Effects of Negative Information on Acquiring Procedural Knowledge

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Abstract

Usually, the material for learning is given in a positive form, i.e. xxx is yyy. This type of information will help organize the core of the target knowledge. Instead of this type of information, negative information, i.e. xxx is not zzz, will help sharpen the edge or extent of the target knowledge. Hence, it is expected that the negative information will have an effect of minimizing the chance of making errors and thus making the learning faster.

For the purpose of confirming this hypothesis, we conducted an experiment on the procedural knowledge, i.e. the procedure of application software. We compared the execution time of operation after presenting the positive information (simple explanation) and the negative information (scene of failure and explanation) in terms of the use of software to different subject groups. The result showed that the negative information had a significant effect for a simple operation but had not an effect for a complex operation.

1. Introduction

In a general educational situation, the information is frequently given in a positive form such as “In order to shut down the Windows machine, you will have to push the start button, then select the shut down item from the menu.” But sometimes, the negative form of information such as “In order to shut down the Windows machine, do not press the power button of your PC” will help to minimize the risk of making an error.

The purpose of this study was to investigate if such negative information actually has a positive effect for acquiring the specific knowledge.

2. Method

2.1 Material

There are a variety of learning situations that can be used for our study, e.g. learning the foreign language, learning the car driving, learning the programming, etc. We decided to use not the declarative knowledge but the procedural knowledge simply because it was easier for us to provide the negative information material as well as the positive information material for the procedural knowledge. And we used the computer software as the material for our study.

Material used in this experiment was “Home Page Builder (HPB) Ver. 6 (Japanese version)” of IBM.

2.2 Collecting Sample Failures

For the purpose of finding out tasks with moderate difficulty, we conducted the usability testing using this software. Three subjects who were male graduate school students participated in the usability testing.
They had no previous experience of using this software. They were asked to perform 24 tasks such as to start the software, to name a new page, to set up a background color, to center the logo, etc. From among 24 tasks, 4 difficult tasks were selected based on the number of errors. They were (1) to create the page title, (2) to create the scroll character that moves from left to right, (3) to insert the picture as the background image, and (4) to close the HPB after saving the page data.

2.3 Creating the Instruction Video

Positive information material was created as a video by showing the simple explanation regarding these four tasks. This video showed the screen image while the correct operation is conducted with the narration explaining about the procedure. This was similar to the usual instruction video on the market in terms of the correct use of the software.

Negative information material was created as a video by showing the scene of failure during the usability testing. After the scene of failure, the positive information video described above was concatenated for each of 4 tasks.

2.4 Experiment

Total of ten subjects were used as the subjects who were the graduate students with no previous experience with this software. Five of them were given the positive information video and another 5 subjects were given the negative information video. Then they were asked to accomplish the same task by themselves.

Before and after the experiment, a questionnaire on the subjective evaluation was given to the subjects. Sample items were “This software is easy to use”, “It doesn’t take much time to learn how to use this software” for the positive information group. The negative information group was given some additional items such as “By looking at the scene of failure, I would like to know how to use this software correctly”.

2.5 Result

The result of the experiment regarding the length of time to achieve the task is shown in Tab. 1.

<table>
<thead>
<tr>
<th>Task number</th>
<th>Average time in second for positive information group</th>
<th>Average time in second for negative information group</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>66.0</td>
<td>40.0</td>
<td>*0.027</td>
</tr>
<tr>
<td>2</td>
<td>206.8</td>
<td>206.2</td>
<td>0.200</td>
</tr>
<tr>
<td>3</td>
<td>182.6</td>
<td>188.6</td>
<td>0.969</td>
</tr>
<tr>
<td>4</td>
<td>74.8</td>
<td>90.4</td>
<td>0.387</td>
</tr>
</tbody>
</table>

Tab.1 Result of the experiment (* Significant at 5% level)

As shown in this table, only task #1 showed a significant difference between the positive information group and the negative information group. Because task #1 is an operation with a short sequence compared to other tasks, it was assumed that the negative information had a positive effect on learning the simple procedural knowledge.

Based on the analysis of the additional data by the questionnaire, it was concluded that giving the negative information influenced the subject to think of the task as difficult, but at the same time, influenced them to increase the motivation to overcome the difficulty.

3. Discussion

Although giving the negative information did not increase the level of understanding in all cases, it was effective for the simple task and was useful in increasing the motivation of the learner.