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Effect of Instruction Type on Successful Completion of a Task

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ABSTRACT

Instructions play a valuable part in modern society, but their effectiveness is often questioned. In this study, 33 undergraduate students completed a series of simple Lego® tasks using three forms of instructional methods. Step-by-step instructions consisting of written instructions, pictorial instructions, or a combination of the two were tested. The number of correctly completed steps and total time taken for each task was collected. Although there was no difference in accuracy with pictorial or combined instruction types, both written and combined instruction types resulted in greater accuracy. No difference between the pictorial and combined instructions could be found, however. The mere presence of pictures may play a role in accurately and timely completion of a simple construction task.

Instructions are found virtually everywhere in everyday life. However, their usefulness is often questioned. Manuals are often ignored for assembly until last resort; yet, educational instructions are widely used and provide valuable information. Researchers have explored instructional methods and their ease of use in many studies. One largely researched form of instructions are teaching methods and testing methods. Lamude and Wolven (1998) stress that a teacher's clarity can have an impact on the learning environment. Dwyer and De Melo (1984) report that overall recall when taking a test was improved when illustrations were either utilized in learning the subject, or in the design of the exam. Macneil (1980) found that there was no significant difference between expository and discovery methods of teaching.

Several studies have compared different map types as instructional methods and have found that drivers prefer and perform better when illustrated maps are available (Kovach, Surette & Aamodt, 1988; Wright, Lickorish, Hull & Ummelen, 1995). Teaching styles for physical activities have also been compared. Verbal and written instructions for scuba diving were equally beneficial (Green & Powell, 1988); while there appears to be a difference between auditory, visual, and tactile based instruction for tennis lessons (Kennedy, 1995). Ability to put together a movie projector was not altered by instructional method (modeling, illustrations, and video presented with audio) (Butts, 1979). In computer-based learning, Mayer, Down, and Mayer (2003) found narrative instructions to be more beneficial than text-based instructions on interactive-based tasks. Lastly, a simple marble task was designed by Powell and Howard (1990) to assess the

difference in success between written, verbal, and a combination of the two methods. They found no significant difference between the two groups. Researchers have primarily focused on the difference between visual and verbal instruction methods. Each type could be dependant on the task being completed. This study focuses on visually-based instructions that are used to assemble a series of simple building block tasks.

The purpose of this study is to compare written instructions, pictorial instructions, and a combination of the two when completing a simple Lego® building task. It is predicted that participants who use combined instructions will score a higher level of accuracy (number of correct steps completed) and will complete the tasks in less time.

METHOD

Participants

Participants were 33 undergraduate South Dakota State University students from Psychology 101 and Psychology 202 classes who volunteered to participate. The sample of participants consisted of 7 males and 26 females. The age of the students ranged from 18-21 years; the average age was 19 years ($SD = 0.06$). Students were randomly assigned to one of three experimental groups ($n = 11$). All students received extra credit in their psychology class for participation in the study. Participants were informed of their right to confidentiality and their right to withdrawal without penalty in accordance with the American Psychological Association's "Ethical Principles of Psychologists and Code of Conduct" (2002).

Materials

Tasks were completed using ten Lego® blocks varying in size and shape. A Lego® "base" was used for the participants to assemble their tasks. Instructions for completing the tasks were provided to each participant. Three formats of instruction were used in this experiment. The first format consisted of written step-by-step directions. For the written instructions, all sentences began with an action-based subject (Dixon, 1982; Dixon, Faries, & Gabrys, 1988). A hand-drawn diagram showing the coding system that was used for the blocks was provided. The second format was a set of instructions that showed how to complete the tasks step-by-step through the use of photographed images of the Legos®. Lastly, a combined format contained the written format for each step with a picture of each individually completed step.

Procedure

Each participant completed a series of tasks in the same order. There were ten tasks of increasing difficulty, and each task varied in the number of steps. At the beginning of each task, the Lego® pieces were arranged in a specific pattern in between the participants and between each task. Participants completed the tasks individually and were prevented from viewing others. Each correctly completed step was tallied as one point, while each incorrectly completed or missed step was scored as zero. Accuracy is determined by the number of correctly completed steps. Each task had a maximum time

limit for completion, which was based on the number of steps per task. This procedure was repeated for all ten tasks. All participants were debriefed.

RESULTS

As shown in Figure 1, accuracy was lower when following the written instructions ($M = 44.27, SD = 10.84$) than when following pictorial instructions ($M = 51, SD = 3.26$) or combined instructions ($M = 50.91, SD = 2.59$). As shown in Figure 2, participants who followed written instructions took longer to complete on average ($M = 1075, SD = 272$) than those who followed pictorial instructions ($M = 244, SD = 35$) or combined instructions ($M = 325, SD = 62$). As shown in Table 1, instruction type significantly altered between the three instructional methods, $F(2, 30) = 3.65, p < .05$. A second ANOVA analysis, Table 2, determined statistical significance for the instruction type and the time taken to complete the tasks, $F(2, 30) = 87.23, p < .01$. A post-hoc analysis shows a significant difference between the scores of the participants using written instructions and those using combined instructions, $t(20) = 1.98, p < .05$ (one-tailed).

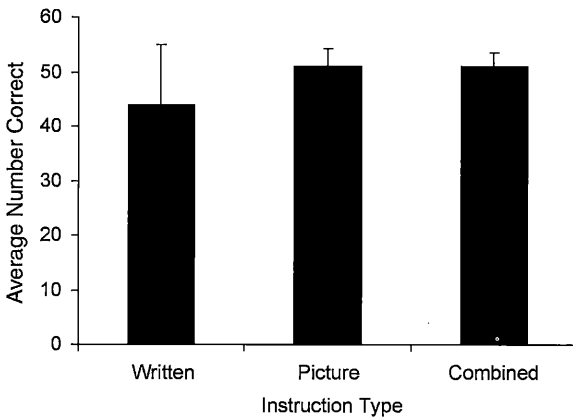


Figure 1. Total average number correct for each instruction type with standard deviations.

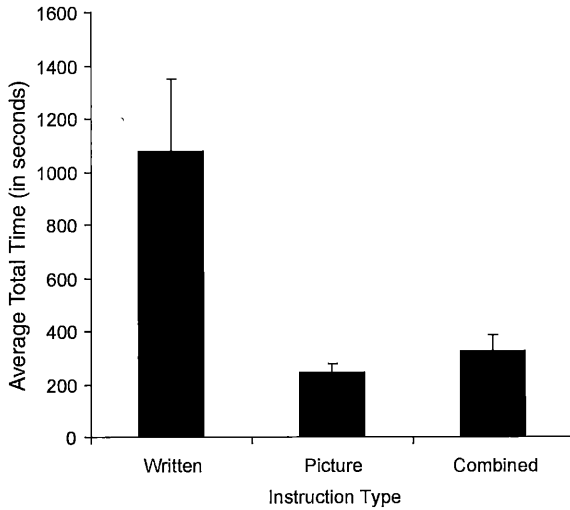


Figure 2. Total average time taken for each instruction type with standard deviations.

<i>Analysis of Variance for Correct Scores</i>					
Source of Variation	SS	df	MS	F	F crit
Type of Instruction	327.45	2	163.73	3.65*	3.32
Within Groups	1347.09	30	44.90		
* p < .05					

Table 1. Analysis of Variance for Correct Scores.

<i>Analysis of Variance for Total Time</i>					
Source of Variation	SS	df	MS	F	F crit
Type of Instruction	4624331.88	2	2312165.94	87.23**	3.32
Within Groups	795159.09	30	26505.30		
** $p < .01$					

Table 2. Analysis of Variance for Total Time.

DISCUSSION

There was a statistical difference between the three types of instructions. However, a statistical difference between pictorial and a combined format of instructions can not be found in this study. Therefore the hypothesis is unable to be supported.

The observers noticed that many participants using combined instructions ignored the written portion of the instructions. Therefore, the similar scores for these two methods can be explained because the participants essentially used the same instructions. As people follow instructions, they tend to discover unnecessary information and then typically ignore it (Kovach, Surrette, & Aamodt, 1988; Dixon, Faries, & Gabrys, 1988). Perhaps the participants in the present study who used the combined instructions took a little longer to decipher essential versus non-essential information.

The tasks in this experiment were not complex; therefore, it is believed that the written instructions provided little further clarity or direction than the pictorial illustrations. It could also be possible that with a more complex task, IQ could play a role in performance using different instructional methods. Further research of this topic should investigate the benefits and specific instances when written instructions should be included with illustrated diagrams.

This study was based on participants completing a building task using small blocks. The results of this study should not be generalized to include mental, physical, or other non-building based tasks. However, this research can serve as a basis to model other forms of instruction or alternate task methods.

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AUTHOR NOTE

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