THE COMPUTER AND THE PRE-SCHOOL CHILD; THE WRITTEN LANGUAGE AND PLAY

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Abstract—Since 1983, the CMIRH* has been working on educational uses of computers. One project currently underway in kindergarten classes concerns the learning of the written language by young children and the links between play and learning.

During the first year of the experimental program the group developed a set of computer programs. This software was tested and evaluated in a total of 5 classes (about 150 children ranging in age from 4 to 6).

Observations from this first phase of experimentation fall into three categories:

—Use of the computer corner by pre-school children: It was undeniably shown that the computer as an interactive pedagogical tool can be effectively exploited by young children. However, it will not be possible to describe a "formula" for their use.

—The learning of the written language and play: The group's primary focus was on the relationship between play and the spontaneous and structured learning of the written language. This could be called a "pre-literacy" level.

—Integration of the computer corner: The experimental program highlights the fact that the effectiveness of the computer corner depends on its integration into the teacher's educational program and into classroom organisation.

We present the evaluation plan, the first results, the main orientation of our actual work and finally some new developments (a data base for evaluation and new programs).

1. PRESENTATION OF THE ALE† PROJECT

1.1 Goals and questions

It is currently felt that, between LOGO and the too rigid CAI programs (computer assisted instruction), it should be possible to develop applications whose goals are to develop fundamental skills (i.e. mastering the written language, scientific reasoning ...), while conserving the underlying desire to learn.

This project was inspired initially by the thesis developed by Cohen [Ref. 1] concerning the potential of young children, her research in the field of early learning of the written language, and an interest in fighting school failure. In this perspective, the use of the computer, given its potential for interaction, can encourage this learning. The ALE project intends to explore the computer's possibilities in learning the written language, in particular in kindergarten.

From this assumption, more precise axes have been defined:

—social function of written language
—reader and writer behavior
—segmentation and relation between oral and written language
—written language structure

However, our priority for the first year is to explore more deeply the links between play activity and spontaneous learning as well as the possibilities and modalities of a progressive structuring of this learning. That point is our precondition in developing new programs. Relative success and failure in the use of these programs allows us to propose partial solutions (cf. next section), and re-orient future productions by further defining the relationship between the different phases of play, spontaneous/structured learning and children's motivation.

These programs and learning situations are in an organisational context (the kindergarten environment), and a socio-cultural framework, both of which interact with the use of the

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†ALE: Apprentissage de la Langue Ecrite et Activités Ludiques Enfantines (written language learning and play activity for young children).
programs and machines. In this perspective, the study of insertion and integration of the computer as a tool in kindergarten classrooms constitutes the second axis of our initial research.

1.2 The project

During 1984, we developed a set of computer programs for use by children as well as a series of associated utility programs for teachers. They were mainly inspired by Frédéric Denizet, one of the few teachers in France with relatively long computer experience in the classroom.

This software was tested and evaluated in a total of 5 classes in two schools (about 150 children ranging from 4 to 6)—one school in a very "underprivileged" urban neighborhood; the other in a rural setting.

Computer configuration. We use a BBC computer network plus, for each workstation, a light-pen and a card-reader. There is a color printer in each classroom. It was necessary to develop a new font for French characters.

1.3 The programs

The programs are written in such a way that they permit:

— Child’s autonomy: The child controls the input and output of the program, using plastic cards in a card-reader (his red card indicates his name, the green one the program he wants to use). He can leave a program at any time. Therefore this system allows individual work and/or group work.

— "Structured freedom": Unlike more classical CAI systems, the programs try not to impose precise directives; the child can use a program as he wants, move between the different parts of a program by standard commands, define his own project. Nevertheless, the inherent design and rigor of the computer (and the program) structure the child’s activity.

Programs are based on activity, creativity and play. The written language is presented not as a goal, but as a tool. Situations are proposed in which written language can be manipulated and used. Some conditions of this learning process are recognized: free exploration, repetitions, auto-correction, switching from random to planned activity, free utilisation time . . .

Two kinds of program are available:

— A first series offers open situations oriented to graphic creation via written commands; commands are given either globally by touching the written word on the screen with a light-pen, or more analytically by typing the words on the keyboard (e.g. “Paysage”, “Tricarond” (cf. next section)). The vocabulary is currently limited but motivation comes through the combinatory aspect of the situation.

— A second series offers more structured activities in which can be found three phases (e.g. “mot-dessin”):

  • exploratory phase;
  • assimilation phase;
  • synthesis phase.

Unlike the first series, the activity here is more fixed and unique; the opening up comes from the introduction of the child’s own language world.

A text editor (“Ecrire”) is an adjunct to these two kinds of programs. After an exploratory period, the editor’s basic functions permit students to write names, words, or even texts, either copied from existing sources or conceived with the teacher’s help. Associated with the second series, utility programs allow teachers to integrate new words or sentences into the students’ programs. That mechanism helps in better integration with the other classroom’s activities.

Finally, as much quantitative information as possible is stored in the computer, mainly about: who came, which programs were used, for how long, and details about the activities inside some programs (e.g. number of words typed or pointed to by the lightpen, amount of success or error, etc . . .).
1.4 A short presentation of the main programs

Entry program. The student is invited to put his red coloured name-card in the card-reader, then the green card corresponding to the program he has chosen. While using other programs, the student comes back to this entry program by typing or pointing out the word “end”.

Ecrire (to write). This is a very simple tool for writing big letters in 3 colors (with french accents). Hard-copy on a color printer is available.

Paysage (landscape). This allows the child to build a landscape with small objects by manipulating their written names. He has a reference booklet with a picture and its text per page. There are two versions: one uses a light-pen to point to the word; in the second one the keyboard is used. The little picture element appears and can be moved by the four cursor arrows (on the keyboard or on the screen). Hard-copy is available. The program currently uses a set of only 22 different picture elements. Several programs can be done on the same scheme with other common environment representations (the street, the farm ...) (cf. Fig. 1). Picture at the end of the text.

Imagier (a picture book with one word per page). The computer proposes a word, the child searches for it in a the book and then points at it’s page number on a number table on the screen; he searches again if he is wrong. The teacher can freely choose the books to use (either purchased or developed in the classroom) and introduce the vocabulary with an utility program.

Tricarond. Similar to “Paysage” but with geometric figures (3 shapes, 3 sizes, and colors). The

![Diagram](image)

Fig. 1. An example of a landscape with “Paysage” and the associated text copied with “Ecrire” (work done by a 4 year old child).
3 choices are made using the light-pen to point out the corresponding word, and then the object is moved to build a picture. Hardcopy is possible.

**Bonhomme-maison** ("man-house"). A simple game. A little man is moved with the light pen in the four directions and can be sent into the house; four levels of difficulty.

**Mot-dessin** ("word-picture"). This program uses a picture drawn freehand by the child himself on a transparent plastic sheet, and words chosen by the child with the teacher. First of all, the teacher has to introduce in the machine’s memory the names given to the picture’s elements by the child. Then, after placing the picture on the screen, a loop of 3 “exercises” using these words are proposed:

- **to question**: When the student points out an element of the picture, then the associated short text (which he previously proposed himself) appears on the screen. The text could be words or sentences. He can move to the next level when he wants to.
- **to be questioned**: Part of his text appears on the screen, the student has to point to the part of his picture associated with meaning of this text.
- **to recopy**: He chooses a picture and has to recopy the word. Errors are signalled until the copy is correct.

## 2. Assessment of the First Year of Experimentation

### 2.1 Methodology

After the program design and implementation, this first year of research focused on the programs’ improvement and validation as well as their integration into the kindergarten classroom’s difficult environment. This first experimentation (from March to June 1984) permitted us to develop a preliminary evaluation system including complementary approaches [Ref. 9]:

- direct observations of children using the programs.
- construction of an observation grid for describing a child’s behavior.
- video films, especially for the study of reading-writing behavior and of the interactions between children.
- regular interviews of the teaching team.
- development and analysis of the first set of stored data on program utilization.

The possibility of comparing the qualitative (interviews, observations) and quantitative computer collected information permits more precise description of computer utilization, which is difficult without that new pedagogical tool. Observations from this first phase of experimentation fall into the three categories that we describe below.

### 2.2 Observations

**2.2.1 Use of the computer corner by pre-school children.** It was shown unequivocally that as an interactive pedagogical tool the computer can be effectively exploited by young children. However, it was also evident that without a code of conduct regarding use of the computers, and without a classroom organization designed to regulate access to and time of use of the machines, there is a high risk of perpetuating, or even increasing existing differences among the children [Ref. 5]. The experimental program provided considerable information and experience regarding these principles and methods of using computers in the classroom [Ref. 7]. However, it will never be possible to describe a “formula” for their use.

**2.2.2 The learning of the written language and play.**

(a) The group’s primary focus was on the relationship between play and the spontaneous and structured learning of the written language. This could be called a “pre-literacy” level. For example, one program, “Paysage”, in which the children create a picture using elements provided by the computer, in addition to providing a play activity for the children, fosters the development of certain aspects of reading and writing behavior. In order for the child to carry out his intention in the composition of the picture, he learns certain basic things (e.g. words go from the left to the right, they are made of letters with a fixed order, there is a limited number of letters, being able to recognize words is a help to get the picture you want, etc...). Feedback from this first year of experiments confirms the guiding importance of a communicative environment.

(b) Limited programs are used to learn the word and the letter. It is necessary to continue to assess the effectiveness.

In this context, research articulates oneself to conclude by saying:

### 3.1 New research issues

Our two main concerns:

- Didacticization and training.
- Initiation to computers through play.
- Psycho-pedagogical respect towards the children.

### 3.2 A research proposal

The first year of research proposes the following research agenda, which implies several steps:

1. a re-organization of the school for even more formalized training.
2. concrete training for adults and children.
3. teachers’ participation in this observational and research activity.
4. making children’s progress visible to the learning environment.

### 3.3 The different levels

On a voluntary basis, the children’s activities are structured:

- **Levels of interaction**
- **Levels of observation**
- **Levels of participation**

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of experimentation should facilitate the production of other programs in which children’s social communication situations could supplement the autonomous games as such. In keeping with the guiding principles of the experiment, these new programs would be based not on an exercise situation, but rather on a model of: trial and error → structured learning → play and/or communicative situation.

(b) Limitations of the experimental program in the area of written language learning. The programs in use demonstrate the usefulness of a semantic association model in the discovery of the word and its parts, and of the beginning of segmentation. Work on the sentence and text will necessarily require the introduction of other models and new software however. The group is continuing its work in this direction.

2.2.3 Integration of the computer corner. The experimental program highlights the fact that the effectiveness of the computer corner depends on a dual integration:

—Its integration into the teacher’s educational project: Classroom observation revealed that the computer activity rapidly becomes tedious and cut off from the child’s daily activity if the teacher does not provide for its linkage to other class activities.

—Its integration into classroom organisation: The use of the computer as a pedagogical tool poses the problem of the organization of time and space [Ref. 8]. Autonomous learning is not necessarily opposed to socialization, nor to exchange among children or between children and adults. However, programs and situations which foster both autonomy and socialization and which are practical in terms of classroom organization are yet to be explored. We want to design situations in which exchange among the children will be encouraged, thought structured.

3. CURRENT ACTIVITIES

In this chapter we restate our main lines of research, the reasons for the choice of a “research-action”, the different experimentation sites and the new evaluation procedure. We conclude by describing the development of new tools: a data base and new programs.

3.1 New research axis

Our two research axes currently are:

—Didactically: What is the specificity of the computer and our programs in written language initiation? More particularly, do new strategies appears for written language apprenticeship through play and functional activities (production and communication in the classroom life)?

—Psycho-pedagogically: what are the conditions for integrating a computer corner, especially with respect to machine access, the working time of the child (minimum and maximum) and the articulation between this activity and the pre-existing ones.

3.2 A research-action

The first year of experimentation shows that the introduction of computers in the kindergarten poses classical problems of pedagogical innovation. Thus, the choice of a “research-action” as our research approach represents a theoretical reference [Refs 11 and 12]. The integration of a new tool implies several transformations as for example:

(1) a re-organisation of the learning times and places in order to facilitate autonomous learning for everyone,

(2) concrete measures to avoid increasing differentiating effects (between boys and girls, natives speakers or not, etc . . . ),

(3) teachers’ introduction to and training for computer use, as well as their participation in the observation system via a log-book

(4) making explicit the pedagogical project of the teacher or the educational team, in relation to the learning models of our programs.

3.3 The different experimental sites

On a voluntary basis among teaching teams, the experimentation in the 6 sites involves educators...
working with 4 to 8 year old children in different situations:
- multi-grade classroom in a rural setting,
- link between kindergarten and primary school,
- class of non French-speaking children,
- extra-curricular activity for young people,
- center of special education.

A users group (across all the sites) has been created to compare each site's observations, to discuss teaching practice together, and to formulate recommendations for an eventual generalization of this experiment.

### 3.4 Evaluation plan

The increase of the number of experimental sites required an extension of the previous data collection system:

- the use of a log book in which the teachers record, every week, their observations and remarks concerning activities of the computer corner. This increase in work is currently causing some difficulty.
- Development of a data base system (cf. below) which allows precise treatment of quantitative data and provides the researchers with flexibility and speed in its use and interpretation. The development of this type of tool for computer assisted evaluation is a break with traditional methods of observation of pedagogical interactions, allowing access to details concerning the use of the program as well as the activity of each child or group of children, without engaging an observer or his presence in the classroom.

In addition, the current installation of a telecommunications network between the various sites should facilitate communication among the educational teams as well as between researchers and teachers.

#### 3.4.1 The log book

After distinguishing the more descriptive starting period from normal use, data are classified into 5 categories:

1. **Computer corner integration:**
   - in terms of classroom space and schedule,
   - articulation between the activity at the computer and other activities.

2. **Running of the computer corner:**
   - total time of machine usage for the week,
   - modifications of the computer corner organization,
   - difficulties.

3. **Behavior of children while using the computer:**
   - level of autonomy (e.g. use of the plastic-cards),
   - interaction among children (competition/cooperation?), between children and adults (e.g. do the children often ask for help? For which programs?),
   - motivation; change in attitude towards programs, towards the written language; rejection; concentration,
   - strategies for machine utilization.

4. **Behavior of the children in relation to the written language:**
   - strategies for discovering the written language: use of the lightpen or of the keyboard?
   - production of new words, sentences or texts:
   - appearance of new behavior patterns towards books and other print materials.

5. **Changes in the teachers' role and tasks:**
   - Do the teacher's attitude and behavior towards the computer programs and the observation of children evolve, and how?
3.5 New developments

3.5.1 EVAL: a data base for the evaluation. For each program, utilisation data are stored in the computer. Every week these data are picked up and stored centrally more securely with other experimental sites' data. The associated data base interrogation system answers all the basic questions envisioned by us (programs hit-parade, machine usage, average utilization time, etc.) and all kinds of teacher questions such as the time division between children, group comparisons (girls boys, native speakers or not, different ages...), evolution through several months, which provide a real feedback of the computer use in the classroom.

We have just installed our data base on a more powerful computer at CMI, for more flexibility and to compare the different sites of experimentation. Until now such analyses can only be given back by us. However we plan to give direct access soon to the data base over the telephone by modem, to all the teachers. A lot of problems have not been solved yet, but they are mainly display problems which compromise the interactive interface. The general idea of providing a classroom analysis as feedback to the teacher is clearly positive and one of the inherent advantages of using the computer in the classroom.

3.5.2 A text-graphics-speech system. Encouraged by the success of our two programs "ECRiRE" and "PAYSAGE", we decided to follow that promising trail in developing a larger and more coherent system, entirely commanded by written commands (of the student), mixing intimately text and graphics in student compositions, and with a spoken output.

This new system will try to provide both play and significant goal activity for the child. It should encourage developing reading and writing facility and help in the first steps of real autonomous writing. The system has to be usable by 4 year old and upwards (without any advanced written language knowledge) and be rich enough so that 7 to 8 year old children still consider it a gratifying tool, providing high quality documents quite beyond their own actual motor capabilities. Options allow the switching from a colourful picture-oriented system (for the youngest) to a text-oriented system (for the older or more advanced children).

It includes graphic composition using elements (small pictures) from the computer, and a simple text editor giving gradual access to all the basic functions of a full text editor. The picture comes from a pictures base made up of an initial set plus new pictures created by the children or by the teacher for a better integration with the other activities.

Those graphic + text compositions can be grouped (concatenated) with stories, journals etc, and be printed out or stored and re-read.

A speech synthesizer provides an aid in reading other children's productions and also could be part of the child's discovery and understanding of the complex link between oral and written language (as an always available, non-judgemental and patient representative of the pronunciation rules). It should encourage play with written language.

That system is "under construction". We plan a first evaluation of the main functions of the system before summer vacation and a more complete experimentation with the system in the schools next year.

BIBLIOGRAPHY

