Informatics tools, isometries and communication in mathematics

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Sructure of the presentation

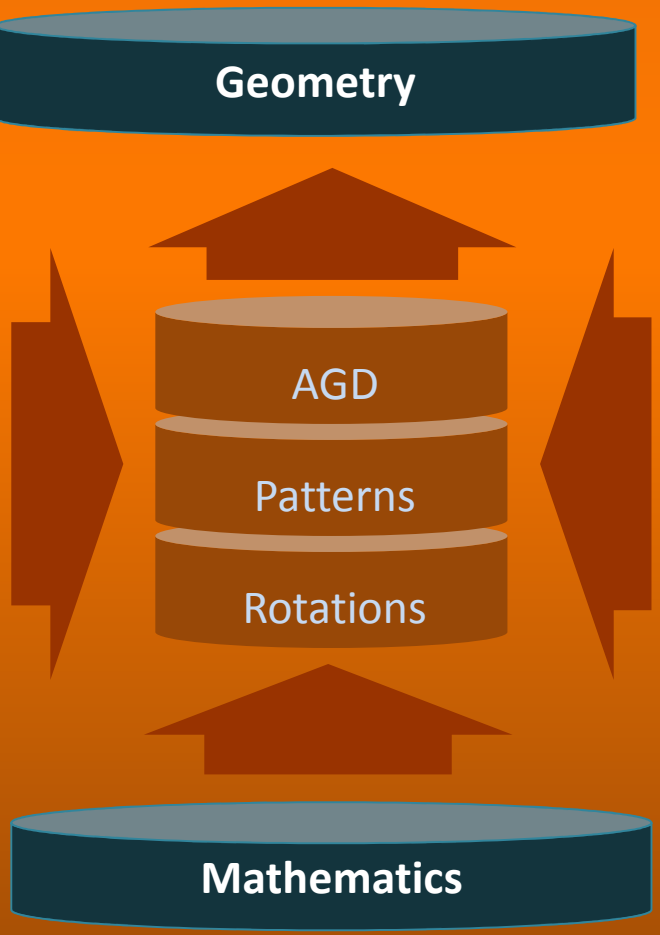
- Poblematic of the research
- Objectives of study
- Theoretical background
- Methodology
- Treatment of the data
- key Findings

The communication refers to a broader study entitled :

"Approach centered on the rotation patterns: a case study with a class of the 9 th year "

Poblematic of the research

- Deficiencies in knowledge and mathematical processes (TIMSS, 1999, PISA, 2003, 2009, GAVE, 2007, 2010)
- Disinterest, lack of motivation and school failure
- Deep and rapid process of change and transformation (NCTM, 2007)
- Plan of action of Mathematics (*Ponte et al.,* 2007and the Project "Learning Goals" (ME, 2009)
- Geometric transformations (Breda *et al*., 2011)



Can be a significant and innovative approach to solving the problem (Devlin, 2002; Orton, 1999; Valley, Palhares, Cabrita & Borralho, 2006, Vale & Barbosa, Vale et al., 2009)

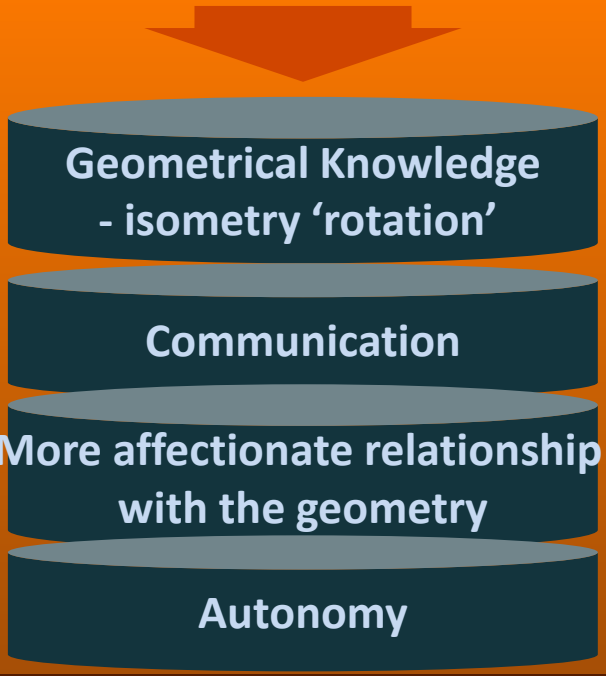
There are few studies which are situated at the confluence of these dimensions

Objectives of the study

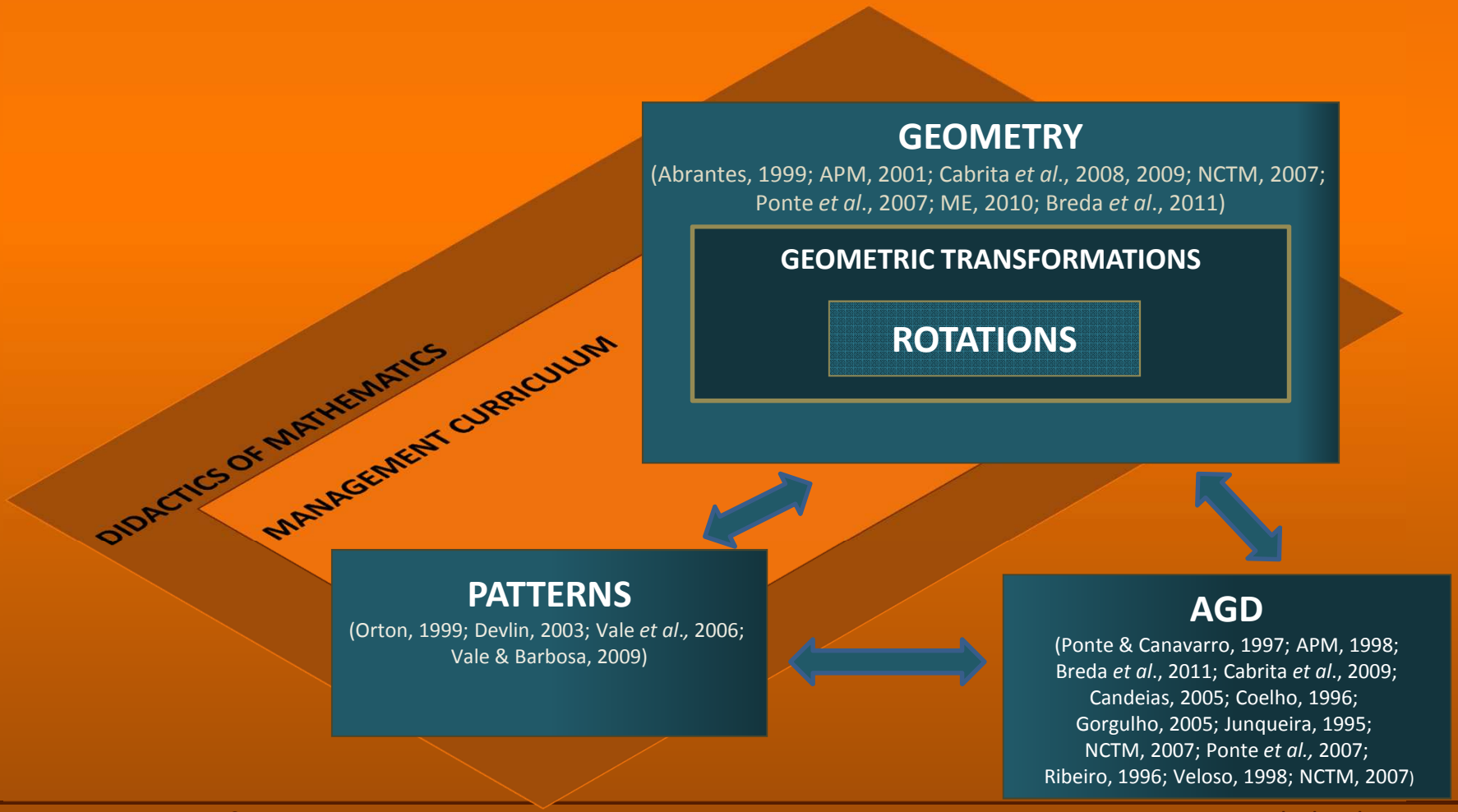
To Assess the impact of an approach of rotations through the study of patterns and using ADGD'S:

Skills

general / transversal and specific



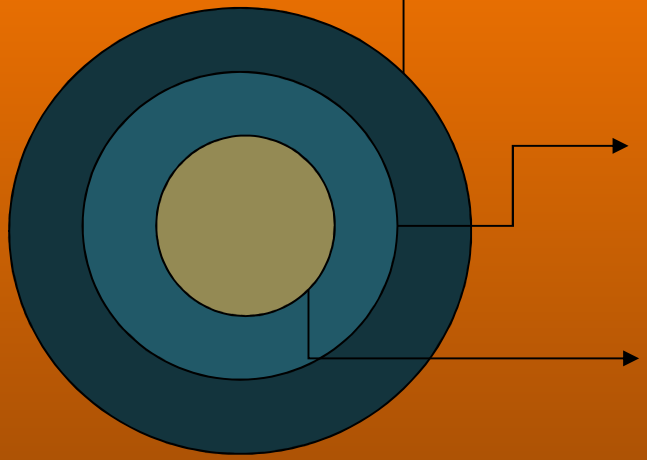
Theoretical background



- **MATHEMATICAL COMMUNICATION**
  - Geometry provides a favorable environment for students to be involved in mathematical activities and to develop communication (in) math (Breda *et al*., 2011).
  - The type of communication that takes place in mathematics classrooms can be a spur for significant learning experiences for students. (Menezes, 1995; Cobb, 1995; Voigt, 1995; Wood, 1995, 1998; Brendefur & Frykholm, 2000; Lampert e Cobb, 2003; AlrØ & Skovsmose, 2006; Menezes, 1995; Moreira, 2001; Martinho, 2007; Ponte *et al*., 2007, Boavida *et al.*, 2008)
  - "Interactions among students, encouraging them to provoke discussions and new discoveries allowing them to build a more solid knowledge" (Martinho & Ponte, 2005).
  - "When students work in groups, participation is more spontaneous and helps all students getting involved" (Martinho, 2007).

Methodology

- Essentially qualitative (Bodgan e BilKen, 1994; Coutinho, 2011)
- Multiple case study (Stake, 2007; Yin, 1989, 2005)
- Participants: 4 pairs of students in a class of 3rd Cycle of Basic Education and the researcher.



Half rural

Elementary school of Aveiro

Class of 9 th year

- Different school achievements
- Facility to communicate ideas

Design investigative

1ª Stage

Characterization of the target group

October-November

inquiry

Questionnaire

2nd Stage

Planification

January-March

document analysis

PEE/PCE/PCT/PAD/Program

3rd Stage

Pre-test

February

document analysis

Test

4th Stage

Implementation

February-March

Direct observation
Document Analysis

Logbook
Students' productions
Informal talks

Design investigativo

5th stage

Post-test

march

document analysis

Test

6th stage

Final Questionnaire

may

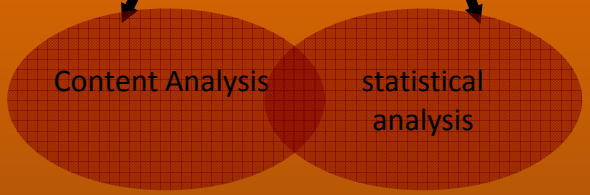
inquiry

Questionnaire

7th stage

Treatment of data

january to december

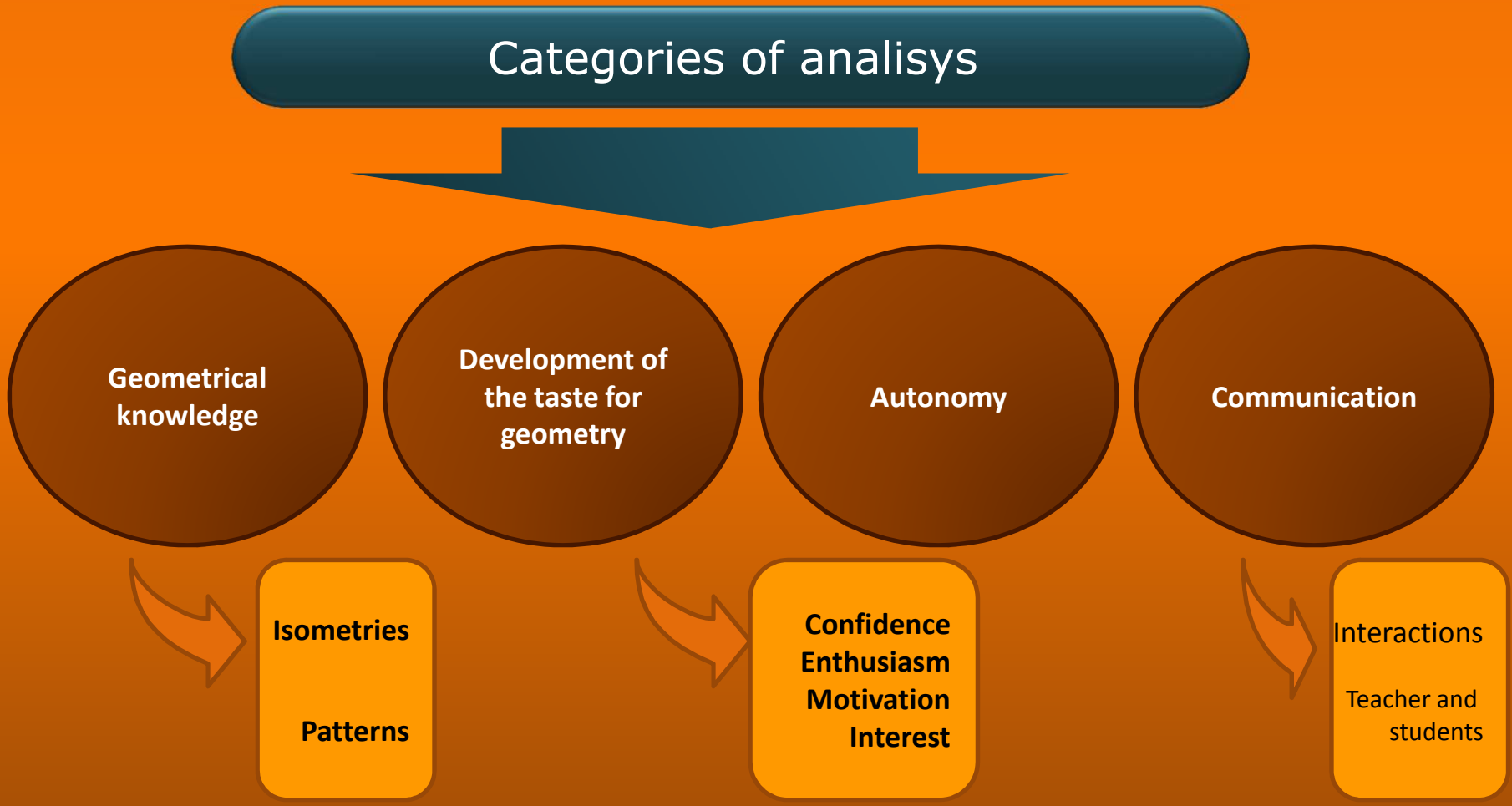


8ª Etapa

Presentation of data

Narrative, transcripts, tables, images, …

Treatment of the data



Didactic sequence:

- 9 diverse tasks applied in Maths class, Accompanied Study and Study Room;
- Students solve them in pairs, using GSP;
- Confrontation of the various resolutions;
- A summary of the main mathematician aspects involved to retain.

Key findings - interactions

G2

- **A2**
  - role of "inquiry" in relation to the group colleague;
  - helped the colleague to think, thus stimulating her learning awareness.
- **A14**
  - assumed the control of the computer in the constructions but recognized in the friend a person in whom to trust and with whom to interact;
  - active and shared involvement ⇨ for a common final conclusion.

A2: In this question [Question 8 of the task 7]What do you need to know? The figure shows only rotational symmetries.
A14: So it is the dihedral group of rosaceae ... [taking possession of the mouse].
A2: And what do we have to do?
A14: To complete the rosacea.
A2: Yes, but what do we have to find in the picture?
A14: I think we have to find the measure of the amplitude of rotation.
A2: Exactly. Measure the amplitude.
A14: But what are the points that I have to consider?
A2: We have to see ... maybe we need to consider these [pointing at the screen]. What do you think?
A14: I'll measure it to see if we can.

Key findings - interactions

G4

- **A12**
  - **The one who stood out the most** :
    - By the involvement in the achievement of activities
    - by the determination, autonomy, mastery of the computational tool
    - in the presentation of results to their peers, having placed pertinent and relevant issues for a better understanding of the general discussions.
- **A4**
  - The degree of interaction and motivation during the sessions and the fact that she is a good student perspectivated better results ;
  - her ideas always prevailed.

Researcher: Can G4 explain how you built the frieze of the last issue of the card?
A4: We started by drawing a line parallel to the given vector. After we determineated the image of the crown by reflection. Then we applied the vector to the figure and we got the crown.
A12: But now we need to repeat the new reason. What is the vector associated with this translation?

Key findings - interactions

G7

- **A15**
  - resisted in taking the initiative of participating in the work ⇨ He only wrote the answers thought by his colleague and did it without big personal involvement;
  - little involvement for the construction of his own knowledge. His role wasn´t decisive for the outcome of the exploitation of the tasks.

A19: Now you build the rosacea generated by successive rotations of 90 °
A15: I've already understood how it's done.
A19: You start ... this is very easy!
A15: Not now. I make the reports. I can do that.
A19: I'll see if you can answer the following point.

- **A19**
  - the type of work developed by the student was decisive in the form as the díade resisted to the didactic experience;
  - A progressive evolution in the type of work developed.

Key findings - interactions

G8

- **A8**
  - interacted well in the group ⇨ assumed the role in the exploration of the tasks clearly different from his colleague;
  - sought to dominate (good student status), in spite of not liking this theme.

- **A17**
  - not always did the student benefit from interaction with the pair;
  - little active participation in discussions, perhaps because she didn't like Geometry much.

Investigator: Then, do you want to present your conclusion?
A8: We don't have anything to add. Investigator: But what were the conclusions that you withdrew from this subject?
A8: It was the same teacher. It is not worthwhile! Go ahead.

Main conclusions - communication

Didactic intervention

- promoted the development of the ability to communicate with most of the students involved, although not all had benefited in the same way, one of the reasons being the (little) pleasure for geometry, even using the ADGD as a support for the resolution of challenging tasks.

The approach of revolutions centered on the study of patterns, using ADGD'S and the work, especially in small and large group formed a good resource to promote communication in mathematics (in most of the students).

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