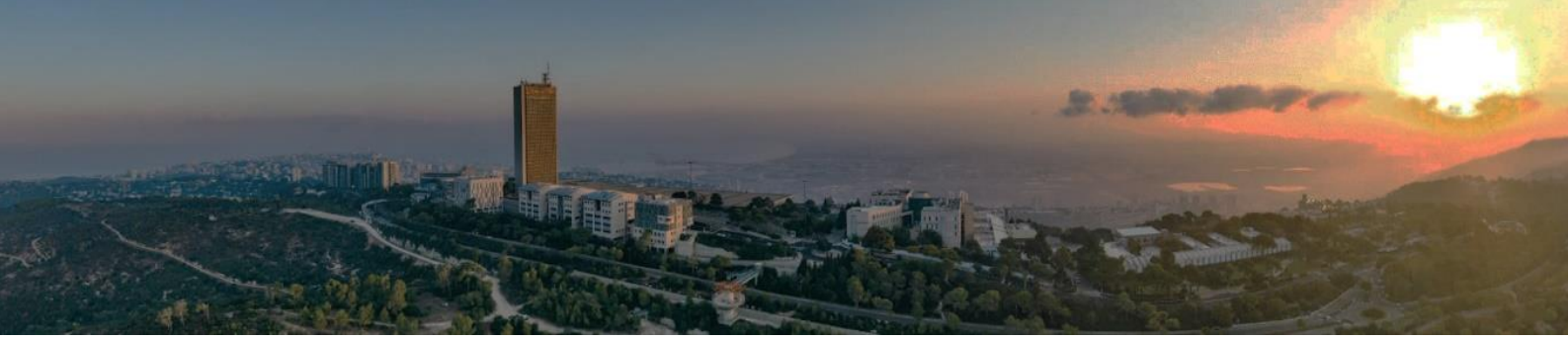
Architectural Drawing and Mathematical Modelling: Conics, GeoGebra and More



PROCEEDINGS

OF THE

46th CONFERENCE

of the International Group for the

Psychology of Mathematics Education

Haifa, Israel | July 16 – 21, 2023

PME-46

MATHEMATICS EDUCATION

FOR GLOBAL SUSTAINABILITY

Volume 1

Editors: Michal Ayalon, Boris Koichu, Roza Leikin, Laurie Rubel and Michal Tabach

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Plenary Lectures
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Seminar
Colloquium
National Presentation
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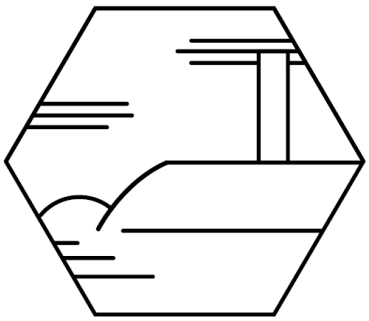
Posters



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ARCHITECTURAL DRAWING AND MATHEMATICAL MODELLING: CONICS, GEOGEBRA AND MORE

Caterina Cumino, Martino Pavignano, & Ursula Zich

Politecnico di Torino (Italy)

This contribution is part of an ongoing research and concerns the 2D graphic representation of a 3D object. The participants are the students of a course of architectural drawing and survey, in the first year of an architecture bachelor's degree. In such an extra-mathematical educational environment, a mathematical modelling perspective of prescriptive type (Niss, 2015) appears as a tool of investigation and as an educational goal, since students are involved in solving mathematical problems in the design phase of an architectural project, developing a rudimental modelling cycle to go from a real-world object to its mathematization and to the critical interpretation of modelling outcomes. The research questions are: Which are students' recurring misconceptions and difficulties intertwined with mathematical thinking? How to improve students' understanding of drawing as a tool to communicate and visualize objects and their geometrical properties? A joint intervention of teachers of architectural drawing and mathematics took place during regular drawing lessons on conics and surfaces; a GeoGebra applet was proposed to show an ellipse as draggable object to highlight shape variations and invariant properties with respect to movements of the foci. At the end of the first teaching period, students' understanding was tested, asking for a 2D representation of a barrel vault with a semi-elliptical cross section, covering a rectangular base gallery. Two surveys were conducted: a satisfaction one and a questionnaire with dichotomous and multiple-choice questions about synthetic 2D/3D geometry. It seems that students' main difficulties lie in a lack of identification of mathematical objects and in the inability to use their mathematical knowledge in the critical interpretation of their outcomes. This may be since mathematics traditionally is thought at any level as a separate discipline and calls for further investigations. The satisfaction questionnaire shows a positive attitude about the joint intervention: 98% of them think that it is useful to better understand other topics of the course and 93,8% of them find the use of a dynamical geometric software (like GeoGebra) very helpful.

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Niss, M. (2015). Prescriptive modelling-challenges and opportunities. In G. A. Stillman, W. Blum, & M. S. Biembengut (Eds.), *Mathematical modelling in education research and practice: Cultural, social and cognitive influences* (pp. 67-79). Springer.


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