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CHILDREN AND COMPUTER:
WHAT THEY KNOW, WHAT THEY DO

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Education, Technology, Computer, Children, Early Childhood studies, Constructivism, Digital divide

This paper describes the design, the methodology and the preliminary results of the research Children and Computer. Experience and Conceptual Frameworks (3-6). *The research, started in 2004, is supported by IBM Foundation Italy and University of Milan-Bicocca –* Dipartimento di Scienze Umane per la Formazione "Riccardo Massa". The research *team, led by Professor Susanna Mantovani, includes: Paolo Ferri, Valentina Garzia, Susanna Mantovani, Anna Poli, Donata Ripamonti, and Angelo Failla (IBM Foundation Italy), Morgana Stell (IBM Foundation Italy).*

1. INTRODUCTION

Engagement, effort, pleasure, concentration, happiness in exploring, trying and producing ideas, experience and performance, cooperative action, all these aspects are very conspicuous when we observe young children using computers in educational settings.. They seem to love technology, computers and digital networks. How can we observe the way they approach, explore, discover, and use these very special cultural artifacts (computers and digital networks), how can we investigate the ways in which they interact with them? We probably need a "phenomenology of motivation" (Lumbelli, 2000, 2001a, 2001b) aimed to develop educational eyes capable of seeing children, who are experimenting and learning with ICT. This would provide a basis to develop and organize learning paths and tools which may make the most of children's energy while avoiding to waste their happiness to connect. Today, observing and studying the way children gain interest, explore and use computers, whether individually, with other children or with an adult, is a key issue in early childhood education, as it is connected with adults' educational ideas, and their influence on relations and teaching practices, as well as with the roles children can play as mediators of shared experiences (Mantovani, Ferri, 2006, Ferri, 2004; 2005, Bove, 2004, Mantovani, 1998, 1996). The research project presented in this paper studies how children and adults explore the potential of new technologies in family and preschool settings. We took as our starting point some shots videotaped and discussed through focus groups with teachers and parents, following the approach outlined by Joseph Tobin in the study "Preschool in Three Cultures: Japan, China, United States" (Tobin, Wu, Davidson, 1989, Mantovani 1998, 1996).

2. WHAT WE MEAN: THE KEY WORDS OF OUR PAPER

- Child

An active, curious and competent person who constructs his/her knowledge by interacting with peers and close adults. This conception challenges the idea that children are passive receptors of notions, empty boxes to be filled, "tabula rasa" on which adults imprint their knowledge.

- Inter-Observation

"When we find something, we instinctively feel the need for inter-observation (…) because looking together with people who know enough and are used to observing and discussing with them enables us at the same time to observe the fact in a richer and more reliable way, and to view the problem from several different perspectives" (Bozzi, 1978).

Inter-observation as a methodology consists in "looking together" and "discussing", mutually exchanging views.

- Visual Etnography

A research methodology that draws on anthropological findings, combining descriptive data collected through observations and reflective interpretations. By putting together both textual and visual dimensions, visual ethnography generates a multi-vocal exchange which elicits reflective dialogical processes, rich in training implications. Such a methodology can be used to observe, describe and record what happens in educational contexts: these video materials are then employed to elicit a process of discussion and interpretation which may help highlight the cultural representations of the people involved.

- Observation

It is a specific behavior showing attention to a given phenomenon; it differs from simply looking at something as it implies aiming one's attention specifically at something, focusing on what the observer considers meaningful and relevant to his/her own interests and motives. It proves to be a key tool in educational contexts (we refer primarily to ethological observation, based on principles of analytical description, and non-evaluative, non-interfering attitude on the part of the observer).

- Educational Relationship

Hinde (1981) defines the relationship as "a series of interactions between two individuals who are known to each other" (where interaction means "one or more exchanges like :A does X to B and B does Y in response"). He further emphasizes that there is a mutual influence between the participants' individual characteristics and the social situation they are engaged in (1986). The educational relationship is therefore determined not only by the specific interactions that take place between the subjects involved, but also by the characteristics of the social context in which it takes place.

Social constructivism

According to Vygotskij' and other scholars, children's learning is the result of active efforts to understand the world, rather than of passive processes. Such efforts prove more successful if children act in cooperation with other people. Accordingly, socio-cultural factors are viewed as active determinants in gaining experience and understanding.

3. RESEARCH GOALS AND THEORETICAL BACKGROUND

Aims of the research are:

- Discussing the ways in which 3 to 6 children use and explore new digital technologies and interpret their meanings and functions at home and in preschool settings;
- Exploring teachers' and parents' ideas and representations with regard to the use of computers, at home and in preschools, and to their educational roles;
- Working out a methodological approach for the study of these issues in early childhood settings and for eliciting and making explicit the educational models;
- stimulating opportunities for dialogue and interpretation on issues like education and technologies, learning tools in the early years, collaborative learning, etc.;
- developing training materials based on this approach. with computers in the early years;

- Outlining some patterns for the development of "new" media education for teachers and schools.

The basic assumption of our research is that in order for teachers and parents to promote a "*good*" use of new technologies in the early years (especially in preschools) they need to gain a deeper understanding of the way in which children *spontaneously* approach these technologies together with an improved awareness of adults' representations and ideas (Mantovani Ferri, 2006). Too often computers and digital technologies are introduced in early childhood contexts without adequate understanding of their cultural meanings, cognitive and social potentials or constraints, which is particularly true in pre-school settings as shown by Varisco (2002) and Albanense, Migliorini, Piertrocola (2000).

On these grounds, our research focuses on exploring the way in which young children approach computers, how they relate to theses tools (both at an individual level and at a social level), what they do with them and what they think about them. Along with observing children, we aimed at understanding the way in which teachers and parents interpret the role of technologies in early childhood education and their educational responsibilities.

Having among its goals a broadening of our theoretical understanding and the development of training materials, our research is based on the assumption that creating dialogue opportunities (focus groups) may promote higher awareness and deeper understanding of the role played by new technologies in the early years. Creating this kind of dialogue may also help provide a sound basis to the design of a way "*to mediate"* the introduction of technologies in early childhood (Rogoff, 2003, 2001, Siraj-Blatchford, J., 2004).

Observing the first natural approaches to computer and web technologies, the changes in systematic use of tools, the cognitive strategies and the relational patterns involved is a way to clean up our minds from adults' prejudices on children's use of technologies. For example, videotaping and observing young children in front of computers helps us understand how the solipsistic concerns and the social exclusion concerns associated with the use of computers are only teachers', parents' and scholars' fears: young children always approach computers and networks in a cooperative way and get bored of them very fast. Obviously, we are talking about educational software and not about videogames (Ferri, Mantovani, 2006, pp.75-121**)**

As early as the 80's, Robert Taylor (1980), in his book *The Computer in the School: Tutor, Tool, Tutee*, put forward the idea that, at school, digital technologies could play three different roles: tutor, tool and tutee. It's clear that each of these roles depends on the kind of dialogue established between the computer, intended as a teacher, and the student. Some

software thought to teach, stimulates a real dialogue between children and computers. In the same way, on line communication software mediates symmetrical and unsymmetrical communication between teacher and student through specific interfaces. In spite of that, nobody has yet defined the best way to establish a dialogue between children and computers and a way to understand educational and communicational patterns. This is a fruitful field of research, if related to the role digital technologies may play in different learning phases, even though deep cultural changes have meaningfully influenced learning processes in the last few years. Therefore, it will be very important to study the way children gain interest, explore and use computers and get bored with technologies. And it will be very important to do so, observing children on their own, with other children or with adults, because this melts with adults' educational ideas, with related consequences in educational relations and in didactics, and with the behaviours of children as mediators of shared experiences in on line environments of cooperative construction of knowledge.

To achieve these goals it will be necessary to consider critically and investigate field video material also in order to understand some specific educational aspects:

a) The meaning of the expression " projects for digital education", both in CMC and hyper textual environments, with special attention to the design of hardware and software interfaces. Some software propose an institutional, repetitive use of technology, but is there an “effective” way for introducing computers in preschool settings and for promoting user-friendly patterns of interaction with these tools in the early years?

c) The way digital tools (hardware and software) can be approached by children of different ages. It's important to analyse the role of some tools (keyboard, mouse, and screen) and it is also important to study the best way to design these output and input peripherals according to children's needs;

d) Analysing the best way to introduce children to usage of cooperative tools for on line communication (LCMS for e-learning), in order to avoid communicative autism that some e-learning methodologies imply.

e) The definition of concrete learning paths with the aim to help political stakeholders teachers and parents to be able to overcome the “digital divide” with their children.

4. METHODOLOGY

The core method of this study follows the approach taken by Tobin, Wu, Davidson in the seminal study "Preschool in three cultures" (1989) and combines the use of video as a 'stimuli' to provoke discussions and sharing among adults with some qualitative research tools, such as narrative interviews and focus groups. We have done videotapes with 3-6 children and computers (at home and in preschool) and we have used them not "primarily" as data, but as tools to stimulate a multi-vocal dialogue (Bove, 2004). Three municipal preschools have been involved in our research and others will be involved in the future. (*Scuola Comunale Clericetti, Milan; Scuola Andersen, Vimercate, Scuola Costa, Milan; these schools are also part of the "Bambino autore project", www.bambinioautore.org).* So far, videotapes have been discussed with teachers and the discussion will be extended to parents in the second phase of our research (Bers, 2004).

We assume that the way in which children explore and use computers (individually, with other children or with adults) is strictly linked to the adults' ideas and beliefs and to their educational models and representations. In our study, the voices of parents and teachers will therefore enrich our interpretations and extend the repertoire of possible educational practice with technologies. We also assume that by studying the way in which children approach computers we will promote higher awareness of how children can be considered as "mediator" of a broader collaborative experience of learning based on the use of digital technologies.

We will also conduct some micro-experiments using our previous findings as the starting point for creating settings of "semi-experimental observations"; this will help us create educational settings for cooperative learning and e-learning with children.

5. DESCRIPTION OF THE RESEARCH PROGRAM

Our research program includes the following phases (most of them already accomplished) :

1. Observation of children-computers interaction based on an "etnographic-visual dialogical" approach that considers learning situations as social contexts, with the purpose of generating a qualitative field of research. This phase combines qualitative research tools (observations

and interviews) with anthropological research tools, usage of video materials as reactor and focus groups (Tobin Wu, Davidson, 1989). Direct observation will be one of the tools used during the research on the field. Paths of observation will be created, using narrative and descriptive modalities, together with "almost experimental" methods. Videos will be taken both in family and schools settings . Based on this, it will be easier to formulate the hypothesis that will lead the "almost experimental" observation, which can be modified or improved by the observer.

2. "Micro experiments" which will help encourage or control some explorative behaviours with ICT on the part of children. Field observations on the use of some tools and cooperative environments of e-learning were conducted in several schools:

- Scuola Comunale Clericetti, Milan;
- Scuola Andersen, Vimercate;
- Scuola Costa, Milan;
- the group of Scools that participate in the project Bambino Autore (www.bambinoautore.it)

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3. Discussion of videos and observation highlights in focus groups with teachers and parents to build and validate the first data collected through observation based on a dialogic and narrative approach, this with the aim of creating exchange and sharing of the hypothesis formulated on the collected material by the research group with teachers and parents. The Video made during the first phase will be used to stimulate exchange among participants according to the method of visual and vocal ethnography already experimented (Tobin, Wu, Davidson, 1989)

4. This phase provides for discussion of first findings based on field observation and research hypothesis, through interviews, research meetings and focus groups organized by researchers, national and international public and private research and teaching Institution.

5. Design and development of supporting tools (Virtual Classroom, KM tools) for children and teachers communities, with the aim to create, share and manage knowledge according to the co-constructed method of introduction of ICT in school. This technological part of the project has been developed as a part of the LCMS open source Docebo. This LCMS system has been designed by the software house Docebo srl, in cooperation with the University of Milan-Bicocca e-learning team (Paolo Ferri, Andrea Garavaglia, Livia Petti, Francesca

Bossi). The LCMS has been customized to be used directly by young children and teachers for discussing and sharing knowledge with other schools and with parents.

6. On the basis of the results of previous phases, new operative and "blended" educational paths for teachers will be built and implemented.

6. RESEARCH RESULTS AND FURTHER DEVELOPMENT

We believe that new digital technologies may become a catalyst for exchange and sharing among adults who care for young children and a starting point for promoting a new way to overcome the "digital generational gap" (Papert, 2006) between children, teachers and parents a to promote a new digital literacy and fluency in schools. Our research has already reached a number of its "medium term" goals, among which:

a) supporting young children in exploring the multiple functions of these technologies and helping them to "protect" themselves from the "isolation" and the "communicational autism" that some e-learning methodologies, especially "instructionism" imply. To achieve this goal we outlined and projected a specific methodology of the co-constructive method of blended learning (in the classroom and on the LCMS). This method main guideline is creating situated, active, and child-centred, techno-learning paths.
b) gaining a better understanding, trough video analysis and focus groups of teachers' and parents' "fears or concerns" about the cultural impact new digital technologies may have.
c) developing a methodological approach which combines the sound theoretical grounding of the reflection on education and on "digital education and learning" with the importance of being aware of the ways in which children and adults approach these tools and react to their stimulation

We outlined here some of the findings that emerge from our video ethno-dialogcal observation. The emergent phenomena (K3/6) are:

- New paths of cooperative learning with computers
- Cognitive Multitasking and a more intense use of video and musical code

- Multiple intelligence at work (Gardner, 1973) through multimedia device: emphasis on video and graphical and musical intelligence. Exit from “only alphabetic” paradigm in learning and teaching (Bolter Grusin, 1999) ?
- New peer to peer interaction, more written and multimedia communication, less deep personal communication, as results from the observation of the children working in the Bambino Autore Project www.bambinoautore.it
- A tricky use "grasshopper mind“ (Papert 1994): Bite and run – Distractattention
- A new mediated way to “construct” and share individually and socially the word through media (user generated content, mobile phone video, sms, vsm – (Goodmann, 1978).

We can say that the use of ICT in our view changes the cognitive skills of children and young people in many ways:
- stressing a multitasking use of media. Our research parents and teachers focus group results testify they strongly agree with this idea. Their children use a multitasking approach in gaming, playing and learning. Sometimes they feel this difference with fear they are not able to act in this way .
- Cooperative learning is the way children adopt also when they are very young, 3-6 years, in approaching computers and ICT. As our observation testifies, they very rarely stay alone when they are using a computer al school.
- Learning by doing the ICT and with the ICT is strongly preferred by the children we observed. Emphasizing the need of meta-reflexion on practical experience lead by teachers.
- On-line communication, especially instant messaging, messaging ecc. are very spread pattern of use ICT (mobile phone Instant messaging) also in the 6-10 range of age. In Italy, particularly the use of mobile phone is a tool used by nearly all children both to communicate with peer (mostly in a written way - SMS-) and with parents (voice communication). In Italy parents use mobile phone with children not only to communicate but also as control/care tool. Mobile phone, in Italy has became a mediated tool for parental care. In school the mobile phone is forbidden and teachers are very concerned about the children use of such a technological tool. In the same way they are very concerned about video game and video User Generated Content.
- The children at home, as testified from our observation, learn from parents using a modelling style, at school this style is very rarely adopted by the teacher.
- In Italy, children form extra-European countries are particularly found on ICT because ICT (Skype at the internet café, e-mail ecc.) is useful for them to keep in touch with parents. It

can help their integration in school because they have an excellence skill to share with pairs and teachers.

- In our view children often dislike educational software because these software are fare more worst designed and low budget than video game and commercial web site on the Internet

Other hints that come up from our qualitative research are the following:

- In Italy the digital native (Prensky, 2001) -is not clear if this concept is exactly similar to NML) phenomenon begins relatively late. It starts with children born after the 1993, not earlier. This probably because of the gap with US and Northern Europe in the spread of computers at home and in the schools. The first serious government plan of new media introduction in school was built up in 1996 PSTD (Plan for the development of instructional technology)
- In Italy the use of ICT is a domestic phenomenon, the use in school is rare and only a few days per month. There's in fact a big divide between the family and social appropriation of ICT and the primary and secondary schools use.
- In Italy there's no specific formal teachers training on technology of education and new media education, except for Indire PuntoEdu project. Unfortunately the technological culture is not an issue for the Italian scholastic system. And the children and young girls and boy use very rarely technology as creative and free tool for education.
- In Italy gender issues are fundamental, particularly in the early childhood years. Teachers in primary school are mostly fifties born female (the "baby boomers" generation). They, as our focus group pointed out, learn technology mostly from the romantic partners. In the same way they perceive technology as male, mechanical and alien. That's why they are very resistant to introduce ICT with kids and female world.
- Gender issues interact also with the way female "baby boomers" teachers (90%) use technology with kids. They are mostly scared computer can transform kids in machines.
- From the point of view of educational innovation, we point out is not a tech issues but a cultural issue. In training teachers to new tech is far more important investigate which kind of prejudices they have on technology than train them about technological issues. Understanding and share the meaning of resistances and prejudice is very important for over come them.

7. CONCLUSIONS

The next steps of our research will involve:

a) Longitudinally examining and mapping the evolution of the real and virtual learning communities we have promoted (beginners and advanced groups).

b) Disseminating these method in other contexts, in early childhood settings and primary schools;

c) Creating, with children and teachers of early childhood and primary schools, specific Learning Objects coherent with the approach of a situated and co-costructed use of technology. These Learning Objects are open-source, strongly contextualized and enriched by personal experiences.

d) Mapping the tacit and unstructured knowledge that is now at work in our project. For the time being, virtual communities don't have user-friendly tools for "knowledge management". These tools should manage the problems of informative-documental management, providing virtual communities with the tools required to build clear and shared conceptual frameworks.

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