

Impact of using audio-visual material on didactics of mathematics in primary school

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ABSTRACT

Rich interactive multimedia enables primary school students to enhance the learning process wherever they are. Teachers and parents can use specific videos produced in order to reinforce concepts with children, by showing real life scenarios. At the same time, it is interesting to check how adults would like to review simple concepts with these videos, probably not correctly assumed in their memories. In this paper, the advantages of using audio-visual material in primary school within subjects related to didactics of mathematics are considered, together with an analysis of the measured impact of posting several related videos in a YouTube channel.

Keywords: mathematics, didactics, impact, video, audio-visual

1. INTRODUCTION

Student's creativity, motivation and active attitude are some of the main shortcomings of the current education system.¹ It is therefore required to develop mathematical thinking from the primary classroom, liberating students and teachers as learners of mathematics.

The 'framing' of particular aspects of the traditional curriculum has an oppressive impact on learners in the ways that suppresses creativity and limits the exercise of learner autonomy through what is perceived to 'be allowed' or 'not allowed' by both teachers and pupils. It is clear that the weaker framing of curriculum for excellence shifted the locus of control over the selection, sequencing and pacing of what counts as legitimate knowledge towards these teachers.²

The main mathematics learning difficulties in primary education are listed in several publications^{3,4} These detected difficulties serve as a reference in order to prepare specific contents to reinforce several mathematical concepts. Audio-Visual (AV) material can help for this purpose.

Both audio and video have been used to support learning for some time, but as new technologies have become available and the cost of making media resources has dropped, it is now possible for individual educators to capture their own audio and video using every day, accessible technology.⁵ Therefore, videos are a popular tool used to engage learners and enhance a learning experience. YouTube statistics highlight the widespread use of video online, with almost 5 billion videos watched on YouTube every single day and 30 million visitors per day.⁶ Thus, videos are an excellent way to present and elaborate concepts, demonstrate a procedure or gain an understanding of learning in action.

The rest of the paper is organized as follows: section 2 presents the use of AV material in didactics of mathematics for primary school, listing its advantages; section 3 presents the considered statistics in order to measure the impact of several educational videos. Finally, in section 4, the most significant conclusions are outlined.

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2. AV MATERIAL IN DIDACTICS OF MATHEMATICS FOR PRIMARY SCHOOL

According to Dumont⁷ two types of learning problems can be distinguished from primary school: a learning disability is situated in the child's own cognitive development, whereas the cause of a learning difficulty is situated outside the child or in another problem in the child. The prevalence of mathematics learning disabilities is estimated at approximately five to eight percent.⁸ Accordingly, it is clear that the students motivation is key to find mathematics as an attractive subject to study, and that this attraction should commence from primary school. AV materials are used to improve learning resources by showing real life scenarios, explaining concepts, observing social groups, and acting as triggers for discussion.

Having audio and video available to primary school students can support their learning in the following ways:

- Provides diverse teaching techniques for learning. Variety is essential when students are approaching Mathematics the very first time.
- Can be used to simplify and explain complex problems. The use of short videos to explain mathematical concepts can help to stimulate the primary school students comprehension.
- Can allow students and parents to access the learning materials as often as required. If videos are recorded and published online these can help to repeat and consequently reinforce concepts, allowing students to learn at their own pace, with instant playback, rewind and pause.
- Reduces frequently asked questions from students.

Some experiences using AV material for Mathematics have been carried out in Spain, showing in some cases high impact in Youtube, for instance “Las Aventuras de Troncho y Poncho” from Angelitoons oriented for Secondary School,⁹ which began in 2011 and count with more than 2 million visits. Its most popular video “Potencias (Powers)” (see Figure 1), counts with almost 700,000 visits (dated on 13/08/2017).

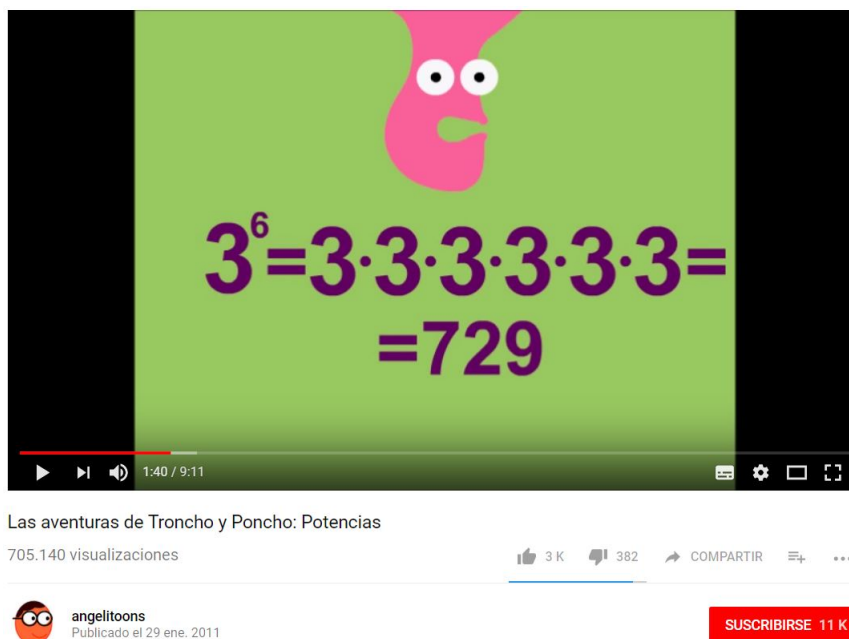


Figure 1. Las aventuras de Troncho y Poncho: Potencias (<https://youtu.be/A55XWvZVWGY>)

Similarly, there are some approaches for AV materials for Mathematics in primary school, focused in specific topics, such as basic operations, fractions, perimeter or area. For example the playlist “Maths: Primary” from

Smart Learning for All,¹⁰ which includes 12 videos, counts with more than 5 million visits in 2 years-time. Its more popular video “Solid Shapes for Kids” (see Figure 2) counts with more than 2 million visits (dated on 13/08/2017).



Figure 2. Solid Shapes for Kids (https://youtu.be/AsQ_uJDBrIU)

Consequently, it is shown that this kind of videos are quite demanded and it could be interesting to count with videos specifically adapted for themes involving learning difficulties.

3. PROPOSED AV MATERIAL AND RESULTS

In this paper, two videos are considered to measure the impact of AV material specifically designed for themes involving learning difficulties. The videos are uploaded in the YouTube channel of one of the authors (R. Lijó-Sánchez):¹¹

- “¿De dónde vienen los números? (What is the origin of the numbers?)” (see Figure 3): A motivational video to introduce the origin of the numbers, showing that not only the decimal numeral system has been used or is currently used in the world.
- “¿Cómo se clasifican los números? (How to classify numbers?)” (see Figure 4): A video devoted to clarify the classification of the numbers among natural, integer, decimal, rational, irrational numbers (and real numbers as a whole as primary school is considered).

With the objective of studying how audience reacts to this kind of scientific contents, and also the importance of an online material consumption based on fidelity (fan phenomena), several statistics have been studied on both proposed videos.

In order to analyze the audience growth between *¿De dónde vienen los números?*, published on February 06th, and *¿Cómo se clasifican los números?*, published on August 18th, a mean test has been performed on data shown at Figure 5. The result of this test reveals a p -value = 0.009071 counting on 'true difference in means is greater than 0' as alternative hypothesis. Result shows that mean in group Aug 18th is 16.49565 facing a mean value of 6.88000 for Feb 06th.



¿De dónde vienen los números?

5.441 visualizaciones

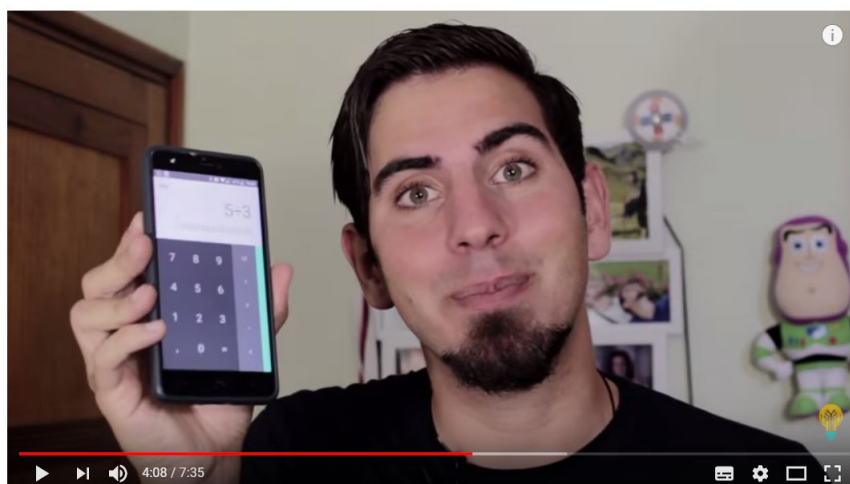
577 4 COMPARTIR



Sígueme la Corriente
Publicado el 6 feb. 2017

SUSCRIBIRSE 15 K

Figure 3. ¿De dónde vienen los números? (<https://youtu.be/vTw0rarSqhU>)



¿Cómo se clasifican los números?

2.223 visualizaciones

245 4 COMPARTIR



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Publicado el 18 ago. 2017

SUSCRIBIRSE 15 K

Figure 4. ¿Cómo se clasifican los números? (<https://youtu.be/0ShQyKjFUeY>)

It is to be noticed that views from women ratio is remarkably low (9% and 8%). When comparing this quantity with FECYT* evaluation of women's interest in science, where it is stated a ratio of 42.5% women interested in science related to men,¹² it is clear that it is very low. According to the White Book of Women Situation in Spanish Science,¹³ the ratio of women growth within the Spanish academic system is 28.6% compared to men.

*Spanish Foundation for Science and Technology

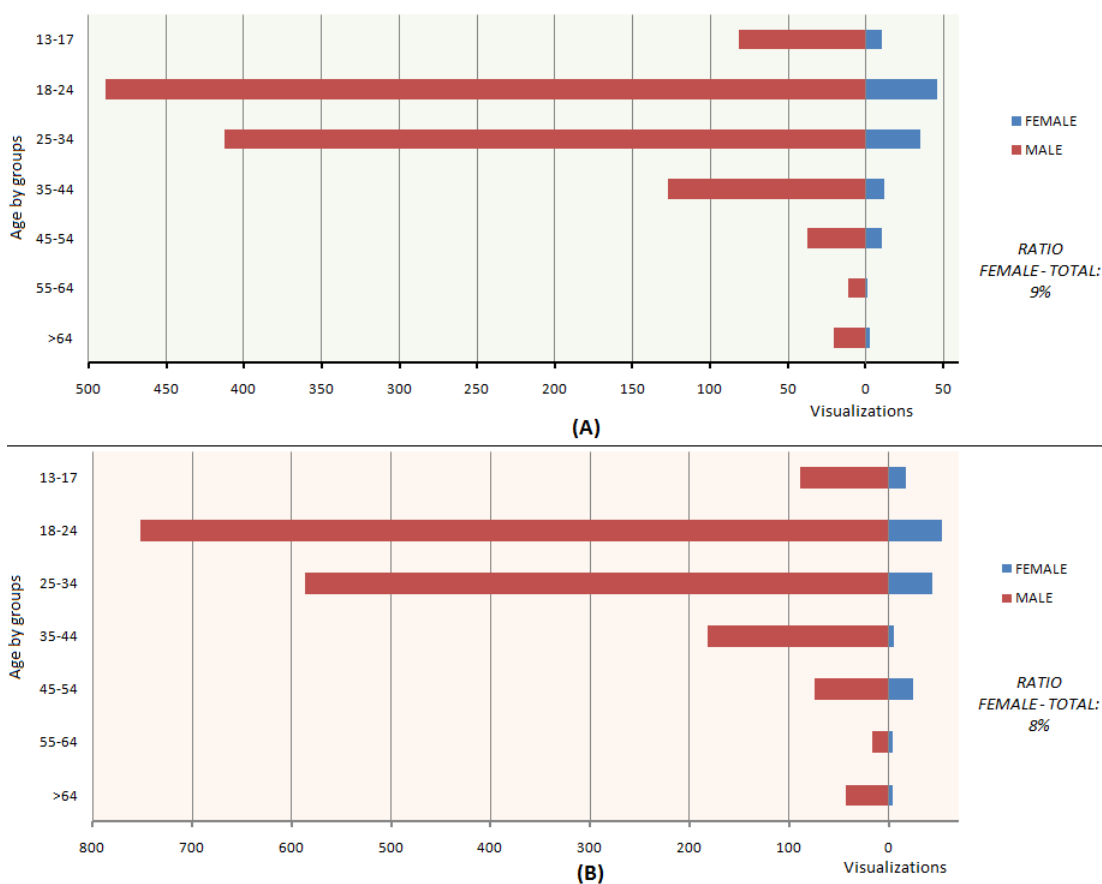


Figure 5. Comparison of empirical absolute frequencies separated by genre (male, female) and age groups (education and occupation range). (A) empirical visualizations from the video “¿De dónde vienen los números?” with initial date of publication from February 06 to March 05 (28 consecutive days). (B) empirical visualizations from the video “¿Cómo se clasifican los números?” with initial date of publication from August 18 to August 23 (6 consecutive days).

Studying how views are distributed through time it could also be measured how immediate the audience reaction is. With data from the first six days after the publication of each video, it can be noticed that first video achieves a total of 516 views while second gets up to 1897 views. However, Figure 6 shows how many minutes does the audience spend watching the video in each one unveiling most people in first video watches at least between five and ten minutes while in second video it is between one and six minutes.

As final study it is relevant to analyze if audience actually interacts and participate actively in the proposed videos. This could give us an idea of the real interest created by them on the topics studied. Through a mean test with alternative hypothesis true meaning interaction is not equal to 0 we obtain a $p - value = 1.247e - 07$ and a 95 percent confidence interval equal to 1.1168-2.3674. This means that there is always interaction between 1.1 and 2.4 for each country where videos are being watched.

4. CONCLUSIONS

For both proposed videos, mean test unveils, with a 95% significance, that audience in the second video has grown related to the first one. This is related to the growth of the YouTube channel itself and a progressive increase in audience fidelity.

However, though in second video the audience reaction is significantly more immediate, it can be noticed that in first video the visualization length is longer. This fact shows that there is not necessary an increase through

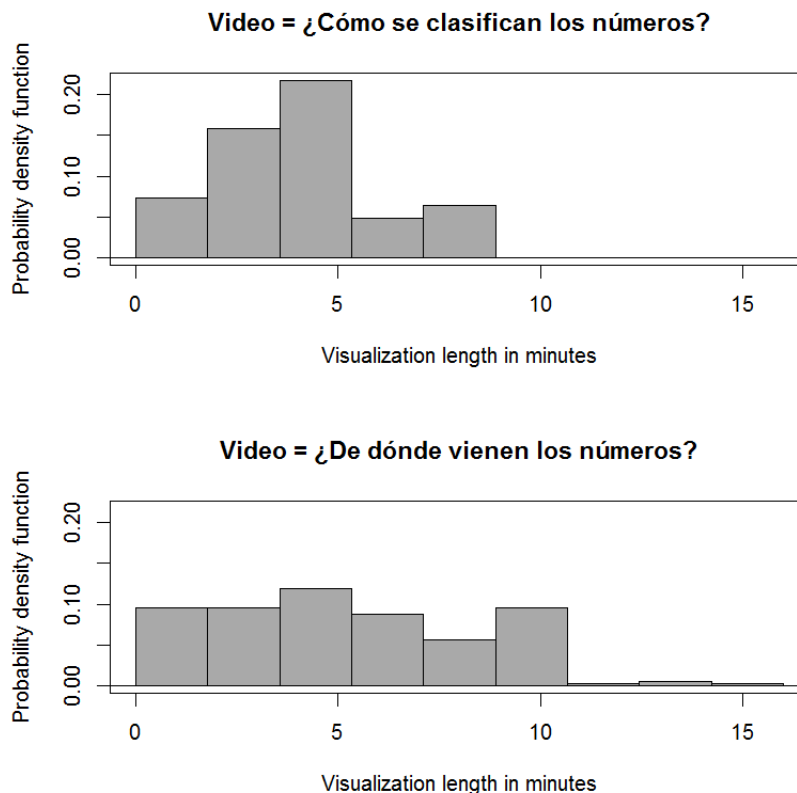


Figure 6. Visualization length for each video

time in how long audience watches the videos. Fidelity means that there is a regular audience predisposed to enter the channel each time a video is uploaded and give it a try. It is important to remember this behavior so that the creator gives enough effort to continuously create high-quality material.

Audience interaction is a useful tool to measure how appealing a video is for viewers. If there is interaction through comments or likes it means that the video content has not only been useful for them but also made them feel involved enough to participate. Studying data for both videos, results show that there actually is a remarkable interaction rate.

AV material has proven to be a useful complementary tool on didactics of mathematics for primary school level. Meanwhile, they also offer a valuable source of knowledge easily understandable for society itself through their dissemination on internet platforms such as YouTube.

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