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Formal and informal learning environments: using games to support early numeracy.

Torbeyns, Joke (ed.) et al., Describing and studying domain-specific serious games. Cham: Springer (ISBN 978-3-319-20275-4/hbk; 978-3-319-20276-1/ebook). Advances in Game-Based Learning, 231-250 (2015).

Summary: Learning environments created to support children's development of early numeracy often use games. This applies to both formal and informal learning environments. However, there is hardly any empirical research on the effectiveness of games being used in such learning environments. Moreover, it has rarely been discussed whether the games are appropriate from a mathematics educational perspective. In this article, we first describe quality criteria for mathematical learning games and provide an overview of studies that investigated the effectiveness of using games to support young children's learning of early numeracy. We suggest that games for mathematical learning can differ significantly in their roles. Some games are intentional, structured, and with clear learning objectives, others have been designed for entertainment purposes, but nevertheless offer opportunities to learn mathematics. We then discuss in more detail the results of an intervention study as an example of a study on using games in informal learning environments. In this study, kindergarteners played conventional board games with classic dice. Although these games were not specifically designed to support numerical learning, the intervention effects were relatively high. However, the number of studies with systematic evaluation is very limited, so that more research is needed. More generally, we suggest that the term "game" should be used carefully and only for learning environments in which playing in its original meaning is an essential aspect.

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Keywords: game-based learning; number games; play situations; early numeracy; mathematical learning environments

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