

# GLOBAL MATH PROJECT – SEEING ALGEBRA IN A DIFFERENT LIGHT

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**ABSTRACT:** Global Math Project is based on James Tanton’s Exploding Dots idea of understanding numbers by visually representing them with dots and boxes. After understanding the concept, the idea can be extended to basic operations with integer numbers or decimals, but also polynomials, infinite sums and even modern unsolved problems. There is an official “Exploding dots” website, with guiding videos, examples and tasks to be completed. There are 9 “islands” to discover, depending on the user’s level of mathematical knowledge. But the author wanted not only to publish a math website and have teachers and students log in and use it, he wanted to make it global, so he organized “Global Math Week” in October 2017, with an estimated target of 1000000 people involved and with an almost double declared audience. For this year, James Tanton’s team is working to raise the number of scholars learning about Exploding dots to ten million.

**KEYWORDS:** Exploding Dots, Global Math Project, Algebra, Arithmetics.

## 1. INTRODUCTION

Students all over the world find mathematics hard to understand, boring, difficult to connect with real life issues and some of them may lose their interest or self-esteem while failing to perform more complex operations as they go through school. This is the reason why many teachers continuously search for new methods of teaching and more entertaining ways of involving students in the learning process. Using an original rewards system, personalized printables, class, local or international projects, hands-on activities, and lately accessing different educational programs or websites, depending on the inspiration and resources teachers have access to, they all have the same purpose: getting pupils closer to understanding maths, facilitating their practice and leading them to higher performances.

In this context, James Tanton, a dedicated American mathematician, author of many awarded books, created a series of videos on Exploding Dots – a method of understanding base conversions in a more visual, real-life approach, that can be easily extended and used in performing more complex operations. A website was created following his idea, to encourage hands-on activities and practice, with introductory

videos and the possibility of “exploding dots” in nine levels of mathematical knowledge:



Fig. 1. Exploding dots, login page [\*\*\*2]

## 2. EXPLODING DOTS

### 2.1 The idea

The idea is simple and attractive for young students: when writing numbers, use boxes for each place value and visualizing digits as the same number of dots in the box:

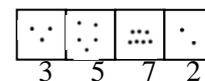


Fig. 2. Visualizing numbers with dots and boxes

This method seems appropriate for very young children but, if we consider using it to convert from a number base to another, it can be a useful, powerful tool to help the visual learning students. The “1 ← 10 machine”, referring to base 10, explains how, for every 10 dots in one box, one explosion transfer them in only one dot in the next box to the left.

Of course, there are 1 ← 2 machine, 1 ← 3 machine and we can build anytime a 1 ← n machine to see how the dots will find their way to their respective place value boxes.

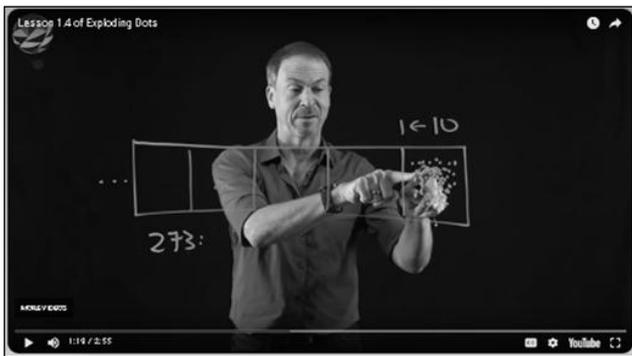


Fig. 3. The  $1 \leftarrow 10$  machine [\*\*\*2]

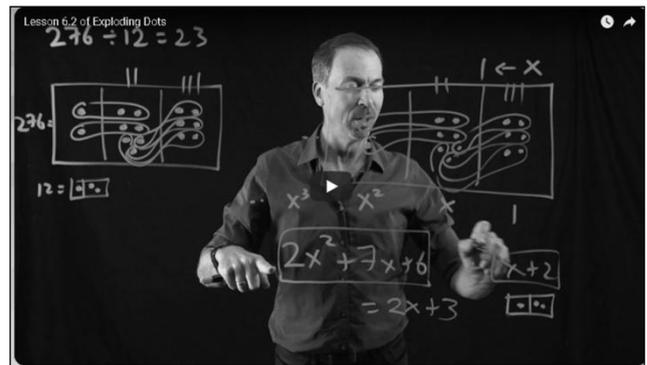


Fig. 5. Whole numbers division and polynomial division are similar when using dots and boxes [\*\*\*2]

## 2.2 The islands

There are 9 islands, corresponding to 9 fields where “Exploding dots” idea can be implemented.



Fig. 4. The islands [\*\*\*2]

Mechania, the most accessible “island”, contains introductory videos about how the machines work, and how different numbers of ones can be written in different number bases. Insighto, the second “island”, deals with numbers written in a certain base and their conversion to base ten. Arithmos deals with sums and products of natural numbers using “exploding dots” system, while Antidotia introduces the “antidot” as the opposite of a dot, which annihilate each other, in order to perform subtractions or additions of integer numbers. Obelus, the fifth island, reveals how integer division using dots and boxes can be extended to polynomial division, just by assuming that the base is unknown:

The last three islands deal with more complex mathematical knowledge: infinite sums, decimals, repeating decimals, irrational numbers and even rational number bases, an invitation to explore more mathematical experiences.

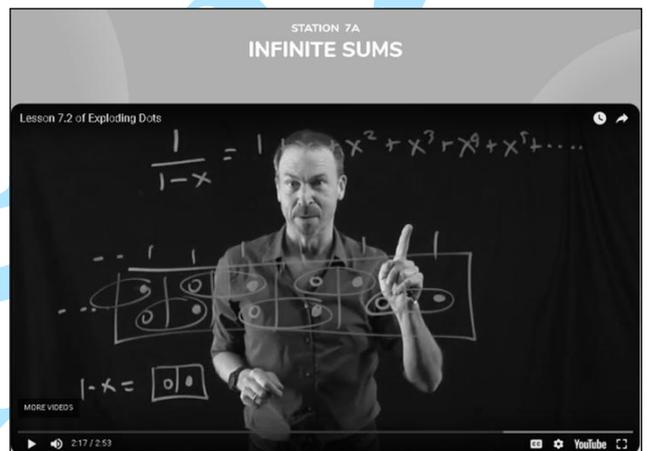


Fig. 6. Geometrical series with dots and boxes [\*\*\*2]

Every island has “stations” with introductory videos and problems to solve, optional stations for further exploring, but also teaching guides, students handouts, and even links to videos where kids explain math for kids.



Fig. 7. First island page [\*\*\*2]

### 3. THE GLOBAL PROJECT

#### 3.1 Teacher login

After logging in as a teacher, one gets a class link to share with students and the number of successful accesses is counted. Information on the global access and the access in teacher's country is displayed. A counter registers each activity performed on the page.



Fig. 8. Teacher's login page [\*\*\*2]

#### 3.2 A global project

It could have been just a resource page for teachers and students, as many others, but James Tanton wanted to spread the word. So, the week 10 - 17 October 2017 was declared the Global Math Week and teachers and students from the entire world were invited to join the project, play with the machines and enjoy mathematics. The daring target was 1 000 000 users, but it was almost doubled, exceeding the most optimistic predictions.



Fig. 9. Global Math Week 2017 participation [\*\*\*1]

This was possible because a lot of enthusiastic teachers worldwide appreciated James Tanton's ideas of teaching algebra in a different style and because the organizers provided not only links to videos and website, but also printable handouts and other resources for classrooms with limited or no access to technology.

#### 3.3 Ambassadors

A global project needed global representation and worldwide promotion. That's why more than 360 ambassadors voluntarily spread the word on five continents, in real life and on social media, about the Global Math Week and the Global Math Project.

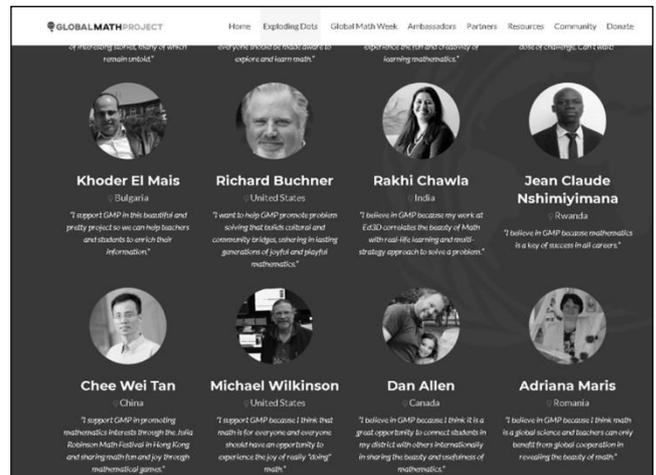


Fig. 10. GMP ambassadors [\*\*\*2]

Teachers or mathematicians, they all declared their support to the project idea, for reasons according to their work conditions and personality.

#### 3.4 Global Math Week 2018

On popular demand, another Global Math Week is going to take place at the beginning of October 2018. This time, the estimated target is even more incredibly daring: ten million people! There are already more than four and a half million to access the page and, considering the fact that some teachers will use the "low technology" instruments and other classes will not have access to technology at all, but their teachers will still be able to present the "Exploding dots" concept, reaching the number seems possible.

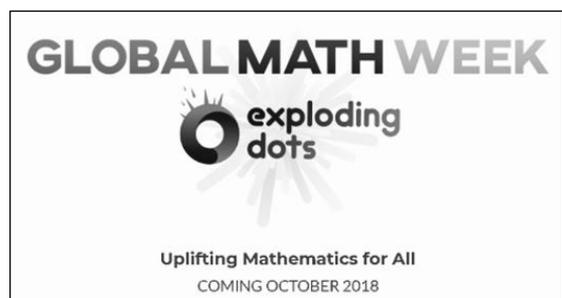


Fig. 11. Global Math Week 2018 [\*\*\*2]

For this "reloaded" event there are intensive preparations as we speak. A new website is going to host the islands, the video lessons got subtitles first,

then, naturally, translations in many languages, performed by ambassadors and volunteer teachers and the word is spread around the globe.

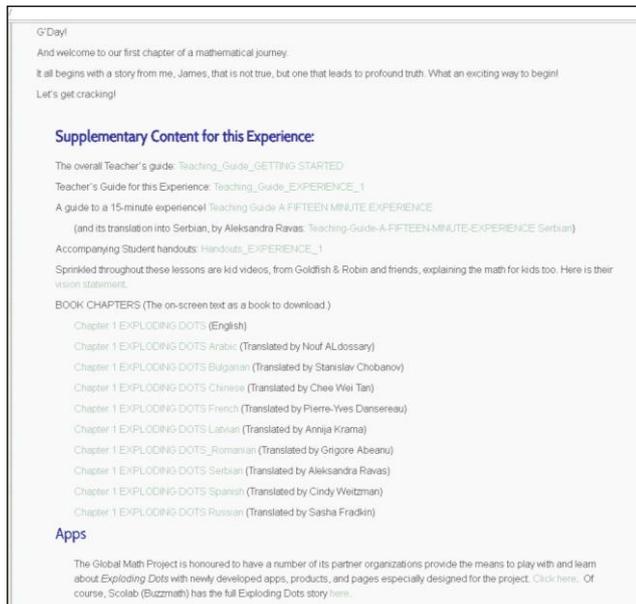


Fig. 12. Translations [\*\*\*1]

## 4. CONCLUSIONS

Exploding dots have a strong, positive impact on teachers around the globe, who are joining the Global Math Project in order to offer their students an interesting experience on seeing arithmetics and algebra in a new light. For some of their pupils, this approach will be more understandable, for others it will make more sense or it will just be another proof that mathematics works in mysterious ways. And everybody will have fun watching an enthusiastic James Tanton explaining his ideas and making mathematics much more attractive.

## 10. REFERENCES

- [\*\*\*1] <http://gdaymath.com/>
- [\*\*\*2] <https://www.explodingdots.org/>
- [\*\*\*3] <https://www.maa.org/programs-and-communities/member-communities/maa-awards/writing-awards/beckenbach-book-prize>
- [\*\*\*4] [www.themathcircle.org](http://www.themathcircle.org)
- [\*\*\*5] <https://www.youtube.com/user/drjamestanton>