Remaking the curriculum

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Remaking the Curriculum

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Theme Group 2: The professional life of teachers
Subtheme: Computers and inservice education

Brief overview of educational system in Mexico (1984)

Grade	Name	% of places to total age group population
K	Preescolar	50 %
1-6	Primaria	100 %
7-9	Secundaria	85 %

After grades 9 the system is more selective. Percentage decrease quickly until there are only 28 000 graduate students.

Education is imparted by the Federal government, by State government or by private institutions.

Federal	74 %
State	20 %
Private	6 %

Free textbooks for PRIMARIA
edited by federal goverment, same book for the whole country.

For SECUNDARIA
Several choices, text has to follow the official program (federal system).

Preparation of teachers
Old system until 1984
Elementary teacher
4 years of Normal School after secundaria (grade 9)
(less math than in secundaria)

Secondary teacher
4 years Normal Superior. The mathematics they learn is algebra, analytic geometry, calculus, statistics.

UNIVERSIDAD PEDAGOGICA.
University for teachers, 4 years after Normal or Bachillerato. They do no prepare mathematics teachers.

Bachillerato   Grades 10 -12
Attached to a University
or to the technological system (centralized curriculum).

Characteristics of the educational system
highly centralized decisions with respect to:
> curriculum
> textbooks
> hiring of teachers
> in-service courses (with credit)

Computers

Proyect Micro SEP
First phase:
Build computers (MicroSEP) for bachillerato Tecnologico. Languages:
BASIC, PASCAL. The computers are not designed to be compatible with any commercial brands.

17 computers per school (800-3200 students) for a computer laboratory.

Primary goal is that students should learn to program on their spare time.
Laboratory will be open 7 am to 9 pm

Secundary goal use computers in the class.

Conferences and workshops to "sell" the computers (a couple of teachers in each building should become enthusiast and be willing to learn to program and use the computers, the rest should not oppose the computers)

Software development

through a central group. This group will produce software and also adapt and market software made under contract by others.
Will also distribute software for other machines (Apple, IBM)

Building of computers in Mexico.
51% of the shares of a company have to be in mexican hands for company to
produce computers in Mexico.

Costs (for Apples for instance 25 % more than price in U. S. in dollars)
Several months of a secondary teacher salary.

Effect of this type of proyect every body is waiting before doing anything
Universidad Nacional Pedagógica for instance.

Problems in introducing the computers that are similar to those observed
in the U.S.
- fear that students will learn faster, know more than the teacher
- integrating computer with math curriculum.

Special Problems
- programming languajes have commands in English
- software available is in English
- price
- large grups (50 students)
- not compatible
- centralized system.

Effect of computers in the curriculum

qualitative thinking
round numbers.

topics that can be introduced earlier
topics that should be introduced earlier
topics that should be deleted
topics for teachers
algorithmic thinking

change of attitude   many solutions to a problem; inductive, exploratory
                            thinking; students learn faster than teachers

Topics that can be introduced earlier
            example: use of variables
            probability: frequentist empirical approach law of large numbers.

Arithmetic of "round" numbers is not associative.

```
10  LET S = 0
20  FOR N = 1 TO 1 000 000
30  LET S = S + .000001
40  NEXT N
50  LET S = S + 100 000
60  PRINT S
```

```
10  LET S = 1 000 000
20  FOR N = 1 TO 1 000 000
30  LET S = S + .000001
40  NEXT N
50  PRINT S
```

Although in theory both programs should give the same answer, they don't.

```
10  FOR N = 0 TO 1000
20  IF N * N = N ^ 2 THEN PRINT N
30  NEXT N
```

```
10  FOR N = 0 TO 1000
20  IF N * N - N ^ 2 = 0 THEN PRINT N
30  NEXT N
```

The set of answers that the computer gives for both programs may not be identical.

Many answers to a problem, many solutions.

Write a program that gives the following output.
  1 3 5 7 9 11 13 15 17 19 21 23 25.

```
10  FOR N = 1 TO 25 STEP 2
20  PRINT N
30  NEXT N
```

```
 5  LET S = 1
10  FOR N = 1 TO 13
15  PRINT S
20  LET S = S + 2
25  NEXT N
```

```
10 FOR N = 1 TO 13
20  PRINT 2*N + 1
30  NEXT N


10  FOR N = 0 TO 12
20  PRINT 2*N + 1
30  NEXT N
```

Two ways to calculate e

```
 5  LET P =1
10  LET S = 1
20  FOR N = 1 TO 20
30  LET P = P/N
40 LET S = S + P
50  PRINT S


 5  INPUT R
10  FOR N = 1 TO 100
20  PRINT (1+1/N)^N
30  NEXT N
```

Algorithm to find a root

```
5    INPUT A, B
10   LET M = (A+B)/2
15   PRINT M
20   IF ABS (F (M)) < .0000001 THEN GOTO 100
30   IF F(M) > 0  THEN 10 LET  A = M
40   IF F(M) < 0 THEN LET B = M
50   GO TO 10
100  STOP
```

Probability

```
10  DIM  V(6)
20  LET R = INT (6*RND + 1)
30  LET V(R) = V(R) +1
35  PLOT 2-R, 2* V(R)
40  LET P = 1
45  FOR R = 1 TO 6
50  LET P = P * V(R)
60  NEXT R
70  IF P = 0 THEN GO TO 20
80  STOP
```

Discovery, exploratory.

```
10  LES S = 0
20  FOR N = 1 TO 12 STEP 2
30  LET S = S + N
40  PRINT S
50  NEXT N
```

```
 5  FOR N = 1 TO 12
10  PRINT N * N
15  NEXT N
```

Babylonian method to extract square roots

```
 5  INPUT N
10  INPUT "YOUR GUESS" S
20  LET S = 1/2 * (S + N/S)
30  PRINT S
40  IF ABS (N -S * S) .0000001 THEN  STOP
50  GO TO 20
```

Topics to be deleted, de-emphasized
paper and pencil algoritms

+   carry

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Theme group: Computers, Problem Solving and Inservice Education in Developing Countries.

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Recommendations

A. Teachers of Mathematics at all levels should incorporate into their teaching short (3-10 line) computer programs for the learners to write and modify.

B. Curriculum developers and publishers should incorporate computer programs related to the mathematicas concepts of each topic.

C. Small, inexpensive microcomputers can be used for effective teaching and learning of significant mathematics conceptes and processes.

D. All teachers of mathematics and/or teacher trainers should have a computer for their own professional use at home and/or in the mathematics classroom. This includes teachers of mathematics from primary through adult groups.

E. Courses for training teachers should be model experiences of the use of computers in learning and teaching mathematics.

F. The computer should be used in teaching mathematics so as to provide a learner controlled environment in which the learner is engaged in generating his own concept structures and problem solutions.

G. The educational system should provide support to facilitate mathematics teacher users of the computers in the classroom. This system should include a computer resource person, inservice for teachers to increase and improve computer use for learning mathematics.

REMAKING THE CURRICULUM

TOPICS THAT CAN BE INTRODUCED EARLIER
        USE OF VARIABLES
        PROBABILITY

TOPICS WHERE COMPUTERS TAKE THE BURDEN OF CALCULATION
        GRAPHING
        STATISTICS

EXPLORING AND DISCOVERING

PROPERTIES OF COMPUTER ARITHMETIC

ALGORITHMIC THINKING
        EFFICIENT AND INEFFICIENT
        POWERFUL ALGORITHMS

TOPICS TO BE DELETED

```
 5 INPUT A, B
10 LET M = (A + B) /2
15 PRINT M, COS (EXP M)
20 IF ABS (COS (EXP M)) <.0000001 THEN STOP
30 IF COS (EXP M) > 0 THEN LET A = M
40 IF COS (EXP M) < 0 THEN LET B = M
50 GOTO 10
```

FINDING ZEROS OF FUNTIONS

```
 5 LET P = 1
10 LET S = 1
20 FOR N = 1 TO 20
30 LET P = P/N
40 LET S = S + P
50 PRINT S
50 NEXT N
```

$$e = \lim \Sigma \, 1/n\,!$$

```
 5 INPUT R
10 FOR N = 1 TO R
→ 20 PRINT (1 + 1/N) AN
30 NEXT N
```

$$e = \lim (1 + 1/n)^n$$

EFFICIENT AND INEFFICIENT ALGORITHMS

```
10 LET S = 0
20 FOR N = 1 TO 23 STEP 2
30 LET S = S + N
40 PRINT S
50 NEXT N
```

```
 5 FOR N = 1 TO 12
10 PRINT N * N
15 NEXT N
```

EXPLORING AND DISCOVERING

```
 5 INPUT N
10 INPUT "YOUR GUESS"; S
20 LET S = 1/2 * (S + N/S)
30 PRINT S
40 IF ABS ( N - S * S) < .00001 THEN STOP
50 GOTO 20
```

GUESS AND CHECK
FIND A BETTER APROXIMATION

```
10 LET S = 0
20 FOR N = 1 TO 1000000
30 LET S = S + .000001
40 NEXT N
50 LET S = S + 1000000
50 PRINT S
```

```
10 LET S = 1000000
20 FOR N = 1 TO 1000000
30 LET S = S + .000001
40 NEXT N
50 PRINT S
```

```
10 FOR N = 0 TO 1000
20 IF N*N = N^2 THEN PRINT N
30 NEXT N
```

PROPERTIES OF COMPUTER NUMBER SYSTEM

```
5 INPUT D
10 FOR X = -128/D TO 127/D STEP 1/D
20 LET Y = SIN (EXP X)
30 LET H = D * X + 128
40 LET V = D * Y + 88
50 IF V < 0 OR V > 175 THEN GOTO 70
60 PLOT H, V
70 NEXT X
```

GRAPHING FUCTIONS

```
10 FOR G = 1 TO 12
20 PRINT G + G
30 NEXT G
```

```
10 FOR N = 1 TO 12
20 PRINT N + N
30 NEXT N
```

```
20 PRINT 2 * N
```

```
10 FOR N = 0 TO 40
20 PLOT N, N*2
30 NEXT N
```

```
10 DIM V(6)
20 LET R = INT (6 * RND + 1)
30 LET V(R) = V(R) + 1
35 PLOT 2 * R, 2 * V(R)
40          LET P = 1
50          FOR R = 1 TO 6
60          NEXT R
70 IF P = 0 THEN GOTO 20
80 END
```

TOSSING A DIE UNTIL EACH FACE APPEARS ONCE.

```
15 FOR N = 1 TO 20
20 LET R = INT (6 * RND + 1)
30 PRINT R; " ";
40 NEXT N
```