

ABSTRACTS

Generation of causal cohesion in science texts: Dissimilar effects on cognitive load by self-report and a dual task

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The current study addresses the question whether learners process, experience, and learn differently through science texts with varied levels of causal cohesion. In particular, we tested whether a generation activity regarding causal cohesion can induce a higher degree of text-integration. We examined learning performance within-subjects immediately and a week later. Between-subjects, we randomly assigned 113 students to three versions of a text on the greenhouse effect: either to a text with connectives (high causal cohesion condition; Graesser, McNamara, & Kulikowich, 2011); or without connectives (low causal cohesion condition); or a text, which required the selection of causal connectors (causal cohesion generation condition). In order to generate cohesion, learners were instructed to choose between four alternatives – because, although, thus or yet – in a dropdown list for each conjunction-gap in the text. These connectives indicated causal relations between clauses and varied systematically in polarity – positive vs. negative – and direction – backward vs. forward (Louwerse, 2001). It was not possible to choose based on syntactical rules, thus learners had to reprocess a sentence's content in order to draw the right conclusions. Cognitive Load was measured via a 10 question self-rating scale (Leppink, Paas, Van der Vleuten, van Gog, & Van Merriënboer, 2013) and by a dual task requiring a rapid verification response to trivial mathematical equations (cf. Brunken, Steinbacher, Plass, & Leutner, 2002). Results show that subjects in the generation condition had longer reading times $F(2,110)=58.66$, $p=.000$, $\eta^2=.516$ and reported a higher intrinsic cognitive load $F(2,110)=2.56$, $p=.082$, $\eta^2=.044$. The accuracy of the generation activity was highly associated with a higher learning performance $r=.760$, $p<.001$ and shorter reaction times in the dual task $r=-.392$, $p=.018$, which indicated decreased levels of cognitive load. However, this effect depended on learners prerequisites: previous knowledge $r=.346$, $p=.039$, reading comprehension $r=.482$, $p=.003$, and performance in a word analogy test $r=.755$, $p<.001$. In line with the desirable difficulty framework (cf. Bjork, 1994), the immediate retrieval performance didn't reveal a generation benefit, but the generation activity led to a sustainable learning performance one week after the treatment $F(2,110)=5.27$, $p=.007$, $\eta^2=.087$. This result reflects a higher storage strength in the generation condition, which resulted in lower levels of forgetting (Bjork & Bjork, 2011), especially for weak learners opposed to strong learners, $F(2,87)=2.65$, $p=.077$, $\eta^2=.057$. This moderation is not in line with the expertise reversal effect (Kalyuga, Ayres, Chandler, & Sweller, 2003). Potentially, weak learners lack the spontaneous integration activity which may have been evoked by the generation task (McDaniel, Hines, & Guynn, 2002).