

AUGMENTED LOG: USING AR TECHNOLOGY TO CONSTRUCT LEARNING ABOUT LOGARITHMS AND EXPONENTIALS

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This poster describes how an augmented reality learning experience effectively motivated and supported students in organising mathematical content related to a usually painful subject in high school mathematics. The outcomes of this experience, monitored through classroom observation, were aligned with the theoretical framework of AR and proved that the use of technology reinforced students' understanding and fostered long-term memory about the topic.

Keywords: Augmented Reality, high school math, constructivist learning

INTRODUCTION AND THEORETICAL FRAMEWORK

Augmented Reality is rather a new entry within educational technologies and has huge potential power as a learning tool that has yet to be explored.

This project had a double goal: from a research point of view the aim was evaluating whether “as a cognitive tool or pedagogical approach, AR aligns with situated and constructivist learning theory as it positions the learner within a real-world physical and social context, while guiding, scaffolding and facilitating participatory and metacognitive learning processes such as authentic inquiry, active observation, peer coaching, reciprocal teaching and legitimate peripheral participation with multiple modes of representation”, as suggested by Dunleavy & Dede (2013).

From a pedagogical point of view the purpose was to investigate the educational dimension of a vision-based AR technology (that is to say the triggering of a superimposed computer generated layer pointing a GPS-enabled device to a precise spot), enhanced by the fact that students themselves have been authors of the digital content, with the goal of evaluating how technology could foster the development of significant mathematical literacy and assess how students could use their day to day technological skills to support their mathematical learning.

METHOD AND ACTIVITY

The activity, which involved a class group of 28 16 y.o. students attending the 3rd year of high school (Liceo Scientifico), was divided into three phases: introduction and synthesis took place at school, while the actual production of the digital media (trigger image and video overlay) was assigned as homework.

The results were gathered by the teacher through the assessment of students' homework and the observation of the resulting classroom discussion.

The three phases were organised as follows:

1. At school: after completing the module on logarithm and exponential functions, the teacher selected and assigned to each student a specific segment of the subject, ranging from practical topics as the properties of logarithm and the techniques for solving exponential equations to historical themes such as the number e and the legend of the chessboard.

The teacher then had students download the *Aurasma* AR free app for iOS- and Android-based mobile devices, log in with the class account – augmentedlog – which had been created for that purpose and point it to the image in figure 1, which triggered an instruction video for the task.

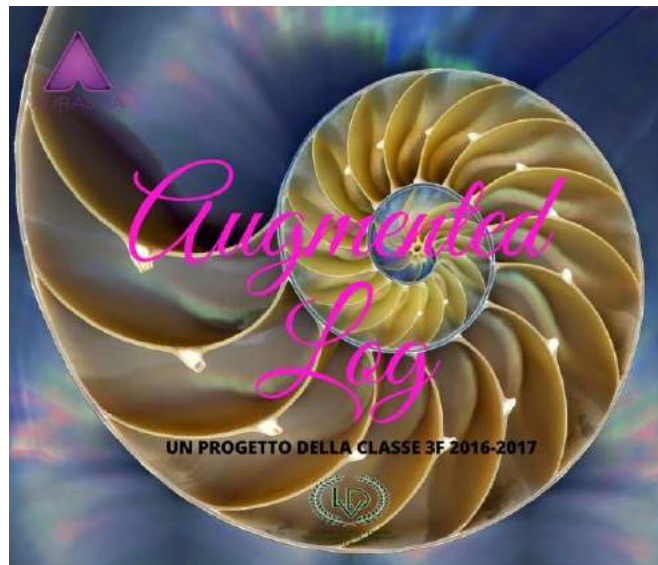


Figure 1

- At home: each student produced a 2/3 minutes video on the given topic with a related trigger image and, using the class account, uploaded and connected them through the Aurasma Studio desktop site <https://studio.aurasma.com/landing> (figure 2).

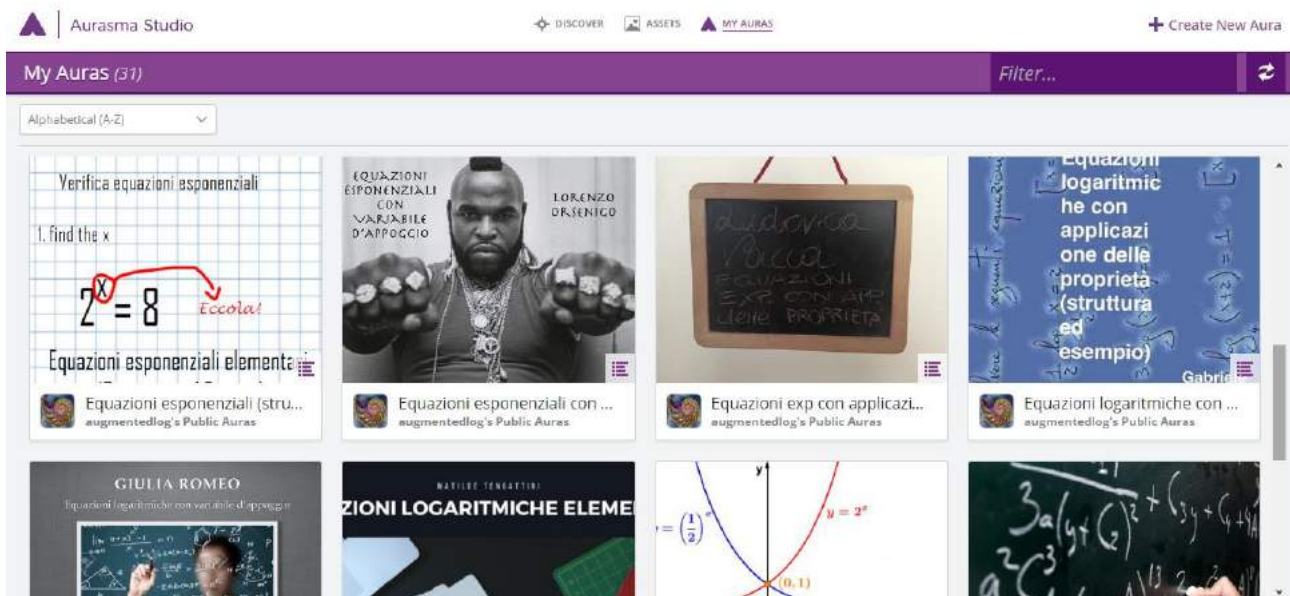


Figure 2

Once the production of the videos has been completed (students had two weeks to finish the task), the teacher collected all the trigger images in a poster (figure 3) and had it printed.

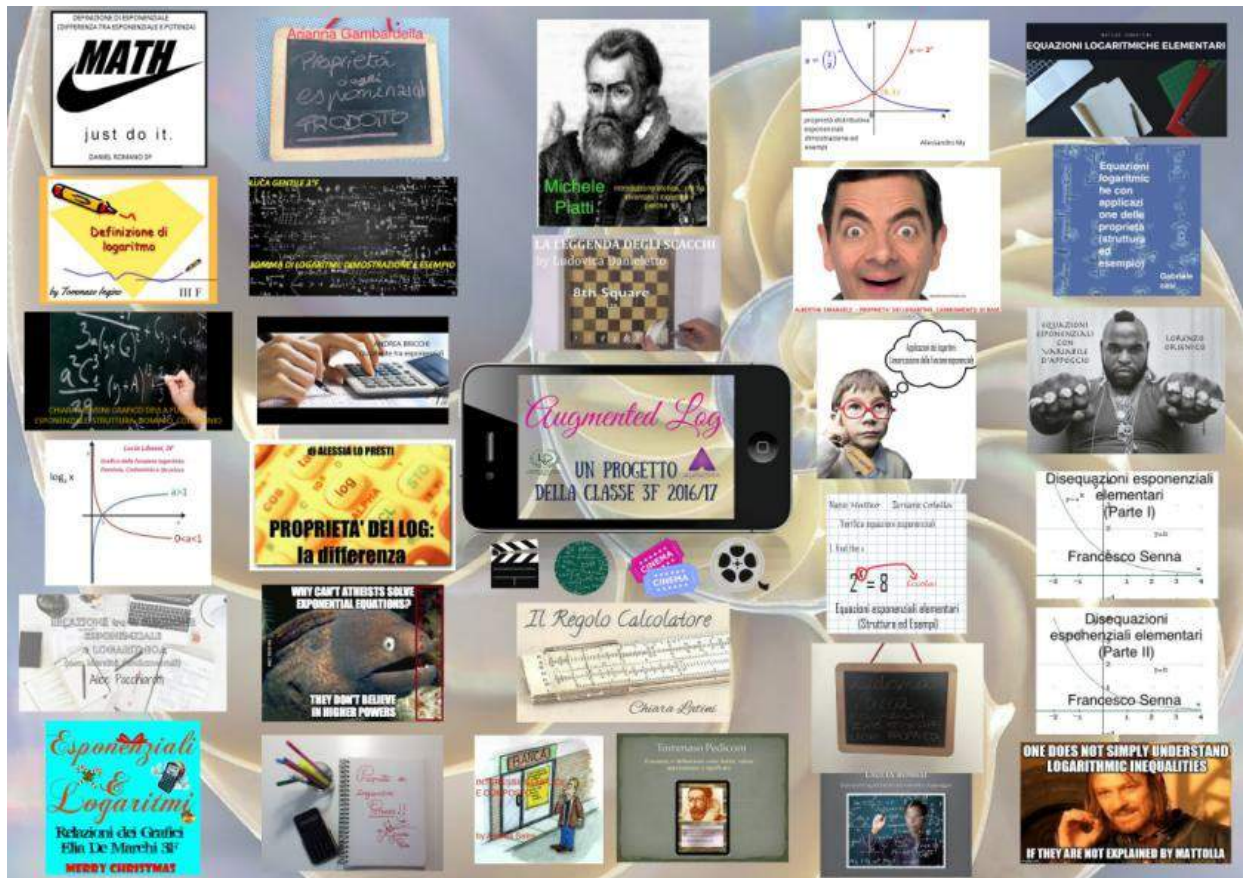


Figure 3

- At school: the poster was brought to school and hung in the classroom so that students could view and share their productions pointing their devices to the trigger images (figure 4) and discuss the results.



Figure 4

To sum up, the AR experience was designed as an *interactive storytelling* learning activity which each student contributed to by creating a specific piece of the story.

The role of the teacher was to identify and assign the single pieces of the story to each student, organise the virtual Aurasma Studio learning environment through which students could connect their digital content and eventually collect and assess the final products as well as build a synthesised whole in order to give back the complete view of the topic.

RESULTS AND CONCLUSION

The skills and attention showed by the students in creating their products and commenting those of the classmates proved that working with AR has been a powerful strategy: this technology captivates students more than other digital means, increasing their yearning to participate and fixing the activity and its mathematical content in their memories for good.

The described jigsaw design approach added value to this experience, making learning “a co-constructed, participatory process” (Dunleavy & Dede) and encouraging students to share their products.

The “interplay between competition and collaboration” (Dunleavy & Dede) turned this AR activity into a deep and successful learning experience, combining traditional and non-traditional settings and interactions, in which the appreciation of students’ technological skills acted as a strong motivational drive and empowered the students’ willingness to focus and discuss mathematical concepts.

References

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