

Chapter 92

Hands–On Math in Kindergarten

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ABSTRACT

The purpose of this contribution is to describe innovative proto-mathematical educational activities at kindergarten level (K) in the context of semiotic mediation. As a result of preliminary analysis of the major difficulties in writing numbers and recognizing the semantic value of the decimal position system found in primary school children, it was decided that the teaching of the different numbering systems would be brought into K, with the help of specific games. The goal is to demonstrate the importance of the natural and simple nature of “mathematical” language for the child, to stress the role of tools in the mathematical learning processes, and to highlight the role of the teacher in the collective mathematical discussion.

INTRODUCTION

International research has amply demonstrated that the abstraction process starts from an early age (Butterworth, 1999; Iannece *et al.*, 2010) and it is therefore during kindergarten (K) that the child’s mental models begin to form in order that they may logically organize the world around themselves. (D’Amore *et al.*, 2004) However prejudice remains and the K period continues to be deemed too early for children to begin their education in numeracy. This chapter describes a part of an innovative project, in two schools in the Italian region of Marche, whose aim is to introduce children to mathematics in a fun way. It also invited the teachers involved to reflect on possible

processes for numeracy in K. In particular we suggest proto-mathematical activities in K to facilitate the positional notation of numbers in subsequent Primary School (PS) years. In fact, international literature shows that children of eight years have difficulty in the positional notation of numbers, which is often done without explicit reference to the value of digits (Iannitti & Vettore, 2007).

The idea to focus on improving education for numeracy during K originated from the training activities and final thesis as part of a degree in Primary Education at the University of Macerata, Italy, studied by the author of this chapter. In fact, thanks to observation, research and comparative studies with colleagues in the Primary School (PS) of the Province of Macerata (MC), Italy, it was possible to record the major difficulties found in PS children in writing numbers and in their rec-

DOI: 10.4018/978-1-4666-4502-8.ch092

ognition of the semantic value of the positional decimal number system. This is in addition to the perception of a general lack of interest in the discipline, which is considered as boring and pointless. These educational experiments were carried out at the Teaching Circles Regina Elena Civitanova Marche (MC) and Ascoli Piceno Center (AP). Both schools are located in an area of an above average socioeconomic status. The teachers involved have been interested in the educational intervention proposed during the training activities of two students in Primary Education. The study described in this chapter refers to the K level of AP.

The main objective of the whole project was to develop a positive attitude towards mathematics among children and to make them reflect on how a given quantity can have different representations (iconic, verbal, symbolic etc.), starting from their original concepts (Vygostkij, 1987).

The development of the educational courses had the specific objectives of encouraging children to have a positive attitude towards mathematics and towards sharing their thoughts with peers and teachers.

In particular we have tried to create educational activities at K to promote:

- The need to group the various numerical bases and to organize them in a more simple way.
- The recognition of the semantic value of the positional decimal system.
- The development of different languages (iconic and linguistic), including the mathematical language.
- Cooperative learning.

Other objectives involved decisively impacting the training of the teachers involved, providing them with the grounds to reflect on the usefulness and efficiency of the course and of the teaching ideas.

The methodology that we used was intended to focus on the problematizing of everyday experiences, stimulating the curiosity of children by investigating and resolving issues in a playful and pleasant way.

The instruments used included *Contafacile* (see “Gioco del due,” or “The Game with Two,” Rinaldelli *et al.*, 2008), a structured tool, and common materials such as flowers, pasta, string, stones, sticks, leaves, dough, cups, posters and colors.

The didactical cycle was useful to monitor the children’s learning process, Centred on semiotic mediation, developed by Bartolini-Bussi & Mariotti (1999), it consisted of the realization of a cyclic path centred on the use of structured tools as mediators of everyday objects.

More specifically, the children were continuously assessed during the various phases of the project through the semiotic analysis of their graphical representations, through ongoing observation during individual and group work, through discussions in the individual stages and through the analysis of materials produced in the final stage.

The project involved teacher training, and their comments were recorded during individual interviews at the beginning and end of the project, in which they were asked to reflect on the possibility of realizing the didactical cycle in their lessons.

The project was realized with the help of Prof. M. P. Saitta, creator of *Contafacile* (2008), who provided materials and worked with the teachers involved and with two university students who carried out the activities in the two schools.

During the project of approximately four months (during years 2008/2010), a total of 6 K teachers, 73 children (aged 5 years coming from three different K classes), and two university students of Primary Education (the researchers). In this chapter, four classroom observation protocols are described, which involved 24 children, two teachers and the researcher.

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