

valued-added approach. The studies in these presentations focus on learning proportional reasoning with the game 'Zeldenrust'. ter Vrugte et al. investigate how collaboration (foster verbalization) and competition (foster engagement) affect learning. Wouters et al investigate whether surprising events yield playful learning. Vandercruysse et al. investigate whether integration of content into the game has a positive effect on learning and motivation. Finally, in a media comparison study Rodriguez Padilla et al. used the 'Number Navigation Game' to investigate if the game experience influences arithmetic fluency and motivation.

### **Combining Collaboration and Competition with Prevocational Game-Based Math Education**

Instructional design, Mathematics, Computer-assisted learning, Game-based learning

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The present study addressed the effectiveness of an educational math game for improving proportional reasoning in prevocational education, and examined the added value of face-to-face collaboration and competition. The study compared four conditions: the game with collaboration, with collaboration and competition, or with competition only, and the game without additional support. It was found that students' proportional reasoning skill improved significantly after playing the game. Though results did not favor one condition over the other, they did indicate that the two factors (competition and collaboration) interact. This interaction is significant for students with below average prior knowledge, demonstrating a negative effect of competition on the effect of collaboration.

### **The Role of Surprising Events in a Math-game on Proportional Reasoning**

Experimental studies, Mathematics, Computer-assisted learning, Game-based learning

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This study examines whether surprising events can be used to stimulate students' playful learning in a GBL environment in the domain of proportional reasoning. The assumed effect of surprise is that unexpected events interrupt an expectation and therefore triggers the player to evaluate the new situation more extensively (enhanced retrieval and updating of an existing mental model). We hypothesized that a group with surprising events would outperform a group without surprising events on learning. Although we had to reject this hypothesis, a closer examination provides some evidence that the effect of surprising events may interact with the educational level of the student.