

HOW TO CONSTRUCT AND USE INSTRUMENTS WITH THE PUPILS, SO THAT THEY APPRECIATE WHAT MATHEMATICS ARE FOR

**Description of two projects (2021-22 and 2023-24)
in a Brussels secondary ‘active school’**

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During two academic years, we proposed to the Lycée intégral Roger Lallemand (LiRL), a Brussels secondary school based on active pedagogy, two different projects relying mathematics with surveying and music.

The LiRL works on three weeks (‘tripleette’) multidisciplinary themes, like *Climate*, *Navigation*, *Coal*, ... or *Angela Davis*, for instance. During the tripleette mornings (‘modules’), the pupils attend courses in different fields, and in the afternoons (‘workshops’), they have the opportunity, thanks to the existence of workshop-classrooms in the LiRL, to build their own instruments, with the help of a technology teacher.

Our first project, titled *En vrai, la géométrie ça sert à quoi ?* and subsidized by the Brussels Regional Government (Cocof) after a contest called *La culture a de la classe*, aimed at teaching third secondary grade (14 years old) pupils how some ancient instruments were made and used in order to elaborate precise maps and plans. The utility of these instruments (Geometric Square, Sector) relies on proportions, which were studied during the mathematical modules. Other modules (French, History) investigated the origins of these instruments, of which some were developed in Belgium, by Michel Coignet (1549-1623) in Antwerp and by Gemma Frisius (1508-1555) in Louvain, for instance. The argument of the tripleette was more generally defined as *Reconstruction after a disaster*, and the final task of the pupils was to measure with the instruments a square (Place Morichar) nearby their school, and to imagine how to rebuild it.

The second project, also subsidized by the Cocof, was titled *Accords et ondes*, and aimed at teaching fifth secondary grade (16 years old) pupils wave characteristics and their relation to the musical theory. Here, the morning modules were devoted to the study of physical and mathematical concepts, such as wave lengths, frequencies, speeds in different environments, or proportions, geometrical progressions, roots and their properties. In the afternoon workshops, the pupils tested wave propagation, calculated the speed of sound,

listened to sounds of different frequencies, in tune or not, with the help of a musician participating in the project. They also construct a simple instrument, called *Epinette des Vosges*, comparable to the *Dulcimer*, in order to understand the importance of the musical scales and intervals.

During the workshop, we will distribute to the participants cardboard models of the instruments and show some pictures and films shot during the projects. We will also present historical texts (translated from French) that induce the pupils, and the participants at the workshop, to use the instruments and appreciate mathematics.