

Teaching Non-Euclidean Geometries to Learn Euclidean One: An Experimental Study

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Abstract : In recent years, for instance, in relation to the Covid 19 pandemic and the evidence of climate change, it is becoming quite clear that the development of a young kid into an adult citizen requires a solid scientific background. Citizens are required to exert logical thinking and know the methods of science in order to adapt, understand, and develop as persons. Mathematics sits at the core of these required skills: learning the axiomatic method is fundamental to understand how hard sciences work and helps in consolidating logical thinking, which will be useful for the entire life of a student. At the same time, research shows that the axiomatic study of geometry is a problematic topic for students, even for those with interest in mathematics. With this in mind, the main goals of the research work we will describe are: (1) to show whether non-Euclidean geometries can be a tool to allow students to consolidate the knowledge of Euclidean geometries by developing it in a critical way; (2) to promote the understanding of the modern axiomatic method in geometry; (3) to give students a new perspective on mathematics so that they can see it as a creative activity and a widely discussed topic with a historical background. One of the main issues related to the state-of-the-art in this topic is the shortage of experimental studies with students. For this reason, our aim is to show further experimental evidence of the potential benefits of teaching non-Euclidean geometries at high school, based on data collected from a study started in 2005 in the frame of the Italian National Piano Lauree Scientifiche, continued by a teacher training organized in September 2018, perfected in a pilot study that involved 77 high school students during the school years 2018-2019 and 2019-2020. and finally implemented through an experimental study conducted in 2020-21 with 87 high school students. Our study shows that there is potential for further research to challenge current conceptions of the school mathematics curriculum and of the capabilities of high school mathematics students.

Keywords : Non-Euclidean geometries, beliefs about mathematics, questionnaires, modern axiomatic method

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