immediately after the learning session, learning with getting feedback usually yields better performance than learning without getting feedback. However, giving feedback did not yield gains in the long term retention of the materials learned. (Rosenbaum, Carlson, & Gilmore, 2000).

Furthermore, the effects of the feedback types also seemed different depending on the task to be learned. When the task was learning a new paired associate, for instance, giving correct answer as feedback helped learning (Pashler et al., 2005). However, when the participants learned to solve verbal analogy problems, giving the principle of the analogy along with the correct answer helped learning (Phye, 1990). The results of previous research on the effects of feedback types on learning suggested that as learning probability rules requires both understanding of the rules and having the arithmetic calculation skills, giving principle or the correct answer as feedback might not be sufficient.

Effectiveness of giving feedback also seems to depend on the initial level of the learner's confidence for their answers. Contrary to the laymen's prediction, learners more easily and effectively changed their answers when they were very confident of their incorrect responses (Butterfield & Matcalfe, 2001; Kulhavy & Stock, 1989).

In Experiment 1, five types of feedback were used to figure out the most effective feedback types for learning probability rules. In Experiment 2, the relationship between the initial confidence and feedback types on learning probability rules was explored.

Experiment 1

The main goal of the Experiment 1 was to find the most effective feedback type for learning probability rules. Five types of feedback were used in Experiment 1: No feedback, right/wrong feedback, correct answer feedback, principle feedback, and principle plus example feedback. As learning probability rules require understanding of the principle itself, understanding of when the rule applies, and having the calculation skills, only the principle plus example feedback is expected to help learning.

Method

One hundred and five Sungkyunkwan University students attending introductory psychology class participated in the experiment. However, only the data from sixty five participants who reported they did not know the probability rules were used for analysis. Two probability rules, independent event rules [$P_r={}_nC_r p^r q^{n-r}$]and conditional probability rules [$p(A \cap B)=p(A)*p(B|A)$] were used as the rules to be learned, because their surface features are very similar. At the first phase of the experiment, participants were asked to self report whether they know the rules or not. Data from participants who reported they didn't know any of the two rules were used. At the second phase, learning phase, the principles for the two rules were presented for one and half minutes each, without showing any examples. At the third phase, the feedback phase, the participants were asked to solve two problems, one from each rule. Two minutes were allowed for each problem. When they finish solving a problem, they were given feedback according to the feedback condition they were assigned, regardless of their answers. At the fourth phase, the test phase, the participants were asked to solve eight problems, four for each rule, two of which were near problem, and the other two are far problems. After the participants solve each problem, they rated the level of confidence from 1 to 5 before getting feedback.

Results and discussion

The average proportion of correct answers for the test items was analyzed. Only in the near problems, the principle plus example feedback yields better performance than the no feedback control condition ($F(4, 60) = 2.77$, $p < .05$). Though the average proportion for the correct answer condition failed to reach statistical significance, the number was larger than the control condition.

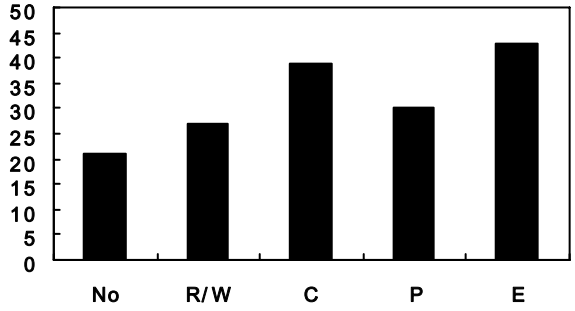

Figure 1. Average proportion of correct solutions for near probles: Experiment 1. (No: no feedback; R/W: right/wrong feedback; C: correct answer feedback; P: principle feedback; E: principle plus example feedback)

Experiment 2

The relationship between the initial confidence and types of feedback on learning was tested in Experiment 2. Previous research has shown that the feedback helped learning only when the participants' confidence for their answer was high (Butterfield & Matcalfe, 2001; Kulhavy & Stock, 1989). In Experiment 2, instead of the participants' confidence for their solutions at the test phase, the participants' confidence at the learning phase was used as their initial confidence. If they were confident of their answers even only after they were given the principles, then they might have some idea of what the principles are. Therefore, they are more likely to get help from feedback.

Method

Of the 98 participants, 61 were regarded as not knowing the principles. Based on their initial confidence score, 18 participants from the lowest and 18 from the highest were selected, and were assigned randomly to the three feedback conditions: No feedback, correct answer feedback, and the principle plus example feedback condition. Experimental procedures were almost identical to that of Experiment 1.

Results and Discussion

The average proportion of correct answers for the test items was analyzed. Only in the near problems and with participants highly confident of their initial solution, the principle plus example feedback yields better performance than the no feedback control condition ($F(1, 30) = 22.73$, $p < .01$). The correct feedback failed to reach statistical significance, because of small number of participants in each feedback condition.

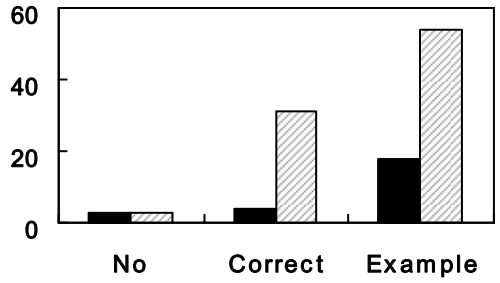

Figure 2. Average proportion of correct solutions: Experiment 2. (No: no feedback; Correct: correct answer feedback; Example: principle plus example feedback; black bar: low confidence; gray bar: high confidence)

The results of the two experiments gave support for the hypothesis that only the most inclusive type of feedback is helpful in learning complicated rules like probability rules, and the feedback can help learning when the learners have high level of initial confidence.

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References

Butterfield, B., & Metcalfe, J. (2001). Errors committed with high confidence are hypercorrected. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27,* 1491-1494.

Kulhavy, R. W., & Stock, W. A. (1989). Feedback in written instruction: The place of response certitude. *Educational Psychology Review, 1*, 279-308.

Pashler, H., Cepeda, N. J., Wixted, J. T., & Rohrer, D. (2005). When does feedback facilitate learning of words? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31,* 3-8.

Phye, G. D. (1990). Inductive problem solving: Schema inducement and memory-based transfer. *Journal of Educational Psychology, 82*, 826-831.

Rosenbaum, D. A., Carlson, R. A., & Gilmore, R. O. (2000). Acquisition of intellectual and perceptual-motor skills. *Annual Review of Psychology, 52*, 453-470.