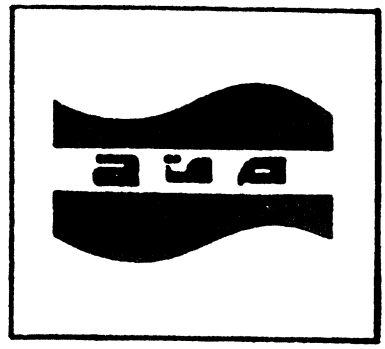
E/ESCWA/ID/87/WG.1/1
C.1

SUB-REGIONAL INFORMATIVE SEMINAR ON:

"COMPUTER APPLICATION IN EDUCATION"

14 -16 NOVEMBER 1987

Baghdad, Iraq



Sponsors

- *National Computer Centre* NCC *Ministry of Planning - Iraq*
- *United Nations Educational, Scientific and Cultural Organization's Regional Office for Science and Technology for the Arab States*

ROSTAS

nic and Social Commission for Western Asia

Distr.
LIMITED
E/ESCWA/ID/87/WG.1/13
16 November 1987
ORIGINAL: ENGLISH

UNITED NATIONS

ECONOMIC AND SOCIAL COUNCIL

ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA

Seminar on Computer Application in Education
14-26 November 1987
Baghdad

COMPUTER APPLICATION IN EDUCATION

Julien Fonjallaz

The opinions expressed in this paper are those of the author and do not necessarily reflect those of the United Nations Economic and Social Commission for Western Asia.

87-1245

COMPUTER APPLICATION IN EDUCATION

A PROGRAMME ORGANIZED BY

THE NATIONAL COMPUTER CENTER OF IRAQ

UNESCO/ROSTAS and ESCWA

15-22 NOVEMBER 1987
BAGHDAD, IRAQ

LECTURE

INTEGRATION OF IT IN THE SCHOOLS OF SWITZERLAND

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 CHENE-BOURG (Switzerland)

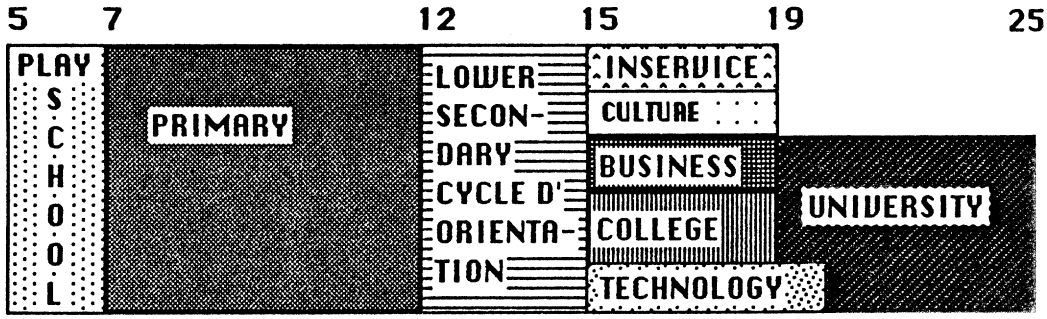
2

INTEGRATION OF IT IN THE SWISS SCHOOLS

I. MANY STATES STRUCTURES WITH A FEDERAL COORDINATION

Switzerland is a federal country of 26 states with 4 different languages (German, french, Italian and romantsh). With the exception of the Polytechnic High Schools, the education are under the responsibilities of each state. This political structure allows an adaptation to the cultural personalities of each state and implies some differences. For instance, the age to start primary school vary between 6 and 7, the length of the primary or secondary school are different, the age to pass the baccalaureate vary from 17 to 19, etc. The following diagram shows the situation of the Geneva state.

THE GENEVA STATE EDUCATIONAL SYSTEM



The swiss conference of the education' minister (SCEM) of each state public education department is allowed to realized an cooperation between the different states and managed the Center for Teacher Training in Lucern. For the informatics, a special comity has been organized more than 10 years ago. A new sub-comity is working for the compulsory education from 3 years.

II. THE DIFFERENT STRATEGIES

Instead of making a description on what is going on in every state, I prefer to sum-up the the different choices and strategies used according to recent data from an enquiries in September 1987. For a global view on the move between Information Technologies and Education, see the document "Relation IT and Education" at the end.

1. STUDENTS INVOLVED

A. COMPULSORY EDUCATION

Mainly degree 9 and then 6-7. Hardly nothing for the youngsters.

FRAMES :

1) Course in half-class at the computer workhop (6 to 12 computers).

2) Course in full-class in the usual classroom with around 12 computers send for a week. The teacher have a computer 3 weeks before with a pedagogical package for proposed activities.

3) A computer for each class with a set of software. Every student goes for around 1 hour a week.

A brake to a general introduction due to a lack of qualified teachers.

B. POST-COMPULSORY EDUCATION

a) Colleges

It will have a compulsory class only for the scientific students. In only 2 states, introduce compulsory computer literacy for every student at grade 10 and 11.

b) Technical schools

For apprenticeship : 12 compulsory hours at grade 10. For other, depending the future work, mainly CAD.

For Engineer School : opening of new diplomas. For other, programming with mathematic class. No computer tool based for students.

c) Business Schools : Office Automation will be for all. For some students : COBOL or Spreadsheet classes.

C. SPECIALIZED EDUCATION

No general inquiries. Different experiments for writing, CAL and LOGO.

2. CURRICULUM & ACTIVITIES

A. COMPULSORY EDUCATION

Computer literacy, word processing, database processing, PAINT, MUSICWORKS, LOGO and CAL for mother tongue, calculi, etc.

B. POST-COMPULSORY EDUCATION

a) Colleges

CTB (word processing, database and spreadsheet).

b) Technical schools

Blackbox, an audio-visual package, training for DRAW and CAD.

For Engineer Schools : MODULA or PASCAL.

c) Business Schools : Office Automation and CTB (word processing, database and spreadsheet).

C. SPECIALIZED EDUCATION

Special interface according to the handicap. Computer literacy, word processing, database processing, PAINT, MUSICWORKS, LOGO and CAL for mother tongue, calculi, etc.

3. TEACHERS INVOLVED

A. COMPULSORY EDUCATION

Retrained and self-trained teachers.

B. POST-COMPULSORY EDUCATION

a) Colleges

Retrained and self-trained teachers.

b) Technical schools

Retrained and self-trained teachers.

For Engineer Schools : professor with an university diploma.

c) Business Schools : Retrained and self-trained teachers. For Programmer-Analyst classes, professor with an university diploma.

C. SPECIALIZED EDUCATION

Retrained and self-trained teachers.

4. TEACHER'TRAINING

A. COMPULSORY EDUCATION

With the help of local structure including the university or/and the Swiss Center for Teacher Training.

FRAMES :

1) During holidays.

2) Half paid inservice training.

B. POST-COMPULSORY EDUCATION

With the help of local structure including the university or/and the Swiss Center for Teacher Training.

C. SPECIALIZED EDUCATION

With the help of a special organization.

5. HARDWARE + OS + SOFTWARE

A. COMPULSORY EDUCATION

Different choices : MS-DOS pc, Smacky (swiss pc Macintosh like), Apple IIe or GS, MacIntosh.

WORD, ACT-LOGO, LOGOWRITER, FILE, EXCELL, MULTIPLAN, LOTUS, MULTIMATE, WINDOWS, PAGE MAKER.

B. POST-COMPULSORY EDUCATION

Different choices : MS-DOS pc, Smacky, MacIntosh.

IDEM + PASCAL, MODULA, COBOL, AUTO-CAD.

C. SPECIALIZED EDUCATION

Different choices : MS-DOS pc, Apple IIe or GS, MacIntosh, Amiga, Thompson TO-8.

WORD, ACT-LOGO, LOGOWRITER.

D. SOFTWARE FOR CAL

Due to the different syllabus, produced by each school or bought.

6. NETWORKING

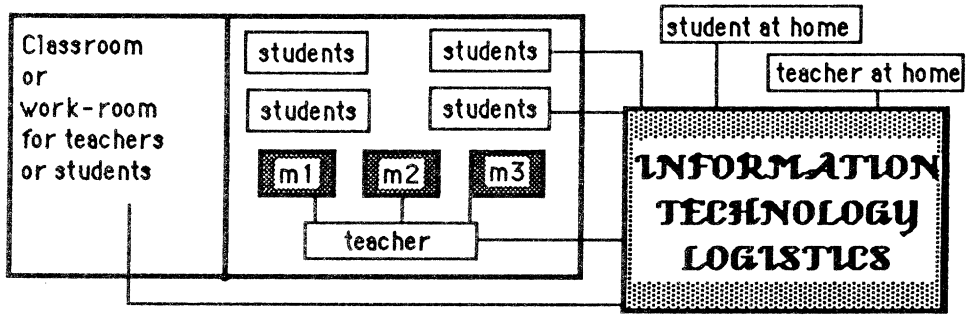
1) SCEM comtel network.

For mailing and data over syllabus, teacher'training, etc.

2) STATE minitel network.

Mailing and data on CAL only for teachers.

Nearly nothing available for the students with the exception of Geneva (SOS-HOMEWORKS).



6. COSTS

The different points :

0) The project management and the evaluation.

1) The hours to teach.

2) The didactical means.

3) The teacher'training (teachers + trainers + hard/soft ware).

4) The school adaptation (classroom, electrical network, etc.)

5) The hardware and its maintenance.

6) The software and its maintenance.

FIRST LAW :

HARD+SOFT WARE COST IS LESS THAN A THIRD.

OR

ONE THIRD HARD+SOFT WARE AND TWO THIRDS MENWARE.

SECOND LAW :

TO "COMPUTERIZE" A SCHOOL WILL BE MORE COSTLY

THAN FOR A FACTORY,

BECAUSE EVERY ONE (the school authorities, the teachers and the students, the libraries, etc) NEED INFORMATION TECHNOLOGY.

7. CONCLUSION

The fundamental aim is to adapt the school to the evolution of the society.

BUT,

FIRST

The integration of IT in the school life implies a specific logic that has to be find out.

SECOND

The school will have to move in order to be able to respond to an important new need for training.

# # # # # # # # # # # #

RELATIONS EDUCATION - IT

EXPERIMENTAL PHASE IN THE 60ies

STUDENTS	TEACHERS	ACTIVITIES	H+S WARE	OBJECTIVES
Those involved are mainly from the universities or colleges.	Programmers or people making researchs in pedagogy.	Programming and very few CAL.	Remote processing on host computer with terminals.	To prove that it is possible.

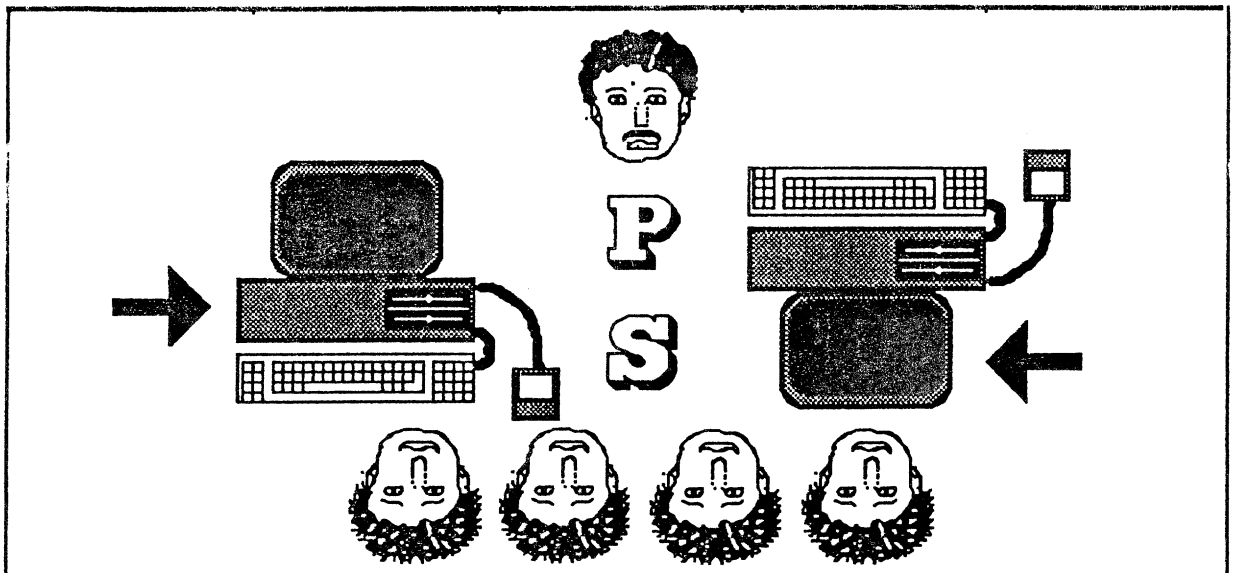
PIONEER PHASE IN THE 70ies

Introduction first in the technical and business schools.	For compulsory classes, programmers.	COBOL or FORTRAN programming.	Remote processing on host computer with terminals.	To prepare for the profesional life.
Then optional classes in the lower secondary level (12-15).	For optional classes, scientific teachers self-trained.	BASIC and to know computer and their uses. A few CAL and start of computer tool based.	First micros with Applesoft, Basic and word processing.	To discover the computer. Contents : computer centered. Researchs on the educational applications.

COMPUTER FOR ALL PHASE IN THE 80ies

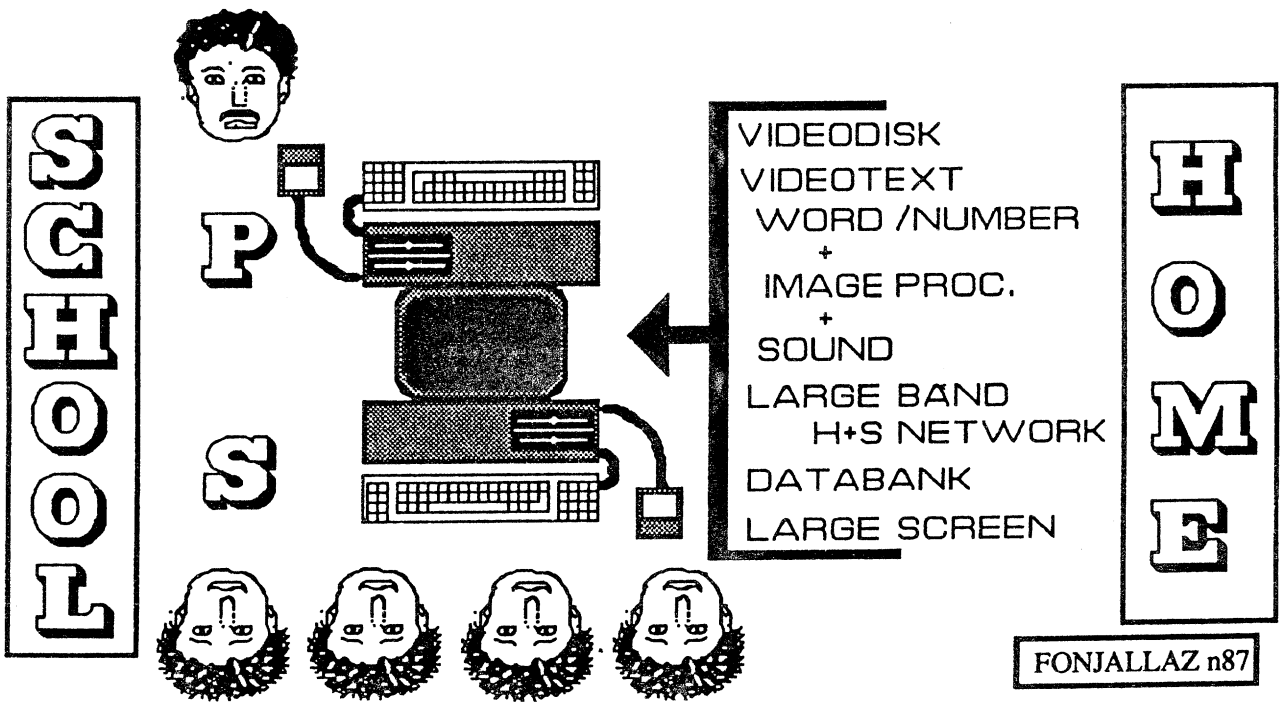
Priorities in the introduction : 1) Colleges, technical & business schools, schools for apprenticeship. 2) Junior High Schools(12-15) 3) Primary schools (9-11). 4) Specialized education for handicapped children.	Except a few cases, computer literacy classes are given by retrained teachers. 2 tasks : 1) To train teacher'trainers 2) To train teachers. SCEM elaborates a concept for teacher training (1987).	1) Computer literacy. 2)Introduction to some packages (word + graphic processing). 3) LOGO. 4) CAL for calculus & mother tong. SCEM elaborates a concept for syllabus (1985).	Now bought by the schools. Choices : MS-DOS or Macintosh computers. First uses of local & public networks. SCEM open a compuserve (1987).	1) To familiarize. 2) Beginning of computer tool based. 3) Educational uses of packages and programming (LOGO, BASIC, PASCAL.. 4) Algorithmic.

PTPO



IT FOR ALL PHASE IN THE 90ies

STUDENTS	TEACHERS	ACTIVITIES	H+S WARE	OBJECTIVES
Very likely; the same priorities than for the introduction	2 new tasks : 1) To train teacher'trainers 2) To train teachers.	1) IT literacy. 2) Networking abilities : home & school services. 3) More CTB. 4) More CAL.	Portable personal Information Processing system and knowledge Information Processing system (KIPS)	To be able (teachers & students) to use a full IT environment for : working, learning, teaching, communicating



COMPUTER APPLICATION IN EDUCATION

A PROGRAMME ORGANIZED BY

THE NATIONAL COMPUTER CENTER OF IRAQ

UNESCO/ROSTAS and ESCWA

15-22 NOVEMBER 1987
BAGHDAD, IRAQ

LECTURE

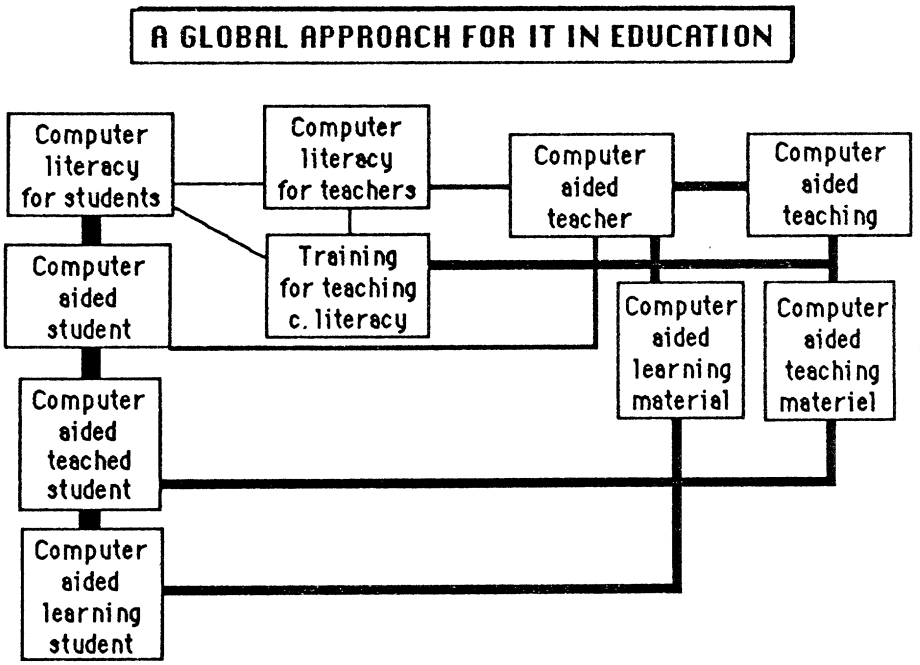
COMPUTER AIDED LEARNING

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 CHENE-BOURG (Switzerland)

COMPUTER AIDED LEARNING

I. INTRODUCTION

Information technologies can be used in so many ways in education. First of all, we think to tutorials for Computer Aided Learning (CAL) but we should not forget Computer Tool Based (CTB) that allows Computer Aided Teaching (CAT).



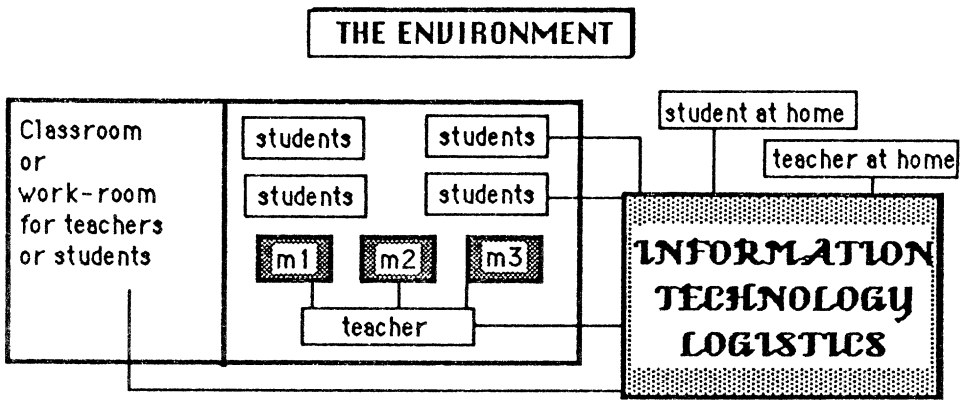
Beyond the difficulties to define exactly every component of this diagram, it is important to take in account these following uses of IT in education :

- many software as word processing, spreadsheet, data base management system, expert-system, etc, can be used by teachers and students to produce their documents, to make their calculations, to retrieve informations. One of the limits is of course the cost but, sooner, the decrease of prices will allow a general use of this computer tool based.

- the same software can be used also to teach. Text analyses, studies of graphics in mathematics, etc are made on time with a computer on line in the classroom. We can imagine too information retrieval for instance to show pictures or to present data on a writer.

So, the interaction teacher-student-computer have two sides : Computer Aided Learning (CAL) and Computer Aided Teaching (CAT). We should not forget the second one!

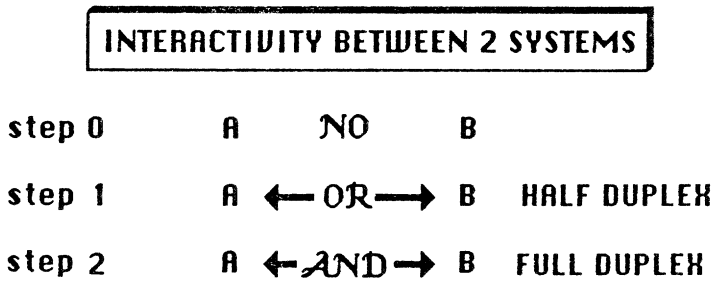
A large use of IT implies network and specific datas as shows by the following diagram :



II. THE DIFFERENT CASES OF CAL

1. RULES OF INTERACTION

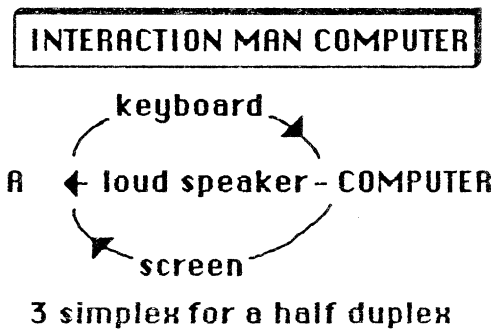
Fundamentally, CAL is an interaction between two or more systems. Let us remind of the different steps of interactivity :



The different steps are basically defined by the three fundamental boolean operators NO, OR and AND.

2. THE INTERACTION MAN-COMPUTER

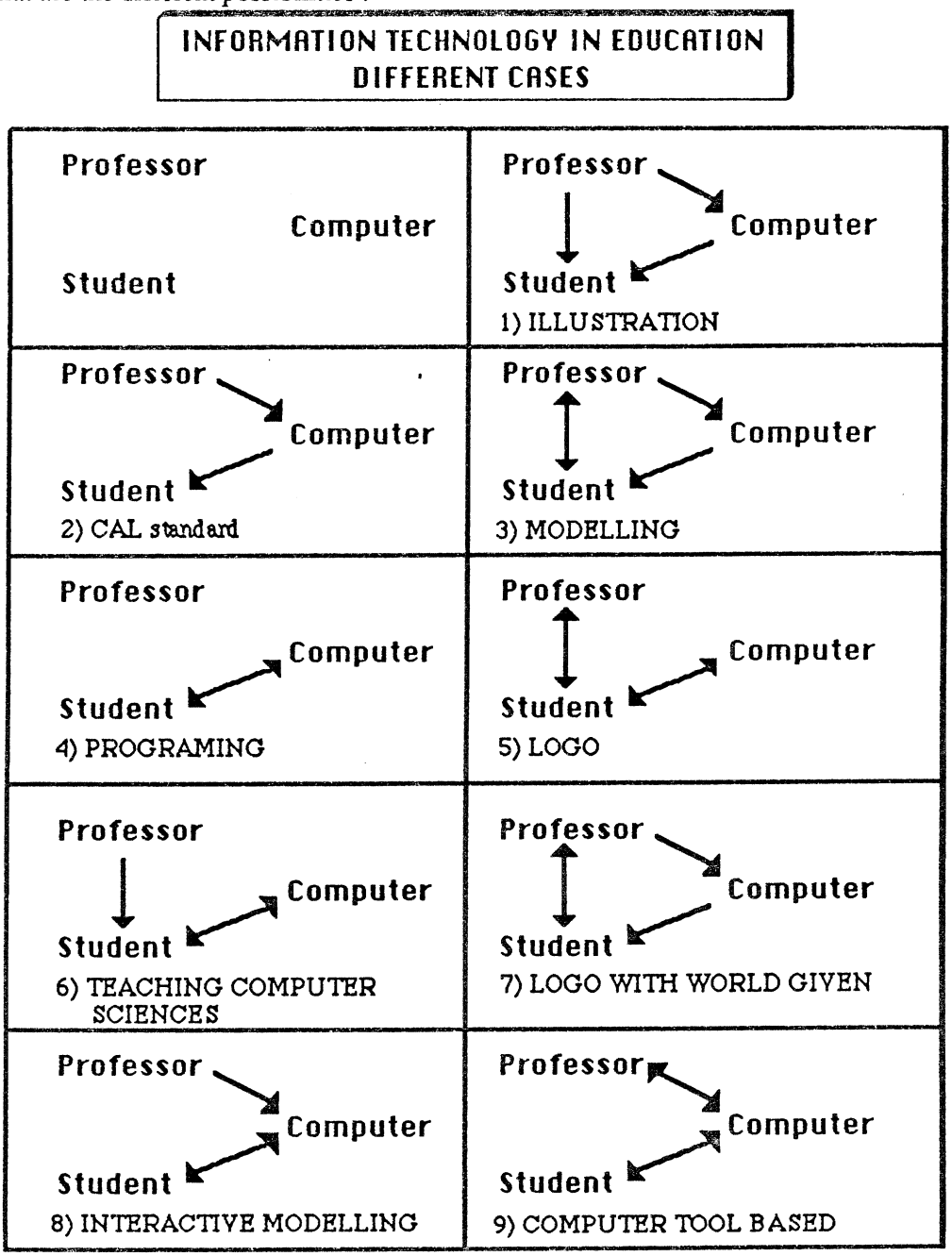
This interaction is made through the peripherals like keyboard, screen, mouse, graphic tablet, etc.



Among the criteria to evaluate the appropriateness of a CAL software is the use of different channels of interaction.

3. THE DIFFERENT CASES OF INTERACTION TEACHER-STUDENT-COMPUTER

CAL implies different cases of interaction between a teacher, a student and a system (hardware + software). According to the different steps of interaction between two systems, what are the different possibilities :



III. NETWORK AND REMOTE CAL

Today, we have to take in account that communication between computers is not only the one between host computer and terminals. Some paid services are offered at home through

MINITEL and others systems running via telephone cable. The fast expansion may imply a certain competition between school and home education or between public and private school. The followings screens are kept on french MINITEL showing some possible uses by a private society and a public school.

norme CEPT 2 **télétel 3** 0,74F toutes les 45 sec*

*dont 0,46F reversé au fournisseur du service

télétel 1 : 36 13

télétel 2 : 36 14

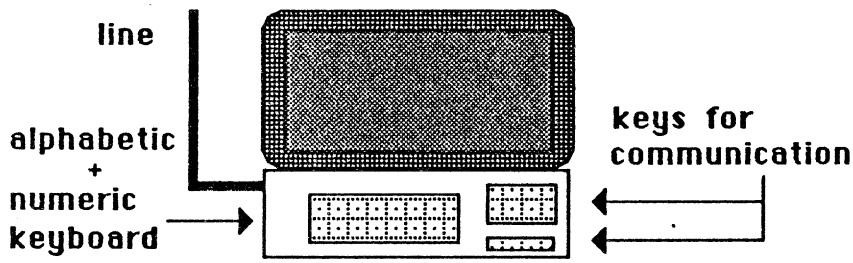
télétel 3, tapez: AST3

code du service: sos2424.....

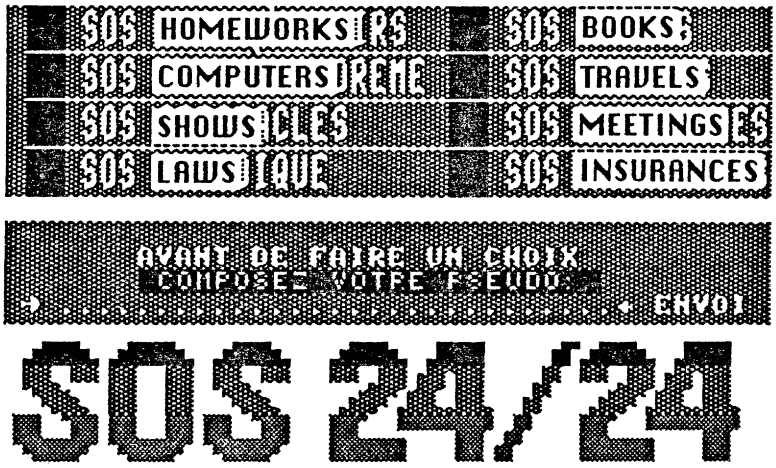
puis →

fin de communication →

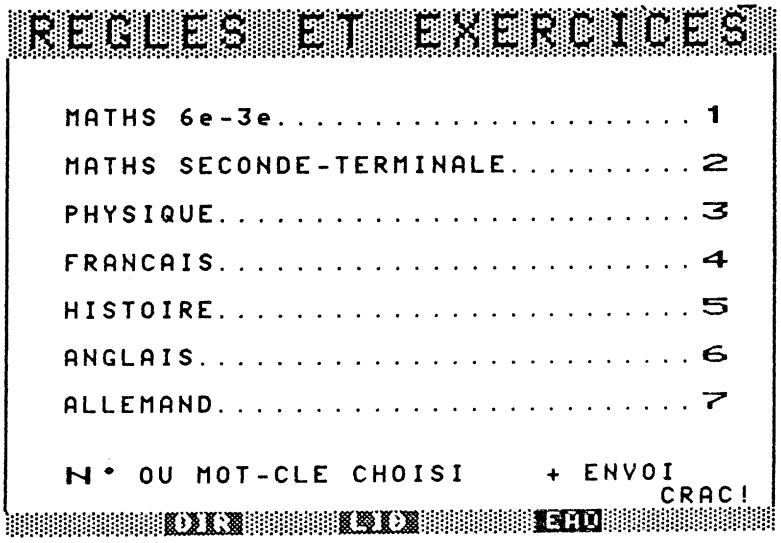
The costs, 0,74FF around US$ 0.15, are shared for one third for communication and two thirds for the service. A MINITEL or VIDEOTEX joints a telephone, a screen and a keyboard to allow interactivity. The rate of transfer is only 300 Bauds and drawings are composed with special characters.



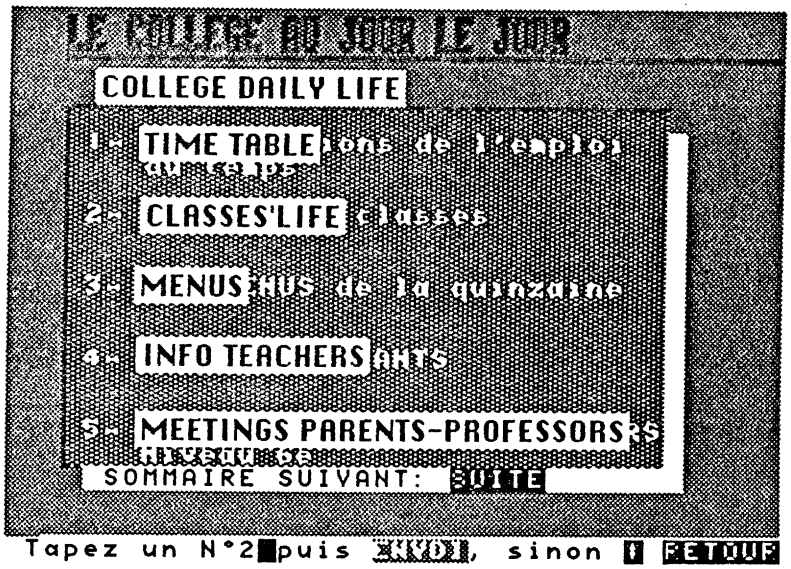
Among the different paid services for the pupils, SOS Professors which the first screen shows what is offered:



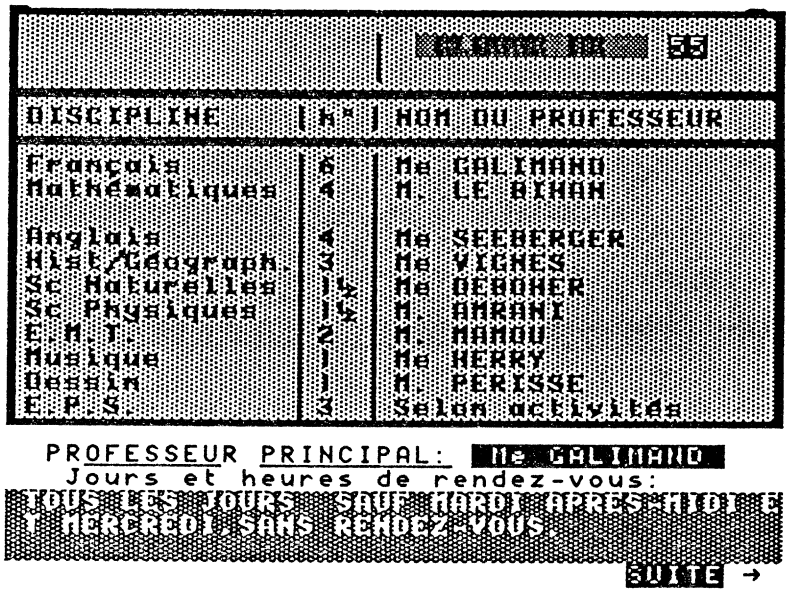
This screen informs over the topics of CAL :



The network allows a school to offer a "minitel service". For instance, these following screens are belonging to the "College Jean Villar" at La Courneuve, close of Paris :



Following number 2, you may get informations on a class :



III. THE DIFFERENT APPROACHES IN CAL

Several types of CAL exist already. The first type deals with individualized teaching such as, for instance, pedagogical assistance. One imagine that the teacher, when he sees a gap, gives as work a selected educational software. Other types can be helpful in illustrating a notion or as a show for the whole class, as well as in vocational training. In the last case, the pupils work alone or in small groups, the teacher being a group leader and a consultant.

Introducing new educational meas should not lead to systematically eliminating the existing ones. Electronics or not, in some circumstances, the blackboard and the chalk remain the best means.

1. CAL WITH A SCENARIO

It consists of presenting a whole group of notions and then testing its understanding according to the pupil's answers. The important thing is not only to clearly present the notions and to ask the appropriate questions, but also to foresee the possible answers.

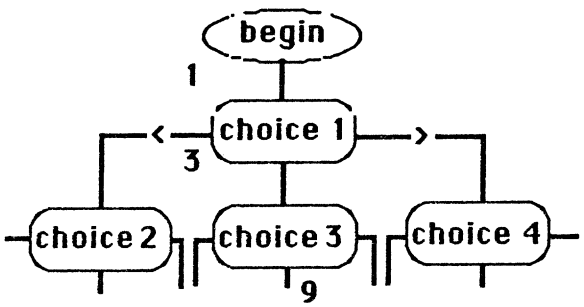
One of the big pedagogical difficulties is the ability of analyzing the logics of the false answer so to allow the pupil to build the notion correctly. Such a means allows to personalize teaching in its method as well as in time (the pupil works at his rhythm).

So, the error is not penalized but is the start point of a scenario leading to build the notions to be learned. There are many ways to go through an educational software. For instance, let us imagine that a step proposes this question : 6 x 7 = . The software must deal with these following answers :

1) 42. This the correct one and we can make a branch to an another question.

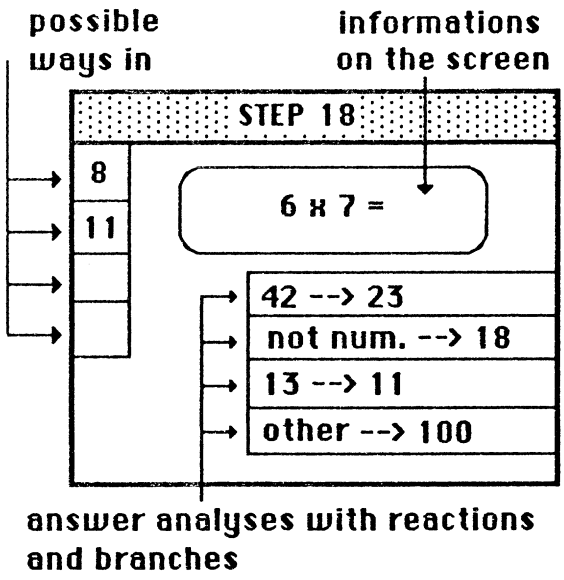
2) 13. It seems that the learner made a confusion between addition and multiplication. After a notice of that fact, we must to branch to same question.

Imagine that the answer is 40, are you able to understand why ? If you do not, you are unable to find a remedy and you must say : wrong, start again. So, due to a lack of knowledge about the reasons of wrong answers, software of that type are often poor and boring. An other problem exist if the pedagogical experience allow to give specific notice for wrong answers, this is the combinatorial explosion. In the case of 3 possible answers for every questions, there are 3^n ways to get the n step!

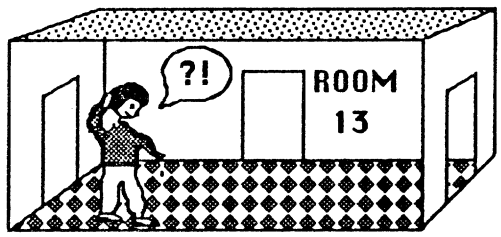


the combinatorial explosion

To produce the pedagogical design of such a software, every step of interaction is described with a frame including different datas as shown by this following diagram :

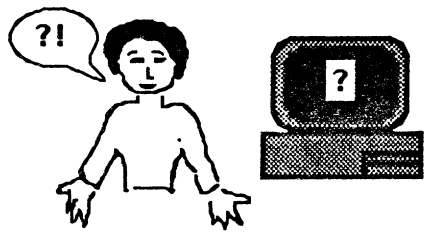


This type of CAL following the Skinner way of learning might put the learner in a passive mood. Using such a CAL software, you fill like in a labyrinth getting rewards or penalties if you give right or wrong answers.



Going to the knowledge...

Despites the theoretical possibilities, practical difficulties make short the personalization software with a scenario. Any ways, this situation must be avoided :



Some software named authoring system has been developed to produce courseware. For instance, PLATO, PILOTE running on IBM-pc, etc. Beyond the programing difficulties, we are always confronted to pedagogical problems like the understanding of the wrong answers, the variation of strategy, etc.

2. LOGO TYPE APPROACH

One can ask pupils to program procedures realizing a precise task, such as: the sum of two fractions. Explaining it to the machine does not require knowing it by heart but explaining it clearly.

This first stage being completed, the use of defined procedures for more complex operations induces an analytical way of thinking, since a problem is decomposed in simpler parts. Regrouping simple procedures, once they are built and verified a synthetical point of view. Moreover, the interactivity of programming language allows work based on "trial/error discovery".

One can also provide a whole set of procedures, be it to make easier a precise notion, be it to concentrate on it . Once those basic tools examined, one can return to the first method described.

It is quite impossible to present LOGO pedagogics in a few lines, but it is important to know it is based on Jean Piaget works (see Seymour Pappert`s "Mindstorms-children, Computers and powerful Ideas")

3. MODELLING/SIMULATING

This form of CAD consists in building and eventually programming a model representing a phenomena (modelling), or in understanding it using a programme which is simulating it. This method can be applied to some subjects or not, and is required to study some dangerous procedures, too quick or too slow to be observed. Moreover, the teacher or the pupil can avoid fastidious calculus, so he can concentrate on the model. Studying thanks to simulation can be advantageous only in so far teaching includes discussing model limits versus the reality. Some models, such as population's growth can be integrated into geography or biology and promote a multidisciplinary vision.

4. DRILL AND PRACTICE

Drill is a fundamental part of any learning process. It is important to provide the pupil a series of situations of increasing difficulty. The educational software offers drills according to the answer.

A more difficult drill when the answer is correct, an easier one on the contrary, so that progress is made according to the pupil. With this method the pupil who has problems won't get discouraged and others won't get bored.

5. USING A DATA BANK FOR INFORMATION RETREVIAL

Written documents (books,Newspapers,etc,) are often consulted. This is however often limited due to long access time, including receiving the document and the actual information searching.

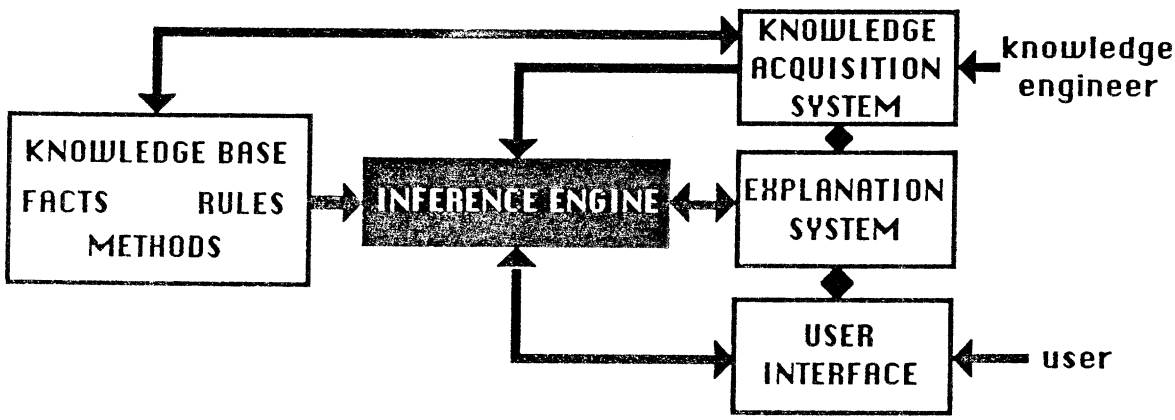
Systems called hosts are conceived to extract the requested subjects in a very short time due to criteria. They can be created by the teacher to illustrate a lesson , or to regroup the information necessary for the pupils. Moreover, the telephone network allows to reach hosts in the whole wold.

The scholar use of such a means, in addition to its possibilities of reaching a more varied information, is training pupils to a service they are going to use during their whole life later on.

6. EXPERT SYSTEMS

The pupil begins to build a set of rules according to his observations of certain phenomena. The structure of a rule is: IF (characteristic) THEN (deduction). Here is an example: IF an animal has hairs, then it is a mammal.

The rules being set, new characteristics are added and the machine draws new conclusions. This way of creating an "universe" that is progressively growing as new characteristics are added was at first created for systems helping decision taking. This king of "clever" programme begins to be used in medicine to help diagnosis. There are expert systems to diagnose computers out of order.



What is the educational purpose of a method? Well, it allows the pupil, on one side, to verify the rightness of his own conclusions, and, on the other side, to realize whether he has done all the possible deductions. This is the same spirit as Pascal's dear "fineness spirit".

Nowadays, many generators of expert system are running on pc whose costs are going from $200 to $2'000. Since this year, a part of my work is devoted to the educational applications of expert systems which starts wittj the test of different softwares.

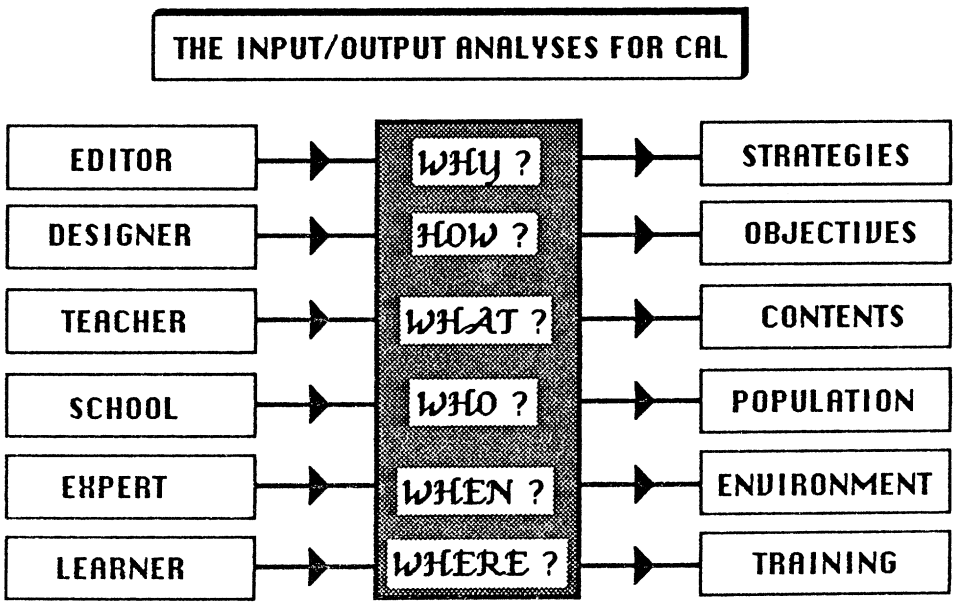
IV. WHEN TO USE CAL

The first approach might us think that CAL is a way to cut down the costs of education by the possibility of teaching without a professor. Some people enthusiastic said that nowadays it cheaper to give to every pupil a computer and educational software packages. But it is not for tomorrow this will append. So, we think that there is two main categories of uses : the first, out of the classroom the school or at home for pedagogical assistance, the second ones are integrated in the normal life of the class.

A software is something more complex than a book. Every teacher using an educational software must know it to make an adequate use in his teaching. This will imply an important work. But the evaluation of educational software by teachers is very difficult because they have to test twice with two different moods : the first at the place of the student that will use it, and the second test as the teacher they are. This two roles are quite opposite as evaluations of teachers or students become often in contradiction.

The use of IT is rather costly in comparison to other media. So we should say that the first principle is to use IT if we can not obtain the some results with an other media.

The following diagram shows the different actors involved in the CAL and the basic questions to answer before using it :



V. A GENERAL CHECK-LIST

This check-list includes the general points. To go further, we must detail according to the type of CAL.

1. ADEQUATION TO THE SUBJECT

Does this software carry out the part of the syllabus concerned. If only a subset, is there any way to program it in order to limit the matter presented ?

2. ADEQUATION TO THE PEDAGOGICAL STRATEGY

Beyond the knowledges, the pedagogical strategies are they adequate ?

3. RATE OF AUTONOMY

This software may be used by a student alone ?

4. RATE OF INDIVIDUALISATION

- RHYTHM OF PROGRESSION

The difficulties are they divided in order to allow different rate of progression ?

- METHODS OF LEARNING

The adaptation of software to the reactions of the learner are they different according to the given answers ?

5. RATE OF INTERACTIVITY

Does the learner must read many messages before giving answers ?

6. TRACE OF PROGRESSION FOR THE LEARNER AND/OR FOR THE PROFESSOR

Does exist a monitoring ability to inform not only for scoring but for advices and informations over the progression of the learner in the software ?

7. SAFETY (NO BUGS)

Does the software run without bugs ?

8. POSSIBILITY OF MAINTENANCE

Is there any possibilities to make corrections or modifications to the software ?

9. ESTETICS

The choice of colors or the presentation are they "nice" ?

10. ERGONOMY

Is the interaction between the learner and the software easy, the screens are they readable ?

11. THE BENEFITS IN COMPARAISON WITH AN OTHER MEDIUM

In comparison to other media, what are the things done with the software that it is impossible to achieve with the normal media ?

12. HELP ON LINE

In case of difficulties, what kind of on line help is available ?

13. DOCUMENTATIONS

- for the learner ?
- for the teacher ?

COMPUTER AIDED LEARNING GENERAL CHECK-LIST

SOFTWARE : _____ HARDWARE : _____

	++	+	0	-	--
1. ADEQUATION TO THE SUBJECT					
2. ADEQUATION TO THE PEDAGOGICAL STRATEGY					
3. RATE OF AUTONOMY					
4. RATE OF INDIVIDUALISATION					
- RHYTHM OF PROGRESSION					
- METHODS OF LEARNING					
5. RATE OF INTERACTIVITY					
6. TRACE OF PROGRESSION					
- FOR THE LEARNER					
- FOR THE PROFESSOR					
7. SAFETY (NO BUGS)					
8. POSSIBILITY OF MAINTENANCE					
9. ESTETICS					
10. ERGONOMY					
11. THE BENEFITS IN COMPARAISON WITH AN OTHER MEDIUM ? WICH OTHERS					
12. HELP ON LINE					
13. DOCUMENTATIONS					
- for the learner ?					
- for the teacher ?					

VI. CONCLUSION

In introduction of CAL in itself will not be a miracle! To be a success it needs of course educational software of good level and a special training for the teachers. This lecture does not take in account the use of IT for handicapped children where many miracles have already been made.

* * * * * * * * * * *

COMPUTER APPLICATION IN EDUCATION

A PROGRAMME ORGANIZED BY

THE NATIONAL COMPUTER CENTER OF IRAQ

UNESCO/ROSTAS and ESCWA

15-22 NOVEMBER 1987
BAGHDAD, IRAQ

LECTURE

THE EDUCATIONAL INTEGRATION OF SPREADSHEET

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 CHENE-BOURG (Switzerland)

THE INTEGRATION OF SPREADSHEET

I. THE SPREADSHEET

The software of spreadsheet type were partly responsible of the fast expansion of micro-computers 10 years ago. Named Visicalc, Multiplan, Lotus, Excel, etc , their development are still going. Made for micro-computers, some versions have been made to run on mini-computers!

A spreadsheet is a set of interactive cells as shown by the following captured screen :

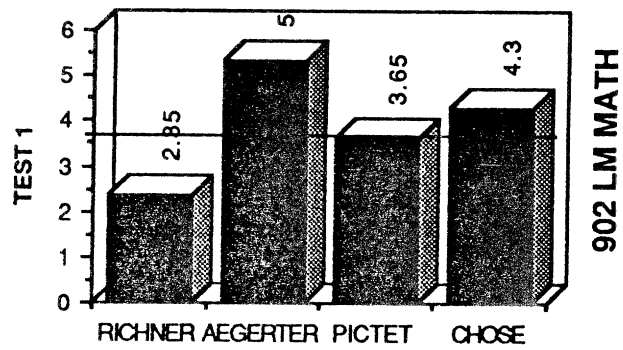
File Edit Formules Format Data Options Macro

A12 | RICHNER

902LM MATH

	A	B	C	D	E	F	G
1	NAME	FIRST		TEST 1	TEST 2	AVERAGE	PRONO
2			COEF.	1	2		
3			POINTS				
4			46	22-Sep-86	1-Nov-86	22-Nov-86	
5	RICHNER	André	18	2.35	3.00	2.80	4.2
6	PICTET	Jacques	28	3.65	6.00	5.20	1.8
7	AEGERTER	Frédérique	41	5.35	3.50	4.10	2.9
8	CHOSE	Eric	33	4.30	6.00	5.40	1.6
9							
10	AVERAGE			3.91	4.63	4.40	2.6
11							

Some spreadsheets have included graphic abilities (Lotus, Excel, etc) and some others are bind with a chart software (Multiplan). Some chart softwares like Cricketgraph are running with different spreadsheets.



A spreadsheet is a set of cells and a set of commands. The dimension might be 512 lines times 1024 columns. It depends on the size of the RAM.

1. CELLS

Each cell has :

1) AN IDENTIFICATION, usually the set composed by the letter of a column and the number of a line. For instance, A12.

2) A VALUE alphabetic or numeric.

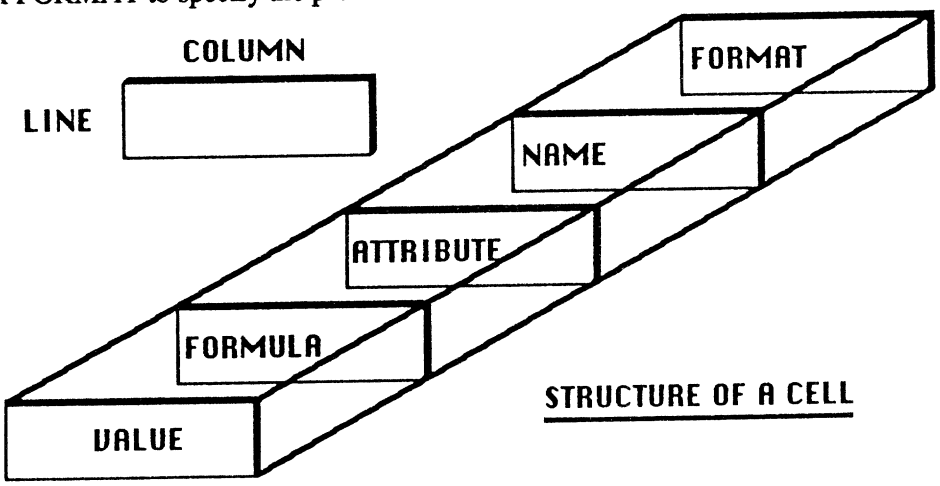
3) A FORMULA of different types : numeric, boolean, test, statistic, alphabetic). These formulas are operators that produce a value according to the definition of an argument. For instance :

- SUM(A1,A10) will place the sum of the cells A1, A10 and those between in the active cell.
- AVERAGE (A1,A10) will place the average of the (A1, A10) in the active cell.
- IF A1<1,1 will place 1 in the active cell if the value of A1 is less than 1.
- FIRST (A10) place the first character of A10 in the active cell.

4) AN ATTRIBUTE to protect or unprotect a cell or a group of cells.

5) A NAME in order to find an area (group of cells) or to define formulas explicitly as 3*X or DISTANCE/TIME.

6) A FORMAT to specify the presentation of datas.



2. THE COMMANDS

There are tree-organized to FORMAT, PRINT, SAVE/LOAD, COPY, ERASE, CREATE/DELETE lines or columns, MOVE, NAME, SORT, FILL, etc. A spreadsheet software may get over 100 different commands. All have on line help, this way you may avoid to read the important documentation.

For instance the following diagram shows an area sorted :

5	RICHNER	André	13	2.35	3.00	2.80
6	AEGERTER	Frédérique	41	5.35	3.50	4.10
7	PICTET	Jacques	28	3.65	6.00	5.20
8	CHOSE	Eric	33	4.30	6.00	5.40

3. THE MACRO-COMMANDS

They allow to program specific commands by the combination of the existing ones. For instance, this way we can create MENU very useful for CAL.

II. COMPUTER TOOL BASED WITH SPREADSHEET

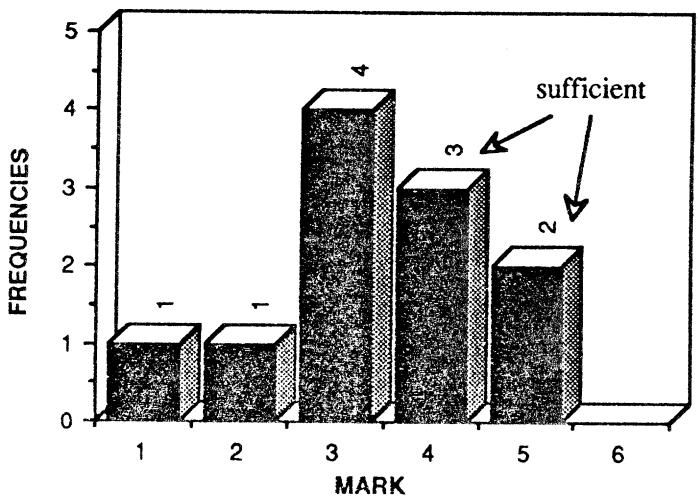
Every teacher has to deal with marks and other datas on students. Unfortunately, a spreadsheet does not correct a test but it is useful to establish a scale, to calculate marks and averages. For instance, let us see how to define a scale for a class :

File Edit Data Graph Curve Fit Goodies Formats

Tools

BAREME

	1	2	3	4
	NAME	SORTED	MARK	Analyse 1
1	1	13	1.768	insuf
2	2	21	2.856	insuf
3	3	23	3.128	insuf
4	4	27	3.672	insuf
5	5	28	3.808	insuf
6	6	29	3.944	insuf
7	7	33	4.488	suf
8	8	35	4.760	suf
9	9	36	4.896	suf
10	10	39	5.304	suf
11	11	41	5.576	suf



Using calculs and graphic abilities, we can see that the first try to define a scale is too hard as shown by the following diagram of frequencies :

The abilities to process datas allow a teacher to check easily :

- which student gets insufficient results by sorting (see the last diagram),
- what mark must have a student to reach a sufficient level (see column G of the first diagram).
- if different classes on the same level are going together.

The work is useful for produce marks but also to retrieve specific datas on students.

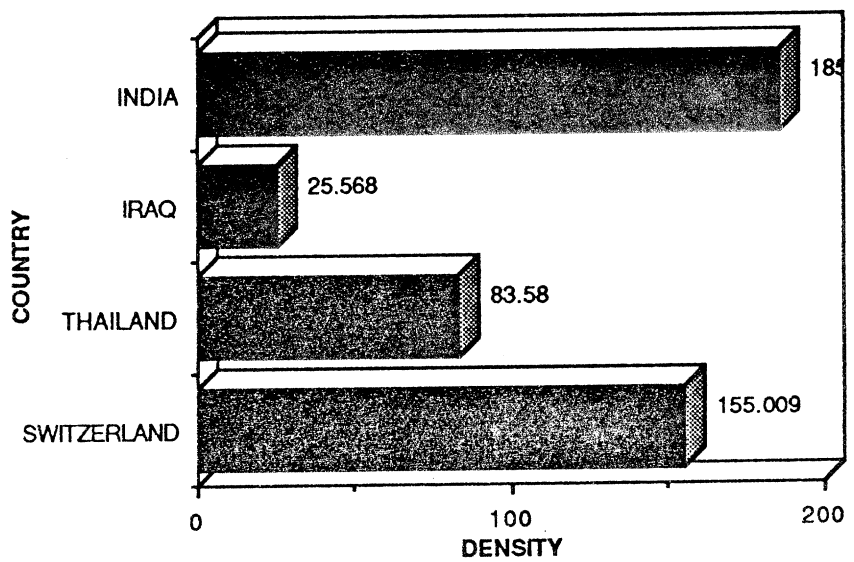
III. COMPUTER AIDER TEACHING WITH SPREADSHEET

According to the nature of this software, Spreadsheet are especially useful for sciences. For instance :

- Geography

To compare the composition of foreign trade and to analyze other datas. For instance, this example shows how useful it is to represent datas with graphics. A bar diagram is much readable than a list of numbers :

1	2	3	4
COUNTRY	SUPERFICY	PEOPLE	DENSITY
SWITZERLAND	41288	6400000	155.009
THAILAND	514000	42960000	83.580
IRAQ	434924	11120000	25.568
INDIA	3287590	610080000	185.571



- Biology

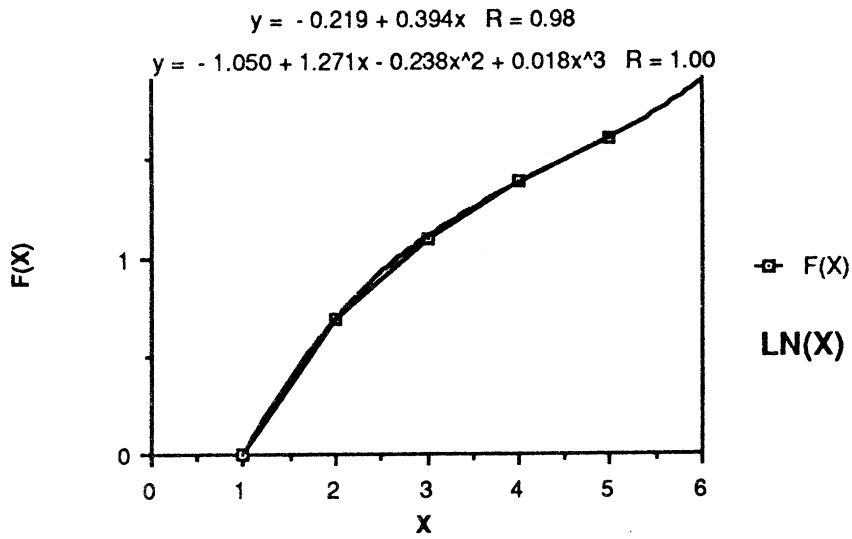
To analyze different models of population growing and to make simulation.

- Physics

To analyze datas form experiences and for modelling

- Mathematic

To analyze datas and to practice modelling.



This diagram shows different polynomial approximations for a set of 5 points.

- Management

The basic field almost useful for everything.

The use in a classroom requests the following conditions :

- graphic representations of datas,
- a personal computer with a large screen,
- a hard disk to store datas and softwares,
- files of datas ready to use.

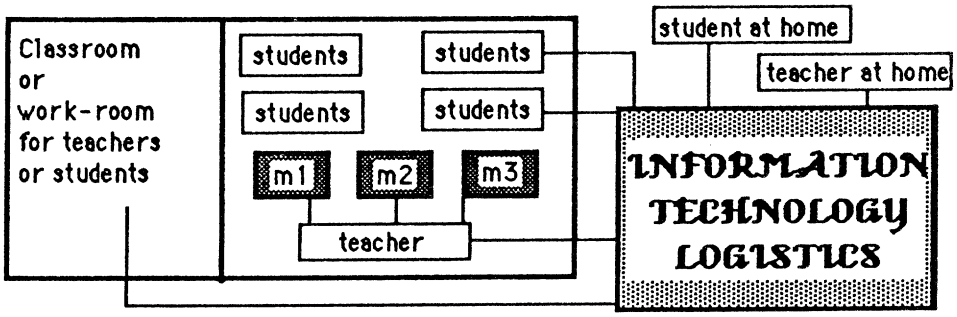
IV. COMPUTER AIDER LEARNING WITH SPREADSHEET

Very few experiences with students under the age of 14. A spreadsheet software is quite more complex than a word processing one. Fortunately, there are macro-commands. So the pupils just need to enter datas and to use the macros included in a MENU. This way, students can use spreadsheet to analyze datas form experiments and to practice modelling. They just need to enter datas on the right areas and to use macro-commands to get new informations and graphics!

It seems today that for students in business college, the first class should be a training to spreadsheet because they will use it their all life!

V. THE ENVIRONMENT FOR SPREADSHEET

To make CAT in an interactive way, the teacher must be able to use any commands in order to get the datas asked by the students. To achieve its training, to use spreadsheet to process his data and to prepare the datas needed for class, he should use the same personal computer and the same softwares at home and at school. The length of training is around 60 hours.



For the use of spreadsheet for CAL, the sheets with special macro-commands might be prepared by a teacher of the same discipline specialized for spreadsheet. For that purpose, the length of training is around 240 hours.

* * * * * * * * *

COMPUTER APPLICATION IN EDUCATION

A PROGRAMME ORGANIZED BY

THE NATIONAL COMPUTER CENTER OF IRAQ

UNESCO/ROSTAS and ESCWA

15-22 NOVEMBER 1987
BAGHDAD, IRAQ

LECTURE

THE EDUCATIONAL INTEGRATION OF EDITING

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 CHENE-BOURG (Switzerland)

EDITING AND ITS EDUCATIONAL APPLICATIONS

I. INTRODUCTION

The different softwares to process alphabetical data are getting better every month. Nowadays, we can find three categories :

- WORD PROCESSING : to produce letter, essay, exercises, novels, etc.

- IDEAS PROCESSING : To create structured text, essay, etc.

- PAGE MAKER : to paste up documents, to create flyleaves, etc.

This lecture would like first to show what are the tools running on personal computer and then, to present some educational applications. And at the end, the fundamental question : what are the effects due to the move from manuscript to compuscript ?

II. WORD PROCESSING

A. EDUCATIONAL APPLICATIONS OF WORD PROCESSING

1 WRITING ESSAY AND COMPOSITION

Every text produced by the students that will be worked many times is the basic use of word processing for obvious reasons.

2 MAKING SUM UP

A student receives a disk with a file to sum up. The teacher must give some orders :
- the maximal number of characters,
- the emphasis to put on different facts,
- the specified format.

3 WRITING A NOVEL

After a discussion to define the story and informations over the different characters, every team of two or three students writes his chapter. It is better that the chapter written by a team is checked by an another one. At this end, the teacher merges the different chapters.

4 COMPLETING A LACUNAR TEXT

The teacher prepare a text with missing parts that have to be filled by the student.

5 WORKING ON A TEXT

The student must for instance to put in the passive form a text given by the teacher.

File Edit Window View Reorganize Templates Formats

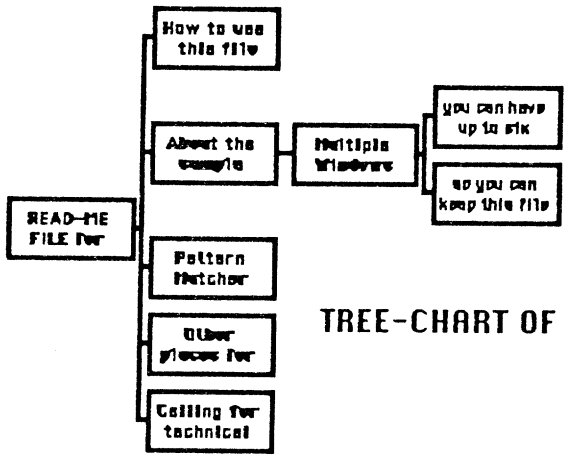
!README!

+ How to use this file
+ About the sample files
  + Multiple Windows
    - you can have up to six outlines open at once
    - so you can keep this file open as you examine the samples
✥ Pattern Matcher Power

Here are some interesting and powerful ways to use MORE's built-in Pattern Matcher (discussed on pp.75-77 of the User's Guide).

+ Other places for ideas
= Calling for technical support

Another thing very helpful is the possibility to see the structure of a document in a tree-chart representation :



TREE-CHART OF A DOCUMENT

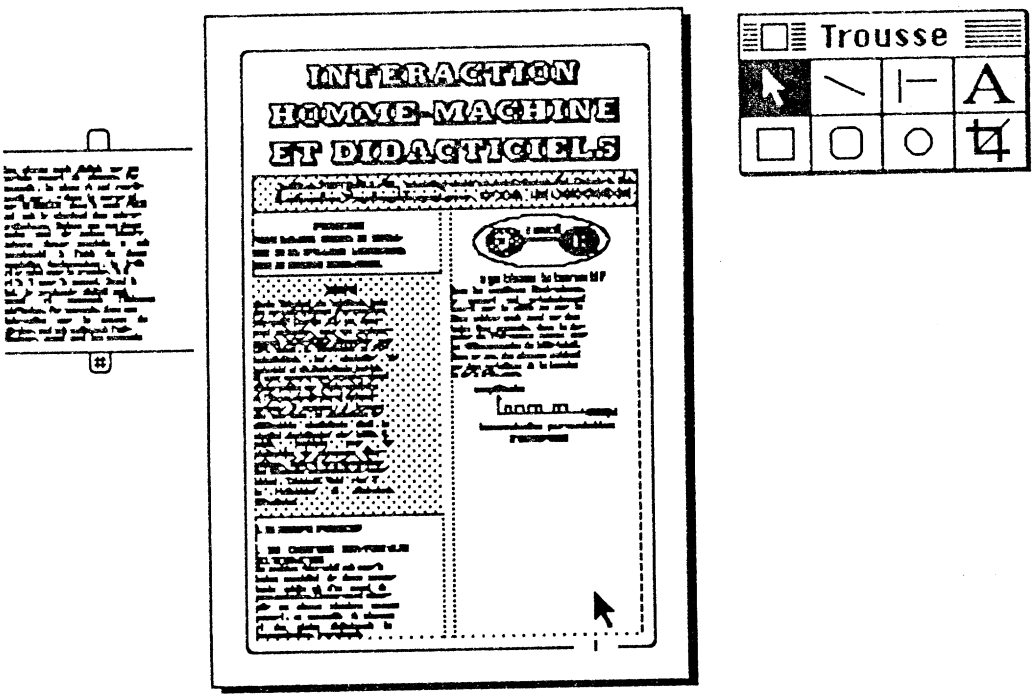
EDUCATIONAL APPLICATIONS

Obvious but especially useful for essay, so for students over 15-16 years old.

IV. PAGE MAKER

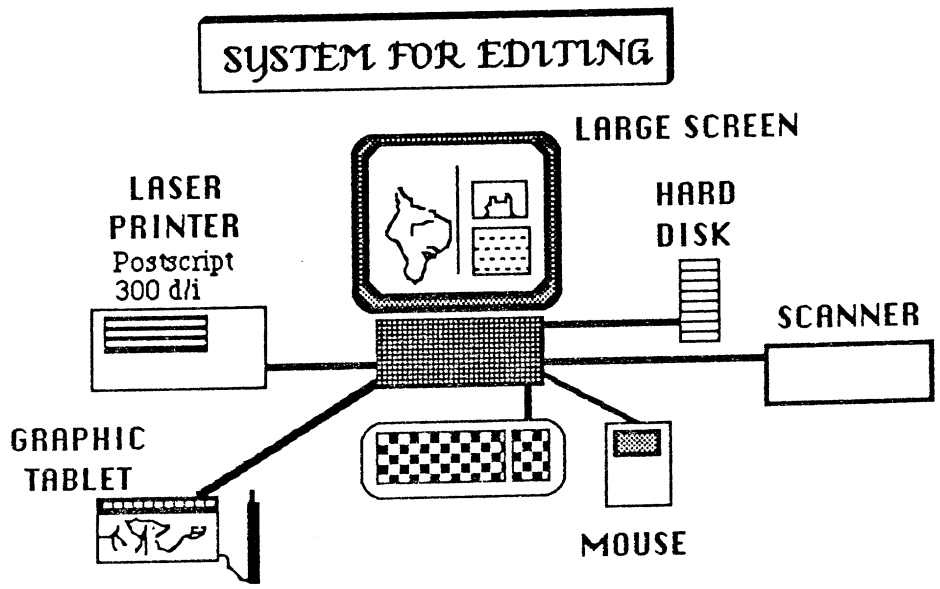
Some software (Page Maker, Ready Set Go, Ventura, etc) allows to build paste-up like model maker does. The different documents to placed are paste on a page. This following captured screen shows the conditions of work :

"Trousse" is the toolbox. The documents made with a spreadsheet, a paint or other software are place on the right or the left, prepared and placed.



V. EDITING FOR TEACHERS

What part of his work spend a teacher to produce documents for his classes ? The following diagram shows the different components of an editing system :



The present scanners can digitize pictures and, using pattern recognition, read written documents.

The graphics tablet is useful to digitize drawings or to make copy of map.

Present cost of such system is around US$ 15'000.

VI. FROM MANUSCRIPT TO COMPUSCRIPT

What are the effects due to the move from manuscript to compuscript ? First of all, let us say that the objective is not to use electronical data processing for everything but to introduce it if there is obvious advantages.

The fundamental distinction between manuscript and compuscript is the possibility to divide the work on the form and on the content. For instance, when we write a text by hand, we have to take in account what we want to say and the way to say it (new line, new paragraph, type of characters, etc). Handwriting is a **sequential** procedure. But using a computer allows **direct access** to the form and the content. So the way to produce text is qualitatively different. For instance, making compuscript starts by writing the main ideas and facts the way they come to your mind. Then you structure them and, so at the end of that step, you work on the form (spelling, punctuation, fonts, formats of paragraphs, adding chart or diagram, etc).

So the move from manuscript to compuscript implies the move from sequential to direct access. The new ability given by must have effects on the methodologies used for teaching. Without a deep analyses of the fact, we may use a new tool with old strategies!

Using the tools for students, beyond the pedagogical advantages, is not matter of "luxe". The school must prepare the students to the professional life and the best way to achieve the objective is to use the same tools at school and at professional work.

VII. AGES AND TRAINING

Some pupils can use word processing from the age of 8. Basic training is around 2 hours. This allows the pupil to write, to save and to print his document.

For students around 11 years old, to produce documents with special format, to make cut-paste, to search words, to use spelling, to repaginate and place drawings, length of training is around 10 times 2 hours.

For teacher, the produce documents with special format, length of training is around 5 times 2 hours plus personal practice. All together 20 hours. For proficiency, 20 hours more.

To use an ideas processing software knowing a word processing, 4 hours are needed.

To use a Page Maker software knowing a word processing, 10 hours are needed.

* * * * * * * * *

COMPUTER APPLICATION IN EDUCATION

A PROGRAMME ORGANIZED BY

THE NATIONAL COMPUTER CENTER OF IRAQ

UNESCO/ROSTAS and ESCWA

15-22 NOVEMBER 1987
BAGHDAD, IRAQ

LECTURE

L O G O ACTIVITIES

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 CHENE-BOURG (Switzerland)

LOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOGLOGOL

LOGO

LOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOLOGOGLOGOL

I. LOGO, A INITIATION' TOOLS FOR ALL AGES

1. A language that is worth an exploring

We often hear said about LOGO : "LOGO oh yes, the small turtle... It's for kids!". Unfortunately, many people make a confusion between childish and simple. In 1981, having got by change a LOGO floppy disk as well a succinct manual, I began to discover this language. I realized with amazement all the following facts :

1) The LOGO turtle has nothing in common with the tartaruca, the Latin name of turtle derived from the infernal beast of Tartare. She is very docile and allows, during the first without variable working phase, to understand the basic language's structure. Superb graphical representations are carried out with the simple command REPEAT.

2) The calculation commands used with numerical variables allows the resolution of many problems of arithmetic.

3) The commands DOT, FPOS, XCOR and YCOR, used with the means quoted above give access to the Analytical Geometry and to point by point graphs.

3) The lists and their particular commands permit an easy manipulation of sentences (list of words), of text (list of sentences) and thus of the procedures themselves.

5) Some commands are analogues to the PEEK and POKE in BASIC. Thus one has accesses to the RAM.

6) The P-lists exist and one can build small expert systems for knowledge processing.

7) Music is available through the use of simple commands.

8) And many etc....

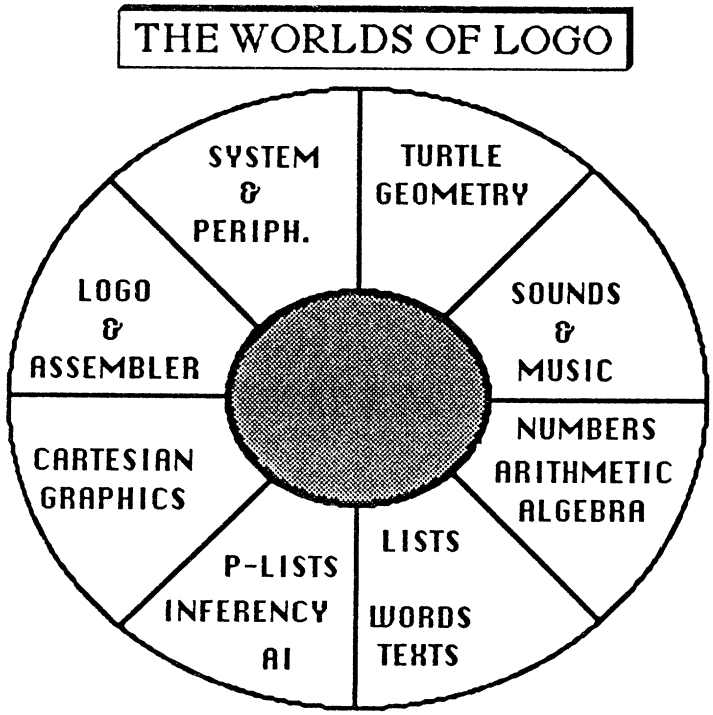
Thus, I was persuaded that LOGO was a complete programming environment and an adequate language for the initiation for adults (Computer literacy), even adults getting training in management computer sciences (programmer analyst). LOGO gets the double aspect to be an easy initiation language and a complete procedural language, it is belonging to the LISP family. In this case, we can imagine the learning of the basic knowledge of programming on LOGO. And then, it will be easier to create macro-commands in software like FRAMEWORK or SYMPHONY.

I proposed to open LOGO classes to an important institute for adult education and to accept children from the age of 9. An analyses of the participants composition shows that the two sexes were almost equally represented, that the age varied between 8 to 68 years (a retired professor of mathematic still having some difficulties with right and left), that some parents come with their children; occupation status varied from housewife to experienced programmer not to mention secretaries, teachers, etc.

2. A learning that considerates the different backgrounds : the workshop structure

To initiate people of such varied ages, motivations and education, there was only one possible way : to organize a workshop. At the outset every one received informations in order to be able to use an Apple II computer. And then, people working by team of two on personal project. Sometimes, a team was short of ideas. i suggested to get a hint in going around and seeing what their fellow students were doing. I developed also some projects, some with procedures ready to use.

II. PRESENTATION OF LOGO



1. LOGO IS A PROGRAMMING LANGUAGE

It is composed of around 250 commands named primitives. A procedure defined is used by giving its name, so like a command. To make a distinction between the commands and the procedures, the first are named primitives.

These primitives can act on :

- SYTEM to use peripherals (disk, mouse, screen, etc.).
- NUMERIC OBJECTS

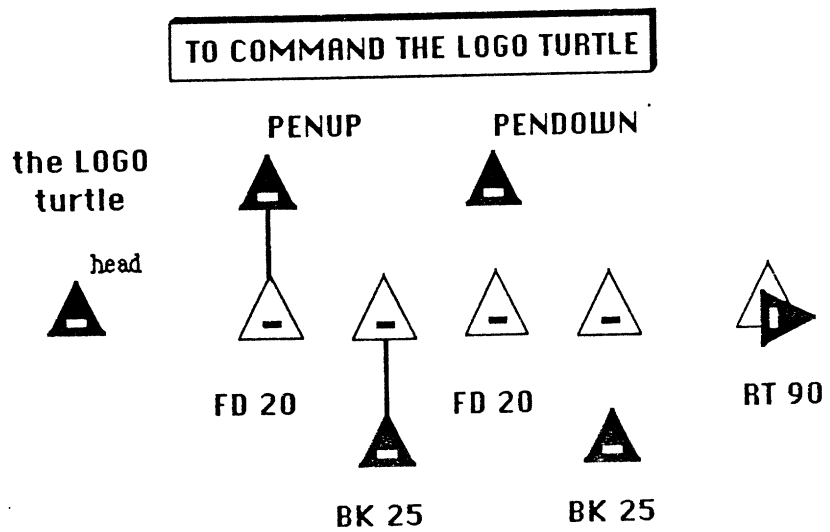
```
To Fact :Num
If LessP :Num 1 [OP 1]
OP Product :Num Fact :Num - 1
End
? print Fact 4
24
? print Fact 12
479001600
? print Fact 0
1
```

- SYMBOLIC OBJECTS

```
To Plural :Word
If EqualP Last :Word "Y [OP Word ButLast :Word "IES]
OP Word :Word "S
End
? print plural "cat
catS
? print plural "bunny
bunnIES
```

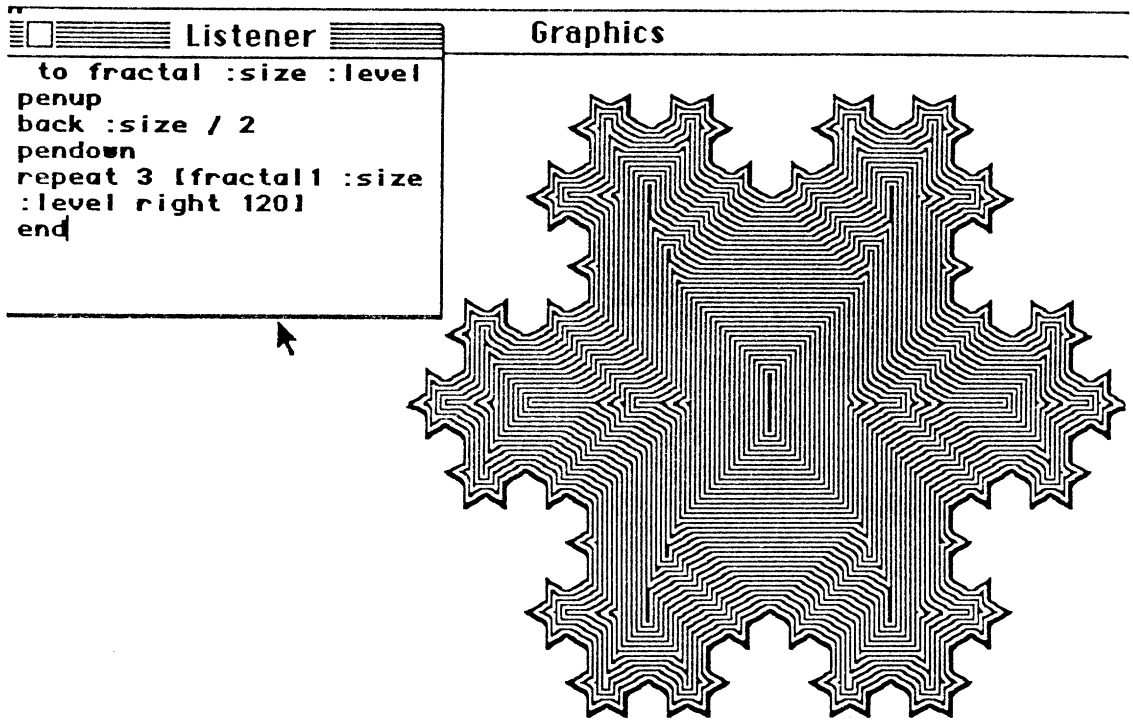
- THE TURTLE

The turtle is a cybernetic animal commanded through words.



Some LOGO gets many turtles to command on the same time. We can see that each turtle is able to move, to change its orientation, to use tools (pens of different colors, rubber).

Using the recursion, we may easily produce fractals.



The qualities of that programming language are :

- The interactivity.
- The recursion. There is no GOTO command.
- The procedural structure with parameters.

  A program is a set of procedures, each starts with the words TO and ends with END.
- The symbolic manipulation.
- The ability to act on the defined procedures.
- The interpretation or the compilation.
- The following structure of datas : scalar, list, p-list, array.

To sum-up, it is a language :

- coming from LISP but with a simplified syntax.
- procedural like PASCAL but a procedure is an autonomous object that can be used alone.
- interpreted like BASIC.
- extensive (shell) like LISP.

2. HARDWARE AND SOFTWARE FOR LOGO

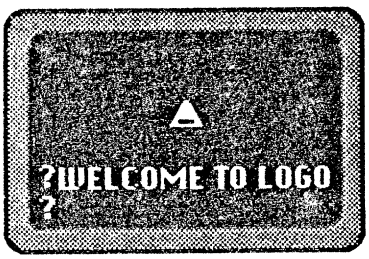
LOGO softwares are running on the following computers:

- IBM-pc (IBM-LOGO, LCSI-LOGO, LOGOWRITER).
- Apple IIe, IIc and GS (Apple-LOGO, LCSI-LOGO, LOGOWRITER).

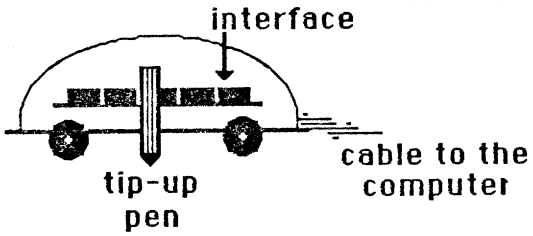
- C64.
- Macintosh (LCSI-LOGO, MacLOGO, ExperLOGO, Object LOGO).
- Philips MSX (LOGOWRITER).

There are versions in many languages.

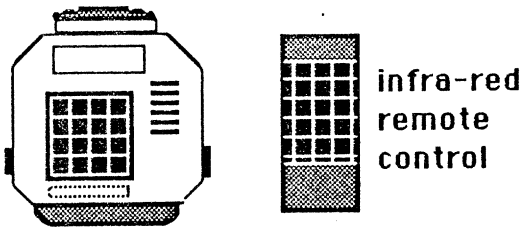
Different factories are producing LOGO-kits.



THE SCREEN TURTLE



THE GROUND TURTLE



EDUCATIVE DRAWER ROBOT

Some others developed interfaces to control robot. These kits have educational applications for youngsters and for students in robotics.

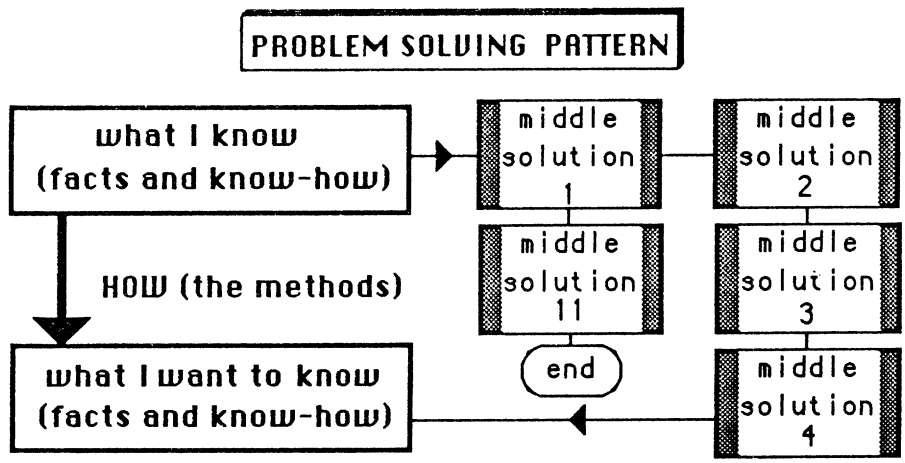
3. LOGO IS ALSO A METHODOLOGY

LOGO is born from an important experiments and discussions on the relation man-computer. We can sum-up by this question : in the relation man-computer, who is programming who ? With another words, must the computer to adapt to man or man to computer. This question has of course educational effects. A group of people in the MIT have been working from 1958 on that field and the first LOGO software were running on a computer PDP-11 in 1960. The name LOGO has nothing to do with turtle geometry but comes from the Greek word logos meaning words and speech. The basic idea was to produce a set a word - the commands or the primitives - to handle objects (characters, words, sentences, numbers, properties, geometrical sets, etc). This in the same way we are doing in the daily life. For instance, a child takes a cube, analyses its properties and then uses it to build a more complex structure, a set of cubes. After this first step, he can manipulate the more complex structure to build another ones. And so on. The method is to understand something by itself in order to use it in a more complex environment. An other idea comes from the fact that every learning process starts with a phase of tests to

understand the properties and ends with a phase of drill to make automatic the behavior. That way, one can work with LOGO in a direct way and a procedural way.

The primitives of LOGO have been chosen to handle different objects in order to practice problem solving. We can use LOGO from the age of 6 with a ground turtle to adults in order to learn differential calculus, adventure games with properties and grammatical or lexical properties. In this way, LOGO is only a medium to learn other subjects like mother tongue, mathematic, physics, etc.

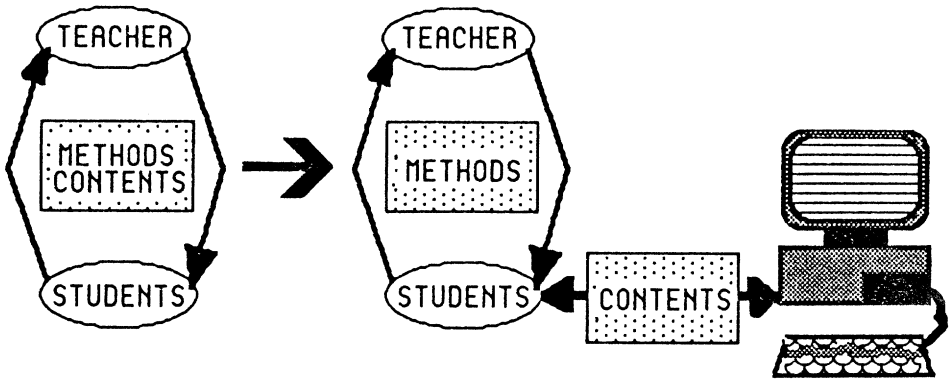
The introduction of a computer have effects on the way to teach. To create workshop is way to individualize teaching. The students are learning with the interaction to the computer. The contents to learn are defined as goals to reach by problem solving. The teacher does not bring the knowledge but guide the students to discover it by try-error process.



The students are active in the learning process. For instance, a team after discussion decided that to draw an equilateral triangle, the turtle have to turn by an angle of 60 degrees. They can evaluate this hypothesis by running a command on the LOGO turtle. This will demonstrate that their hypothesis was wrong. So they have learned something and they must find out an other hypothesis. And so on.

The teachers also helps the students to describe their problems and creates a relationship based on the socratic methods. This way of learning takes of course much more time but the knowledges are not built by imitation but by assimilation, according to the J. PIAGET's researches. The LOGO methodology is a way to change the position of the student : instead to be teached, he is teaching a computer how to reach a specified objective. To get this, he has to give to the machine datas and algorithms.

THE CHANGE FROM A BINARY TO A TERTIARY RELATIONSHIP



The way of teaching is the one of present time because today, for instance,we do not employ an engineer to make calculations - there is computer that does it quicker - but to define the problem and to propose the solving methods! The coming of the computer implies a change in the relation between man and its work. The change in the educational methods is only the adaptation to the change in the society!

III. LOGO ACTIVITIES

According to the different experiments, it is possible to define the following list with the relation age-contents.

AGE	ACTIVITIES	SPECIFICATIONS
From 5	To pilot a turtle through a special keyboard	Exploration in the immediate mode.
	The ground turtle is very useful	The reactions of the computer must be concrete and immediate.
6-7	To pilot the turtle with words	Lateralization.
8-9	LOGO for calculations and geometry	To develop the expression. What to say and how to say. Decentration (me not= turtle). To anticipate and to check : foreseen and made
9-10	LOGO for coordinates and actions on words	LOGO is an interface to the world and actions are words made through words.
10-11	To define procedures	**Visual flight rules**
- - -	- - - - - - - - - - - - - - -	Start of the formal stage - -
12	To define nested procedures	

	To define procedures with variables	To develop the hypothesis-inference method of
13-15	To use flow control	reasoning.
	Programming (numbers, words)	The reactions of the computer
	Robotics	may be postponed and formal
	Adventure game	To develop the conception
		The distinction between the
		syntactic and semantic level.
	Artificial intelligence	**Instruments flight rules**
adult		

IV. BIBLIOGRAPHY

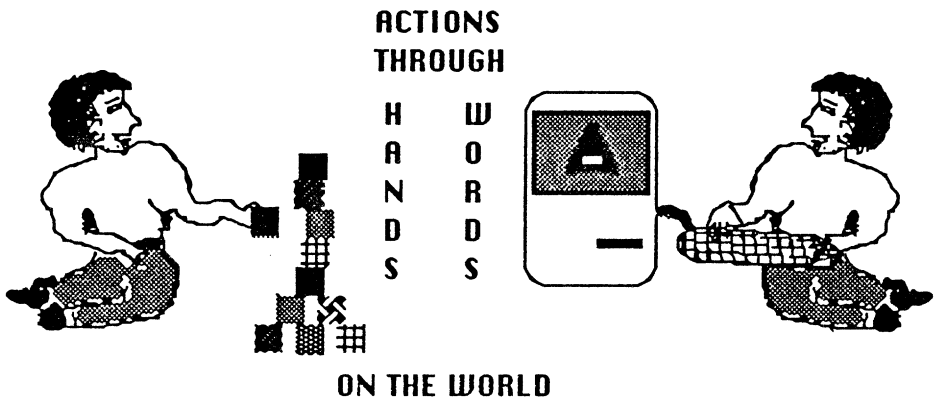
1. Mindstorms, children, computers and powerful ideas, S. PAPERT, Basic Books (New York), 1980.

2. The Turtle Geometry, H. ABELSON & A. diSESSA, The MIT Press, 1980.

3. Artificial Intelligence, Making the machines "think", N. GRAHAM, Tab Books, ISBN 0-8306-1076-6. Many exercises made with LISP but easy to move to LOGO.

* * * * * * * * * * * * * *

LOGO INTERFACE TO THE WORLD



LOGO PROJECT

JF

TITEL OF THE PROJECT : .....

AUTHORS'NAMES : .....

START ON : ..... END ON : .....

PROJECT DESCRIPTION (SENTENCES, DRAWINGS, etc)

PROJECT SOLVING (SENTENCES, ALGORITHM, DRAWINGS; etc)

ALREADY MADE PROCEDURES CAN BE USED :

IS ON THE DISK : ..... UNDER THE NAME : .....

HOW TO USE :

1) LISTING ☐ 2) DISK ☐

3) FLOWCHART ☐ 4) DRAWING ☐

COMPUTER APPLICATION IN EDUCATION

A PROGRAMME ORGANIZED BY

THE NATIONAL COMPUTER CENTER OF IRAQ

UNESCO/ROSTAS and ESCWA

15-22 NOVEMBER 1987
BAGHDAD, IRAQ

LECTURE

SYLLABUS CONFERENCE PAPER : INTRODUCTION TO INFORMATICS, AN EDUCATIONAL APPROACH TO A SYLLABUS FOR MIDDLE SCHOOL

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 CHENE-BOURG (Switzerland)

Informatics in Elementary Education
J.D. Tinsley and E.D. Tagg (eds.)
Elsevier Science Publishers B.V. (North-Holland)

INTRODUCTION TO INFORMATICS: AN EDUCATIONAL APPROACH TO A SYLLABUS FOR MIDDLE SCHOOL

Julien Fonjallaz

Cycle d'Orientation de l'Enseignement Secondaire
Centre de Recherches Psychopédagogiques
Geneva, Switzerland

For younger pupils and for a generalized initiation to informatics, a set of factors is imposed. To avoid passive consumers of informatics, one must look forward to create a comprehensive approach. Consequently, the educational strategy must amplify human potentiality (autonomy, creativity, communication abilities) and favour a good social use of this new technology for information processing.

This paper shows the global concept of teaching this introduction in a comprehensive school (12 - 15), and then focuses on the part relevant to the conference field. Up to now trials have been carried out in optional classes but experiments on a larger scale are about to start involving all pupils.

"The less we are taught, the more we learn"

An anonymous pupil

INTRODUCTION

The fast expanding invention of the microcomputer is the main factor making this introduction necessary. Using a micro becomes commonplace. Who would have thought, seeing these strange people driving their frightening automobiles in the beginning of the century, that now everybody would use a car. For micros, more than their fabulous technology, their accessibility is incredible. The image of strange people operating on mysterious machines is over. Deliberately, economical and political factors will not be treated.

The introduction to informatics will bring new means:

- for the pupils (methods of resolution, tools for calculations, texts and images processing, etc.)
- for the teachers (like the pupils PLUS a new pedagogical means).

This introduction will bring a new and rich pedagogical means. It brings the best hopes as did the audio-visual means. Our educational strategy must include this potentiality. To avoid the audio-visual poor assessment, we realize that the importance is not to bring computers into the classroom but to train teachers. A syllabus must link all these aspects. Teachers need multimedia abilities.

We can see it is impossible to brighten up the educational contents but it is necessary to imagine and improve a new educational approach. Pupils, parents, teachers and school systems are concerned.

The important problems and the basic conditions of success will be briefly explained:

1) For the pupils: what is known about cognition shows that, around the age of 12, children go from the concrete operations stage to formal operations stage (1). In computer science, one faces the problem of manipulating variable quantities. These variables have a mnemonic and a value. The comprehension of the notion "variable", the fundamental distinction between the variable's symbol (signifiant) and the variable's value (signifié), belong to the formal operation stage abilities. That implies an appropriate educational strategy otherwise the learning process stops. Support classes will be necessary. Many benefits, for instance in learning mathematics, will be brought by that successful acquisition. Another condition is to give access to an EDP workshop, under a teacher's supervision, outside normal classes.

2) For the parents: first, much information and then evening classes. A Parent School exists already. It allows the parents to follow the same courses as their children in order to help them out and to help their own self-training. This year, a course named "L'enfant, l'école et l'ordinateur" has started.

3) For the teachers: to favour interdisciplinarity, informatics will be taught by other subject teachers. To reach this objective, important training is necessary. This way informatics will not be only for scientific teachers. Two courses: the first one for those who will teach informatics, the second for those who will use computers as a new educational means.

4) For the school system: to assure training resources and experiments, in order to integrate informatics among other educational means, the school system must adopt a general policy.

THE GENEVA STATE EDUCATIONAL SYSTEM

A short survey shows which is the population involved. Compulsory school attendance goes from 7 to 15 years old. It is split in a primary cycle of 6 years and in a lower secondary cycle of 3 years which is subdivided into sections (scientific, latin, modern, general). This school is named "Cycle d'Orientation" (Comprehensive School) because possibilities are given or imposed to change sections according to performances. According to the section followed, it may open or close opportunities: either follow up in a higher secondary school or a full time apprenticeship. So there are different curricula for some subjects in the different sections. To belong to one section or another depends mainly on the difficulties in formal operations and in verbal communication. As our hypothesis is that the introduction to informatics should reduce these difficulties, this syllabus is constructed for all pupils. This will be one of the main points to check.

CONCEPT OF INTRODUCING INFORMATICS TEACHING

1) Our ten years experiment

From the year 1974, an adaptation of teaching materials, named Computer Education in Schools (CES) and made by ICL, is taught. Around 500 pupils followed this optional class and about ten teachers got a special formation. The main points were:

- to understand computers uses by survey and visit.
- to understand information processing by programming in a language having an Assembler logic. Works were made in batch with cards. Pupils got personal access to the computer.

2) Our present objectives

They come from that first experience and take into account the following facts:

- the easier access due to micros.
- the help of elaboration processes in the cognitive field.
- the importance of not learning a language but programming methods.
- the management of the double status of informatics either as a means of teaching or an object of teaching.
- the favouring of a real interdisciplinarity.

These objectives have to make the pupils able to:

- understand informatics like a tool for problem-structuring/solving.
- understand applications of informatics in other subjects.
- make out the importance and the value of informatics in society.

To carry out these general objectives, a set of 5 learning modules have been created. Three are obligatory and two optional. These modules assure a continuous training.

3) Obligatory modules

First Module: using a micro

In our 7th grade, pupils are 12 years old.
Ten two hours classes.
To reach this objective, practical studying of a language having these following properties (2)

Features	Educational grounds
- interactive	to allow an heuristic approach: attempts, errors, discoveries*
- procedural	decomposition of the problem solved at a specific level.
- algorithmic	description of action sequences
- symbolic	formal manipulation.

The language will be LOGO.

At the end of the module, pupils must be able to:

- use alone software organized in a menu.
- realize limited projects following their own interest or according to their teacher's recommendations.

These abilities allow Computer Aided Learning and integration in other subjects.

---

* It means that errors are a natural part of a learning process. The question is not to give guilty feelings but to give working methods and "debugging" knowledge (3).

Second Module: understanding the system structure

In our 8th grade, pupils are 13 years old.
Ten two hours classes.
This objective will be reached by:

- the study of the system configuration, a computer + devices
- the functional description of the devices.
- the notions of network, remote or local processing.

At the end of the module, pupils must be able to:

- identify the different parts of a system and describe their function.
- explain in a critical point of view the different ways to use information processing. They will be aware of potential misuses.

Third Module: exploiting a computer

In our 9th grade, pupils are 14 years old.
Fourteen two hours classes.

At the end of this module, pupils must be able to:

- realize the influence of informatics on the working methods in professional and private life.
- use general public applications.
- know their civil rights about information processing.

4) Optional Modules

One may start after completing the first module.

Fourth Module: understanding of the computer's functioning

To satisfy the pupils' curiosity over the general laws of the computer's functioning, we propose the study a language closer to the working logic of the computer than the human way of thinking. That implies a language like ASSEMBLER simple enough to be understood, and having the following properties:

- a small set of instructions
- a single accumulator
- memory and operation codes made by mnemonics.

Moreover, the functional analysis of an operating system is taught to understand the general information flow.

Fifth Module: operating his own computer

To allow pupils the best use of their computer
The program will be according to their needs.

DESCRIPTION BY OPERATIONAL OBJECTIVES

1) The method

The modular decomposition of the general objectives describing the concept is still used in the analysis of the operational objectives. Every module is split up into sequences of operations, forming steps. Every step is ended by the description of abilities reached by the pupils. This way, a better control of the learning process is possible both for the pupil and the teacher. Due to a lack of space, only the first module will be described.

2) First Module: using a computer

Step 1: A short introduction to operate the micro

1) Micro-system display
2) Starting/ending
3) Running an existing program
4) Presentation and use of the keyboard, control keys, editing commands
5) Presentation of the six basic commands of the TURTLE geometry.

At the end of this step, a pupil must be able to:

- start and end, in safe conditions, the micro-system
- show its elements and explain their function
- run an already made program
- run commands in prompt mode
- distinguish the simple commands from the parameter commands
- understand the language restrictions when giving orders.

Step 2: Programming

1) Notion of command sequences, procedures. A program is defined as a nest of procedures
2) Editing and running simple procedures
3) Saving and re-using his work
4) Notion of prompt mode and procedural* mode.

At the end of this step, a pupil must be able to:

- create a sequence of orders, edit it in a procedure
- run his procedures
- make a program by nesting procedures
- save his work on a floppy disk
- distinguish prompt and prodedural* mode.

Step 3: Operators - Operands

1) Presentation of arithmetic, logic, list operators and their syntax
2) Use of operators for constant operand
3) Notion of variable and value
4) Notion of link:
   - between a variable and its value
   - between variables
5) Presentation and use of input/output procedures.

---

* A command sequence is defined in a procedure and then run

At the end of this step, a pupil must be able to:

- understand the notions of operator and operand, and distinguish the action from the object affected
- use operators over constant operands
- make the transition to variables and distinguish the mnemonic of variable from its value
- give a value to a variable:

  a) by assignment
  b) by link between variables
  c) by acceptation

- have access to the value of a variable by display

Step 4: Work Structure

1) Procedures with parameters, functions
2) Nesting procedures
3) How to use a library of procedures

At the end of this step, pupils must be able to:

- understand the causality between using variable operands in a procedure and the necessity to parameterise it
- use procedures with parameters
- use functions
- understand the distinction between a procedure and a function (one returns a value but not the other) and see that they are made the same way
- break up a task into a set of easy problems realized by procedures
- make a program by nesting procedures so that every step is made and run separately
- use recursion

Step 5: Communications man/computer/man

Making or/and using package (program + documentation)

At the end of this step, pupils must be able to:

- know how to documentate their own program in order to use and maintain it
- communicate their programs with a documentation
- use a package knowing how to extract from its documentation what is necessary to be able to run it.

Remarks: programs will be made in geometry (4), arithmetic and word processing. The importance is to show that informatics is not only to make calculations.

CONCLUDING REMARKS

A top-down analysis has been used from the general motives to pupils' activities described in detail. Before setting the official syllabus and producing teaching materials, an experiment is necessary. We will find out if cognitive difficulties are solved and if our syllabus is clear enough to be taught even by non specialist teachers. One realizes that introduction to informatics interferes in:

- the cognition
- the working methods
- the communication abilities

for both teachers and pupils and it is not easy to handle all the side effects.

Experiments made in optional classes allow us to be optimistic. Pupils are open minded. It is easier to acquire a new way of thinking than to change an old one. That is why it is most important to find a strategy interesting to teachers. We do not mean those who already have a computer but those for whom informatics may be beautiful - but only for other people. We do not have to persuade these teachers to become informaticians but to use informatics as a new pedagogical means. This way the introduction will be successful and a poor assessment of audiovisual means will be avoided. We are faced with a new tutorial function.

A question to end with: why do we have to teach programming nowadays? It is possible to find a lot of software which runs with simple command statements. This way of using computers will increase. We think that the answer doesn't belong within Informatics. It is a social problem arising from the fact that in every school system selection is based mainly on two abilities:

- formal skills
- verbal communication.

Teaching programing, in a real educational approach is an excellent medium for increasing these abilities. This way, Informatics might be the Latin of modern times.

REFERENCES

(1) Piaget Jean, La naissance de l'intelligence chez l'enfant (Delachaux et Niestlē)

(2) Papert Seymour, Mindstorms: Children, computers, and powerful ideas (Basic Books)

(3) Sleeman and Brown, Intelligent Tutoring Systems (Academic Press)

(4) Abelson and diSessa, Turtle Geometry (MIT Press)

COMPUTER APPLICATION IN EDUCATION

A PROGRAMME ORGANIZED BY

THE NATIONAL COMPUTER CENTER OF IRAQ

UNESCO/ROSTAS and ESCWA

15-22 NOVEMBER 1987
BAGHDAD, IRAQ

WORKSHOP

A CHECK-LIST FOR

A CURRICULUM CONFERENCE

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 CHENE-BOURG (Switzerland)

JF/WORKSHOP

A CHECK-LIST FOR CURRICULUM CONFERENCE

COMPOSITION OF THE CURRICULUM CONFERENCE :

A. FINALITIES

OBJECTIVES	DESCRIPTIONS	PEDAGOGICAL NOTICES

B. POPULATION INVOLVED AND SCHOOL STRUCTURE

DATA ON STUDENTS	DATA ON TEACHERS AND TEACHER TRAINING ABILITY	DATA ON SCHOOL

OBJECTIVES	DESCRIPTIONS	PEDAGOGICAL NOTICES
C. GENERAL OBJECTIVES		

OBJECTIVES	DESCRIPTIONS	PEDAGOGICAL NOTICES
D. OPERATIONAL OBJECTIVES		

OBJECTIVES	DESCRIPTIONS	PEDAGOGICAL NOTICES
E. TEACHER TRAINING		

OBJECTIVES	DESCRIPTIONS	PEDAGOGICAL NOTICES
F. DIDACTICAL MEANS AND SOFTWARES		
G. HARDWARE		

COMPUTER APPLICATION IN EDUCATION

A PROGRAMME ORGANIZED BY

THE NATIONAL COMPUTER CENTER OF IRAQ

UNESCO/ROSTAS and ESCWA

15-22 NOVEMBER 1987
BAGHDAD, IRAQ

LECTURE

INFORMATION TECHNOLOGY IN SECONDARY SCHOOLS PAPER 1 : INTEGRATION OF INFORMATICS

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 CHENE-BOURG (Switzerland)

1.2. A program that can be set up quickly thanks to a policy of ongoing research

This project integrates various forms of New Information Technologies (NIT) and is based on ten years of experience including the creation of optional courses (starting in early 1975 with pupils working with cards in batch processing) and other research in computer-based learning. The experience accumulated together with study of the development of NIT (especially the emergence of micro-computers) has permitted the creation, in few months, of a plan integrating a complete pedagogical concept, the procedure for training teaching staff and the purchase of the equipment (hardware and software).

1.3. General orientations : problems and their solutions

This article will describe both the problems encountered and the strategies developed with respect to the different participants in this project. These are the pupils, the teachers, administrative and governmental authorities in the Dept. of Education as well as the parents (represented by their organizations).

First of all, we were faced with the question, from what point of view should we undertake an introduction to informatics ? Should we trim it to the requirements of working life to the needs of the economy ? Which pupils are we trying to reach ? Should we try to narrow the gap, which to some extent corresponds to the generation gap, existing between present users of NIT and everyone else ? NIT is steadily expanding throughout society and its growing influence necessitates a policy of offering a comprehensive knowledge of informatics to all those who attend our schools. And we should not forget the fact that, in Geneva, two thirds of the population are working in the fields of services.

1.3.1. The first problem : informatics as an object, a tool or a mean ?

The numerous links between NIT and education raise the question of whether an introduction to informatics should be offered as an object (a separate subject), as a tool or as a mean to an educational end. Regardless of the potential qualities of computers the fact remains that, for the present, there is not enough courseware to introduce informatics as a teaching aid. Indeed, what is the use of equipping schools if the equipment is not used due to a lack of appropriate software ? Moreover, it would be naive to think that the more presence of this equipment, plus cursory training in its use, would enable teachers to offer quality instruction.

1.3.2. The second problem : "club" versus large diffusion ?

According to the choice, the teacher training, the syllabus change. Particularly, for the "club" option, we need only distribute equipment (hardware and software) and we leave the rest on autodidact teachers. The teachers are mainly mathematicians, the pupils activities BASIC programming. Like this, less than 5 % of the pupils and the teachers are involved. It would be only the extension of what is going on at present. Low cost but for what result ? To keep the know-how associated to informatics in the hand of a very small group.

1.3.3. The third problem : computer sciences versus computer literacy ?

The answer is less obvious for secondary school then for primary school. The teacher's qualifications and the pressure from the post compulsory school would tend to privilege the computer sciences option. But, if we want a large diffusion, we must understand that formal algorithmic is impossible at this level.

1.3.4. The strategic choices

According to the general problems, different choices have different effects on teacher training, the syllabus, the quantity and the quality of the equipment, the number of pupils and teachers involved, the tempo of integration, the side effects on others disciplines. And of course, on the costs too.

Due to a lack of educational software, the first strategic choice was the introduction of informatics as an independent subject including information as an object and tool-based computing. It was not a question of eliminating informatics as a mean but rather of establishing a priority between the two possibilities. A complete and effective introduction, with part of the staff trained to teach it, would, we feel, be the best way to train teachers to be also able to produce educational software.

The second choice was to assure a large diffusion of Informatics and New Information Technologies in order to offer to every pupil and teacher the knowledge that could amplify their human abilities. That is why, for the third choice, computer literacy will be compulsory and computer sciences will be offered in optional classes as a complement.

1.4. The structure of this article

Sequentially, it reflects the concerns as they were dealt with. Within the frame of the strategic choices, the first priority is to develop a thorough pedagogical concept defining the abilities that pupils must develop. This obviously necessitates a definition both of the content and the appropriate methodology required. Only then can one determine the qualities desirable in the teachers concerned. After defining the activities of the pupils as well as the selection of suitable instructors we took up the problems of establishing a timetable for the installation of the equipment, its configuration and the type of micro-systems required and the software needed.

2. The pupils' syllabus

2.1. What is the content of the computer literacy

Broadly speaking these courses should enable pupils to :

- understand and use informatics as a tool in problem solving;
- know and make use of its applications in everyday life, and not just at school;
- appreciate the significance of informatics role in society and have a point of view on its use (1).

2.2. Organizing the syllabus and structuring the class

The syllabus breaks down into three modules. The existing optional courses will remain and their content adapted (two modules to go further in informatics from the beginning of Grade B).

To facilitate practical work this teaching will be done in smaller classes and, for more important aspects, periods lasting 2 hours. All modules are allotted the same time, two hours per week during a semester. It was felt desirable to have two pupils per micro-computer so that they can discuss the carrying out of practical tasks and decide their strategy on the basis of the machine's reactions. This policy involves having one teacher for a maximum of twelve pupils working on six micro-computers.

This division of the syllabus into modules of one per year in the Cycle d'Orientation was undertaken in order to adapt the program to the abilities and interests of the pupils which develop rapidly at that age.

2.3. The Syllabus

2.3.1. Preamble

Once the general objectives of each module defined, the syllabus was broken down into operational objectives (1) for the pupils so that the teacher can easily evaluate their work. Due to lack of space, however, you will find here only an overview.

2.3.2. The first module (Grade 7/12-13 year-olds) : LOGO

This affords a first contact with micro-computers and imparts basic notions of programming. Learning to program is viewed as an activity which can effectively mobilize the students interest and activity which can effectively mobilize the students interest and intellectual activity (cf. the works of Seymour Papert). The use of the LOGO language fosters skills useful in manipulation of formal concepts. A program is a text that obeys syntactic rules, the consequences of which (the semantic aspect), are univocal when executed. Regardless of the area concerned (texts, numbers, sounds or images) this activity trains the pupil to organize his work (by analyzing the tasks, then combining the simple procedures designed to carry them out), while perfecting programs exercises his/her hypothetico-deductive reasoning (2). This course has been placed in the 7th Grade expressly because it coincides with the cognitive development of the pupils who at this age enter the formal operations phase (cf. works of Jean Piaget).

With the knowledge thus acquired the pupil can develop personal applications or, at the request of his teachers, use it in other academic disciplines.

of a new coherence. Whilst our society is entering the information age, education will be an essential factor to prepare everybody to **master** IT and this way, IT will not imply a loss of human qualities.

REFERENCES

1) An educational approach to a syllabus. In "Informatics in Elementary Education", North-Holland (1984). Julien Fonjallaz

2) Introduction d'un cours d'initiation à l'informatique. State Departement for Education, Julien Fonjallaz (1984).

3) La programmation, moyen de (se) découvrir. In "Actes 1984 de l'AIPELF", Sherbroock, Canada. Julien Fonjallaz.

4) Banalisation ou domestication de l'informatique? In Gymnasium Helveticum. Julien Fonjallaz (2/1984).

5) Integration of IT in a secondary school. Papers in "Children in the information age", UNESCO Conference in Varna (Bulgaria), Julien Fonjallaz, Pergamon Press (1986).

6) Integration des TI : beaucoup plus que pour des motifs économiques. Congrès de l'EAO, Paris, (1986). Julien Fonjallaz.

7) Evaluation intermédiaire de l'introduction d'un cours d'informatique, State Departement for Education, (mai 1986). Julien Fonjallaz.

* * * * * * * * *

INTEGRATION OF INFORMATICS IN A SECONDARY SCHOOL (grade 7 to 9)

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 **CHENE-BOURG** (Switzerland)

Abstract

The introduction of informatics in the education seems to be a fashion or a must in many countries. Beyond the economical reasons, the best criterion of the success of this integration will be reached if informatics become a useful tool in everyday life for the main actors of school, the pupils and the teachers. So, the challenge is not to adapt man for a computer age but to prepare how to use it for a new man age.

This paper describes the choices and the means use for this integration that starts, for the pupils, in September 1985. For the preliminaries and the syllabus, see an earlier paper (1, see references at the last page).

TABLE OF CONTENTS

have to create data retrieval services some for the pupils and some for the teachers only. An other task will be to reduce administrative work for the teachers, the school authorities.

Without dreaming, we can imagine pupils and teachers working at home, in remote processing, with the school information system.

7. Conclusions :

The desire to define this process not as an introduction of the computer into the school but as the computerization of school life is something more than playing with words. Aiming for an cultural approach of informatics implies defining its philosophy. Generally speaking, this philosophy means striving to diffuse the NIT culture democratically and also to permit the acquisition of a toll that, if well used, will simplify life (one could also say enrich it) to a great extent.

Furthermore, certain endeavors based on the imposition of equipment and not on the planning of human resources have turned out to be disappointing and costly. The only way of ensuring success is to take into account all interactions between, on the one hand, NIT and education as well as, on the other, between all the participants in school life. In addition, it is necessary to follow closely the development of NIT in order to avoid introducing attitudes that go against the current or are already obsolete.

If we wish to break the program down into stages, the first of which aims, within five years, to offer to all pupils the possibility of acquiring an overview of informatics which is coherent and can be used in everyday life, we must ensure that a fifth of our teachers themselves obtain this overview. The integration of informatics as a teaching aid is a parallel development. By establishing a priority with clearly defined objectives, and others that can be defined as one goes along (since their development is difficult to foresee), we will be able to adjust. Who can foresee today what role informatics will play in the society of tomorrow ? If we do not reject this transformation, but rather deal with it little by little, we are better able to adapt to it. Though there remain many unknown factors, the integration of NIT into production and service industries requires their restructuration. Education, being a service, cannot escape from this process. But anticipating this process allow us to reduce the secondary effects by gearing it to the development of human society.

REFERENCES

1. Fonjallaz Julien, "Introduction to Informatics : an educational approach to a syllabus for middle school", in Informatics in Elementary Education, J.D. Tinsley and E.D. Tagg (North-Holland)

2. Fonjallaz Julien, "La programmation, moyen de (se) découvrir", in Les Actes du Congrès 1984 "L'ordinateur : virage ou mirage pédagogique ?" de l'Association Internationale de Pédagogie Expérimentale de Langue Française, Sherbrooke (Canada)

3. L'EDUCATIQUE, numéro 18 de "Informatique-Informations", revue du Groupe Informatique de l'Enseignement Secondaire (GIDES), Genève

* * * * * * * * * * * * * * * * * * *

COMPUTER APPLICATION IN EDUCATION

A PROGRAMME ORGANIZED BY

THE NATIONAL COMPUTER CENTER OF IRAQ

UNESCO/ROSTAS and ESCWA

15-22 NOVEMBER 1987
BAGHDAD, IRAQ

LECTURE
INFORMATION TECHNOLOGY IN SECONDARY SCHOOLS

PAPER 2 : FROM COMPUTER LITERACY TO THE SCHOLASTIC INTEGRATION OF INFORMATION TECHNOLOGY

Julien FONJALLAZ
Teachers'trainer for Primary School (Geneva),
Teacher and teachers'trainer in Secondary School (Geneva),
Assistant at the Center for Psychopedagogical Research (Geneva),
Chargé de mission for the Educational Informatics for the lower secondary level (Geneva),
Advisor for Informatics in Compulsory Schooling, Conference of Education Ministers, Bern.
39 Av. Petit-Senn, 1225 CHENE-BOURG (Switzerland)

FROM COMPUTER LITERACY TO THE SCHOLASTIC INTEGRATION OF INFORMATION TECHNOLOGY

Julien FONJALLAZ
Advisor for Informatics in Compulsory Schooling,
Conference of Cantonal Directors of Public Schooling, Bern.
P. O Box 218 1211 GENEVE 28 (Switzerland)

ABSTRACT : The initiative to introduce Informatics into the lower secondary level of the Geneva state educational system began in March 1983. The rate of introduction was adjusted to the number of trained teachers available. Therefore in September 1985, classes were started in one third of the colleges and by 1987 all 9th graders will attend a computer literacy course.

How was the initial project finally applied? Among the problems encountered: inserting the course in the student's time-table, forming the teachers scientifically and pedagogically, and developing the class material. Generally speaking, how does one go about acheaving the "computer literacy" stage and reaching the "information literacy" one, a necessary step to the full integration of Information Technology (IT) ? Moreover, what effects does this initiative have on the everyday lives of the students, the teachers and of the school in general ?

KEYWORDS : Curriculum, Teacher training, Computer literacy, side-effects, LOGO.

I. INTRODUCTION : BETWEEN INFORMATION TECHNOLOGY AND EDUCATION , A DEEP INTERACTION

An efficient integration of any new technology in a system must take into consideration the ways of life of the users in order to enable them to put their human potentials to full use. Indeed, to allow a constructive integration of IT in the schooling system, it is necessary to study the fundamental characteristics of the latter. Naturally, the specificities of the technology involved play an important role, but what really matters is how they affect Man. There is an ever-growing need for this method of integration because such a technology bears important consequences for economy, culture and education **(see ref. 1)**. Moreover, information being the support of our knowledge, IT not only will affect it, but even moreso, affect the way in which this knowledge is transmitted : that is, the scholastic institution and pedagogy. At this point, we should take into account the present evolution from the Electronic Data Processing System (EDPS) to the Knowledge Information Processing System (KIPS) **(6)**. Furthermore, we must not forget that the school Institution is a part of the tertiary economic sphere which is restructuring itself by means of IT in order to improve its productivity. So there is no reason why the schooling system should bypass this process. But does productivity mean in the field of education?

II. THE CHARACTERISTICS OF THE SCHOOL AND THE TEACHING PROFESSION

The "Cycle d'Orientation", lower secondary level, regroups all the students from grades 7 to 9 in colleges of approximately 500 students and one hundred teachers. What specificities are we to bear in mind ? First of all, teachers are specialists with a university education and are

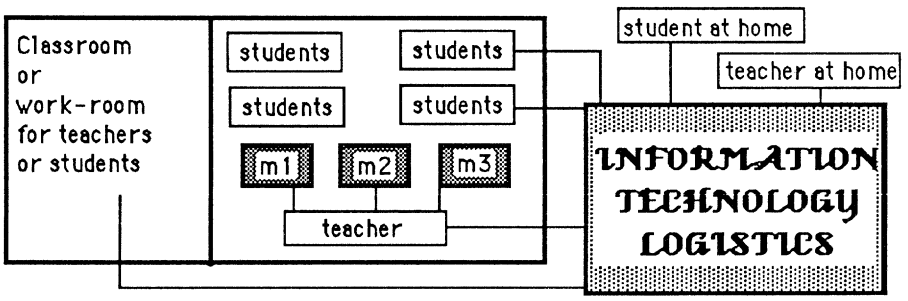
fully prepared for teaching with an extra 2 years of educational studies. Teachers of a subject form a group that organizes the working-conditions (curriculum, methodology, books). Furthermore, teachers are quite involved in their work, thus "Ready-to-teach" products are more often rejected. This is true, even for educational software which usually does not circulate outside its author's team. For this reason, the distribution of audio-visual methods is somewhat hampered. That is why, in preparing for the use of informatics as a means of education, the training will emphasise the teacher's personal investment, based on his own experience with the new material. He won't have to adapt himself to ready-to-use teaching software. The training stage will concentrate on the needs of the study-group's particular domain, so as to establish a method based on the educational uses of IT. Of course, this method is time-consuming and more expensive. However, it is of utmost importance to associate IT and education but this introduction will not be superficial by doing this way.

III. THE GENERAL QUESTIONS FOR THE IMPLEMENTATION OF IT

1. Education at school with a teacher VS at home with a personnal computer?

These are the two extremes. However certain other points must be considered. At school, you learn more than just to read and write. For instance, students are not only sensitive to the their teacher's degree of knowledge, but also to his personality. Break-time is more than just a pause in the school day. Students learn just as many things in the play-ground as they do in the class-room. So, the introduction of IT that omits these simple facts is doomed to fail. There is more to culture than just abstract knowledge. Bearing this in mind, do we just sit a student in front of a computer and then pray for some miracle ? What must we do when the novelty wears off ? Because the student will quickly become bored with the educational software of the question-answer type. To "play" with a teacher is more funny! Actually, the problem resides not only in the quality of the educational software, but also in the part it plays in a student's life. No easy answer, but two things have to be taken in account. First, the computer must not compete against the teacher and second, one must be carefully weigh the extent to which the teacher's presence is necessary.

2. Computer-aided teaching



Nowadays, despite the fact that schools are equipped with computers, very few projects consider combining computers with the familiar school teaching aids. Much is to be gained with the integration of these means, by stimulating the student and by making the lessons more attractive and efficient. Indeed, IT can be used to illustrate a point, solve a problem, simulate an experiment or retrieve information. Any teacher in any branch can use this computerized help to his advantage; however, for this help to be effective, a class needs more than just a PC and a large screen. It is necessary to have an "IT logistic" with data banks and networks. Last but not least, teachers must feel at home with the hardware and software needed. On the diagram, m1, m2, and m3 are working tools : i.e. a overhead-projector, a black-board, documents, audio-visual aids etc. It

is obvious that the goal is not to add, but to **integrate** IT. To do so, the traditional teaching aids must undergo a complete revaluation, that will allow the audio-visual to reach their full capacities.

3. The computer-aided (teacher or student)

An important part of a teacher's activity consists in manipulating information (essays, tests, exercises, grades etc.) and it would be a paradox if he didn't use IT to process his own work. Among the tasks included in the integration of IT in the school system is training teachers to use computerized tools. Does this mean : one teacher, one computer? Much more is at stake here. If a teacher uses a PC to organize data concerning his class, must he then rewrite them by hand at school? And what if students start bringing their home-work on microdisks ? Will they be obliged to rewrite their essay on paper? Students also have a lot of information to process- their school life is spent learning how to compose and recompose. So, does it mean : one student, one computer?! Lets look at this from another point of view : today, every middle-class home has a (dish)washing-machine, telephone, TV, video, etc. Twenty years ago, these were the luxeries of a happy-few! So why should a class-room be limitated to four walls, a few desks and chairs and a teacher standing in the middle? The school should be allowed to raise its standard of living **(6)**. Finally: do developed societies have a developed education because of their development, or are they developed because their education is ?

4. Logo, (computer + teacher)-aided learning

This year, I found some old math students of mine in computer-literacy course. LOGO activities - one of the various possibilities of computer-aided learning **(4)** - confronted them with basic notions such as angle, measure etc. However, despite their good grades, their difficulties revealed that they had not really grasped these notions. But through LOGO, they must explain their reasoning, step by step, in order to reach a set goal and are confronted with the results of their thoughts and actions. We can come across this LOGO approach elsewhere- maths, grammatical rules, etc. Work carried out shows that : LOGO procedures are, more often than not, elementary; the difficulties lie not in the programming, but in the comprehension of the contents to program; once this goal is reached, the acquired knowledge is more efficient. This way, learning becomes a procedure of problem-solving **(3)**. A student actually participtes and seeks out his inner knowledge- right or wrong- in a coherent way. The mistakes are neither hidden nor ignored.

5. Educational software is not always costly

Be it in class or out of class, with a teacher or alone, software such as word-processing, spreadsheets, LOGO and others, are efficient educational software. They are ready-to-use, but to be of any use, they need to be surrounded by a good pedagogical environment.

IV. WORKING TOWARDS IMPLEMENTATION (1983-1985)

How can IT be successfully implemented in education when teachers still see themselves as artisans ? But this is precisely what makes its force. We must avoid a loss of human contacts and of our cultural identity. Everything must be done to accomodate student and teacher learning.

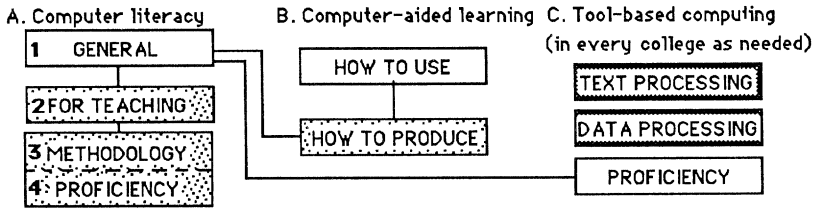
1. The original curriculum

Right from the start, the 4 following decisions were made **(5)**: (1) Of the 3 ways of the integration of informatics : object, tools and means, the first two have priority. (2) The activities proposed must concern all students. (3) Training must include the largest number possible of teachers. (4) To prove the value of IT as an assistant and as a teaching means for teachers, as well as a means of learning for the students.
The general aims **(1)** must ensure the possibility of students using the IT to reach 3 objectives : (1) To use informatics as a working-tool forproblem-solving. (2) To use informatics as an assistant in their everyday school-life. (3) To determine the use of IT in society.

This curriculum, the same for all students, is organized in 3 modules. Its content must be of an easy access to all, since the school regroups students with different academic abilities. So as to satistfy those who want to pursue their study further, 2 optional modules are foreseen to enlarge knowledge on PC and programming.
To encourage student participation, class effectives count 12 students maximum; Each module numbers 2 grouped periods per semester in every grade. Students should work two by two, learning as much from discussions with their partners as from direct contact with the PC.

The organization of the curriculum **(4)** in modules was created to adapt to students capacities and interests. The first module, in 7th grade initiates them to a functional knowledge of the PC and proposes LOGO activities as the means of studying certain subjects like maths, music and French. This about coincides with the student's development in formal skills. The 2nd module, in 8th grade, initiates children to tools such as word and graphic-processing, the spreadsheet, the dBase. The students learn how to use these tools in their everyday school-life. The 3rd module, in 9th grade, studies the implementation of IT in society and informs students of its professional and social aspects including telematics. From the 7th grade, these knowledge and know-how will allow any teacher of any subject use computer activities in his class because the students are already trained.

2. The teacher inservice training organization



This training having been delegated to recycled teachers, the Pedagogical Center organizes a specific branch. In the following diagram, each block (with the exception of the 3rd column) consists of 2 weekly hours to which we must add 2 hours of home-work. Class attendancy (spotted blocks) replaces 2 hours of teaching.

3. The creation of educational material

Studies on teaching methods have shown that even for trained teachers, the passage to the teaching of computer literacy is not easy. So, in addition to the student's text-book associated with a set of educational software, a teacher's edition has been compiled with pedagogical counselling consisting of video-tapes and booklets.

4. The choice of software

How many different word-processings, spreadsheets are there on the market ? For each one, a special study group has been created with the teachers concerned with its use. The selection was based on the 7 following criterion : (1) All software and its documentation must be in French. (2) It must be of an easy access so one can grasp the necessary information in a few minutes. (3) The orders must be short, concise and easy to memorize. (4) A subset of basic orders should be operational after 2 or 3 hours of training and allow 3/4 of the common manipulations. (5) The help information must be linked with a manipulation to allow self-learning. (6) The possibilitytransfer of data from one software to another. (7) The software should be powerful enough to enable a professional use by teachers. In this manner, teachers and students will be using the same tools and this will stimulate their mutual communications.

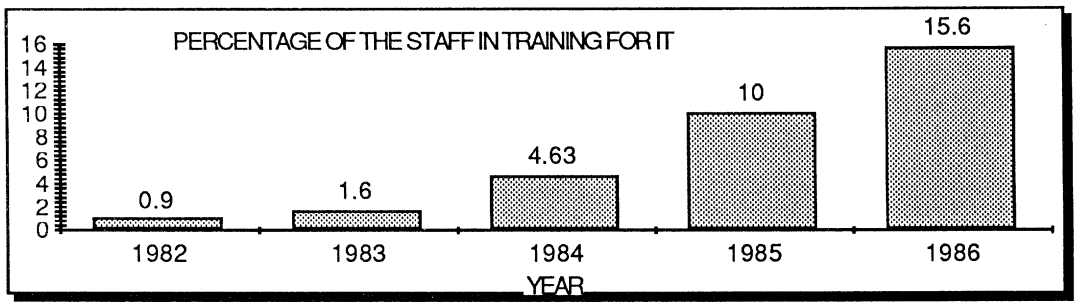
V. FIRST IMPLEMENTATION (1985-1987)

In introducing informatics as a familiar study-aid, and for it to appeal to students, the initial plan suggested a very early initiation. This sholastic approach **(5)** would furthermore prepare the students for their future social and professional lives. Unfortunately, the Department of Public Instruction restricted the introduction of the class to the 9th grade. This decision made the accomplishment of the general objectives very difficult, but we did our best with the promise that the initial curriculum **(1)** would eventually be implemented as from 1987.

1. The curriculum and its time-table

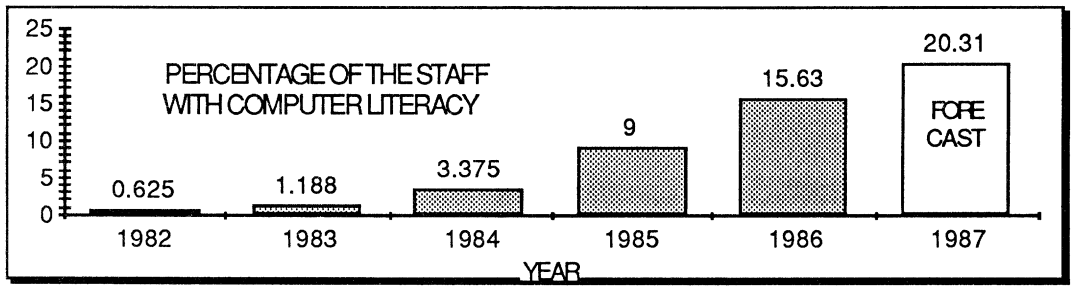
The present curriculum is only a summary of the initial one : 24 periods for LOGO and the basic information needed to use a computer, 4 periods for word-processing or spreadsheet, 8 periods for the social and professional aspects. To enter these 2 weekly periods into the 32 time-table, a few adjustments were made.

2. The present state of the teaching profession



The teaching staff manifested a great enthousiasm for computer-literacy and IT. The teacher inservice training organization was developped to cater these needs as shown in the previous diagram.

2.1. Towards a basic training



Every teacher should receive basic knowledge in 3 domains: (1) Minimum knowledge with which to operate a micro-computer. (2) Examples implementation in society. (3) Initiation to the uses of IT in the field of education. Members of the direction of every college follow it to be a able to follow this integration.

2.2 Towards the teaching of computer-literacy

This tuition takes 4 years, but already in 3rd year, teachers can give computer-literacy courses. They can then approach the educational aspects according to their own teaching experiences. The main difficulty is to train teachers to become educators of computer literacy and not computer-fanatics.

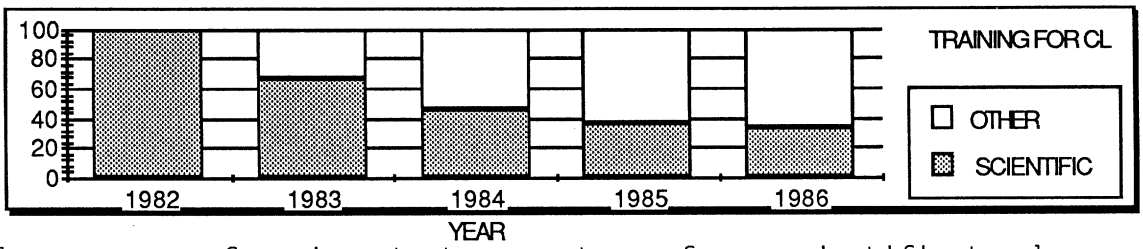
2.3 Towards computer-aided learning and computer-aided teaching

Informatics as a means of education is not the main target at this stage; stress is put on the teacher's personal assessment of experimentation,

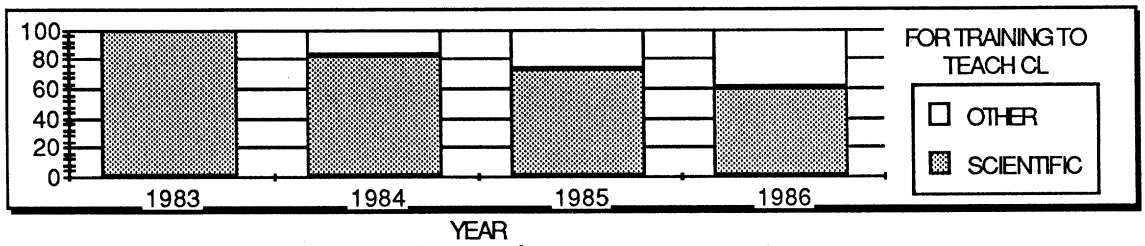
supervised by the study groups in each subject. So the debate on IT **(4)** will take place before its introduction and not after !

2.4 IT is usefull for every teacher, so no exclusion for training

Our objectives is not simply to train a certain percentage of the teachers : we want this percentage to include representatives of every subject taught within the school. Essentiel to prepare the information literacy.



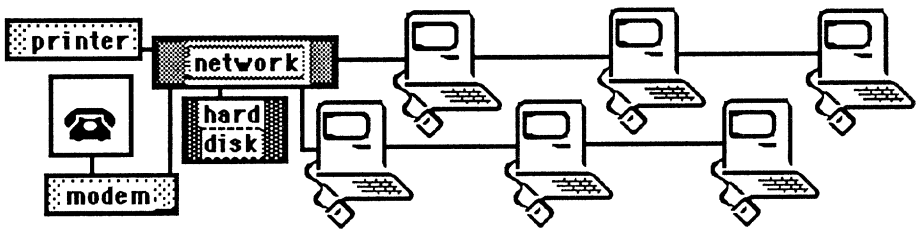
The presence of an important percentage of non scientific teachers among those who teach computer literacy , is an important factor to avoid the limitation of informatics only to the mathematical field. The fact that IT might be shared by any teacher allows its integration.



3. Assessment and project-management

From the very start, it had to be directed in concentrated groups. Despite great enthousiasm, research on the effects and cognition of informatics had to be dismissed, due to a lack of means. Here is a list of each of the subjects broached by a specific team including teachers: (1) The appropriateness of the curriculum, time-table and text-books. (2) The appropriateness of the pedagogical approaches. (3) The observation of the strategies employed by the students. (4) Can informatics be a means of retrieving failing students ?

4. Training the informatics work-shop leaders



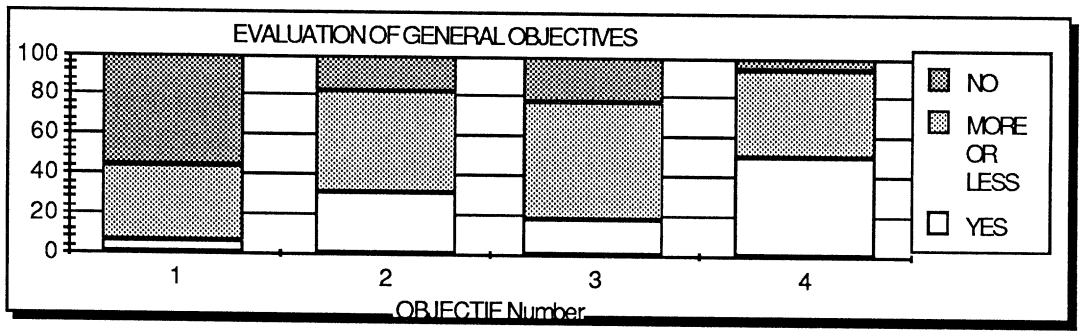
If the equipment mal-functions, it should not upset the course. To avoid this, each school should have two specially-trained teachers to check that everything is under control and to "debug" their collegues. The following diagram shows the basic equipment of every college.

5. Pedagogical and scientific teacher-aids

The first level is provided by experimented teachers, which includes 2 work-shop leaders. Seeing that most of the teachers are undergoing training themselves, the 3rd and 4th courses should approach the methodological aspects. Furthermore, part of the job of the educational team is to produce video-tapes on the pedagogical approaches and the strategies employed by students. Regular get-togethers are organized about it.

6. The first results

In February 1986, the teachers filled up a questionnaire composed in 3 parts : the first one concerned the curriculum, the 2nd: the working methods of the students and the 3rd part concentrated on the teaching methods and conditions (appraisal of the material, educational software, in-class organization, text-books, documentation)-and teachers were asked if they thought that the 4 general objectives of the course had been reached. They are : (1) The use of informatics as a tool for problem-solving. (2) The applications of informatics as an assistant in the student's everyday school-life. (3) The determining of the use of IT in society. (4) The demystification of the computer.



This outline resumes the results of the questionnaire and shows that only the 4th goal has been reached. Reasons given for this failure are lack of time and the advanced age of the students. An analysis of these results shows that the aim to introduce informatics with the same curriculum for different types of classes is possible-the different teachers' assessments of the project do not vary. Another fear was banished: the isolation caused by informatics. Be it in or out of class, for students and teachers, IT has become a ground for communication. A complete study **(7)** has been in order to carry out improvements.

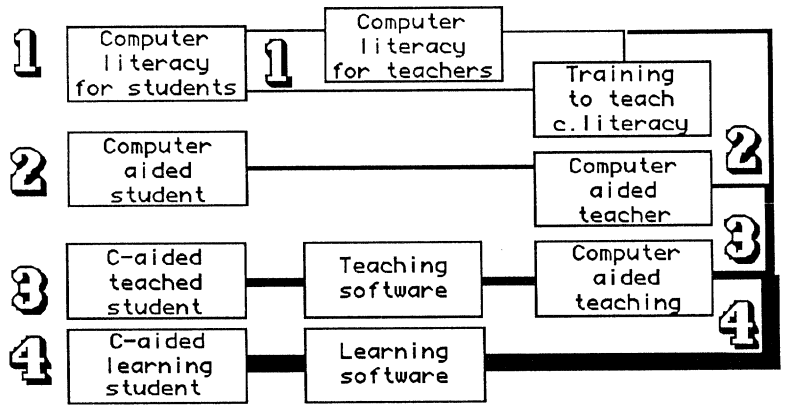
7. The first side-effects

The arrival of informatics has influenced an ever growing number of teachers to use it as their assistant. Teaching implies the management of an important quantity of information (tests, grades, documents, etc.). This aspect must not be overlooked, because it also plays a part in the integration of IT. If the school encourages the use of tools such as the word-processor, spreadsheet, the teachers will find it a paradox to mark grades by hand. Some of them demand free use of computers and educational software. For instance, a teacher using a spreadsheet to teach certain notions of geography will consider it his right to take it home to continue preparing his lessons. On top of that, the IT work-shop could very easily become a trading station. Another one of the teachers questions is: when will we have a PC with a large screen for teaching a whole class? The uses of IT in the classroom increase every day : the managers of schools would also like to get into the deal and use informatics for the school management.

VI CONCLUSION : ONLY A SHORT STEP IN THE GOOD DIRECTION

The following diagram shows the different stages of this process and their interactions centered on the students. We now have a pretty good idea of the implications of the integration of IT in the schooling system. In addition to the human complexities, we also know that it will be very costly. For the simple reason that there are so many possible applications of IT, it is often more expensive to computerize a school than a factory of the same size.

The number shows the different steps and the increase of the interaction of IT and educational system.



Finally, it is essential to point out the ambiguity that surrounds the goals of the introduction of IT into the educational system. It seems that all too often, apparend pedagocical concerns are just a cover-up for a very different objectif : the acquisition of a certain technical knowledge in preparation for futur professional technology uses. From my point of view, tomorow's school will not necessarily be today's covered with a thin coat of informatics, but it must be the product of a new coherence. Whilst our society is entering the information age, education will be an essential factor to prepare everybody to **master** IT and this way, IT will not imply a loss of human qualities.

REFERENCES

1) An educational approach to a syllabus. In "Informatics in Elementary Education", North-Holland (1984).
2) Introduction d'un cours d'initiation à l'informatique. DIP, J.Fonjallaz (1984).
3) La programmation, moyen de (se) découvrir. In "Actes 1984 de l'AIPELF", Sherbroock, Canada.
4) Banalisation ou domestication de l'informatique? In Gymnasium Helveticum. J.Fonjallaz (2/1984).
5) Integration of IT in a secondary school. In "Children in the information age ", Pergamon Press (1986).
6) Integration des TI : beaucoup plus que pour des motifs économiques. Congrès de l'EAO, Paris, (1986).
7) Premier bilan sur l'introduction d'un cours d'initiation à l'informatique, CRPP (1986).

* * * * *