

# Effects of Learning Context on Judgment of Learning and Transfer of Cognitive Skill

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## Abstract

Some researches have demonstrated that metacognitive knowledge like judgment of learning (JOL) has effect on development of strategies and transfer performance. To illuminate this relationship, present study examined the effect of the difficulty of learning on JOL and transfer performance. It was also examined whether a brief instruction intriguing motivation could have effect. Results suggest that after people learned easy materials first, their JOL could easily be inflated which blocks generating elaborated strategy and resulting in poor transfer performance. Moreover, even a brief instruction could improve transfer performance.

## Introduction

Many studies have proven that difficulty of initial learning affects the performance of transfer session and metacognition plays an important role in effective learning (see, e.g., Benjamin, Bjork, & Schwartz, 1998; Meyer, 1998). Doane, Sohn, and Schreiber (1996) demonstrated that the difficulty of initial learning influences the skill acquisition and transfer in polygon discriminating tasks. Difficult-learners performed better for the transfer phase than easy-learners. They obtained some strategic skills, while easy-learners did not. Simon and Bjork (2001) examined a metacognitive knowledge, judgment of learning (JOL) in motor skill learning with random and blocked practice condition. JOL is learners' own assessment of how well they have learned. Random practice caused lower JOL but higher transfer performance.

We presumed that the level of JOL affects transfer performance via development of strategic skills. To examine this relationship, we conducted two experiments; in experiment 1, we examined the effect of difficulty of initial learning on JOL and transfer performance and in experiment 2, we examined the effect of instructions on the learners' motivation.

## Experiment 1

In experiment 1, participants in easy or hard learning condition are compared in the aspect of JOL and transfer performance. We predicted that hard learning should result in lower JOL, but better performance on the transfer task.

## Methods and Procedure

Seventy-six undergraduate students from Yonsei University, Korea participated in this experiment to receive

course credit. They randomly assigned to easy learning condition (n=42) and hard learning condition (n=34).

On each trial, a pair of horizontally aligned polygons was presented on the computer screen, and the participants should decide whether the two stimuli were same or different as quickly and as accurately as possible. Materials were adapted from polygon stimuli from Doane et al. (1996, presented in Figure 1).

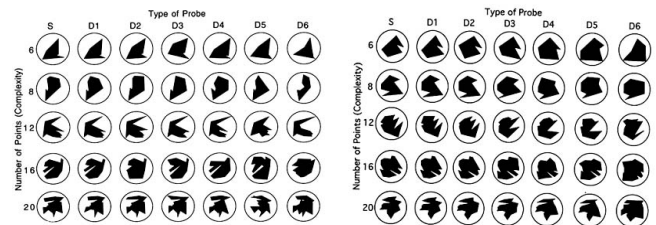


Figure 1: Polygon stimuli adapted from Doane et al. (1996)

There were two phases for the experiment; the acquisition and transfer phases. The acquisition phase for both conditions was consisted of 6 blocks and 30 trials per block. Easy learning condition included comparing S probes with S, D4, D5, and D6 from set A. For hard learning condition probes with S, D1, D2, and D3 from set A were used. The transfer phase included comparing S probes with S, D1, D2, and D3 from set B. In this phase, all participants were tested with the same discrimination task for 4 blocks with 30 trials per block. Participants were also asked to write down the predicted score for next phase right after they finished each block. A schematic depiction of the design of each experiment is shown in Table 1.

Table 1: Experimental designs used in the present research.

Exp	Condition	Acquisition phase (Block 1-6)		Transfer phase (Block 7-10)	
		set	difficulty	set	difficulty
1	Easy vs hard				
	Easy A/Hard B	A	D4-D6	B	D1-D3
	Hard A/Hard B	A	D1-D3	B	D1-D3
2	Instruction effect				
	Easy A/Hard B	A	D4-D6	B	D1-D3
	Easy A/Hard B	A	D4-D6	B	D1-D3

## Results and Discussion

Figure 2 shows the mean accuracy of different-discrimination judgments and JOL for easy and hard

learning groups as a function of block. There was a significant interaction between learning difficulty and phase ( $F(1,696) = 49.64, \eta^2 = .07, p < .001$ ). And JOLs of easy-learners were significantly higher than hard-learners especially in the acquisition phase ( $F(1,696) = 6.417, \eta^2 = .09, p < .02$ ). Thus, easy-learners showed high confidence, but poor performance in the transfer phase. The opposite results were observed with hard-learners.

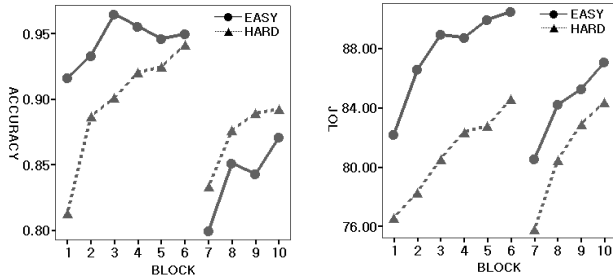


Figure 2: Mean (a) accuracy and (b) JOL for easy and hard learning groups as a function of block in Experiment 1.

## Experiment 2

In experiment 2, participants in easy learning condition with instruction or without instruction were compared.

### Methods and Procedure

Twenty-seven undergraduate students from Yonsei University, Korea participated to receive course credit. They participated in easy learning condition as in Experiment 1, but with instruction; “The following session will be more difficult than the previous session. Please pay attention to the task.”

### Results and Discussion

Easy learning group in Experiment 1 was employed for the control group which had no instruction between phases. Figure 3(a) shows the mean accuracy of different-discrimination judgments for both instruction and no-instruction groups as a function of block. They showed similar learning performance for the acquisition phase which is natural, because they were exposed to the exactly same stimuli. For the transfer phase, however, the instruction group performed significantly better ( $F(1,59) = 4.09, \eta^2 = .065, p < .05$ ). Figure 3(b) shows no effect of instruction on JOL. Reaction times did not differ between the instruction and no-instruction groups, either.

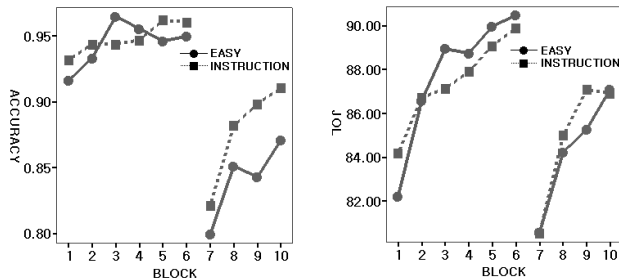


Figure 3: Mean (a) accuracy and (b) JOL for instruction and no-instruction groups as a function of block in Experiment 2.

Thus, the results suggest that instructions did not affect learners’ confidence but helped them to enhance their transfer performance. Furthermore, reaction times did not show any differences between two groups which means hard-learners performed better not because they spent more time on the task but because they focused and consequently developed strategies to process stimuli more precisely.

## General Discussion

The present research was conducted to address two main questions: (1) Does the difficulty of initial learning condition influence JOL and transfer performance? (2) Does giving learners brief instructions have an effect on JOL and transfer performance? Our data provide evidence to answer these questions. First, the difficulty of initial learning affected participants’ JOL. Participants in easy learning condition were more confident about their own performance. However, their actual performance was poor at transfer. The low confidence resulted from hard learning turned out to be more effective for actual performance at transfer. Second, even a brief instruction had a significant effect on performance at transfer. This suggests that some changes in metacognition caused by a simple instruction can play a critical role in performance on novel tasks.

Despite the significant effect of the instructions, further studies should be performed to examine the durability of the effect because the effect of the instruction might be temporal. And in this experiment, transfer phase followed right after the acquisition phase. Delayed transfer session might be needed to ensure transfers of participants’ strategic skills. In addition, if possible, arbitrary manipulation of JOL level will lead us to understand the clear relationship between JOL and performance.

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