

ABSTRACTS

Visuospatial tests correlate with STEM animation learning: Perspectives to cognitive load measurement?

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One of the problematic areas of cognitive load theory is the measurement of cognitive or working memory load (e.g., Kirschner, Ayres, & Chandler, 2011). We propose that assessing students' visuospatial abilities can help predict their performance in challenging cognitive load situations, such as STEM instructional animations containing transient information. Our goal is to provide future alternatives to cognitive load measurement.

In this experiment, we used three visuospatial computerized instruments from a battery recently developed (Castro-Alonso, Ayres, & Paas, in press) and investigated their relationship with animation learning about the STEM topic of vinification (wine making). We used adapted visuospatial tests for (a) the card rotations test, which measures spatial ability; (b) the Corsi block tapping test, which measures mainly spatial working memory; and (c) the visual patterns test, which measures mainly visual working memory. We also assessed gender effects, and the impact of allowing pauses to stop the transient pace of the animations. Altogether, we employed a 4 x 2 x 2 mixed design, where tests scores (card rotations, Corsi blocks, visual patterns, and retention test of vinification) was the within-subjects factor, and (a) gender (males vs. females), and (b) animation pause (pause vs. non-pause) were the between-subjects factors. We also investigated correlations between the four test scores.

The participants were 80 Chilean STEM technical students (50% females), randomly allocated to the conditions. On individual computers, the subjects attempted the three visuospatial tests, before being shown the vinification multimedia. Only half of the students observed the multimedia with a pause/resume option. Following the multimedia presentation, students completed the computerized retention test.

The mixed ANOVA showed only a significant main effect of test scores, $F(2.557, 194.338) = 214.96, p < .001$. Participants overall scored significantly higher on the visual patterns test ($M = 88.36\%$), followed by the multimedia retention test of vinification ($M = 57.05\%$), followed by the Corsi blocks test ($M = 49.87\%$), and their worst performance was overall in the card rotations test ($M = 26.24\%$). Investigating correlations, we observed a lack of significant findings between the three visuospatial tests (all $ps > .063$). In contrast, there was a significant correlation between the card rotations and the vinification tests ($r = .28, p = .012$), and between the Corsi blocks and the vinification tests ($r = .27, p = .014$).

In conclusion, both spatial ability and spatial working memory may be more useful than visual working memory (measured by the visual patterns test that did not show correlations) for learning a STEM animation topic similar to the present study. The ANOVA showed no gender differences in the visuospatial tests or the retention test, nor a cognitive load effect for pausing the pace of the animation.