

Do Implementation Intentions Foster the Use of Effective Strategies in Learning with Text and Graphics?

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Abstract. Successful learning with text and picture requires learners to actively process both information sources. This can be achieved by applying appropriate learning strategies. However, it is not guaranteed that learners will use such strategies. Therefore, a promising means to facilitate the use of learning strategies are implementation intentions. Implementation intentions are specific “if-then” plans that strongly link opportunities for applying learning strategies with the actual act of applying such strategies. In order to investigate the effects of implementation intentions on learning outcomes, a study was conducted comparing two groups who learned either with or without implementation intentions. Current interest in the learning task was included as a predictor. The positive effect of implementation intentions was moderated by the learners’ interest in the task. Especially less interested learners benefited from implementation intentions, indicating that implementation intentions facilitate learning of learners with less suitable learner characteristics in particular.

Keywords: Multimedia learning, implementation intentions, learning strategies, motivation.

Research on multimedia learning (i.e., learning with text and picture) has shown that a presentation of text and picture yields better comprehension than a presentation of text alone (Mayer, 2009). This advantage is ascribed to the availability of two representational formats, which allows for the construction of a more sophisticated mental representation. In order to profit fully from multimedia, however, an active processing of both representations is necessary. Learners can achieve this by applying cognitive strategies (Weinstein & Mayer, 1986). Cognitive strategies are defined as strategies that facilitate the encoding and processing of information.

Cognitive strategies specific to multimedia learning can be derived from the Cognitive Theory of Multimedia Learning (Mayer, 2009). They pertain to the selection of relevant information in text and picture, to the organization of selected information into verbal and pictorial mental representations by connecting relevant elements within each respective representation, and to the integration of both mental representations (Kombartzky, Plötzner, Schlag, & Metz, in press).

Students have to learn, however, when and how to use these strategies. If the initiation of behavior is not automated yet, the active and deliberate use of strategies demands central-executive resources (Fernandez-Duque, Baird, & Posner, 2000). Therefore, measures for improving the use of cognitive strategies should aim at facilitating the automation of strategy initiation. To achieve this, we suggest the use of implementation intentions.

Implementation intentions are a well-researched concept in motivational psychology. They represent specific “if-then” plans that link situational cues with the actions necessary for attaining a goal (Gollwitzer & Sheeran, 2006). That is, if a goal is to acquire knowledge from a multimedia presentation, then a corresponding implementation intention could be: “If I have read a sentence, then I will look for corresponding elements in the picture.” A meta-analysis incorporating 63 studies indicates that implementation intentions are highly efficient for goal attainment across a variety of samples, settings, domains, and dependent variables (Gollwitzer & Sheeran, 2006).

After a person has formed an implementation intention, the situational cues defined therein become highly activated and will facilitate the recognition of a situation that requires a corresponding action. Recognizing this situation will then automatically trigger this action. Hence, actions that are evoked by implementation intentions, share similarities with automated behavior (Gollwitzer & Sheeran, 2006). The formation of implementation intentions delegates behavioral control from the self to specific situational circumstances, thus creating “instant habits”. Therefore, they should be advantageous compared to an active and cognitively demanding control of action.

Hypotheses

We assumed that implementation intentions are effective in supporting the use of cognitive strategies in multimedia learning. Learners who have internalized implementation intentions about the use of strategies should show more frequent strategy use and consequently better comprehension than learners who have not. Since the effect of implementation intentions is sensitive to motivational factors, we further hypothesized that current learning motivation plays an important moderating role when learning with implementation intentions. Based on previous research, there might be two possible moderation effects. On the one hand, Koestner, Lekes, Powers, and Chicoine (2002) found that implementation intentions are more effective if aiming at advancing intrinsic goals than if they are aimed at advancing extrinsic goals. Thus, implementation intentions might show a stronger effect for learners who are highly motivated with regard to the learning task. On the other hand, implementation intentions have shown a compensatory effect to overcome initial reluctance when the activities involved are unpleasant (e.g., Orbell & Sheeran, 2000). Hence, implementation intentions might help especially those learners who are less motivated with regard to the task at hand.

Method

Sixty students from the University of Tübingen participated in this study (44 female, 16 male; mean age = 23.72 years, $SD = 3.79$ years). The study used a two-group experimental design with current learning motivation acting as a covariate.

The experiment used paper-based materials and was split into three parts: First, participants' current learning motivation and other control variables (prior knowledge, reading skills) were assessed. Their current learning motivation was measured as a covariate by means of the *Questionnaire of Current Motivation* (Rheinberg, Vollmeyer, & Burns, 2001). The scale "task interest" was deemed the most important aspect of motivation for this study's task. Then, in the following learning phase, participants had to learn about the biological processes of mitosis and meiosis by means of an illustrated explanatory text (2,119 words, 19 schematic illustrations).

Before studying the materials, participants in the experimental condition were instructed to internalize two pre-phrased implementation intentions about the use of strategies of text-picture integration ("If I have turned a page, then I will thoroughly look at the picture first." and "If I have read a sentence, then I will search the picture for the contents described therein."). In the control condition, participants were not instructed to internalize implementation intentions. They were, however, informed of the usefulness of the two learning strategies contained in the pre-phrased implementation intentions. After learning, participants' learning outcomes were assessed by a multiple-choice post-test, both recall and transfer.

Results

Multiple regression analyses were conducted for recall and transfer performance with implementation intentions, task interest, and the interaction of implementation intentions and task interest as predictors. Concerning recall performance, the regression model was significant (adj. $R^2 = .13$, $F(3,56) = 3.83$, $p = .01$). There was neither a main effect for implementation intentions ($b = 2.65$, $SE = 1.78$; $\beta = .19$, $p = .14$), nor for task interest ($b = -1.63$, $SE = 1.82$, $\beta = -.11$, $p = .38$). However, as expected, an interaction between both predictors emerged ($b = -5.65$, $SE = 1.82$, $\beta = -.39$, $p = .003$), R^2 change = .17, F change (3,56) = 3.83, $p = .01$. Simple slopes analyses for low and high task interest were conducted (cf. Aiken & West, 1991). For learners with low task interest, a significant positive slope indicated that implementation intentions positively influenced recall performance ($b = 8.31$, $SE = 2.6$, $\beta = .59$, $p = .002$), while no effect was found for learners with high task interest ($b = -3.00$, $SE = 2.49$, $\beta = -.21$, $p = .23$; see Figure 1). For transfer performance, the regression model was only marginally significant (adj. $R^2 = .08$, $F(3,56) = 2.64$, $p = .06$). We found no main effect for implementation

intentions ($b = .66$, $SE = 1.5$; $\beta = .06$, $p = .66$), but a main effect for task interest ($b = -3.42$, $SE = 1.53$, $\beta = -.29$, $p = .03$). Surprisingly, transfer performance decreased with increased task interest. Furthermore, there was a significant interaction between both predictors ($b = -3.22$, $SE = 1.53$, $\beta = -.27$, $p = .04$), R^2 change = .12, F change (3,56) = 2.64, $p = .06$. Simple slopes analyses showed that implementation intentions had a marginally positive effect for learners with low task interest ($b = 3.88$, $SE = 2.19$, $\beta = .33$, $p = .08$), but no effect was found for learners with high task interest ($b = -2.56$, $SE = 2.1$, $\beta = -.22$, $p = .23$). Summing up, the results suggest that implementation intentions support learners with little task interest, but do not affect the performance of learners with higher task interest.

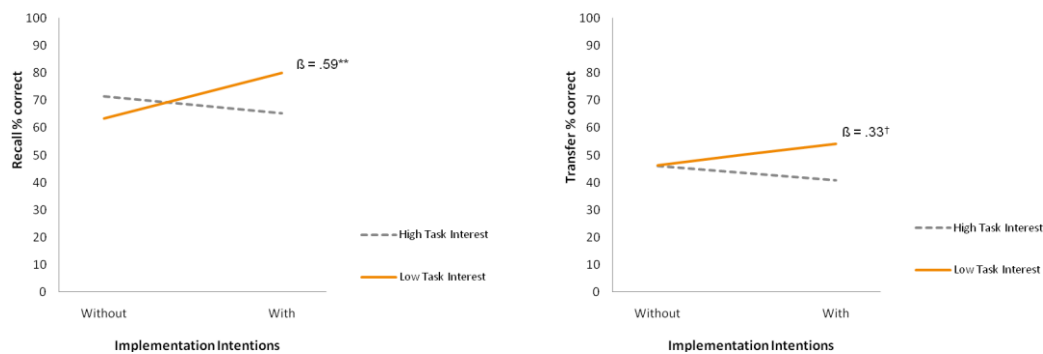


Figure 1. Simple slopes analyses for recall and transfer performance. † $p < .10$, ** $p < .01$.

Discussion

While the use of implementation intentions did not show an overall positive effect on learning outcomes, it was shown that implementation intentions significantly help uninterested learners to improve their learning performance, while seemingly not harming highly interested learners. This result corresponds well with previous findings that implementation intentions have a strong compensatory effect, especially when the involved activities are unpleasant (e.g., Orbell & Sheeran, 2000). Thus, implementation intentions seem to be a promising means in order to improve learning especially for those who are in need of help the most.

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