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BAMBINI CHE CONTANO: A LONG TERM PROGRAM FOR PRESCHOOL TEACHERS DEVELOPMENT

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This paper aims at reporting about a five years program for preschool teachers development, with the author as a teacher educator, on appointment of the city council of Modena. The project has involved every year about 25 teachers. In this paper the political background and the structure of the program are reported together with some outcomes concerning the materials for teacher development, the activities realized in schools by the teachers and the construction of a community of inquiry involving teachers, teacher educators, pedagogists and policy makers.

INTRODUCTION

Modena is a city of about 190.000 inhabitants in the region Emilia-Romagna. In Italy compulsory education starts at 6 (first grade of primary school) but there is an ancient sensitivity to the organization of public school institutions for children aged 0 – 6, especially in some regions, like Emilia-Romagna. After the Second World War, parents, educators and politicians of this region united their efforts to provide child care for young children. Originally inspired by the need of women to return to the work force, this education system has been developed in different places (e.g. Reggio Emilia, Modena, Bologna) with programs that have caught the attention of early childhood educators worldwide. In order to fill the social gap between peasant, working and middle classes (*cognitive democracy*) the civil society agreed to start high quality schooling as early as possible, as 6 years old children might have already experienced the devastating effects of social inequalities. In Reggio Emilia, Loris Malaguzzi developed the so-called Reggio approach, well known all over the world (http://www.reggiochildren.it/?lang=en), while in Modena, Sergio Neri developed a parallel approach, with similar formats for teacher development and similar involvement of parents and the civil society. The differences between the two approaches may be very roughly outlined focusing on different curricular choices for children aged 0-6, with a major focus on *enculturation* in Modena and on the so called *"hundred languages of children"* in Reggio Emilia.

I have worked in both programs, for a short time on appointment of Reggio Emilia city council and for a longer time on appointment of Modena city council. The latter collaboration was started in the eighties, when Sergio Neri was in charge of the pedagogical coordination of the municipal preschools, and was resumed in 2007 after a ten years interruption. An outcome of the first phase collaboration was the preparation of the field of experience *Lo spazio, l'ordine, la misura*, i. e. early year mathematics, of the *Orientamenti* (1991, the national suggested curriculum for preschools: http://www.edscuola.it/archivio/norme/programmi/materna.html). This contribution concerns the second phase of collaboration, started in 2007.

THE PROGRAM FOR TEACHER DEVELOPMENT

As preschool is not compulsory in Italy, in the case of this program, the educational policy has to be distinguished into two parts: the national one; the local one.

The political choices at the national level

In 2007 a major effort was started by the Ministry of Education to design anew the standards (*Indicazioni*) for students aged 3-14, thus involving also the level of preschools (covered by *Orientamenti* from 1991). General educators called up the complete responsibility for the new document for the age 3-6, without consulting experts of specific subjects (contrasting the choices made in the early 90s), and decreased the reference to the adult culture as a curriculum organizer and increased the freedom and responsibility of children themselves in defining the direction of their learning. The six fields of experience of the *Orientamenti* were reduced to five, with the merging of mathematics and science in only one field of experience (*la conoscenza del mondo*, i. e. world knowledge). In the fifth field of experience words like numbers and counting totally disappeared, as considered too much oriented to mathematics in the adult sense. The draft document of *Indicazioni* was officially issued in July 2007 to raise comments from schools. The part of the *Indicazioni* for children aged 3-6 was quickly put in the shade, as comments from schools were not positive at all. In 2012 a new version of *Indicazioni* has been issuedfor students aged 3-14. In this case, although the number of fields of experience for preschools has not been restored to six, the weight of early years mathematics has been increased distinguishing in the fifth field of experience two subfields, concerning mathematical and scientific experience. http://hubmiur.pubblica.istruzione.it/web/istruzione/prot7734_12) **The political choices at the local level (Modena)**

In 2007, when I started the second phase of collaboration with the Modena city council, preschool (and especially the presence, if any, of early years mathematics) was in the heart of the debate at the national level, as learned societies had strongly criticized the choices made by general educators. To design anew a program for preschool teacher development it was necessary, first, to agree on the intended curriculum for schools. Officially, the 1991 *Orientamenti* have not been abrogated as the new *Indicazioni* were still only a draft to be discussed by schools. The local authority for instruction, Adriana Querzè, a very intelligent and open-minded policy maker, agreed that, for mathematics education, *Orientamenti* (1991) still represented the framework of the municipal preschools in Modena as a model of enculturation, updating the original text to meet the needs of schools in the new millennium. Hence the political choice was to focus on early years mathematics (especially on numbers and space) to be tested in the large laboratory of the 22 municipal preschools.

The local organization

Every year, eight different projects are offered for teacher development by Modena city council: Italian language, Mathematics, Science, Art, Music, English, Orienteering and Philosophy for children. Enrolment in one project is compulsory for each teacher of the 22 municipal preschools and included in their working hours. Local teachers from governmental, private or religious preschools are welcome to (yet not forced to attend) the meetings. Also prospective preschool teachers from the Faculty of Education are welcome, as a part of their compulsory schedule for practicum. The system of Modena municipal preschools and the programs for teacher development are coordinated by a team of pedagogists (education committee). For the Mathematics project, two pedagogists have been involved in sequence: Maria Teresa Corradini (2007/2011) and Mariavittoria Vecchi (2011/now). I am the only permanent mathematics teacher educator with some other invited teacher educators for specific meetings. In 2010 a new member was appointed by the city council to join the small steering committee: Susanna Stanzani, a former teacher, expert in multimedia documentation; for nearly two years, she has part time taken care of the collection of materials from schools and authored the multimedia report on behalf of the city council.

For each project, every year the pedagogist specifies, in cooperation with teacher educators, the focus of the yearly project, the timetable and the contents of each meeting and the way of documenting school activities. She is in charge also of special meetings at schools to discuss with small groups of teachers problems found during school activities. In this sense, she represents a bridge between teacher educators and teachers. Her feeling of teachers' attitude is precious to detect whether there are problems or needs in the implementation of activities.

At the beginning of every school year a group of teachers is appointed (about one per school) for each project. Teachers are encouraged to be permanent members of the projects, but, for Mathematics project, in the period 2007-2012 there was a large fluctuation, because of different reasons (teachers' retirement; teachers' moving to other schools; new teachers entering municipal preschools and so on). This fluctuation represents a problem as every year it is necessary to welcome newcomers and to organize meetings so that they feel comfortable and ready to work. Now (2012) expert teachers are expected to take part as tutors in the small group sessions (third meeting, see below).

The general structure of five half day meetings with the group of about 25 teachers is shared by all projects. All the meetings but the third involve teachers, teacher educators and pedagogists.

First meeting (October): welcome to newcomers, summary of the past experiences and launch of the year activities (adult education and examples from classrooms)

Second meeting (November): continuation; design of some activities for different students' age (3, 4 or 5 years old);

Third meeting (January: small groups of teachers with pedagogist and expert teachers, in schools): 2-3 sessions for discussion on the ongoing activity (problems, needs, criticisms, new ideas);

Fourth meeting (February): discussion about the issues of the third meeting;

Fifth meeting (May): presentation and discussion of some activities realized in the schools; small exhibition of materials from schools.

If necessary, additional meetings with the pedagogist or the teacher educators are agreed with groups of teachers to meet specific needs.

Occasionally each project presents to the large group of teachers (about 160) of municipal preschools the outcomes of the project. The Mathematics project, called Counting and Measuring at the beginning, and later *Bambini che contano* (Counting Children), presented the partial outcomes in September 2010, after a three years activity, with speeches by the teacher educator, the pedagogist and a group of teachers. The multimedia report of the project will be published on-line at the beginning of 2013 at the website of the documentation centre for education of the town council of Modena (http://istruzione.comune.modena.it/memo/)

The outcomes of a complex long term program of teacher development concerns different issues. The general effectiveness is measured by changes in teachers' beliefs and school activities. They both have been focused in the program, the former with teachers' interviews and the latter with the documentation of school activities.

THE REPORT *BAMBINI CHE CONTANO* (COUNTING CHILDREN)

The multimedia report is divided into several parts and organized into three frames: http://memoesperienze.comune.modena.it/bambini/index.htm. The first part (introduction) is accessible from the left frame and concerns the intended program from a political perspective (video interview with Adriana Querzè), from a pedagogical perspective (interview with Mariavittoria Vecchi) and from the mathematics educator perspective (interview with Maria G. Bartolini Bussi). In the same introduction video interviews with teachers focus the links between theory (as perceived in the meetings with teacher educators) and practice (the school realization) and the changes, if any, in their system of beliefs about early years mathematics.

The main frame contains a rich repertoire of activities realized in the schools, with teachers' design and report. For each activity, there is a collection of commented children's protocols (drawings, transcripts of individual interviews, transcripts of either small group or large group discussion, video clips, and so on). School activities are divided into four parts, each structured in different chapters: Hands and finger counting; Slavonic abacus; Everyday mathematics; Numbers in space. The main frame has been designed to be independent from the other parts of the multimedia report. It is targeted to laymen (as long as they are interested in education) and may be used, for instance, to present school activities to parents and members of the civil society.

The right frame links to a rich collection of materials for teacher development, that put at disposal of teachers printable texts, videos, annotated and translated references usually available only to researchers in specialized literature, a glossary and a short presentation of each quoted author.

The reference to scientific literature in teacher development has been discussed and agreed by the teacher educator, the pedagogist and the policy maker. This choice cannot be taken for granted: in most cases in Italy teacher development is likened to teacher training with exemplary activities to be repeated in schools. The long term feature of this program allowed maintaining a high quality offer, to work at a slow pace, involving teachers as protagonists of the innovation and treating them like professionals of culture and education rather than like imitators of recipes.

THEORETICAL FRAMEWORK

To approach the issue of counting and measuring some foci were agreed with the pedagogists and teachers at the beginning and reconsidered every year (in the first meeting). The approach drew on the firm belief that mankind came to construct mathematics as a cultural object, producing *artefacts* which embody mathematical meanings and processes, although the emergence of meanings for users cannot be realized without specific activities (Meira, 1998). Hence we focused:

- The function of some selected cultural artefacts, developed by mankind.
- The teacher's role as cultural mediator in the enculturation process.

The theoretical framework for analyzing and designing the teacher's role in the classroom process was slowly reconstructed with teachers after the framework of semiotic mediation (Bartolini Bussi & Mariotti, 2008), that had already been validated from primary school on. In this paper I only report the main ideas from the perspective of the teacher's role.

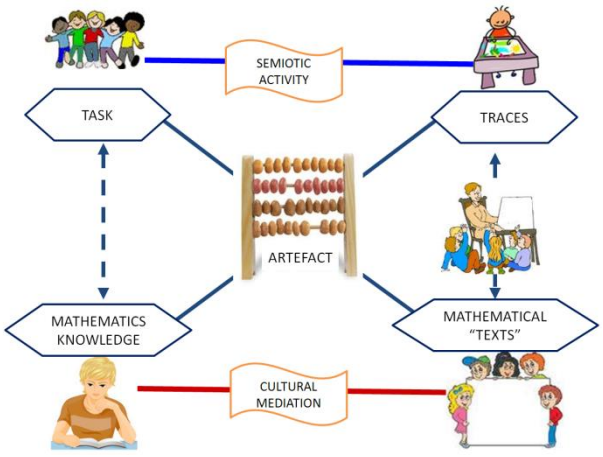


Figure 1: Semiotic mediation

The teacher is in charge of two main processes: the design of activities; the functioning of activities. In the former the teacher makes sound choices about the artefacts to be used, the tasks to be proposed, the pieces of mathematics knowledge at stake, according to the curricular choices. In the latter, the teacher exploits, monitors and manages the children's observable processes (semiotic traces), to decide how to interact with children and what and how to fix in the individual and group memory.

Some cultural artefacts were considered by the group as paradigmatic at the beginning (others were added later taking into account teachers' suggestions). A giant

Slavonic abacus (especially for children aged 4 and 5, see fig. 2) was chosen at the beginning as paradigmatic by the whole group (see below).

Mathematics knowledge at stake was shared exploiting the research studies on counting and measuring processes. This choice was strongly biased by the initial choice to give value to numbers, counting and measuring; later a focus on space too was introduced.

Exemplary tasks were collaboratively designed by the whole group during the meetings. Others were creatively designed by teachers during school activities. Tasks were intended for individuals, for small groups or for large groups.

The design process is encapsulated by the left triangle of the fig. 1. The other parts of the scheme concern the functioning in the classroom. When children are given a task they start a rich and complex semiotic activity, producing traces (gestures, drawings, oral descriptions and so on). The teacher's job is first to collect all these traces (observing and listening to children), to analyze them and to organize a path for their development towards mathematical "texts" that can be put in relationship with the pieces of mathematics knowledge into play.

EXAMPLE: THE GIANT SLAVONIC ABACUS

The artefact

At the beginning of the second year of activity (2008/09) all the municipal preschools were given a giant Slavonic abacus. Teachers themselves had designed it with forty beads because this number meets the most common needs of school activity (e.g. counting children in the roll, counting the days per month in the calendar). The large size fosters large body gestures (even steps) to move the beads. Intentionally, schools received a dismantled abacus, as most teachers agreed that the very assembling could have been an important part of the exploration of the artefact.



Figure 2: The giant Slavonic abacus

The mathematics knowledge at stake

The "embodied" mathematical meanings were analyzed in the meetings:

Partition, to separate counted beads from beads to be counted;

One-to-one correspondence, between beads and numerals;

Cardinality, given by the last pronounced numeral;

Sequence of early numerals, to be practiced in counting.

Place value (early approach), as beads are divided in tens.

THE SYSTEM OF TASKS FOR THE SLAVONIC ABACUS

A system of suitable tasks was collaboratively produced in the meetings, drawing on the same methodology of projects for primary and secondary school (Bartolini Bussi & Mariotti, 2008; Bartolini Bussi, 2009; Bartolini Bussi et al., 2011). The aim is to foster children's productions of different voices to allow the teacher to organize a *polyphony of voices*, which, according to the theoretical framework of semiotic mediation, nurtures the individual construction of mathematical meanings during classroom discussions. In this way the same artefact is looked at from different perspective. Some tasks tested with 4 or 5 years old children follow. Teachers have arranged these tasks (or similar ones) according to their educational planning.

Task 1: The first impact

Tasks are different if the abacus is assembled (A) or if it is dismantled (B): *A) What is it? Have you seen it before? What's its name? B) What have I carried today? What do you see? Do you know objects with many beads?* Such tasks, to be used in either small or large group discussion, aim at evoking earlier experiences and involving children. At the end the name may be introduced (in Italian *pallottoliere* – abacus has the same root as *pallina* – bead). This tasks foster the emergence of a *narrator* voice. An individual drawing of the materials is in the fig. 3 (A).

Task 2: The structure of the artefact

How is it made? What do we need to build another one? How to give instruction to build another one? Such task, to be used in either small or large group discussion, aims at identifying the components and naming them in a correct way and at describing the spatial relationships between them. They foster the emergence of a *constructor* voice. After discussion, individual drawing tasks are given: *draw our abacus*. The previous verbal analysis of the structure of the artefact fosters the production of very detailed drawings, with, for instance, the right number of beads and the realistic representation of legs and other parts (fig. 3, B and C).

Task 3: The use of the artefact

The task is functional to the context where the artefact is used. For instance it may be used to keep the score in skittles or to count the present children during the call. It may be given in small or large groups. *How do you use it to keep the score? How do you use it during the call?* This task fosters the emergence of the *user* voice.

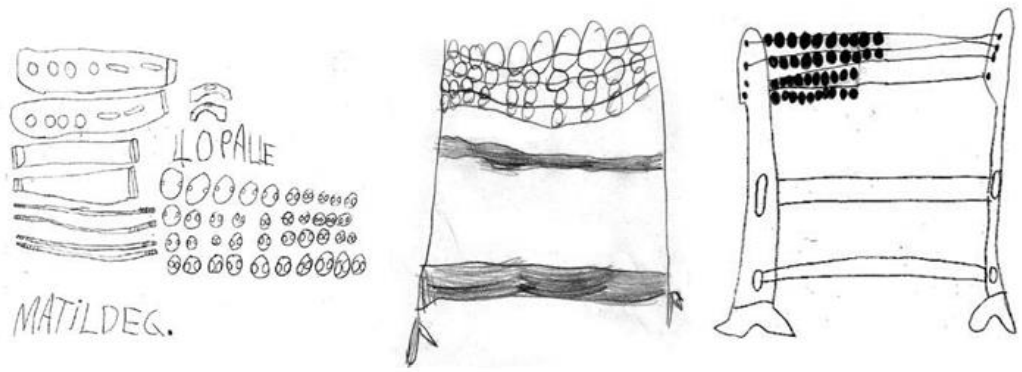


Figure 3: Drawings of materials (A) and of assembled abaci (B,C)

Task 4: The justification for use

In this case too the task is connected with the context. Children are asked to explain *Why does it work to keep the score?* and similar. This is a very difficult task, that fosters the emergence of the *theoretician* voice, to explain what mathematical meaning or process makes us sure that the functioning is effective. This task may be given indirectly, showing a puppet that makes mistakes and encouraging children to comment and to correct it, if they do not agree, explaining why.

Task 5: New problems

These last tasks were not designed in advance but emerged together with creative solutions in classroom activities. For instance, in a classroom, children proposed to use the Slavonic abacus to plan the preparation of tables for lunch. They suggested registering on the abacus the number of children for each table on a different line. When they realized that the tables to be set were 5, they told that there were not lines enough and decided to create a new line on the floor, lining up 10 small cubes and moving them accordingly. These self posed tasks foster the emergence of *problem poser and solver* voice.

THEORY AND PRACTICE

The system of tasks for the giant Slavonic abacus may be usefully referred to literature on mathematics education.

The emergence of the *narrator* voice in the task 1 is related to *devolution* (Brousseau, 1998) as it fosters the personal involvement of children in the tasks. The emergence of the *constructor* voice in task 2 is related to Rabardel *instrumentation* (1995) as it concerns the component of the artefact as an object. The emergence of the *user* voice in task 3 is related to Rabardel *instrumentalization* (1995), as it fosters the emergence of individual *utilization schemes.* The emergence of the *theoretician* voice in task 4 is related to mathematical meanings, hence consistent with the Vygotskian approach through semiotic mediation (Bartolini Bussi & Mariotti, 2008). The emergence of *problem poser and solver* voice in task 5 shows that, in spite of the teacher's cultural guidance, children creative ideas have space to be developed. However, it is better to

say that, in this program, those tasks were not exercises of application of that literature, but rather *experiments developed, interpreted, analyzed and generalized, in collaboration between teacher educators, teachers and pedagogists in a dialogic way, exploiting the literature.*

In each task, *explanation* is in the background. There are, however, different kinds of explanation s(Levenson & Barkai, 2013), which are related to the different voices: a narrative explanation (task 1); a communicative explanation (task 2); an argumentative explanation (task 3) that develops into a proving explanation (task4).

CLOSING REMARKS

The protagonists in the recorded interviews show that an inquiry community (Jaworski, 2005) has been constructed with shared values, beliefs and competences.

> Adriana Querzè (policy maker): "We have played with the title "Counting children" as our children count with hands, with artefacts, with abaci, with situations, but, above all, count as they can exercise their rights of citizenship. Knowledge makes up citizenship as it allows reading and understanding reality. In the case of math and science, it allows constructing skills in analyzing and arguing, hence, in a broad sense, in communicating one's own point of view. We believe that it can be done also with young children, who are "citizens in the age of development", yet "citizens" to all purposes.[…] Parents can understand from this documentation what their children do in school, also for learning, strictly speaking. […] We believe that teacher education and development must be high quality […] and we want to dispel the myth that teaching young children is easier.[…] The "good" mathematics questions, the tasks, are not very different in preschools and university. Yet to look for answers to good questions with 3 years old children is much more difficult, hence requires a deep knowledge of mathematics and of methodology".
>
> Mariavittoria Vecchi (pedagogist): "It is necessary to join disciplinary, methodological and didactical competences together with relational competences. On the one hand teacher education and development cannot be reduced to practice and, on the other hand, a purely theoretical knowledge, with no elaboration on the job, is fruitless. Teachers' practices need to be deeply analyzed together with the theoretical models. It is necessary to give teachers high quality cultural tools, to enhance their planning autonomy, to make them keen on what they are doing and to construct a community of inquiry where the voices of mathematicians, teachers and pedagogists dialogue with each other".
>
> Marina (teacher): "I feel more competent in mathematics and more expert in the organization of school activities".
>
> Laura (teacher): "The child is the centre of this mathematical experience. The teacher has to come along with child in this experience".
>
> Rosa (teacher): "Meetings are very important for our professional development as we bring there our experience with children and discuss with each other".

Cinzia (teacher): "Children do mathematics in a spontaneous way. The most important thing is to raise that at the level of consciousness [..]. This program is very demanding, but I am enthusiastic. It's up to us to transpose knowledge to practice".

The above short excerpts from the multimedia report show that the program *Bambini che contano* is the offshoot of a synergetic effort of teacher educators, pedagogists, policy makers and teachers. Each of them has played a specific role and collaborated to construct an inquiry community where to develop their existing knowledge and beliefs system (Kreiner, 2011).

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