# Testing an Educational Videogame in a setting with Limited Technology Access

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**Abstract:** Using videogames as a learning tool is not new and it has been shown to be effective in most cases; however the setting and environment in which these tools are used seems to have a great impact on the results. Using our own serious educational videogame, a study was conducted in a rural (low SES) school where students have limited access to computers and technology. The main objective was to assess if the involvement of students with videogames in rural schools could result in an increase in performance and such increase could be maintained. Results indicated that indeed there is an increase in performance and in most cases it is sustained.

## Introduction

In a previous study the use of videogames in education seems to improve the user's cognitive abilities, it has an impact in rational decision making and general performance in education (Spence and Feng, 2010). The capacity of affecting cognition and even the subject's behavior resides not in the potential, but in the popularity of the game, (Green, Pouget, & Bavelier, 2010). The most interesting fact is that the combination of a game play experience, with the learning content, increases the general understanding of such material (Wouters, van Nimwegen, van Oostendorp, and van der Spek, 2013). The majority of educational game developers choose the game's content based on needs analysis, they develop the core game mechanic primarily with play testing and it is suggested that a systematic collaboration between teachers and game developers is essential to achieve better educational games (Kinzer, Hwang, Chantes, 2015).

Guatemala is an underdeveloped country, it struggles in a variety of fields most notably health and education (CIA World Fact Book). In 2015, only the 51.6% of the population lived an urban area, the country has a median age of 21.4 years and a fertility rate of 2.9 children born per woman. Rural schools in Guatemala have limited access to technology and most of the students from these schools have never use a computer before.

## Objectives

The main objective of the study was to verify if the use of an educational videogame in a setting with limited access to technology (computers and internet) could have an impact in the learning process and if the impact would persist afterwards.

## Procedure and Subjects

A new serious educational videogame, Cerebrex was developed by the authors, which consists of 12 minigames, each one of one minute duration and could be played indefinite times, the minigames focus on numeric, visuospatial, memory and rational areas. Cerebrex reached semifinals at the ECGBL (European Conference on Games Based Learning) in 2014. A rural school in Patzun, Guatemala was chosen for the study, since the school does not own a computer lab, simultaneous work and collaboration was held with the local municipality in order to have access to a public computer lab. An agreement was reached to allow the students to use their installations.

The target audience was 6th year students, a total of 118 students participated in the experiment. All students took the general aptitude test Factorial Evaluation of the Intellectual Aptitudes (FEIA, Santamria, et. al, 2005) in order to measure their cognitive abilities in the numeric, visuospatial, memory, verbal and rational areas. After taking the test the students were taught how to use the game and given access to the videogame for 10 weeks. After this period of time, all students took the general aptitude test again concluding phase 1. In phase 2, the access to the videogame was suspended for 10 weeks and at the end of this time, they took the aptitude test again.

## Results

The mean age of the subjects was 13, with a range of 10 to 17 years old, 45% of the sample were girls and 55% were boys. The results showed that as hypothesized, playing the game had a marked increase in several of the subtests, and, what is more important this increment was sustained after 10 months. To see if the effects in phase 1 and 2 were significant an analysis of repeated measures was used. The difference is significant. Analyses were run also to look at the effect of age and gender, but those variables did not have an impact in the results.

| Area | Phase | Mean | Std. Deviation |
|---|---|---|---|
| **Numeric** | *1st Testing* | 3.94 | 1.91 |
| | *2nd Testing* | 5.58 | 2.23 |
| | *3rd Testing* | 6.43 | 2.31 |
| **Visuospatial** | *1st Testing* | 5.35 | 2.24 |
| | *2nd Testing* | 7.81 | 3.77 |
| | *3rd Testing* | 9.01 | 2.92 |
| **Memory** | *1st Testing* | 6.31 | 2.46 |
| | *2nd Testing* | 7.84 | 3.11 |
| | *3rd Testing* | 7.52 | 2.58 |
| **Rational** | *1st Testing* | 5.53 | 2.53 |
| | *2nd Testing* | 6.86 | 2.96 |
| | *3rd Testing* | 6.43 | 2.67 |
| **Verbal** | *1st Testing* | 4.84 | 2.68 |
| | *2nd Testing* | 7.14 | 3.26 |
| | *3rd Testing* | 6.81 | 2.59 |

**Table 1: Summary of Descriptive Statistics Results.**

Comparing the means from the results of the first and second testing, it was found that there was an increase, thus the student's performance improved after playing Cerebrex for 10 weeks. Comparing means from the results of the second and third testing, it was found that there was an increase only in the visuospatial and numeric areas, the mean in the memory, verbal and rational areas slightly decreased. A repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean significant difference in all test areas, the numeric test ($F(1.95, 159.79) = 36.97$, $p = 0.00$), verbal $F(1.98, 162.31) = 28.04$, $p = 0.00$), in visuospatial ($F(1.98, 162.07) = 42.27$, $p = 0.00$), memory ($F(1.86, 152.10) = 9.51$, $p = 0.00$) and the rational area ($F(1.97, 161.30) = 7.89$, $p = 0.001$).

## Discussion and Conclusion

The results of the study suggest that there was a statistical significant increase in performance, as was expected to be present during both, the second and third testing. Such increase occurred in all test areas, however it was unexpected the effect found in the verbal area, given that Cerebrex does not include any minigame that could be categorized as verbal or to specifically target verbal stimulation. Playing Cerebrex was a first time experience with computers for many students, this may be a limitation of the study and in a subsequent study should be considered. Changing the game mechanics for certain minigames could be an area for future work. Testing a completely new game, which can focus more on verbal stimulation, could be interesting to develop as these skills are of paramount importance to all future learning.

## References


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