CHILDREN'S SYMBOLICAL SYSTEMS:
THE POWER OF EDUCATORS' BELIEFS AND BACKGROUNDS

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Abstract

This study is rooted in Emergent Literacy field, a process starting from the age of 2, during which children become able to understand and to produce symbols, before schooling. In particular, it is investigated the development of written numbers.

The aim was to find out the influence of educators' backgrounds and beliefs on children's paths toward writing of numerals.

The data was collected through questionnaires to educators, tests to children and observations of learning environment and practices during regular days at bilingual German-Italian kindergartens in Berlin. A qualitative analysis based on the principles of Grounded Theory has been conducted on data of observations and questionnaires. Besides, a reinforcing game involving the use of symbols permitted a comparison between two kindergartens in a quasi-experimental design.

The learning environment is resulted a factor affecting the children's path, considering both the different settings and the daily activities like expression of educators' beliefs. ,

Keywords: Preschool, Emergent Literacy, numbers writing.

1. INTRODUCTION

The development of children's symbolical system begins before the schooling. From the age of 2, children become able to understand and to produce symbols: this phase is called Emergent Literacy. Deloache (2004) define a symbol "something that someone intends to represent something other than itself" and she assumes that the symbolic capacity transforms the interaction of children with others.

Research on emergent literacy started in the early 1970s and several components have been identified: print awareness, language and phonological awareness. Only recently it has been presented a model considering those components immersed in a social and cultural framework. Leigh Rodhe (2015)'s Comprehensive Emergent Literacy Model (CELM) takes into account culture, community and demographics like the environment in which the elements of emergent literacy are placed. Rodhe focused on EL as an "interactive process of skills and context". In the centre of CELM is situated writing, that involves all the others components. Writing permits to children to express the acquisition of literacy process. Most of the body of the researches in the area of early writing investigated graphemes and first words; less attention is paid to numerical notation. The project here presented aims to contribute to that gap. Lucangeli, Tressoldi, Re (2012) carried out a longitudinal study with the goal to find out whether the development to reach the correct representation of Arabic numerals has an unique or multiple paths. The findings point that, even though there are common ways to represent numbers, the paths are differently for each child. Therefore, it is clear that

there are several paths towards the learning of written numbers but it is still unknown the reason why there are so many different ways. Therefore, this study tries to explore the relation between different representation of quantities of preschoolers and the influence of the adults, adopting a sociological perspective.

2. METHODOLOGY

2.1. Design

The project of the study took place in the bilingual (Italian/German) kindergartens in Berlin; it combines two different research designs: observational and quasi-experimental, both are conceived in a longitudinal way. N. 37 children were tested during preschool years and n.15 educators participated to an on-line survey.

The instruments of research are ecological observations, children test, questionnaires. The test consisted in asking to children for writing numeral from 1 to 9 in random order.

The quasi-experimental part is a comparison of two kindergartens comparable in term of location, characteristics of children and organization. One of the two used a game designed for this project and based on Maria Montessori's studies; the game permitted to work with the manipulation of numerals and matching them with the quantities. Three were the research questions:

1- Are there educational practices (mathematical stimuli in the learning environment, activities, plan of work, didactic address, etc.) that can encourage children's written representations of numbers?

2- How educator's beliefs, awareness and individual background influence the children's paths

to written representation of numbers? What favor different children's paths? Can we notice different educational practices between Italian or German educators?

3-how educators can improve their approach? Which modalities or tools can be adopted by teachers?
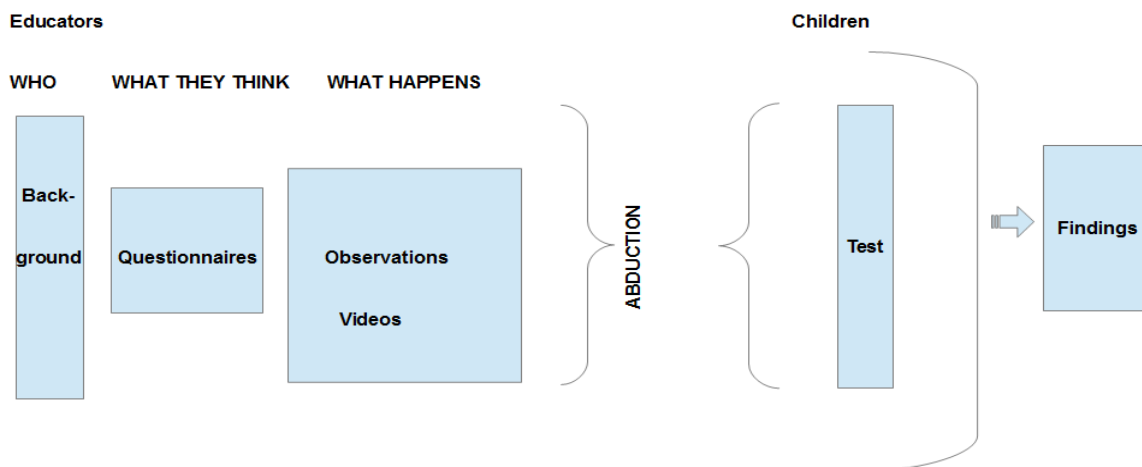
Fig 1. Method

**Fig.2 Game with symbols and quantities**

2.1.1 Analysis and Results

A qualitative analysis is conducting on data of observations and questionnaires. I have based the analysis on principles of Grounded Theory, using Word to organize data and defining conceptual categories and labels. Core codes summarize educators' beliefs about how children learn, how teachers can effect on the process of symbolization and what is the purpose of their job, also regarding to the use of the governmental program for kindergartens of the city of Berlin. From questionnaires I also have an insight of the feelings about different Germans vs Italians educational approach.

Test are sorting thank to Lucangeli, Tressoldi, Re (2012)'s classification: 1) Continuous form; 2) Discrete forms; 3) Graphemes; 4) Other pseudo-symbolic form; 5) Biunivocal correspondence: correct representation of numerosity trough signs or symbols; 6) Different Arabic number; 7) Correct Arabic number.

Fig.2 Example of test classification in *linear* path

| Continuous Forms | Discrete Forms | Graphemes | Other symbols | Biunivocal correspondence | Wrong numbers |
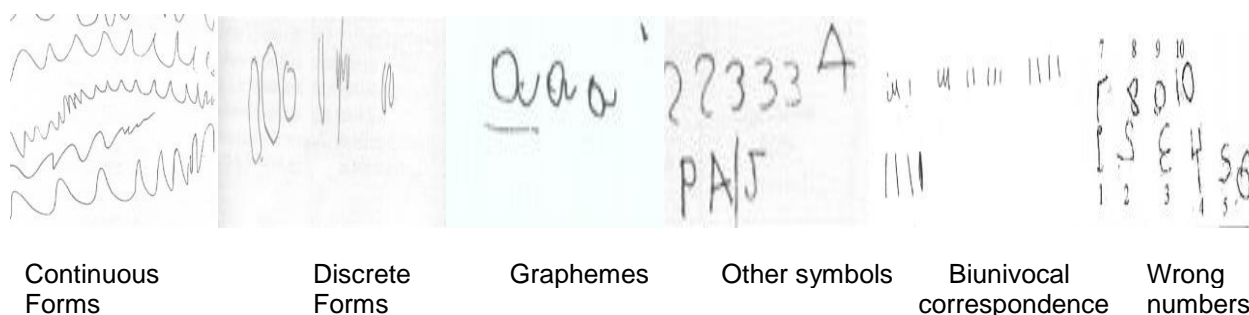
For each child is defined the path followed, which is categorized in one described by Lucangeli, Tressoldi, Re (2012): *linear (*use of almost all representation forms at earlier ages and the correct representations at age of 5), *forward and backward (*use of a more "advanced" form at a previous age followed by more primitive later), *no symbols (*complete absence of the use of graphemes or other symbols), *symbols* (use of symbols before the use of correct Arabic numbers), *early number developmental path*, (characterized by an early use of numbers)

Table 1. Percentage of paths for each kindergarten

Kindergartens	Path				
	Linear	Forward and backward	No symbols	Symbols	Early developmental path
Angolino	16,70%	16,70%	0,00%	33,33%	33,33%
Arlecchino	0,00%	0,00%	66,70%	33,33%	0,00%
Asilo Italiano*	7,70%	0,00%	30,80%	46,20%	15,40%
Girasole	0,00%	12,50%	50,00%	12,50%	25,00%

Note: The last two underlined are the kindergartens compared in the quasi-experimental design.

*Kindergarten where children participated to the game specifically designed for the project.

Differently from the results of Lucangeli et al (2012)'s research, I found only two children' production of Biunivocal correspondence. The classification that I adopted is slightly different from that of the above-mentioned study. Besides, most of children reached the wrong number stage and only few showed the correct number Arabic stage.

3. DISCUSSION

Results point clearly the learning environment like a factor affecting the preschooler's paths. Looking at the

different settings emerge a connection between the richness of written stimuli in the classes and the majority of the paths of children. Those kindergartens where maps, clocks, signs are on the walls are the same where the higher percentage of *symbols* paths were found. It is not a case there are only pictures and handicrafts in the rooms of the kindergarten showing the less numbers of *symbols* paths (Girasole). Another observed difference is about the address of the weekly activities: only in Asilo Italiano is offered a daily class for the preparation to school (Vorschule); that means training some symbolic skills everyday. In the others the focus is on music and movements. The daily activities are surely the expression of educators' beliefs, investigated trough a questionnaire.

What emerge is a connection between beliefs of educators about the importance of external stimuli during preschooler years and more *symbols* paths of children. This suggest that educators in those kindergarten feel probably more proactive in offering some incentive to children. For the same educators result fundamental being familiar with some real experience of counting or playing for the mathematics development before schooling, instead of mathematical concepts.

Some differences in German and Italian approaches are also brought to the light thanks to the educators' words. Italians tend to see the German approach more direct to the independence of children; Germans notice instead the more relaxed behaviour and positivity of Italian colleagues, defining them as "ruling in an organized chaos". They also observe a distinct method of just-arrived-in-Germany from Italy colleagues.

Two of kindergartens are here compared, showing how in that kindergarten where specific activity of symbols manipulation was proposed, the majority of paths are identified as *symbols.* Confirmed that the path to numerals is not unique, tools like this game affect on the path to written numbers, increasing the numbers of children who produce symbols before writing the Arabic numerals.

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