Informatics tools, isometries and communication in mathematics
Structure of the presentation

- Problematic 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 ”
Problematic of the research

- 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., 2007 and 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

- Geometrical Knowledge - isometry 'rotation'
- Communication
- More affectionate relationship with the geometry
- Autonomy
Theoretical background

GEOMETRY
(Abrantes, 1999; APM, 2001; Cabrita et al., 2008, 2009; NCTM, 2007; Ponte et al., 2007; ME, 2010; Breda et al., 2011)

GEOMETRIC TRANSFORMATIONS

ROTATIONS

PATTERNS
(Orton, 1999; Devlin, 2003; Vale et al., 2006; Vale & Barbosa, 2009)

AGD
(Ponte & Canavarro, 1997; APM, 1998; Breda et al., 2011; Cabrita et al., 2009; Candeias, 2005; Coelho, 1996; Gorgulho, 2005; Junqueira, 1995; NCTM, 2007; Ponte et al., 2007; Ribeiro, 1996; Veloso, 1998; NCTM, 2007)
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 3\textsuperscript{rd} Cycle of Basic Education and the researcher.
Design investigative

1\(^{a}\) Stage
- Characterization of the target group
  - October-November

2nd Stage
- Planification
  - January-March

3rd Stage
- Pre-test
  - February

4th Stage
- Implementation
  - February-March

- Inquiry
  - Questionnaire
- Document analysis
  - PEE/PCE/PCT/PAD/Program
- Document analysis
- Test
- Direct observation
- Document Analysis
- Logbook
  - Students' productions
  - Informal talks
Design investigativo

5th stage
- Post-test
  - march

6th stage
- Final Questionnaire
  - may

7th stage
- Treatment of data
  - January to December
  - Content Analysis
  - Statistical analysis

8th stage
- Presentation of data
  - Narrative, transcripts, tables, images, ...

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Treatment of the data

Categories of analysis:

- Geometrical knowledge
- Development of the taste for geometry
- Autonomy
- Communication

Isometries
Patterns
Confidence
Enthusiasm
Motivation
Interest
Interactions
Teacher and students

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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 determined 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

- **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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