Motivating the Application of Math Skills through Video Games

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Research Question:

Are games an effective means of enhancing learning of probability and statistics? Is it more effective to let players passively calculate or directly ask them to perform the calculations?

Background:

Garfield and Ahlgren in "Difficulties in Learning Basic Concepts in PRobability and Statistics" find that there are three common reasons that students seem to naturally be intimidated by or otherwise not understand concepts of probability in the classroom setting. These problems and how we seek to address them follow:

1. Underlying difficulty with rational number concepts & proportional reasoning.
   We are giving students an opportunity to practice developing these skills by directly challenging them to apply them.
2. Probability seems to conflict with personal experience. Live experience with what odds actually mean will give students relevant experience and better comprehension of the implications of probability.
3. Distaste due to prior exposure being abstract and formal.
   Providing a conventional video game experience which will allow the students to try and fail and experiment with few negative repercussions for failure will bring a more positive study experience than the pressure of graded exams in a purely academic setting.

A mixture of "low-road" learning through repeated use of the required calculations and "high-road" learning through applying this knowledge through a larger more abstract application of managing an entire battle presented by Victor Ratio should serve as an excellent means by which to follow Plass, Homer, and Kinzer's idea of how video games facilitate the transfer of learning in "Foundations of Game-Based Learning".

Title Screen: Victory Ratio

Movement Actions   Math Incentive Screen

Additionally, there is a research backing for strategy games to facilitate the learning of mathematical concepts in a 2016 study performed by Hernández-Sabaté et al in which they used eye trackers to monitor players for using geometric calculations and resource management while playing a real-time strategy game, or RTS.

Method:

Local highschool and middle schools will be investigated to determine their curriculum and timelines for their math courses to find a proper date to perform the study. Interested teachers will have to be found, and further permission slips may need to be sent out to parents due to ethical concerns of studies involving children as well as the simple fact that parents may have a stigma against video games. Often, these teachers do teach the same class to multiple groups of students, so teacher difference is easily controlled. Each teacher selected will perform this study with 3 groups, each with a different method.

Group 1 will have a traditional classroom curriculum

Group 2 will play Victory Ratio at the beginning of the probability curriculum with a mechanic enable that asks the player to setup the equation for determining probability before combat in exchange for an attack boost.

Group 3 will play Victory ratio at the beginning of the curriculum as well, but they will play a version of the game without the math question at the start of combat.

Each group will be given a pre-test survey for competence and efficacy. After playing the game, they will continue to take the originally scheduled curriculum, and grades will be compared between the three groups for improvement at the end of the curriculum, as well as a post-test survey for efficacy and competence.

Hypothesized Results:

We expect to see great improvement in the performance and confidence of students who played Victory Ratio when compared to the traditional curriculum. Between the two GBL groups we expect the group playing with the math incentive enabled to perform better, but we would be very pleased to see the group without the incentive to perform comparably well or even better.

Sources