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Performance in educational math games: is it a question of math knowledge?

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, 117-131 (2015).

Summary: In order to develop game-based learning environments (GBLEs) that accommodate to learners' needs and individual differences, GBLEs can be enriched with learner models that describe learner profiles from which adaptive instruction can be offered during gameplay. Learner models can encompass several parameters or learner characteristics derived from measurements taken either prior to play (e.g., already available knowledge of the subject matter of which the GBLE is comprised) or during gameplay (i.e., learner behavior in the GBLE). This study makes a case for two skills which may be relevant from the perspective of adaptive gameplay, namely (1) the knowledge or skills with respect to the learning content and (2) the gaming skills. The current study investigates the joint inclusion of both gaming skills and domain knowledge creating learner profiles. In addition, this study sheds light on how performance during gameplay can be attributed to certain learner profiles. To investigate this, a commercially available 3D educational game for primary school children was offered to 53 children of the third grade. Learners' behavior while playing in the GBLE was captured and logged. Prior to gameplay, math knowledge, and gaming skills were measured. Subsequently, learners' in-game performance was measured. Results revealed that learners with high or low gaming skills can be distinguished into two learner profiles. More specific, learners with high gaming skills outperformed learners with low gaming skills in more complex mini-games. The findings of this study suggest that a learner's gaming skills can be taken into account in developing learner profiles and hence in the design and development of GBLEs.