Illustrating for Learning from Texts: Is There an Advantage Over Note-Taking?

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Abstract. Illustrating is a strategy for learning from texts which fosters the construction of a verbal as well as a nonverbal representation of the learning material. In this study, we compared learning by illustrating with learning by note-taking, an entirely verbal learning strategy and varied whether learners were allowed to use their illustrations/notes as an external storage for answering the posttest. We found better learning results for learners who were able to rely on an external storage. Learners who illustrated, on the other hand, did not outperform learners who took notes in a posttest. However, post-hoc analyses showed an aptitude-treatment interaction: Only learners with high spatial abilities profited from the illustrating technique.
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It is a well-known phenomenon that learning from texts is enhanced by inserting illustrations (*multimedia effect*; Mayer, 2003). However, learner-generated illustrations have only recently become an object (see Van Meter & Garner, 2005). Illustrating, as defined in this work, is a strategy aimed to constructing an external representation of information presented in texts. This may include representational as well as logical pictures. Positive effects of illustrating on learning and transfer have, for example, been found for the drawing of representational pictures (den Elzen-Rump & Leutner, 2008), or for the instruction to illustrate the contents of texts in any kind of representation (Seufert, Zander, & Brünken, 2007). According to Van Meter's model of drawing construction, drawing is supposed to be beneficial because of the reciprocal construction of a verbal and a nonverbal representation.

In the presented study we assessed whether learning by illustrating offers advances over learning by note-taking, an entirely verbal method. Note-taking has also been found to be beneficial when learning from texts (e.g., Kobayashi, 2006). Furthermore, research on note-taking has shown that learners can use their notes to review the learning contents (Kiewra et al., 1991). We addressed the following hypotheses:

1. Participants who use the illustrating or note-taking strategy with and without an external storage (experimental groups) score higher in a posttest than participants who use the just-reading strategy (control group).
2. Participants who illustrate (illustrating groups) score higher in a posttest than participants who take notes (note-taking groups).
3. Participants who may use their illustrations and notes as an external storage while answering a posttest score higher than participants who cannot.

Method

Sample and design

One hundred university students (30 male, 70 female, mean age 24) were randomly assigned to one of five conditions of a 2x2 factorial design with a control group. Factor 1 was the learning strategy (illustrating vs. note taking). Factor 2 was the availability of an external storage while answering the

posttest (external storage vs. no external storage). The control group only read the learning texts and was advised not to take notes or to illustrate.

Materials

Learning texts. Five short learning texts were presented. The first text was about the incidents in a bank robbery, the second about a stock quotation, the third about a decision-heuristic in a fishing club, the fourth about the budget of a company, and the fifth about the installation of water pipes in a house.

Posttest. In the posttest participants were to answer questions about the learning texts. Two tasks to every learning text were presented: The first task was to retell the events (free recall). As a measure for the completeness, we counted the percentage of propositions in students' free recall that were identical to the learning texts. The second task was a transfer-question in which the participants were to draw conclusions about the events. To assess the answer to the transfer task, we first rated the correctness. After this, the quality of the given reason was coded on a five-point Likert-scale (0 = no reason given, 1 = wrong reason, 2 = reason mostly wrong, 3 = reason mostly correct, 4 = correct reason). For the analysis, the given scores were aggregated over the four texts.

Control measures. Seufert et al. (2007) found that learners with higher spatial abilities profited more from learning by illustrating. Therefore, we introduced two subscales on verbal and spatial abilites of the I-S-T 2000-R (Intelligence Structure Test, Amthauer et al., 1999).

Procedure

In the learning phase, for each of the five texts, participants had five minutes to either take notes or to illustrate the contents of each text graphically or to just read the texts. After finishing the learning phase, participants had five minutes to finish the posttest tasks for each of the five texts. The experimental conditions with an external storage were instructed to use their illustrations and notes to answer the questions. Finally, participants worked on the tests on verbal and spatial abilities.

Results

An alpha-level of .05 was used for all statistical analyses. We found neither significant group differences in verbal abilities $F < 1$, nor in spatial abilities $F < 1$.

Planned contrasts according to our hypotheses showed that against our expectations, the experimental groups did not score significantly higher in the posttest than the control group; free recall: $t(95) = .96$, $p = .17$ (one-tailed); transfer correctness: $t(95) = .36$, $p = .36$ (one-tailed); transfer quality: $t(95) = .77$, $p = 0.22$ (one-tailed).

We assumed that participants who used the illustrating strategy scored higher in the transfer posttest than participants who used the note-taking strategy. Against our expectations, participants in the note-taking conditions scored descriptively higher in the free recall task (see Table 1), $t(95) = 1.80$, $p = .08$. Though, descriptively, the results for the transfer measurements matched our hypotheses (see Table 1), the planned contrasts both failed significance; transfer correctness $t(95) = 1.63$, $p = .05$ (one-tailed); transfer quality $t(95) = 1.46$, $p = .08$ (one-tailed). We also assumed that being able to use the illustrations or notes while filling in the posttest should lead to higher posttest scores. Planned contrasts (external storage vs. no external storage) confirmed this hypothesis for the free recall task (see Table 1); $t(95) = 1,90$, $p = .03$ (one-tailed). However, we could not confirm this hypothesis

according to the transfer correctness ($t(95) = .61$, $p = .27$; one-tailed) or the transfer quality ($t(95) = .83$, $p = .41$.).

Table 1: Mean (Standard Deviation in Parentheses) of the Verbal and Spatial Abilities and the Transfer Scores for the Groups.

	Control group (n = 20)	Note-taking no ext. storage (n = 20)	Note-taking + ext. storage (n = 20)	Illustrating no ext. storage (n = 20)	Illustrating + ext. storage (n = 20)
Free recall	51.13 (11.63)	50.26 (10.12)	51.01 (15.65)	40.56 (13.43)	50.56 (11.62)
Transfer: correctness	3.90 (.85)	3.50 (1.19)	3.70 (1.16)	3.95 (1.05)	4.05 (1.15)
Transfer: quality	14.60 (3.19)	13.26 (4.74)	12.75 (5.14)	15.00 (3.73)	13.95 (4.52)

Discussion

According to the model of drawing construction by Van Meter and Garner (2005), drawing should lead to better retrieval and transfer of textual information as it fosters the dual coding of the material in a verbal and a nonverbal representation. Indeed, research on drawing and illustrating found beneficial effects of creating an illustration for learning (e.g., Seufert et al., 2007). We compared learning by illustrating with learning by note-taking, an entirely verbal strategy for the construction of an external representation. Against our expectations, however, we did not find an advantage in the posttest for learners who used illustrating compared to learners who used note-taking for learning. However, learners in the groups with an external storage had better free recall results compared to learners who solved the free recall task without their illustrations or notes, respectively. In a post-hoc analysis, however, we found an aptitude-treatment-interaction-effect for learners free recall results; $F(3, 71) = 2.67$, $p = .05$. For learners with low spatial abilities, the illustrating technique led to worse results whereas learners with high spatial abilities profited more from learning by illustrating than from learning by note-taking. Thus, our next step will be to have a closer look on learners' process data and to analyse possible influence factors on the results of learning by illustrating.

A reason for the lack of expected results could also be the relatively short time that passed between learning and the posttest. Den Elzen-Rump and Leutner (2008) reported differences between an illustrating group and a control group only for a delayed posttest conducted after several months. Further studies should consider that the effects of illustrating and the availability of an external storage could be stronger after some length of time and introduce a delayed posttest.

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