

# GEOMETRIX

Thematic Line of the Center for Research & Development in Mathematics and Applications (CIDMA)

## Coordinators



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## Main Team



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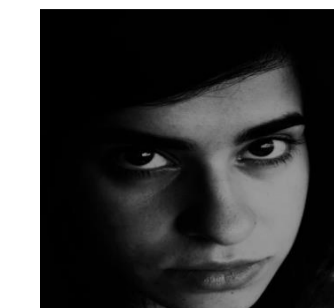
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Isabel Santos



Jorge Ruivo



Catarina Mouta



José Ferrão



Cláudio Henriques



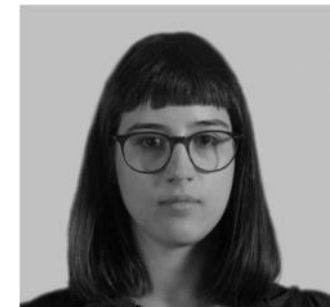
Fábio Henriques



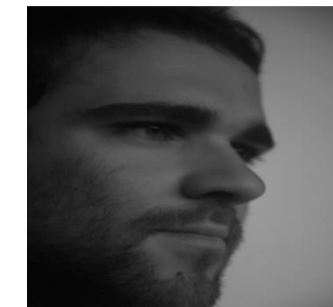
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Adriano Oliveira



Tânia Ribeiro



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Miguel Araújo



Inga Sabóia



Margarida Almeida



Hugo Resende



José Santos Dos Santos

## Achieved Goals and Overcoming Challenges

### Outputs 2013-2015

Board game CMAT Lousada for primary school children. Connecting cultural heritage and mathematics in a simple, natural and harmonious way

1st version of a prototype for a digital Learning Environment on Mathematics for Autistic Children (LEMA) – 1st assessment with end-users

NIM GAME – combinatorial and geometric game for secondary/higher education. Android mobile application available in Google Play Store

Habash constructions for the determination of al-qibla with GeoGebra

Stereographic projection and Mobius transformations with GeoGebra

**Abstract**  
Geometrix is a research and development thematic line of the Center for Research and Development in Mathematics and Applications (CIDMA) of the University of Aveiro. It integrates a multidisciplinary team, bringing together mathematicians, computer programmers, educators and graphic designers around a common goal, the study, creation, development and use of inclusive teaching and learning environments, crisscrossing all levels of education, guaranteeing their access to vulnerable groups such as children with special needs and the elderly. Geometrix relies in research on mathematics, technology and mathematics education for the development of (computational) tools to support and empower students with knowledge and skills in mathematics, from basic to higher education. It is also committed to the creation of extension activities where mathematics / culture / community / university are articulated in a natural and meaningful way.

### Outputs 2016

CMAT for Ovar Council

LEMA 2nd version – refinement based on data analysis linked with the assessment of 4 children with ASD

Analysis of NIM's users usage data having in account the identification of user learning patterns through statistical analysis

Spherical tilings as orbits by rotations of an equilateral triangle, with GeoGebra

Calouste Gulbenkian funded project LEMA within the program: Special Education 2016

Training Sessions

[AF1] - Meaningful Math Learning in Children with Autism Spectrum Disorder, Cátia Belém (21 trainees 12\*2=24 hours)

### Outputs 2017

Calouste Gulbenkian funded project LEMA within the program: Special Education 2016

Training Sessions

[AF2] - Technologies and Digital Tools for Mathematics Teaching, Cátia Belém (22 trainees 11\*2=22 hours)

[AF3] - Functionalities of the Learning Digital Environment of Mathematics for Children with ASD Isabel Santos (33 trainees 12\*3=36 hours)

LEMA 3rd version – refinement based on data analysis linked with the training actions with 23 teachers

1st National Congress of Autism and Mathematical Learning – CNAM 2017, June 29, 30

ORIESPA, a digital learning game for children with special educational needs, aiming the development of spatial abilities

Elements of a one-parameter family of triangular spherical tilings and of one-parameter families of dihedral spherical pentagonal tilings

### Outputs 2018

1st version of the digital game "Puzzle" developed for the elderly community with the main goal of improving their cognition capacities

Evolution / deformation of the one parameter families of dihedral spherical pentagons

### Awards

24/05/2016  
Palace of the Marquises of Fronteira  
CENTRO NACIONAL DE CULTURA  
M. LURDES GANDARINHO  
HONORABLE MENTION IN THE COMPETITION SOS CERAMIC TILES 2015, IN THE CATEGORY OF MASTER THESIS

22/11/2018  
European Parliament  
EUROPEAN DISABILITY FORUM  
M. ISABEL SANTOS  
WINNER  
EDF-ORACLE E-ACCESSIBILITY SCHOLARSHIP 2017-2018  
PHD THESIS

3/12/2018  
Multipurpose Pavilion  
Prémio Engenheiro Jaime Filipe  
GEOMETRIX  
SCIENTIFIC AND TECHNOLOGICAL INNOVATION AWARD, ENGINEER JAIME FILIPE, 2018

### PhD Thesis

**Maria Isabel Santos:** Digital technologies to support the development of mathematical reasoning of students with autism spectrum disorder, Univ. of Aveiro, March, 2018, 380 pp. [Supervisors: Ana M. D'Azevedo Breda, Ana M. P. Almeida].

### MSc Thesis

**Luisa Oliveira:** Teaching tasks for basic education using GeoGebra, University of Aveiro, Dec. 2017, 238 pp. [Supervisor: Ana M. D'Azevedo Breda]

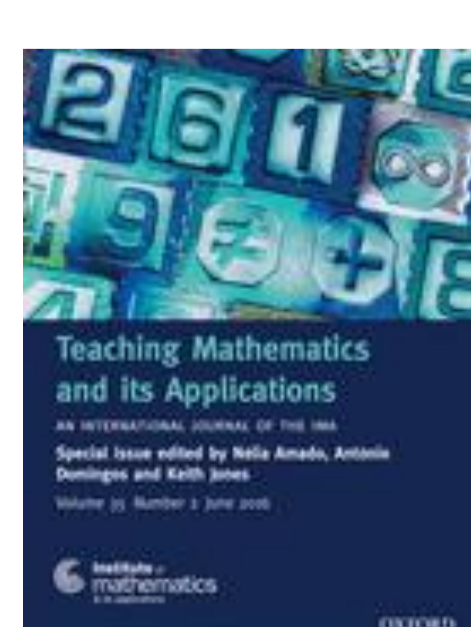
**Maria Lurdes Gandarinho:** Thematic and historical aspects of a journey through the art of ceramic tiles and paintings of Aveiro, University of Aveiro, Dec. 2015, 129 pp. [Supervisor: Ana M. D'Azevedo Breda].

**Dulce Nogueira:** Topics of the history of trigonometry, University of Aveiro, Dec. 2013, 232 pp. [Supervisor: Ana M D'Azevedo Breda].

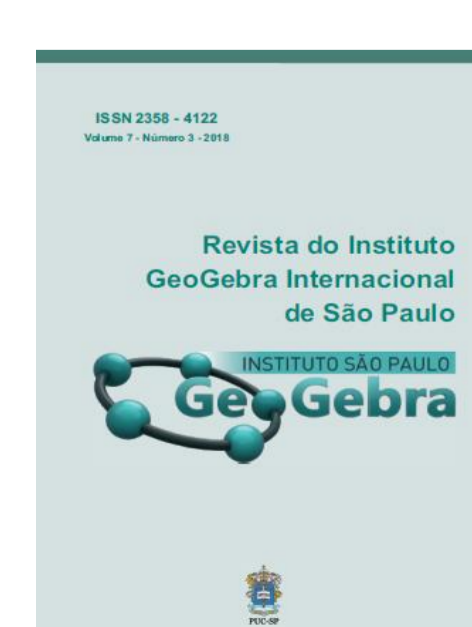
### Relevant Publications



**Brief Report: Preliminary Proposal of a Conceptual Model of a Digital Environment for Developing Mathematical Reasoning in Students with Autism Spectrum Disorders**  
Santos, M. I., Breda, A., & Almeida, A. M., *Journal of Autism and Developmental Disorders*, August 2015, 45(8), pp 2633–2640



**Complex functions with GeoGebra**  
Breda, A., & Santos, José M., *Teaching Mathematics and its Applications*, June 2016, 35 (2), pp. 102-110



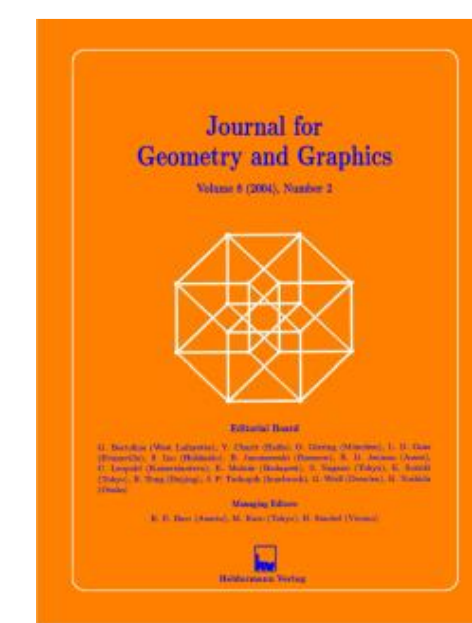
**Symmetries of ceramic tiles of Aveiro facades by means of GeoGebra**  
Carlos, L., & Breda, A., *Revista do Instituto GeoGebra Internacional de São Paulo*, June 2017, 6 (2), pp. 81-92



**Design approach of mathematics learning activities in a digital environment for children with autism spectrum disorders**  
Santos, M. I., Breda, A., & Almeida, A. M., *Educational Technology Research and Development*, October 2017, 65(5), pp1305–1323



**A new class of monohedral pentagonal spherical tilings with GeoGebra**  
Breda, A., & Santos, José M., *Portugaliae Mathematica*, February 2018, 74(3), pp. 257-266.



**Spherical Geometry and Spherical Tilings with GeoGebra**  
Breda, A., & Santos, José M., *Journal for Geometry and Graphics*, November 2018, 22(2), pp. 283-299.

Geometrix members were supported, in part, by Fundação para a Ciência e a Tecnologia (FCT), within project UID/MAT/04106/2019.

### Future work

- CMat Penafiel
- CMat Castelo de Paiva
- Fernão de Magalhães Circumnavigation Game Invitation of the Director of the Office of the Organization of Ibero-American States – in Portugal
- From LEMA to DILEMA
- GoldenG
- Education Games for All (EGfA)
- Spherical Tilings with GeoGebra