Chapter 48
Gamification and Smart Feedback:
Experiences with a Primary School Level Math App

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ABSTRACT

Gamification is a recent trend in the field of game-based learning that accounts for development effort, costs, and effectiveness concerns of games. Another trend in educational technology is learning analytics and formative feedback. In the context of a European project the developed a light weight tool for learning and practicing divisions named Sonic Divider. This simple app is based on features of gamification. More importantly, it features formative assessment and feedback functions based on Competence-based Knowledge Space Theory. The authors applied and evaluated the tool in Austrian classrooms and found some evidence for the motivational aspect of the gamification elements, in particular scoring. They also found positive effects of an individualized and meaningful feedback about errors. Finally, there occurred certain gender difference, for example, girls were much less attracted by competition elements (e.g., by comparing high scores) then boys, however, more attentive towards feedback coming from the tool.

BUZZ WORD GAMIFICATION

Educational computer games are a highly popular but also a highly challenging field when it comes to an effective and efficient adoption in the classrooms. This holds true from the perspective of the necessary technical infrastructure, from the pedagogical embedment as well as the perspective of a meaningful and formative use of individual gaming results. Not least, there are increasingly critical questions about the effectiveness of using high quality computer games for (usually limited)

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subject matter. One approach is to make use of the enormous quality and motivational potential of existing computer games (the so-called commercial off-the-shelf games) or simulations for targeted educational purposes. Examples were reported by Kurt Squire (e.g., 2003) in the context of learning from simulation games such as Civilization or Age of Empires, Constance Steinkuehler in the context of massively multiplayer games (e.g., Steinkuehler & Johnson, 2009), Maja Pivec (2007), Sara de Freitas (e.g., de Freitas & Maharg, 2010), or David Shaffer (e.g., 2006). A recent trend is the concept of "gamification", which refers to the idea of utilizing game characteristics and game features for non-game applications in order to make them more fun, more engaging, and perhaps educationally more effective.

Among the most regularly and successfully utilized gamification features is goal-setting including progress paths and badges, awarding the player to identify goal completion. Ling et al. (2005) argues that the most motivating goals are those just out of comfortable reach and that this technique is most effective when users can see their progress toward the end goal. Furthermore, people often increase engagement and efforts when they believe that they are close to a specific goal (Fox & Hoffman, 2002). A related (or resulting) technique is providing badges – little but visible indicators of achievement, success, and ability – perhaps even status. Even if players never earn the badges, through viewing a set reachable and accomplishable challenges they come to understand valued activities within the system. Of course, it needs to be mentioned that tokenizing the achievements of players bears certain downsides, for example the avoidance of competition and fear of failure (cf. Montola et al., 2009). Other techniques are levelling (i.e., granting players access to new levels of the system – just novel interfaces, in its simplest case), graphical enhancements of the system, the use of (visually appealing) avatars, the implementation of additional challenges and quests, or the provision of mini games (such as board, card, or racing games) for diversion and recreation. Finally, an important aspect of gamification is sweepstakes, lotteries, and "real" giveaways. However, as Alfie Kohn in his book "Punished by Rewards" (1999) argued, this type of motivators may provoke more (perhaps too much) concentration on game-related achievements while producing lesser quality. In his example he demonstrated that children draw more pictures, but in lesser quality, when paid for drawing pictures, more importantly, children did not like drawing pictures as much as before after they were stopped being paid (Kohn, 1999). Despite the risks, there is a clear trend towards the application of gamification (cf. Anderson & Rainie, 2012 for a critical review). Future work, however, must increasingly address the actual effects and benefits of gamification, in particular in school settings.

SMART, FORMATIVE FEEDBACK

The notion of gamification and the related techniques, provide a natural and convincing link to the ideas of formative feedback, which is considered a key driver of successful education. Especially new technologies enter the field, aiming at supporting teachers in gathering large scale data, aggregating and analyzing them, and perhaps most importantly, to visualize and present the outcomes of analyses in a way that is most useful and beneficial for the learners. Certainly, such attempt is not new; teachers of all times have focused on supporting their students to the best possible extent and to bring them forward - to identify knowledge/competence gaps to inform learners and to facilitate a deeper understanding. This trend is accompanied with the daily growing mass of data available about students. Information