Eedu Elements, a Finnish K-6 school in a mobile game

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ABSTRACT
Education is one of the most important factors in every person's life. Globally it has even more important role, since it is the fundamental source of democracy and it also forms basis for overall humanity and equality. Eedu Elements will implement Finnish Elementary School into mobile applications, which will be available for Apple, Android and Chrome users globally in 2012.

Author Keywords
games, education, learning, school, mathematics

INTRODUCTION
Experienced teachers are aware that when a pupil is asked to teach another pupil, both pupils learn. This fact has not been applied enough in educational games, mostly because of a lack of technology and game AI that enables players to teach conceptually challenging themes still remaining easy-to-use game play.

Eedu Elements connects learner into things they can experience on daily basis when teaching skills into their game characters. The game characters learn like humans do: inductively case-by-case by building relations between new and existing concepts. The background of Eedu Elements is in learning-by-doing, learning-by-teaching and to some extent learning-by-programming. The approach is learner centric: the game introduces mathematics in a way that learner can build his/her mental conceptual structures by adding new concepts into known ones.

One of our special focuses has been scientific proof of concept: We have shown educational outcomes as well as motivation towards teaching virtual pets: Under experimental settings, more than 60% of players increases their skills remarkably during the two hours gameplay (Ketamo & Suominen 2010; Kiili, Ketamo & Lainema 2011). The outcome in natural learning environment with possibility to long-term gameplay is even greater: In fact, we have shown that the best outcome is achieved when there are enough informal discussions between game play (Ketamo & Kiili 2010).

The AI technology behind the game is based on authors earlier work (e.g. Ketamo 2009). Each game character is a teachable agent that learns through interactions and evaluations during the gameplay. The most important finding is that performance measured from player's game characters correlates highly with assessment done with traditional paper tests (Ketamo 2009; Ketamo 2011). Finally, we can say that while teaching his/her virtual character, learner reproduces a model about his/her mental conceptual structures. Because of this, we can produce detailed analytics about learning.

KEY FUNCTIONALITY AND GAME PLAY
Since opening its public beta in February 2012, Eedu Elements has gained interest of over 3000 users in more than 100 different countries. The key functionalities (figure 1) are following: i) Player will learn while teaching. ii) Player can use his / her strengths without knowing any language. iii) Cognitive load can be adjusted according to the learning progress.

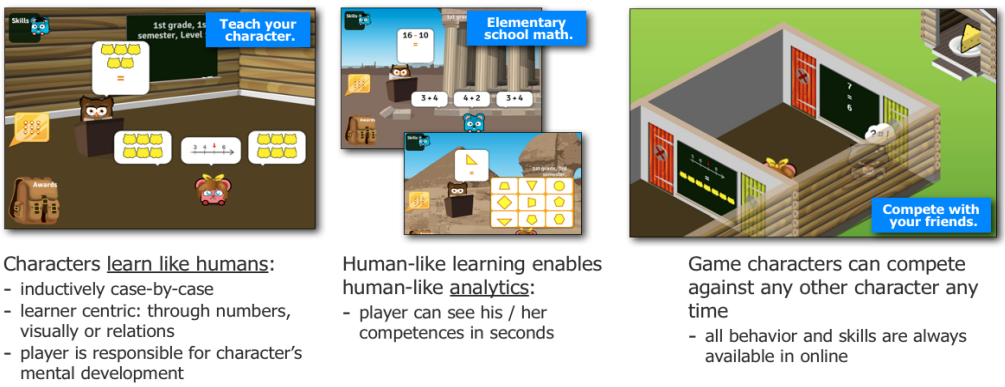

Figure 1. Eedu elements key functionalities.

Eedu Elements provides scaleability for millions of simultaneous users, but also fast development environment for new learning concepts: HTML5 framework makes game development, distribution and maintenance efficient.

LEARNING- AND ACADEMIC ANALYTICS

In-game learning analytics are meant for parents and teachers to quickly observe what learner has taught for his/her game character. The visualisation (figure 2, left) shows correctly taught concepts in selected level with green bars that are that higher what better learner knows the concept. Wrongly understood concepts are show with red bars at the bottom of the screen. The general year-based diagnostics (figure 2, right) shows the performance in upper level themes.

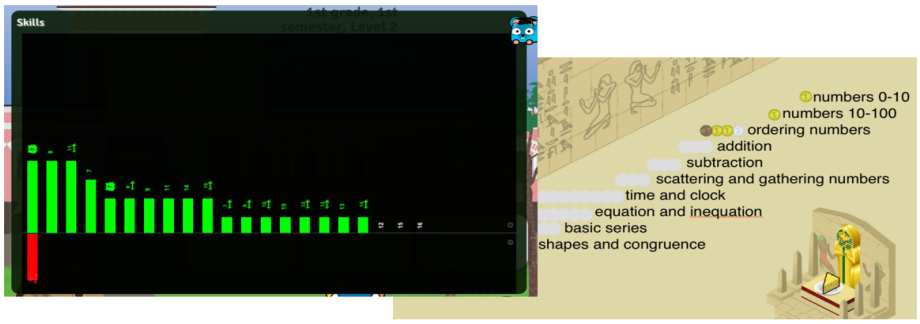

Figure 2. In-game learning analytics in Eedu Elements game.

Academic analytics are meant to provide relevant information for practice and curriculum development for school administrators and national policy makers. The analytics (figure 3) can show the general score, like Pisa, for countries, but the real strength of the analytics are in details:

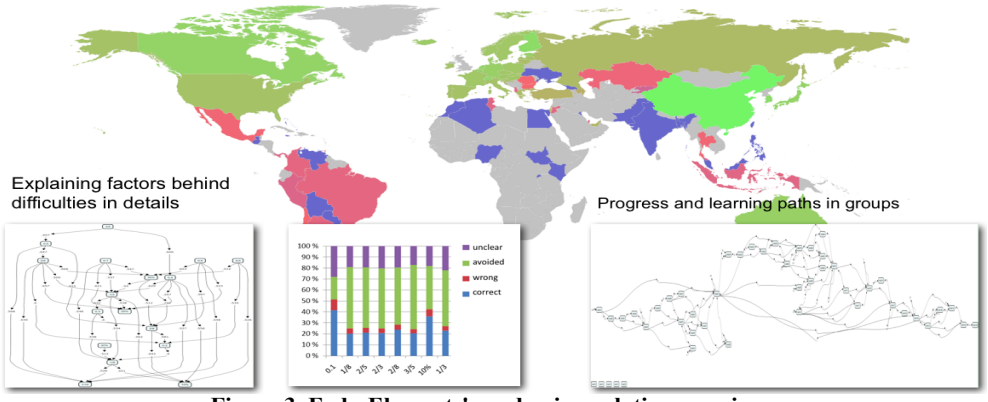

Figure 3. Eedu Elements' academic analytics overview.

CONCLUSIONS

In general, the paradigm on how an education is going to change is that school is no longer a place to learn and repeat single skills. Furthermore, there is no need to play the games only in school; games can be played outside the school and experiences can be discussed and shred at school. The skills and competences can be learned via play, e.g. in highly adaptive game environments, designed to support learners individual needs. School hours are for extending learners' mental conceptual structures via team work, social interaction, play, and active participation. Furthermore, games and other virtual environments can offer much more than just entertainment. They can provide relevant and meaningful information for individual learner, his/her parents, teachers and even for whole educational system in an national level. This, however, requires careful planning and years of research on game design and analytics.

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