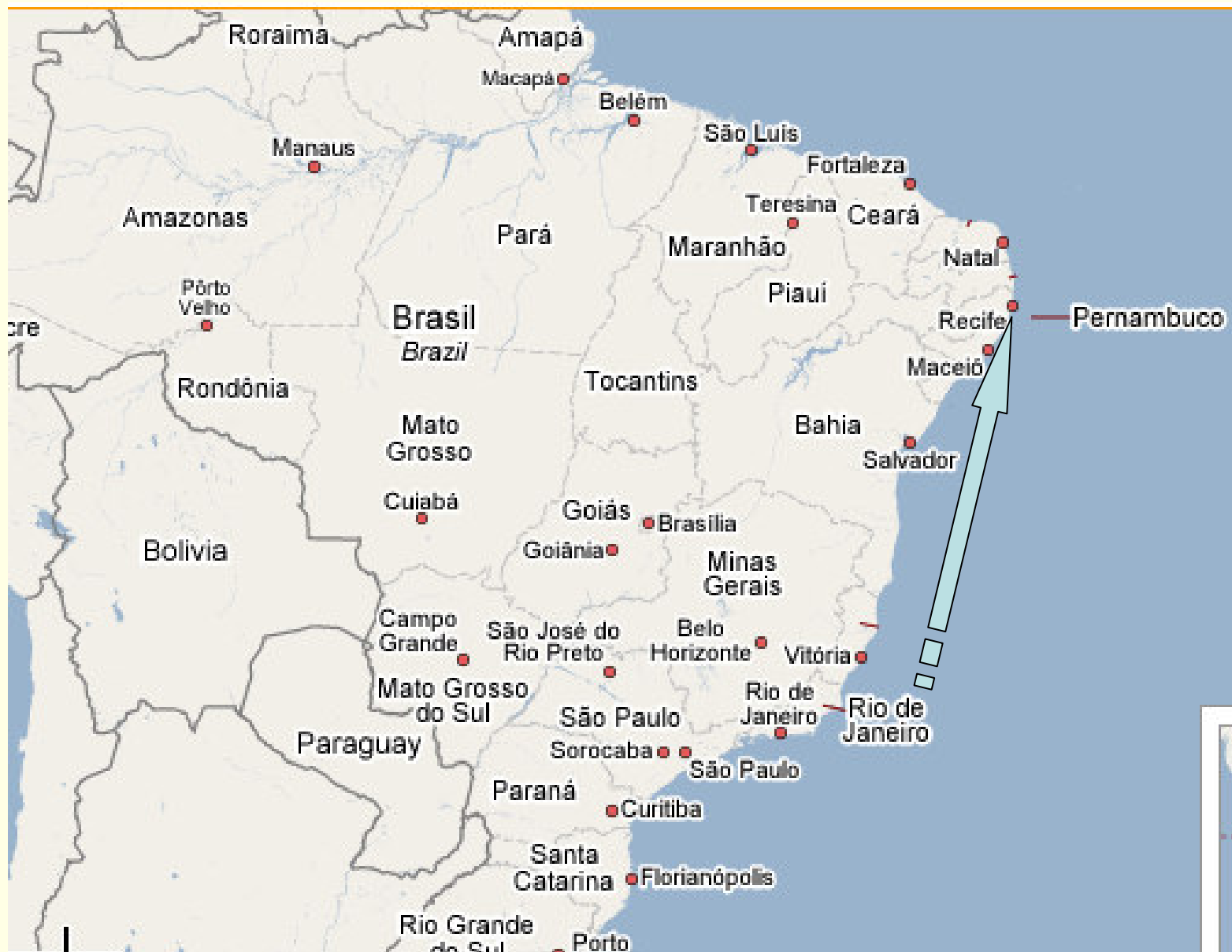


DESIGNING TANGIBLE INTERFACES
FOR MATHEMATICS LEARNING
IN ELEMENTARY SCHOOL

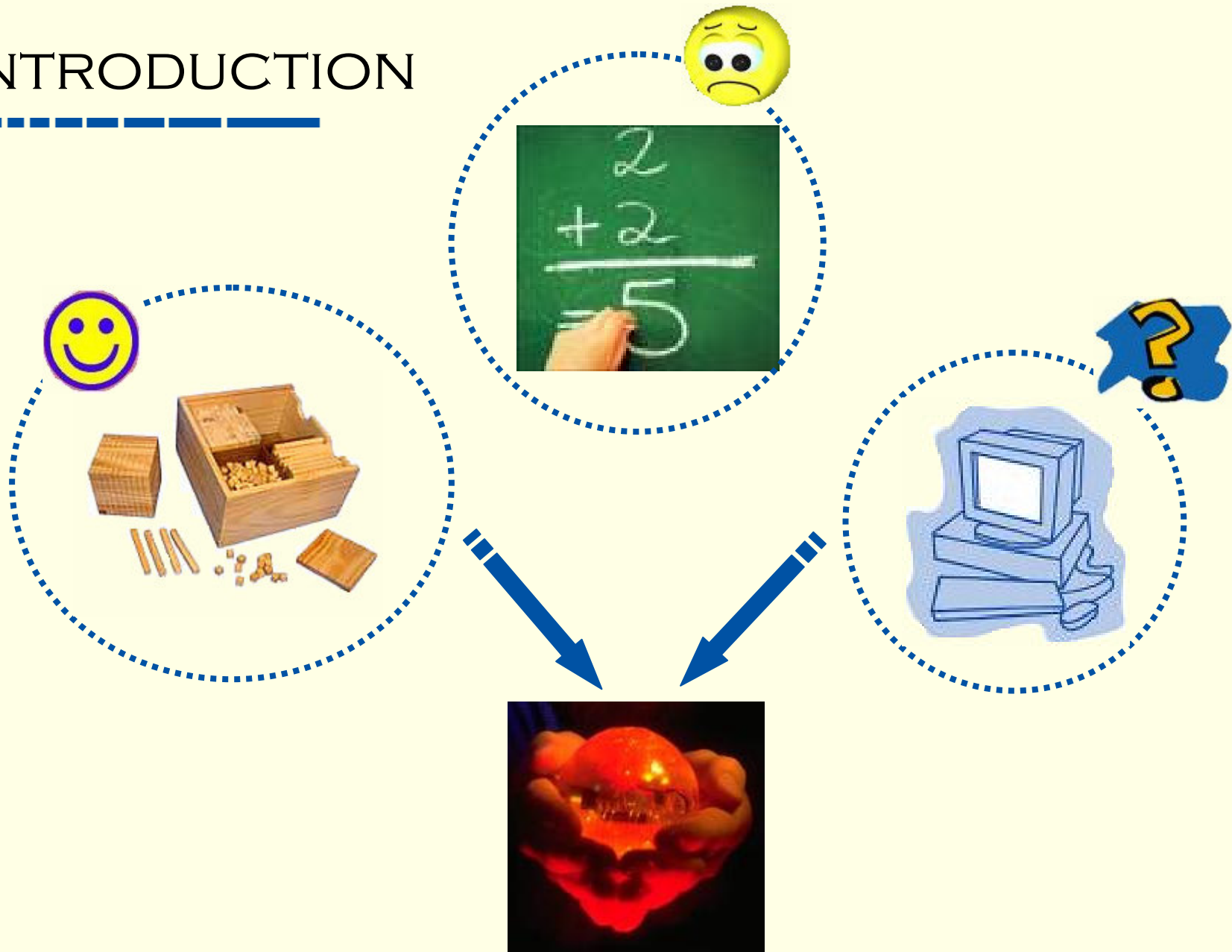
Taciana Pontual Falcão (CIn/UFPE)
Luciano Meira (Dept. of Psychology / UFPE)
Alex Sandro Gomes (CIn/UFPE)

Rio de Janeiro, CLIHC 2007





INTRODUCTION



[INTRODUCTION]

GOALS

METHOD.

RESULTS

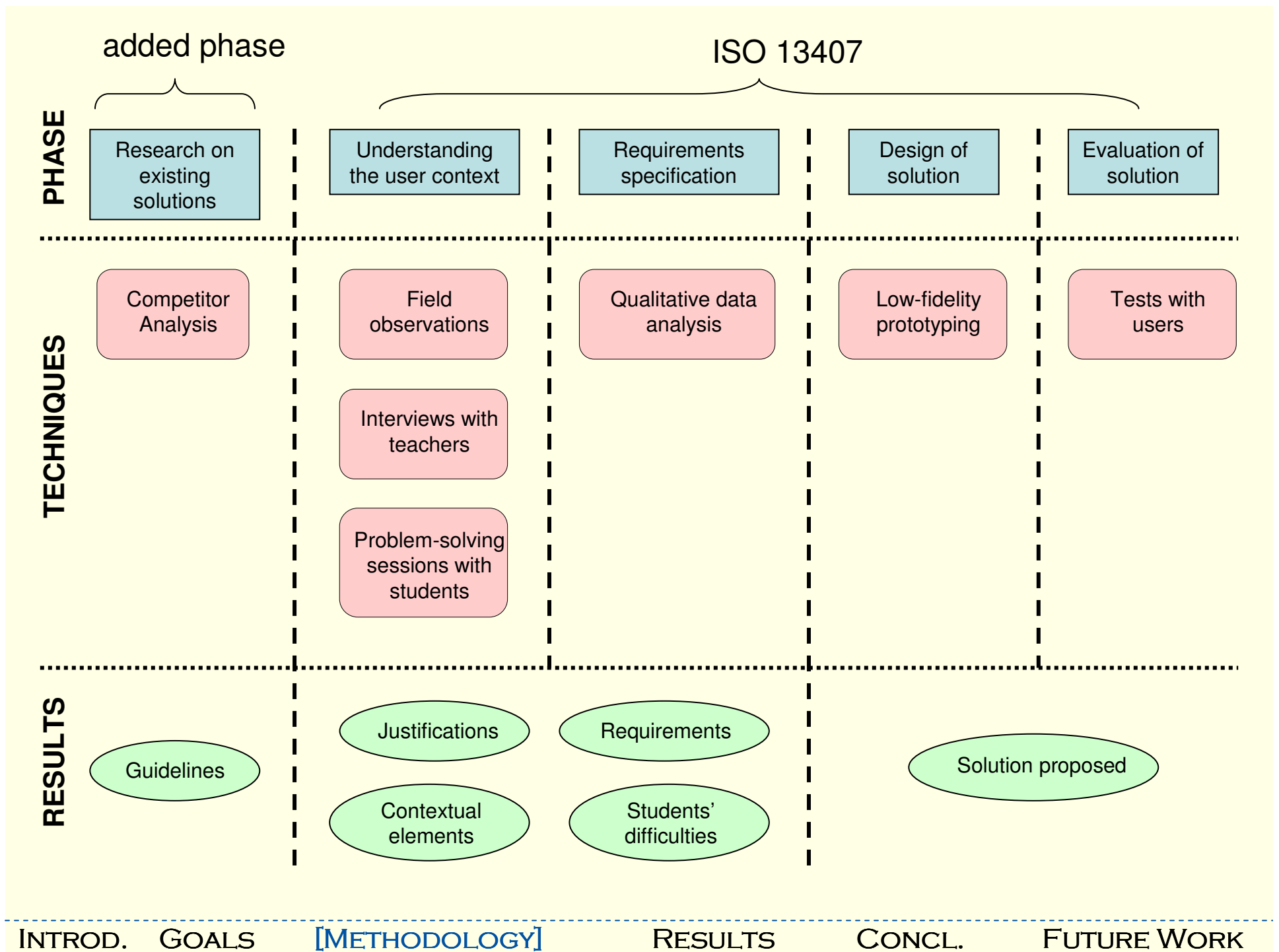
CONCL.

FUTURE WORK

GOALS

- ▣ PROPOSE A TANGIBLE INTERFACE SUITABLE FOR BRAZILIAN CLASSROOMS
 - ▣ Learning of fractions

- ▣ PROPOSE DESIGN STRATEGIES FROM WITHIN A CONTEXT-BASED AND USER-CENTERED METHODOLOGY

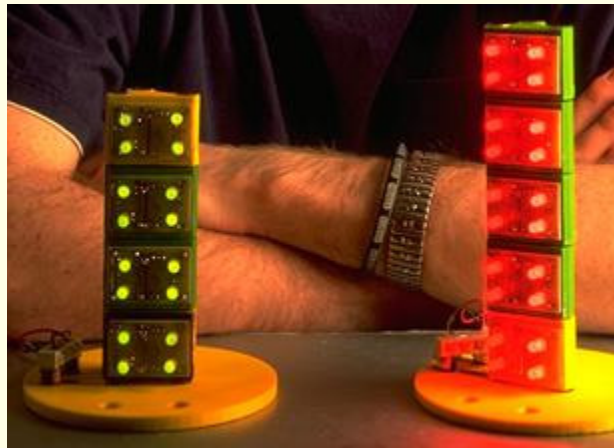


RESULTS

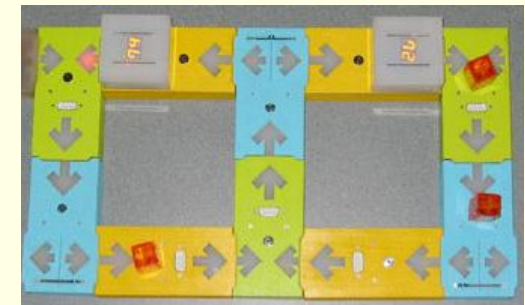
RESEARCH ON EXISTING SOLUTIONS

Competitor Analysis

RESULTS



Competitor Analysis



INTROD.

GOALS

METHOD.

[RESULTS]

CONCL.

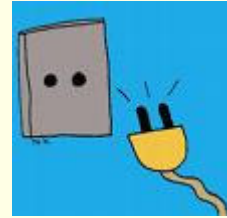
FUTURE WORK

RESULTS

Competitor Analysis → Guideli



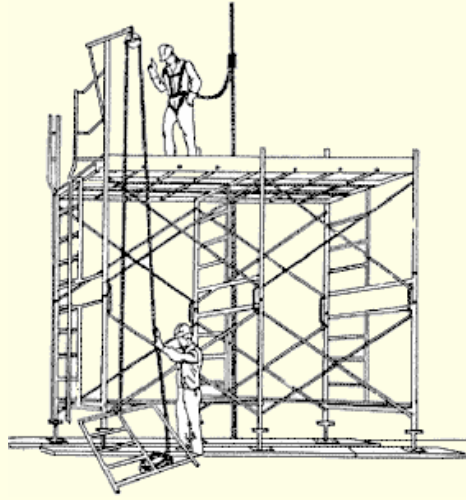
Multi-sensorial representations



Be functional even in the lack or electric power



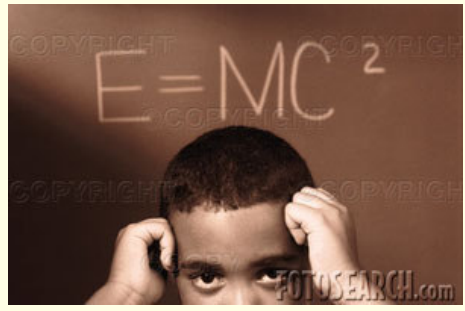
Scaffolding



Collaborative work



Reflection and Creativity



RESULTS

UNDERSTANDING THE USER CONTEXT

Field observations

Interviews

Problem solving

REQUIREMENTS SPECIFICATION

Qualitative Data

RESULTS

Field Observations

Interviews

Justifications

- CLASSROOM USAGE
- TANGIBILITY
- ACCEPTANCE
- ENGAGEMENT
- PRODUCT FOR THE LEARNING OF FRACTIONS

RESULTS

Interviews

Field Observations

Requirements

CONTEXT ELEMENTS	REQUIREMENTS
<ul style="list-style-type: none">■ Different levels of achievement	[SCAFFOLDING]
<ul style="list-style-type: none">■ Teachers' interest in materials which make students think	[STIMULATE REASONING]
<ul style="list-style-type: none">■ Need for connecting the use of the material to the curriculum	[BE ADEQUATE TO SCHOOL CURRICULUM]
<ul style="list-style-type: none">■ Interest in using the material in different learning situations	[ALLOW MULTIPLE ACTIVITIES]

INTROD.

GOALS

METHOD.

[RESULTS]

CONCL.

FUTURE WORK

RESULTS

Interviews

Field Observations

Requirements

CONTEXT ELEMENTS

REQUIREMENTS

▣ Lack of resources

[LOW COST]

▣ Children behaviour and legal restrictions

[BE SAFE FOR USERS]

▣ Group work in class
▣ Exchanges among students

[COLLABORATIVE USE]

▣ Students with disabilities in regular classes

[MULTIPLE REPRESENTATIONS]

▣ Learning through different forms of interaction

INTROD.

GOALS

METHOD.

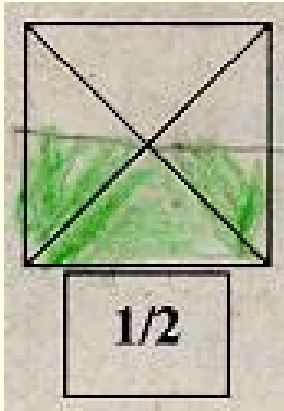
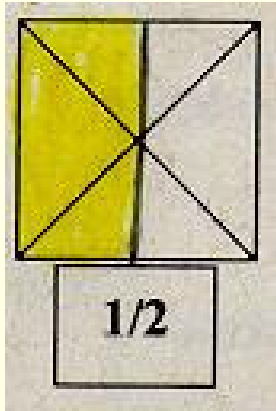
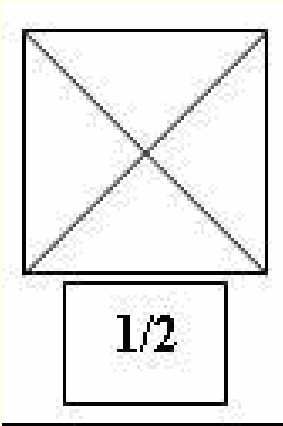
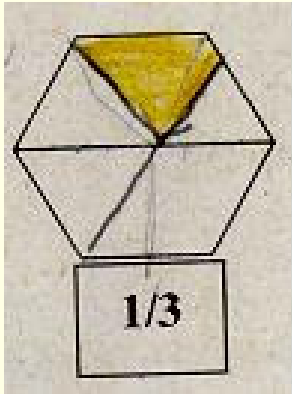
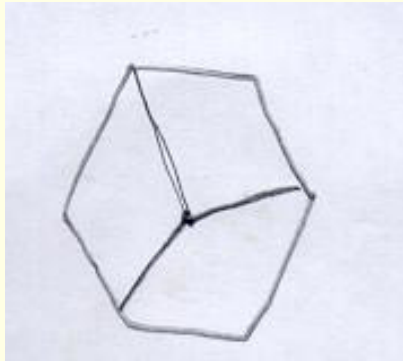
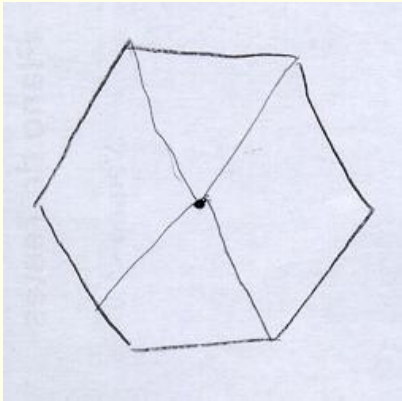
[RESULTS]

CONCL.

FUTURE WORK

RESULTS

Problem solving



RESULTS

Problem solving



Difficulties

- FRACTIONS AS PARTS OF A WHOLE (CONTINUOUS MODEL)
 - Understanding the notion of equal parts and partitioning areas (or even volumes) that require a more accurate spatial reasoning.
 - Exploring and recognizing multiple ways of partitioning areas, other than the more common ones.

RESULTS

DESIGN AND EVALUATION

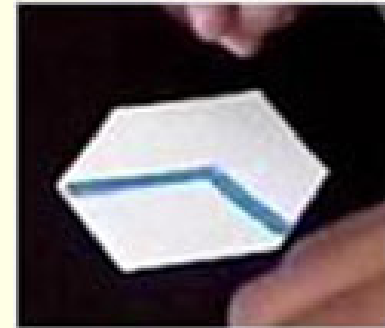
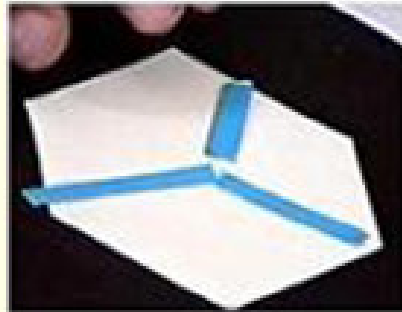
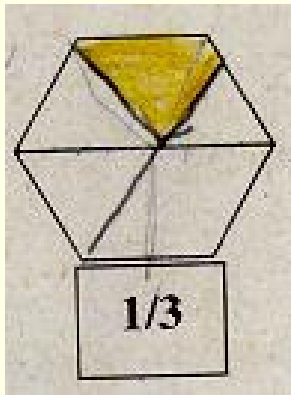
Prototyping

Tests with users

RESULTS

Prototyping

Tests with users



INTROD.

GOALS

METHOD.

[RESULTS]

CONCL.

FUTURE WORK

RESULTS

Prototyping

Tests with users

▣ BENEFITS

- ▣ Easy to manipulate, allowing students to explore a greater number of possible ways of partitioning figures than when using paper and pencil
- ▣ Useful resource to give students hints and explanations
- ▣ Students' engagement
- ▣ Collaborative work and richer interactions

RESULTS

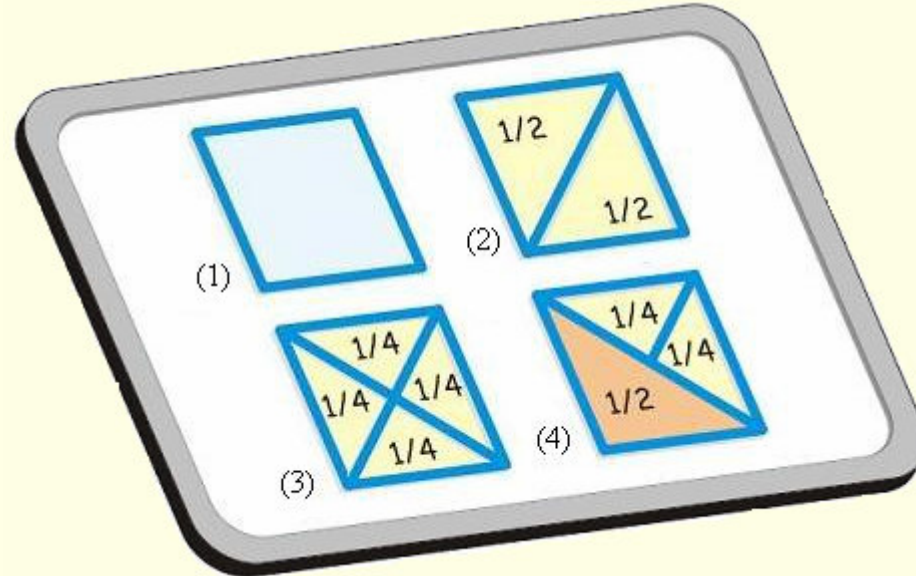
Prototyping

Tests with users

Proposal

PARTS&BITS

- ▣ Exploring and dividing figures
- ▣ Concept of “whole”
- ▣ Equivalence of fractions
- ▣ Adding and subtracting fractions



INTROD.

GOALS

METHOD.

[RESULTS]

CONCL.

FUTURE WORK

CONCLUSIONS

▣ CONTRIBUTIONS

- ▣ Design guidelines to develop tangible interfaces for Education
- ▣ Requirements (specific to the context)
- ▣ Students' difficulties with fraction
- ▣ Tangible interface for the learning of fractions

▣ CHALLENGES

- ▣ The whole set of elicited requirements is not easily satisfied
- ▣ Low cost technologies

FUTURE WORK

- ▣ DEVELOPMENT OF PROTOTYPE
 - ▣ Usability tests
- ▣ REVISITATION OF DATA
 - ▣ New ideas

tacianapontual@gmail.com



OBRIGADA!

*“No one ignores everything. No one knows everything.
We all know something. We all ignore something.
That’s why we always learn.”*
PAULO FREIRE