

# THE USE OF “GRAPHICS FOR INTERACTIONS” IN SOLVING MATHEMATICS PROBLEMS WITH MULTICULTURAL STUDENTS

Carme Aymerych\* & Núria Rosich\*\*

\*CEIP Rocafonda de Mataró(Spain)

\*\*University of Barcelona (Spain)

\*[maymeri8@xtec.net](mailto:maymeri8@xtec.net), \*\*[nuriarosich@ub.edu](mailto:nuriarosich@ub.edu)

## ABSTRACT

*The Pisa Assessment has highlighted the difficulties experienced by students in learning of mathematics in Spain. The present study focuses on the use of graphics, which allows teachers to visualize and to think about the interactions that take place during learning math in new immigrant students' classroom. The graphs are displayed as a good instrument for analyzing communicative networks on the interactions that are carried out during the resolution of mathematics tasks and at the same time, this instrument enables teacher-researchers to think about the basic teaching-research.*

## INTRODUCTION

When students arrive to our country, they are assigned to a school of the town they live in and since they ignore the official language (the Catalan language) these students are integrated in special classrooms, in order to introduce them to the knowledge of the language and the culture of our country. In general, teachers of these classrooms are teachers with a significant experience who receive basic training in linguistics, but they do not receive any special training in mathematics. This is the case of the classroom teacher where the investigation is carried out.

The presented experience takes place in (1) a classroom with multicultural students; (2) with the classroom teacher who has had a lot of experience and knowledge of the language of our country; and (3) with a teacher-researcher as a collaborator (expert in mathematical knowledge).

In the recent years, Spain has become one of the countries receiving immigrants from different countries: North Africa, Latin America, and from countries of the former Soviet Union. This has made the autonomic government arbitrate several measures for the integration of these students in schools. When they arrive in our country, they are assigned to a school in the town where they live. They do not know the official language (Catalan) and for this reason, these students are integrated into new immigrant student classrooms in order to introduce them to the knowledge of language and culture of our country. In general, teachers in these classrooms are experienced teachers who receive training in basic aspects of linguistic, but receive no special training in mathematics. This is the case of the teacher from the group where the investigation takes place.

## THEORETICAL FRAMEWORK

Since the study investigates the use of the interactions involved in conversation learning, first we try to define these interactions. We define as communicative

interactions those, which are produced between two subjects orally in a conversation. In our case these interactions are between the teacher and students or students and students, and their content is about teaching and learning of mathematics. Therefore, the interactions are in the middle of the communicative process. So, we believe that in a systemic model, they can be seen as an “interactive relationship[s] and a whole dynamic” (Marc & Picard, 1992). Morin (1999) provides us with a very general notion of communicative interactions saying that communicative interactions are reciprocal actions that change the behavior or the nature of the elements in the presence of influence.” It is clear that the interactions produced in a pedagogical conversation are oriented, from the beginning, to specialized interactions as the ones noted by Vion (1992). The difference between a didactic dialogue (Amigues, 1996) and other kind of dialogues is that the first tends to create a cultural relationship referring to a known object.

We share with Goffman the idea that an interaction is defined as a reciprocal influence carried by participants on the respective actions while they are in the physical presence of each other (quoted by Vion, 1992).

It is important to point out the structure and functionality of the interactions. Kebrat-Orecchioni (1990) presents a hierarchical model in which different components establish inclusion, subordination and functionality relationships. Every interaction can be broken down into sequences, that is to say, exchange blocks linked by a sharp degree of semantics and or pragmatic coherence.

This investigation asks: (1) how can we improve communication between teachers and students? (2) how can we improve communication among students themselves? (3) how are we able to assess whether the use of educational materials helps understanding?

## **METHODOLOGY**

One of the main points of a multicultural classroom is the use of language as a learning tool, in our case, of mathematical language. That is why we want to analyze conversational networks that take place around the resolution of mathematical tasks, in the classroom with multicultural students. This article presents an analysis of the resolution of a mathematical problem as well as our reflections on it.

Given the communication difficulties that take place in a multicultural classroom, our starting point is a hypothesis that the use of teaching materials will improve communication (understanding) and the resolution of mathematical tasks.

That is why the goals that this research proposes are: (1) to determine the degree of communication established between teachers and students and among students in activities with and without use of mathematical content materials; (2) designing activities involving the use mathematical materials.

Two teachers are involved in this experience: one as a classroom’s teacher and another as a teacher-researcher. The researcher is involved in this experience by collaborating in the design of learning tasks and contributing with her experiences in teaching mathematics as a person skilled in teaching of mathematics. The motivation for the participation of the teacher-researcher in this experiment is to learn how to manage a multicultural classroom and at the same time to contribute her experience to teaching of mathematics.

The methodology of this case study was designed on the basis of the design-based research (DBR). This choice responded to the characteristics of the study.

The students involved in this study were students from a new multicultural classroom in a public school aged 3-12. The school has a rate of 20% of students from other cultures.

The group study was formed by the following students: (1) Three students aged 11-12 from Morocco with a one-year stay in school. They attended the fifth grade of primary; (ii) one student aged 11-12 from China with a year of permanency in school who studied in the fifth grade of primary; and (iii) two students aged 10-11, from Morocco. They stayed one year in school.

The instrumental techniques used in the investigation included the following: (1) observations of the participant-observer Gonzalez and Latorre (1987); (2) class journal where the experiences during the sessions were recorded by the class teacher and researcher; (3) e-mails between the two teachers; and (4) five audio recorded class sessions.

## **EXPERIMENTAL PART**

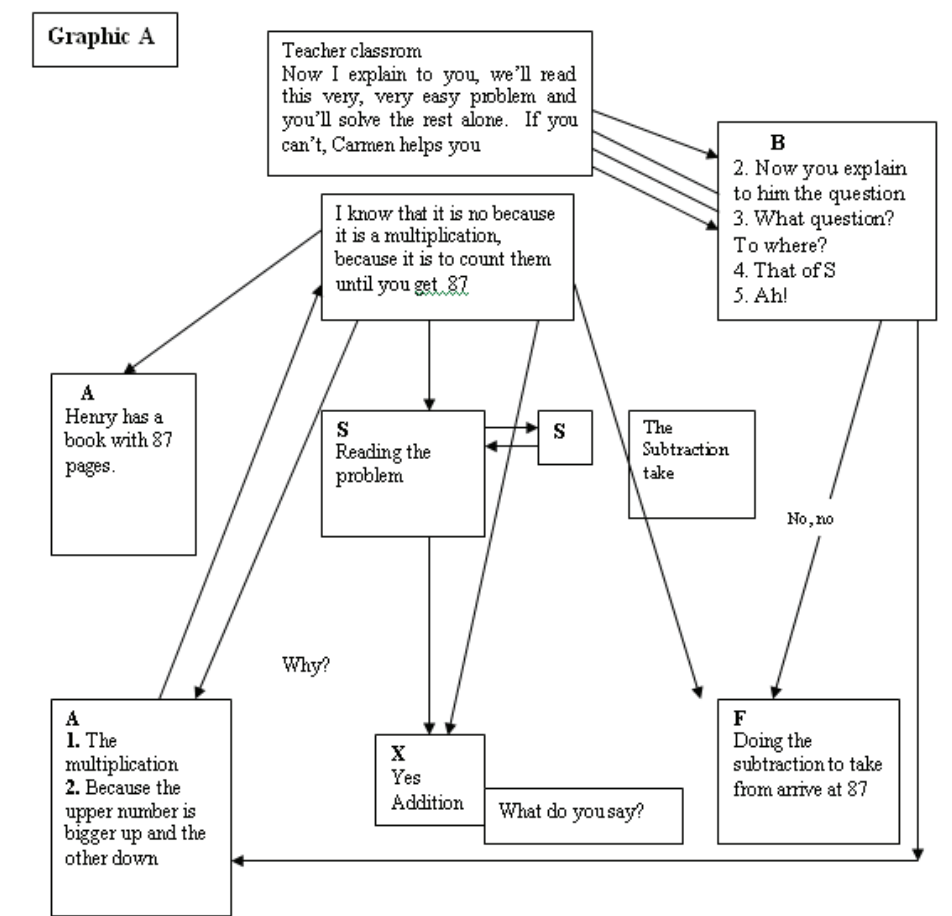
The main aspect of the study was the role played by the mathematical content in new immigrant student classes. That is why it was decided to adapt for students both arithmetic and geometric tasks.

The arithmetic activities focused on a game called "Fermez la boite" which took three sessions. It was decided to use the game due to the fact that it was one activity that could motivate students to participate in dialogues on math tasks. The game had chips and dice and students had to operate with the number obtained to get the quantities of chips and win.

In geometry we also choose the game format. The game took place in two teams. The game consisted of composing geometric shapes using the polydron. In order to get it, one had to compose a geometric shape and verbally describe to the opponents the figure that the other team had to compose without seeing it. This game also sought the communicative participation.

The type of analysis used was a communication networks analysis with the help of graphics. To this end (1) the sessions of class were transcribed; (2) hypertext schemes were made from communicative units of the speakers participating in the dialogue, in order to see how many interactions took place and what the degree of their quality was; and (3) schemes were reduced to identify the meaning knots.

The situation that we present in the graph A shows an activity made by the classroom teacher without using didactic material. The teacher proposes the resolution of a simple problem. The problem says: "Enrique has a book that has 87 pages. If he has already read 23 pages, how many pages are left? How many pages does he have to read?" We can see that it is a problem of the second grade of primary level.



In this figure one can observe that the classroom teacher starts solving the problem talking to the whole group, but at this moment all questions are always unidirectional, in other words, the questions are directed at one student (A, B, S, etc.). The kind of questions that the teacher poses are very concrete, awaiting monosyllabic answers (if not a number, etc.), but they do not allow discussions at group level, that is between students and the teacher. In this figure, we also observe the absence of conversational knots and the presence of students without any participation.

Since students are not clear which operation they must carry out to solve the problem, the session of the resolution of the previous problem continues. The classroom teacher introduces the expert teacher in mathematics to see if she succeeds in facilitating the resolution of the problem by students.

In the graphic B we see the representation of the interactions that take place with the teacher and researcher, and we can observe that most of the time the teacher talks to the class in general, giving clear slogans that help in the resolution of the problem, reducing the number of pages to make it clearer to the students who achieve their solution; most of the students participate in the discussion.

**Graphic B**

If we compare both graphics we can clearly see two forms of teachers' behavior in this investigation, giving an example how to plan math activities in a group with great communicative difficulties. In figure A the teacher maintains unidirectional dialogue, while in the figure B the teacher manages to involve the whole group as the main interlocutor.

## DISCUSSION

Three different arithmetic games and one geometric were analyzed with similar graphics. The educational games play an important role and one can observe improvement of the communication but not in an outstanding way. The use of the graphics has allowed the two teachers involved in the experience to understand how to bring the mathematical tasks into communicative play in didactic learning atmosphere. These teachers realize that teaching materials are interesting and provocative for the activity, but what really matters is the type of communicative interactions that the teacher develops with them. Consequently, the mathematical activities designed with

teaching materials for immigrant students must take into account the role of such interactions.

The study suggests some recommendations for the teacher training about the design of activities which encourage dialogue between students and the teacher. For this reason, we recommend using graphics as a good tool for research teachers who want to study all the classroom communication.

## REFERENCES

- Amigues R. & Zerbato-Poudou, M. (1996). *Les pratiques scolaires d'apprentissage et d'évaluation*. Paris: Dunod.
- Kerbrat- Orecchioni, C. (1990-1994). *Les interactions verbales*. 1, 2, 3. Paris: Armand Colin.
- Marc, E. & Picard, D. (1992). *La in:teracción social. Cultura, instituciones y comunicación*. Barcelona: Paidós.
- Morin, E. (1999). *El método. La naturaleza de la naturaleza*. Cátedra.
- Vion, R. (1992). *La communication verbal. Analyse des interactions*. Paris: Hachette.