THE
microFOCUSware
LESSON PLANNER
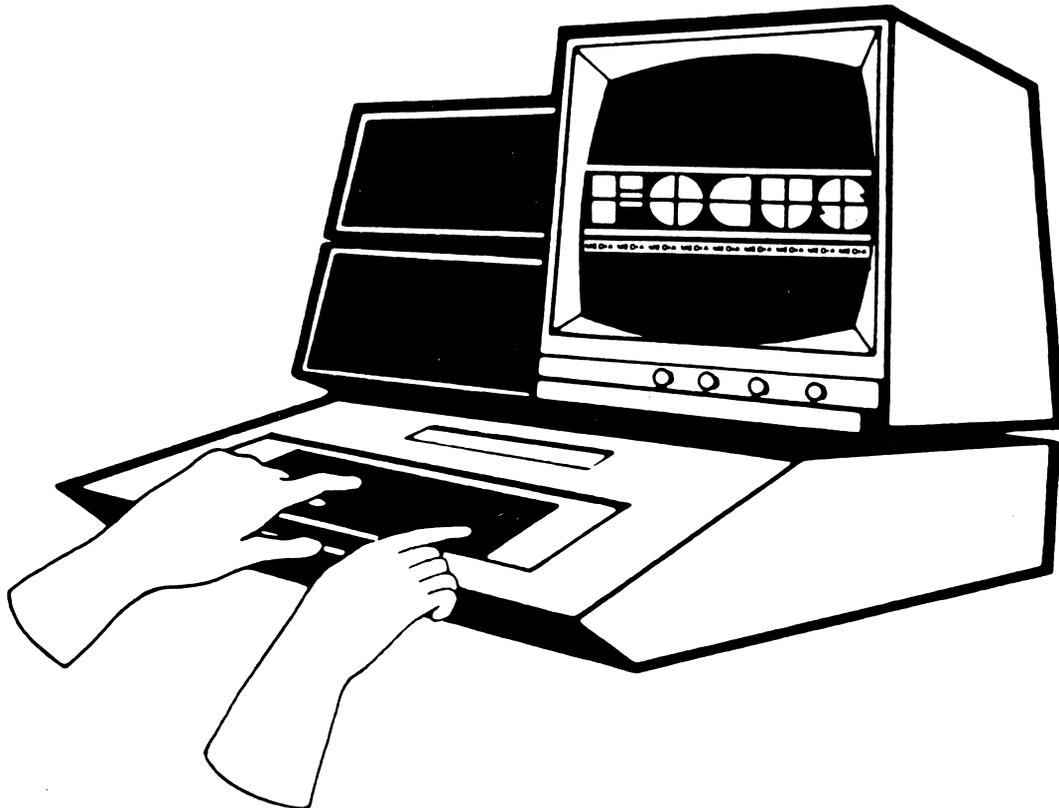
DISCOVERING THE
SCIENTIFIC
METHOD

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Discovering the Scientific Method

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TO THE TEACHER

"DISCOVERING THE SCIENTIFIC METHOD: Snigs...Flrks...Blorgs" is
really a package of two educational computer programs that
provide a model of scientific inquiry. If your goal is to teach
the scientific method to your students, then this program should
help you achieve this goal by enabling your students to:

    (A) Define the terms HYPOTHESIS and ANALYSIS
    (B) ORGANIZE DATA into simple categories
    (C) RECORD the RESULTS of experiments
    (D) DRAW CONCLUSIONS from recorded data
    (E) MAKE GENERALIZATIONS from their conclusions

    These programs will be effective in a middle/junior high
school or high school classroom or with gifted upper-elementary
students.

    The first program in the package is tutorial in nature and
introduces the concepts of HYPOTHESIS FORMATION and DATA
ANALYSIS. Once this is mastered, the student progresses to the
second program, which contains three problems. Each problem
presents information for the student to "solve" by forming
hypotheses, performing tests, and analyzing the results of these
tests.

    At the end of this TEACHER'S LESSON PLANNER, you will also
find a set of student worksheets. These worksheets have been
designed to allow you to review each student's work, spot
difficulties that he/she may be having, and provide you with an
opportunity to make suggestions that will assist the student in
becoming a more critical thinker. The worksheets should not be
handed out until the first program has been completed since the
first worksheet page gives information about the sample problem.
You are authorized to make as many copies of this worksheet
packet as you need.

FOR THE FIRST TIME USER

When the disk is booted up following the instructions on the
accompanying card, a menu will appear:

    DISCOVERING THE SCIENTIFIC METHOD...Snigs...Flirks...Blorgs

                        Program Menu

Part #1 - This program introduces the science skills of
          hypothesis, analysis, and test. Also included is a
          helpful example similar to the problems in Part 2.

Part #2 - Three baffling problems are waiting for you to solve
          scientifically! Use all of your science skills to
          solve these strange puzzles!

TYPE THE NUMBER OF THE PROGRAM YOU WANT ------>

Typing a 1 or a 2 will cause the appropriate program to be
automatically loaded in the computer's memory.

PART 1: THE TUTORIAL

PART #1:

     This program is the introductory tutorial that explains the meaning of "hypothesis", "analysis", and the general procedures of the scientific method. Much of the program involves a series of text screens. The rate at which these screens appear is completely under the control of the student.

     Also included in this program is an example problem: THE BOOGLES. A group of numbers is identified as being BOOGLES. Another group of numbers, the student is told, is catagorized as NON-BOOGLES. The student is shown how the data presented can be organized so that they are easier to analyze. Several hypotheses are formed as to what exactly make a number a BOOGLE. Each hypothesis is tested. The student sees that an incorrect hypothesis can be positive in that it helps in getting closer to a correct hypothesis.

     Finally, the student is given a hypothesis to "test". This involves typing numbers and checking each one for BOOGLEness. If the student types ten consecutive BOOGLES, the definition of "BOOGLE" is given.

     At this point, the student is given the option of reviewing the example problem or of going ahead with the three problems in Part #2. Just before going on, the student is invited to look over Worksheet #1 (included at the back of this booklet). This page shows how the BOOGLES problem can be organized and the data recorded. Thus, the page becomes a model for future problems. There is a similar worksheet for each of the problems in Part #2.

PART 2: THE PROBLEMS

This program contains three problems, all somewhat similar to the example problem in Part #1. At the beginning of Part #2, a Main Menu appears that allows the student to choose among the problems.

```
*********************************************************************
*     THERE ARE THREE PROBLEMS TO BE SOLVED IN THIS PART          *
*                    OF THE PROGRAM                               *
*                                                                 *
*     THESE PROBLEMS SHOULD BE SOLVED IN THE ORDER LISTED         *
*                        BELOW                                    *
*                                                                 *
*             WHICH PROBLEM DO YOU WISH TO SEE?                   *
*                                                                 *
*             (1) THE SNIGS                                       *
*             (2) THE FLIRKS                                      *
*             (3) THE BLORGS                                      *
*             ----------------                                    *
*             (4) QUIT FOR NOW                                    *
*                                                                 *
*     TYPE THE NUMBER OF YOUR CHOICE ---->                        *
*                                                                 *
*********************************************************************
```

Each of the problems presents information which identifies certain combinations of numbers and letters. SNIGS, for example, are a class of four-digit numbers. FLIRKS and BLORGS are classes of four-letter combinations. At the end of each problem, the program returns to the Main Menu, where the student can choose another problem or quit.

In two of the problems THE SNIGS and THE FLIRKS, the student is first given examples. These constitute "Initial Data", and there is room on the worksheets for the student to record these data.

In the problem THE BLORGS, no "initial data" are given. Instead, the results of tests constitute the only data with which the student can work.

By typing test items during these problems, the student will gain further evidence regarding members and non-members of the groups SNIGS, FLIRKS, and BLORGS. As the student forms hypotheses regarding the definition of each of these, subsequent tests either confirm or refute the hypotheses.

To fully understand the dynamics of the program and the scientific skills that it models, you are encouraged to sit down with the program and actually work through it. A cursory glance at the program will not be enough; approaching the program as a student would approach it is necessary to provide you with the necessary insights into the thinking skills involved in solving the problems. During this trial run, please take note of your own thinking processes -- be aware of how you form hypotheses, of how your experimental choices are related to those hypotheses, and of how you seek patterns in the data that help you to analyze the experimental evidence.

Students will need and use the worksheets in the back of this lesson planner. Their written record of work completed is of critical significance; without it, evaluation of student work and progress is quite difficult.

It is strongly recommended that you collect the students' worksheets after each problem. This will give you the opportunity to check the work, problem by problem, identify specific weaknesses, and give suggestions on how the work can be improved.

Problem #3, the BLORGS, is the "payoff" problem of the program. Whereas in Problems #1 and #2, a problem definition is given after ten consecutively positive tests, no such definition is given after Problem #3. Instead, the student is asked to generate the problem definition. The loftiest aim of SNIGS...FLIRKS...BLORGS... is to generate a problem definition based upon experimental evidence.

A final word about Problem #3: some students may ask you
for the "actual" definition of BLORG. This definition should
NOT be given to the students, despite cries of "Unfair!" or
attempts at bribery. The best strategy is to respond that
Problem #3, like real scientific problems, will not yield its
answer that easily. There is no such thing in experimental
science as an "answer upon demand." A scientist wishing to find
the "real" answer to a research problem cannot just "look it
up", but must rely on empirical evidence to approach -- but
perhaps never reach -- the final answer. The definition of
BLORG is given here only for your reference. You are cautioned,
however, not to let this definition influence your evaluation of
the sentences your students write at the bottom of their
worksheet. Those statements must be evaluated against the
evidence the students have produced, and not against the actual
problem definition.

> BLORG: a combination of 4 letters whose first and last
>   letter are dissimilar consonants, and whose
>   second letter is a vowel. The letter "Y" is
>   not considered a vowel by the program. The
>   third letter is not relevant to BLORGness.

In order to make evaluation of student work easier, you are
encouraged to make a "Skills Checklist" for each student.
Included on such a checklist might be skill components that you
wish to monitor. Some of these are suggested in the paragraphs
that follow:

A. RECOGNITION OF SELF-EVIDENT HYPOTHESES -- Sometimes,
students may form hypotheses that can be verified or refuted by
initial data or previous test results. This behavior indicates
that these students have not learned to recognize that existing
data can be valuable during hypothesis formation.   Guide these
students by suggesting that, each time they make hypotheses, the
existing data should first be checked for information regarding
that hypothesis.

B. FORMATION OF APPROPRIATE TESTS -- Once a hypothesis has
been formed, the ensuing test should be such that it will yield
direct evidence about that hypothesis or its converse. As you
read over and check the worksheets, pay particular attention to
the relationship between hypotheses and their respective tests.

C.   USE OF EXPERIMENTAL "CONTROLS" -- A very important
aspect of scientific methodology is the inclusion in an
experiment of one or more controls.   SNIGS...FLIRKS... BLORGS...
will model that concept.   If a student tries a series of tests
in which three items remain the same and one item varies, that
student has used controls (the unchanged items) and a variable
(the changed item).   This type of testing should be encouraged.
If it is missing from an early problem, suggest its use in a
later problem.

D.   INDUCTIVE THINKING -- The first of the student
worksheets has several examples of logical, inductive thinking.
As you look over that sheet, notice how, in just a few tests, it
was determined that numbers greater than 501 are not BOOGLES.
As the number of tests increase on the student's page, watch for
this type of "narrowing in" process that will allow for
conclusions based upon evidence and arrived at inductively.

Worksheet #1 - Sample Problem: THE BOOGLES

This sheet is provided to give you an idea of what a completed
worksheet will look like. Study its form carefully, and use it
as a model for setting up your own worksheets.

Initial Data:

```
          ------------------------------
          :  Boogles : Non-Boogles :
          ==============================
          : 14,16,12 :  47,81,23   :
          ------------------------------
```

HYPOTHESIS	TEST	RESULTS
1. Boogles are numbers below 20:	44	Boogle
2. Boogles are all even numbers:	36	Boogle
	88	Boogle
	2	Boogle
	58	Boogle
	4	Boogle
	600	Too big for a Boogle
	400	Boogle
	500	Boogle
	510	Too big for a Boogle
	502	Too big for a Boogle
	-12	Too little for a Boogle
	0	Too little for a Boogle
	:	:
	:	:
	:	:
	:	:
	:	:

Problem #1 -- THE SNIGS

INITIAL DATA:

```
-----------------------------------------------------------------
     HYPOTHESIS                    TEST          RESULTS
=================================================================
                                 :      :
-----------------------------------------------------------------
                                 :      :
-----------------------------------------------------------------
                                 :      :
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                                 :      :
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                                 :      :
-----------------------------------------------------------------
```

Problem #2 -- THE FLIRKS

INITIAL DATA:

        HYPOTHESIS   TEST   RESULTS
==
                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

                                    :   :

Problem #3 -- THE BLORGS

INITIAL DATA:

HYPOTHESIS	TEST	RESULTS
	: :	
	: :	
	: :	
	: :	
	: :	
	: :	
	: :	
	: :	
	: :	
	: :	
	: :	
	: :	
	: :	
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	: :	
	: :	
	: :	

Write your definition of a Blorg on this line:_____
_____
_____
_____
_____
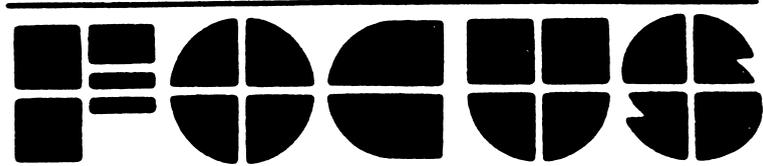
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Notes and Tips for Using Focus Media Software Titles

Apple II Computers

Starting Up Apple II Programs
1. With the computer off, insert the disk into the disk drive and close the disk drive door. If there are two drives, use drive 1.

2. Turn on the computer.

3. After the program starts up, follow the instructions on the screen to proceed.

Using Apple 3.5 Inch Disks
When using our 3.5 inch disks, you may occasionally encounter a disk-turn message. A disk-turn message tells you to remove from the disk drive the disk currently in use, turn it over, and replace it in the drive. If do you encounter this message while using a 3.5 inch disk, simply replace the current disk with its side counterpart. For example, if you encounter such a message and the 3.5 inch disk currently in the drive is marked "Side A," you should replace it with the 3.5 inch disk marked "Side B." Conversely, if "Side B" is the current disk, then you should replace it with "Side A." You may also see similar messages using "Side 1" and "Side 2."

MS-DOS Compatible Computers

Please Note: You should use MS-DOS version 2.1 or later—version 3.0 or later for *The Young Learners System* and version 3.1 or later for *Step Write Up!* and *The Physical Science Laboratory*.

Starting Up without Hard Drives
1. With the computer off, insert a copy of MS-DOS and close the disk drive door. If there are two drives, use drive A.

2. Turn on the computer.

3. When you see "Enter new date:" press the ENTER key.

4. When you see "Enter new time:" press the ENTER key.

5. When you see the "A>" prompt remove the MS-DOS disk and replace it with the Focus Media program disk.

6. Turn to the "Program Description" section in your Teacher's Lesson Planner. If there are instructions with respect to starting the program you should follow them.

7. If there are no instructions in the Teacher's Lesson Planner for starting up the program, type AUTOEXEC at the "A>" prompt; then press the ENTER key.

Starting Up with Hard Drives
1. Turn on the computer.

2. When you see "Enter new date:" press the ENTER key.

3. When you see "Enter new time:" press the ENTER key.

4. When you see the "C>" prompt type "A:" and press the ENTER key. Place the Focus Media program disk in drive A.

5. Turn to the "Program Description" section in your Teacher's Lesson Planner. If there are instructions with respect to starting the program you should follow them.

6. If there are no instructions in the Teacher's Lesson Planner for starting up the program, type AUTOEXEC at the "A>" prompt; then press the ENTER key.