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## Big events in Mathematics using math trails

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The intention of this poster is to present several big events held in Portugal, in the cities of Porto and Matosinhos, and in France, in the city of Lyon. We consider mathematics learning outside of the school building and we use day-to-day materials (monuments, buildings, traffic, gardens, etc.) as support materials. It is important to bring learning to life and learning outside the classroom (DfES, 2006). One way of experiencing outdoor mathematics is to walk a math trail. We used the Shoaf, Pollak, & Schneider (2004, pp. 4) statement to guide our work and to advise our implementation of math trails. The math trails can be created using the traditional way – paper sheets with tasks on them. But, nowadays, they can be created using smartphones, combining the concept of math trails with advanced technology in a modern learning environment. The MathCityMap-application (MCM-app - [www.mathcitymap.eu](http://www.mathcitymap.eu)) provides a new approach to an already well-known idea - experience mathematics in outdoor activities and using smartphones (Jesberg & Ludwig, 2012; Cahyono, Ludwig & Marée, 2015; Cahyono & Ludwig, 2016; Zender & Ludwig, 2016). Through the MCM\_app, students went on an outdoor walk along a route and solved mathematics problems that were contextualized with the surrounding environment. The students passed through special places in these cities, where mathematics can be experienced in everyday situations. For example: buildings for logic problems, statues for numbers and counting, lakes and fountains for geometry, a swing to calculate angles measures, lake bridge to calculate areas, garden benches to apply combinatorial calculus, functions to model the proportions of colors along a corridor, or using the GPS tasks to pinpoint the foci of a very large ellipse. A task which was really appreciated was an introduction to the Dewey classification system with decimal numbers, because a new theme can always emerge, since there is always a decimal between two different decimals, there is always room for improvement in this system. And the task was to find the decimal number associated with a given book from the library. Finding the number of pages of mangas in there was as well a hit but the GPS tasks where one had to finish a square or place oneself at the middle between two inaccessible points were unexpected by the students. We have streamlined math trails held around Porto, Matosinhos (Portugal) and Lyon (France), based on the MCM\_app: “Matemática vai à Baixa” – Mathematics goes to downtown (competition), June 8, 2016, Porto. Participants - exactly 297 students (age range 9 to 18 years) and 40 teachers; “Matemática vai ao Jardim” – Mathematics goes to the Garden (competition), March 23, 2018,

Matosinhos. Participants - exactly 170 students (age range 9 to 18 years) and 23 teachers; Math.en.Jeans Congress, March 22nd-24<sup>th</sup>, 2018, Lyon, France. Participants - around 700 (students - age range 9 to 25 years, teachers and researchers); the national gathering of the Collège commission, June 21st-23<sup>rd</sup>, 2018, Lyon, France. Participants – exactly 130 (lower secondary teachers in France). It is very gratifying to note that in all events, teachers and students participated in mass. Stands out the great enthusiasm from the students and mathematic teachers, they participate in general with energy and are willing to repeat the experience. All students and teachers can take advantage of a new context to transmit knowledge, contributing to greater motivation for learning mathematics. Students were amazed to participate in the math trails, but to cross a math trail using mobile devices and GPS functions to find the tasks location were fantastic. These activities generally increased the students' engagement to learn mathematics. The teachers were interested not only to play but as well to understand the different types of questions that could be addressed. These actions were fairly disseminated by the media. Usually mathematics appears in the news surrounded by a negative scenario, but with our events, mathematics came to the house of families in a positive, constructive and dynamic way. In the poster, we would present examples of tasks of the routes from the math trails, highlighted the details to consider them like starting points to promote the modelling process in the learning. To evaluate the degree of satisfaction of teachers and students were conducted surveys in different events, which show the high degree of satisfaction and evaluate the impact on learning (see, for example, Caldeira, Faria, Figueiredo & Viamonte, 2016).

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