

Books in augmented reality in teaching. A case study.

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ABSTRACT:

Through this article we want to demonstrate that books in augmented reality are useful in teaching/learning processes to increase student performance. The following methodologies were used to carry out the research: mixed (qualitative research, quantitative research); quasi-experimental research with case study; Evidence-Based Results. Six class groups were used; four classes for comparison/control and two classes sample, on which the experimental phase was conducted. The results showed that there was a greater improvement in the classes that used books in augmented reality. Further research is needed to evaluate the impact of books in augmented reality in other school levels well. The results encourage teachers to adopt books in augmented reality as a support to traditional books in their teaching processes.

KEYWORDS: *Augmented reality books, Digital education, Information and Communication Technologies.*

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I. INTRODUCTION

In the education sector there are different technologies, methods and approaches that can be used to provide support in the teaching/learning process. Among these there is also augmented reality.

Augmented Reality (AR) is a variant of Virtual Environments (VE), or Virtual Reality as it is more commonly called. VE technologies completely immerse the user within a synthetic environment. While immersed, the user cannot see the real world around him. Differently, AR allows the user to see the real world, with virtual objects superimposed or composited with the real world. Therefore, AR complements reality, rather than completely replacing it.

The Augmented reality books use the latest technologies, and offer the reader a totally different experience, particularly for children they offer a more pleasant experience, as the paper format is enriched with animations and/or images through the use of apps three-dimensional.

Augmented Reality (AR) is a technology that allows you to view virtual objects and information in the environment in real time. Augmented reality has considerable potential in the teaching field as it allows us to understand and model abstract and complex concepts in a simpler way.

Augmented reality in the teaching process allows:

- the creation of real-life scenarios in the classroom, going beyond the theoretical description;
- the combination of theoretical information with practical-experimental activities also through a more playful modality, with the possibility of learning without real consequences in case of errors;
- an immersive experience.

II. METHODOLOGY

The following methodologies were used for the research: Quasi-experimental, due to the problem of sampling and group research, as it was conducted empirically on a case study; Evidence-Based Results (EBR); mixed methods (quantitative and qualitative research). The research was conducted through a case study, “Comparison of parallel classes”.

The experimental phase of using books in augmented reality involved the two plexus of a primary school. We will define plexus S, the plexus where the augmented reality books were used; and the R plexus, the comparison/control plexus. The S plexus has only one section, and the research involved classes IV-C with 13 students, and class V-C with 15 students. The R plexus has two sections, and the research involved classes IV-A with 16 students, class IV-B with 15 students, class V-A with 18 students and class V-B with 16 students.

Augmented reality books are used in classes IV-C and V-C of the plexus S of primary school for the disciplines of Science, Geometry and Geography.

In order to have initial reference values and then be able to compare them with the final values, at the beginning of the school year for the fourth and fifth classes, entrance tests (questionnaires) were administered to the classes for the disciplines Science, Geometry, Geography, the maximum score obtainable was 50 points.

The results are: For class IV-A of the Science test the average points obtained by the students was 30.4, with a standard deviation of 4.5; in the Geometry test the average points obtained by the students was 32.5, with a standard deviation of 3.6; in the Geography test the average points obtained by the students was 33.3, with a standard deviation of 3.8.

For class IV-B of the Science test the average points obtained by the students was 31.5, with a standard deviation of 3.1; in the Geometry test the average points obtained by the students was 32.8, with a standard deviation of 3.2; in the Geography test the average points obtained by the students was 32.4, with a standard deviation of 3.6.

For class IV-C of the Science test the average points obtained by the students was 30.8, with a standard deviation of 5.7; in the Geometry test the average points obtained by the students was 31.8, with a standard deviation of 4.5; in the Geography test the average points obtained by the students was 37.4, with a standard deviation of 5.2.

Considering that between the IV classes there is a minimum difference in the average in Science and Geometry equal to 2%, and in Geography equal to 10%, from a statistical point of view we can say that the samples are similar and comparable.

For class V-A of the Science test the average points obtained by the students was 32.3, with a standard deviation of 4.1; in the Geometry test the average points obtained by the students was 32.0, with a standard deviation of 3.4; in the Geography test the average points obtained by the students was 34.5, with a standard deviation of 3.9.

For class V-B of the Science test the average points obtained by the students was 33.3, with a standard deviation of 3.5; in the Geometry test the average points obtained by the students was 34.0, with a standard deviation of 3.9; in the Geography test the average points obtained by the students was 33.7, with a standard deviation of 4.7.

For class V-C of the Science test the average points obtained by the students was 31.8, with a standard deviation of 3.0; in the Geometry test the average points obtained by the students was 31.1, with a standard deviation of 2.5; in the Geography test the average points obtained by the students was 31.7, with a standard deviation of 3.2.

Considering that between the V classes there is a minimum difference in the average in Science equal to 3%, and in Geometry and Geography equal to 6%, from a statistical point of view we can say that the samples are similar and comparable.

Once the entrance tests have been completed, the class teachers carry out their lessons. Augmented reality books are used in classes IV-C and V-C of the plexus S.

The topics proposed to students in classes IV-A, IV-B and IV-C are the same, just as the topics carried out in classes V-A, V-B and V-C are the same.

At the end of the lessons (at the end of the year), students take tests to evaluate their skills for the Science, Geometry and Geography disciplines. The maximum score obtainable was 50 points. The results are: For class IV-A of the Science test the average points obtained by the students was 33.4, with a standard deviation of 3.4; in the Geometry test the average points obtained by the students was 34.7, with a standard deviation of 4.0; in the Geography test the average points obtained by the students was 35.0, with a standard deviation of 4.8. The improvements in the Science test were 6%, in the Geometry test 4.4%, and in the Geography test 3.4%. On average the class of these three disciplines had an improvement in the three tests of 4.6%.

For class IV-B of the Science test the average points obtained by the students was 34.3, with a standard deviation of 3.7; in the Geometry test the average points obtained by the students was 36.8, with a standard deviation of 3.8; in the Geography test the average points obtained by the students was 36.1, with a standard deviation of 4.7. The improvements in the Science test were 5.6%, in the Geometry test 8% and in the Geography test 7.4%. On average the class of these three disciplines had an improvement in the three tests of 7.0%.

For class IV-C of the Science test the average points obtained by the students was 35.1, with a standard deviation of 6.8; in the Geometry test the average points obtained by the students was 35.0, with a standard deviation of 6.0; in the Geography test the average points obtained by the students was 41.5, with a standard deviation of 4.8. The improvements in the Science test were 8.6%, in the Geometry test 6.4%, and in the Geography test 8.2%, on average the class of these three disciplines had an improvement in three tests of 7.7%.

For class V-A of the Science test the average points obtained by the students was 35.2, with a standard deviation of 5.1; in the Geometry test the average points obtained by the students was 34.9, with a standard deviation of 4.4; in the Geography test the average points obtained by the students was 37.0, with a standard deviation of 3.8. The improvements in the Science test were 5.8%, in the Geometry test 5.8%, and in the Geography test 5.0%, on average the class of these three disciplines had an improvement in the three tests by 5.5%.

For class V-B of the Science test the average points obtained by the students was 35.7, with a standard deviation of 3.2; in the Geometry test the average points obtained by the students was 36.2, with a standard deviation of 3.1; in the Geography test the average points obtained by the students was 36.3, with a standard deviation of 5.6. The improvements in the Science test were 4.8%, in the Geometry test 4.4%, and in the Geography test 5.2%, on average the class of these three disciplines had an improvement in the three tests by 4.8%.

For class V-C of the Science test the average points obtained by the students was 36.0, with a standard deviation of 4.0; in the Geometry test the average points obtained by the students was 36.5, with a standard deviation of 2.1; in the Geography test the average points obtained by the students was 36.9, with a standard deviation of 3.7. The improvements in the Science test were 8.4%, in the Geometry test 10.8%, and in the Geography test 10.4%, on average the class of these three disciplines had an improvement in the three tests of 9.9%.

III. Results

Comparing the six classes we can see that those of the plexus S (experimental, classes IV-C and V-C) who used the augmented reality books are the ones who improved the most.

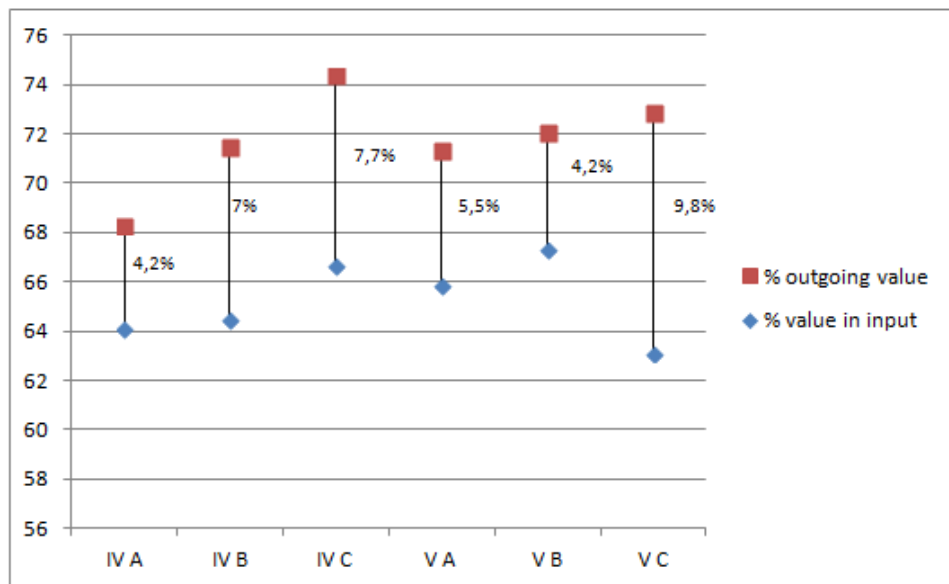


Figure 1: percentage increase of the single classes

Overall, summing all the data, we obtain that for the experimental classes (plexus S, IV-C and V-C) there was an improvement of 8.8%, while for the other classes (plexus R, classes IV-A, IV-B, V-A and V-B) there was an improvement of 5.3%.

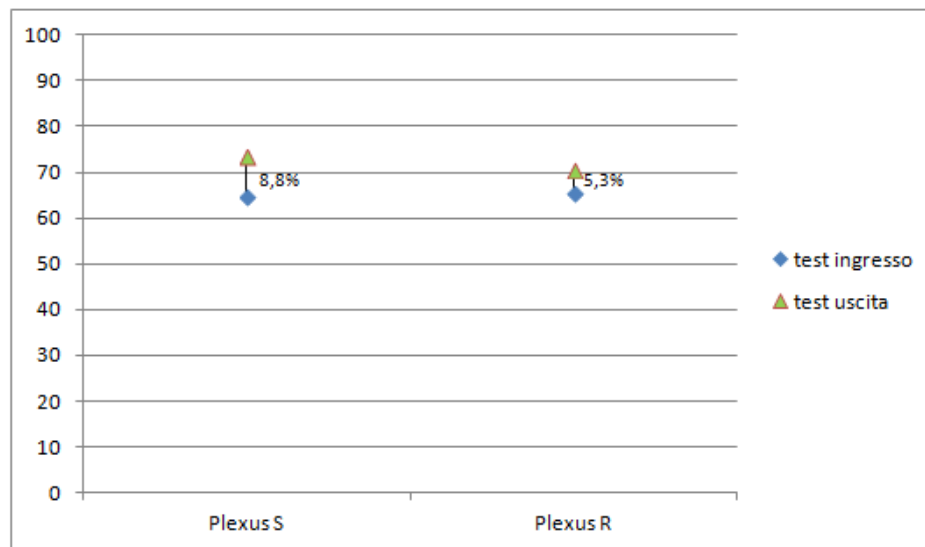


Figure 2: percentage increase of the single plexus

Ultimately, the use of books in augmented reality led to an improvement in student results equal to 3.5% more in the plexus S compared to the plexus R.

IV. CONCLUSION

The technological novelty brought by augmented reality presupposes the introduction of innovative principles and procedures relevant in the educational and training field as it allows the creation of new potential for use in the classroom, since it is able to expand the real world of training contents and also create new and exciting ways for students to interact and engage with their surroundings.

In this context, educational research must also take into account and enhance this new digital evolution and through study, and operational implementation must be able to offer valid suggestions and provide information on possible application implications.

The inclusion and use of augmented reality could become increasingly feasible for schools thanks to advances in pedagogical development, concepts, applications, digital technology and decreasing hardware-software costs.

From the results of this research it emerged that the use of augmented reality books integrated into traditional teaching activities represents one of the key factors for educational success in learning processes.

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