



## MICROCOMPUTER UTILIZATION IN BASIC PROGRAMMING COURSES

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### I. INTRODUCTION

Traditionally, classroom demonstrations of computer programs have been done on time sharing terminals connected via modems, phones, and phone lines to the university "central" computer. As anyone who has ever conducted such a demonstration knows, this approach is, to say the least, unreliable. It is not uncommon for professors standing in front of their classes to find that one of the elements in the electronic path from the keyboard to the computer and back to the monitors has failed or that the response time of the central computer is now measured in minutes instead of seconds. The result is that the students, while they may be entertained, certainly lose the value of the "on-line" demonstration. This paper discusses an alternative approach to classroom demonstrations--namely the use of the microcomputers.

### II. BASIC AT CMU

BASIC is used primarily in two courses at Central Michigan University. CPS 110 - Introduction to Computers - is a general education course for non-majors taught on campus using the large lecture format to classes of 100 to 150 students.<sup>1,2</sup> CPS 501 - Survey of Computer Science - is taught mainly off campus (about 150 miles "off campus") at various regional centers of the Institute for Personal and Career Development (IPCD) of CMU as part of a graduate program in management.<sup>3,4</sup>

Because of inadequate funding of the Computer Science Department and the University Computer Center, neither facility has a computer of sufficient size and speed to support time sharing to the extent that it would be needed for classes of 100 - 150 to run their programs. Consequently, CPS 110 students keypunch their BASIC programs and submit them to the central computer through RJE (batch) terminals. Turnaround time varies from 15 minutes to 24 hours depending on what percentage of the system resource the administration decides to

release for academic use (0 to 50 percent). Thus, the CPS 110 students have no opportunity to see interactive programs in operation except in the classroom demonstrations.

The CPS 501 course is taught in areas remote from the university in "classrooms" which do not have access to computer facilities. Students in this course are typically middle or low level management personnel of industrial or military installations in the Detroit area. Most of the students work full time at installations which, although they have computers, do not make their computer facilities available to the students, so the only "hands on" experience the students have is using the terminal/microcomputer during and after the weekly (or bi-weekly) class.

Both CPS 110 and CPS 501, then, have strong compelling needs for classroom demonstrations of BASIC programs. During the day (10 a.m. to 5 p.m.) the central computer is perpetually backlogged to such an extent that time sharing access is at best unpredictable. The access and response times are simply not adequate to demonstrate "interactive" use of BASIC. I assume that many other underfunded institutions have similar situations. After 5 p.m., when the administrators go home, the time sharing access usually improves. Unfortunately, the 150 mile telephone connection to the Detroit area is not always as good as it might be. Detroit and Mt. Pleasant are "served" by different phone companies and the military bases at which the course is sometimes taught seem to have a particular problem in holding a line connection. In summary, the on-campus and off-campus courses both have time sharing service that is at best undependable.

### III. MICROCOMPUTER HARDWARE

To overcome these problems with the use of the central computer via time sharing I have turned to microcomputers. The particular hardware configuration

currently used consists of:

Southwest Technical Products Corporation

6800 CPU with

4K ROM, 8-20 K RAM

SWTPC Floppy Disk (Dual)

SWTPC Terminal (Keyboard and TV Monitor)

SWTPC Cassette Tape Interface

Cassette Tape Recorder

SWTPC Printer

Not all of this equipment is necessary. The minimum configuration is the CPU/8K RAM, the keyboard, TV monitor(s), the cassette tape drive, and the cassette interface. Total cost for the minimum configuration from SWTPC is \$1,319 in kit form. A similar hardware configuration from Radio Shack (TRS-80) is \$698 assembled. The "maximum" system currently used costs \$2,819 from SWTPC in kit form and \$2,884 from Radio Shack assembled. Details of this hardware cost are given in the APPENDIX. The entire "maximum" system costs less than one intelligent time sharing terminal and modem. There is, of course, no phone charge, connect charge, or CPU charge associated with the microcomputers.

At CMU we have available many large lecture theaters with multiple TV monitors installed for video tape presentations. With a bit of cable splicing, the SWTPC microcomputer video output can be connected to the monitors so the 100-150 students may all see the programs being demonstrated. Off campus a 12" monitor and a 19" monitor are used. The small monitor is used for the person typing in the programs and the 19" monitor is used for the 15-30 students. Although additional monitors would be desirable in the off-campus "classrooms", they are not available. Before turning to the applications of microcomputers in the classroom, a large note of caution is in order. Not all of the versions of BASIC available on microcomputers are satisfactory for classroom use. The SWTPC BASIC<sup>5,6</sup> is adequate except for the absence of all of the MAT instructions. The Radio Shack BASIC, which occupies 12K of ROM\*, seems complete, but we have not received the hardware or software yet (we ordered them within one week of announcement in April). Many, if not most, of the various versions of BASIC available lack several of the

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\*This is the Radio Shack Level II BASIC. The referee for this paper has used it, and has found it to be excellent.

features commonly found in "large computer" BASIC and may be totally unacceptable for classroom use.

#### IV. MICROCOMPUTER APPLICATIONS

The most obvious use for microcomputers in the classroom is to explain and run the programs in the textbook being used. An ability to list the program in segments is particularly useful. I virtually never have to write a single line of BASIC on the board or overhead projector; I simply type it on the keyboard and the students view it on the monitors. A side benefit is that my typing is much easier to read than my handwriting, so I am told.

In addition to demonstrating complete programs, the microcomputer is useful for demonstrating short program segments. For example, to show how loops work one need type only:

```
100 FOR X = 3.5 to 10.5 STEP 0.5
110 PRINT X
120 NEXT X
RUN
```

The microcomputer then responds with the values of X generated by the loop. Numerous other facets of BASIC such as the built in functions can easily be demonstrated:

```
100 PRINT "A", "RND", "INT(A)",
      "ABS(A)", "SGN(A)"
110 FOR A = -10 to 10 STEP 0.5
120 PRINT A, RND, INT(A), ABS(A), SGN(A)
130 NEXT A
RUN
```

Numerous other examples often given in texts can easily be run on the microcomputer faster than they can be written on the board.

The most spontaneous use of the microcomputer is in answering "What would happen if..." questions. The proper response to these questions is "Let's type it in and see..." Even if the microcomputer's response is to print an error message, the demonstration is most timely and animate.

In addition to demonstrating programs in the text, the ease of retrieval of previously written programs from the floppy disk or the cassette tape permits the demonstration of a wide variety of other programs. Contrast this with a typical time sharing system where program retrieval may be slow, tedious, and unreliable. When students request copies of a demonstration program not in the text or a program composed in class this may be easily accomplished in SWTPC BASIC:

1 LIST #7

.

9999 GO TO 1

10000 END

RUN

Since system commands such as LIST may be part of a program, lines 1 and 9999 cause multiple hard copies of the program to be generated on the printer with no additional editor commands. The process is terminated by a control C from the keyboard when sufficient copies have been printed.

Many other examples will doubtless come to mind as you recall the numerous class questions to which you have responded. The key to the success of the microcomputer is its immediate availability. From power off to a fully loaded BASIC system takes less than 30 seconds on a SWTPC system with the floppy disks. In the Radio Shack system all that is required is to turn on the power and begin typing BASIC commands/instructions as the entire BASIC system is in the 12K ROM.

#### V. SUMMARY

In this brief paper I have attempted to show that a new cost effective technology has arrived for class demonstrations of BASIC. As the numerous compiler construction classes begin to write FORTRAN, PL/I, etc. compilers for microcomputers, this technology will be available for a very reasonable price. Other possibilities that we are currently exploring for the on-campus classes is the purchase of 10-20 Radio Shack minimal systems (@ \$698) for the students to use for their homework. For hard copy, the students could save their working programs on cassette tapes, move to a microcomputer with a printer, load their program, and run it. This proposal, of course, awaits funding. The students would benefit greatly by the improved turnaround and availability. The better financed students could simply buy their own microcomputers or perhaps check them out from the library or rent them to greatly increase their interest in computing and computer applications.

#### REFERENCES

1. Cook, Robert N., An Approach to Introductory Computer Science Courses For Non-Majors, SIGCSE Bulletin V9, No. 3, August, 1977.
2. Logsdon, Tom, Programming in BASIC, Anaheim, 1977.
3. Lott, Richard W., BASIC with Business Applications, Wiley, 1977.
4. Mader, Cris and Hagin, Robert, Information Systems: Technology, Economics, Applications, SRA, 1974.
5. SWTPC MF-6800 Disk Operating System Ver. 1.0, Southwest Technical Products Corporation, San Antonio, Texas, 1978.
6. SWTPC Disk BASIC Ver. 3.0 User's Guide, Southwest Technical Products Corporation, San Antonio, Texas, 1978.

# APPENDIX

	<u>Radio Shack</u>	<u>Southwest Technical Products Company</u>
CPU	12K ROM \$ 499 <sup>1</sup> 4K RAM	4K RAM \$ 439 +8K RAM 250
Keyboard	included with CPU	325
Monitor	199	175
Cassette Tape Drive	included with monitor	50
Cassette Interface	included with CPU	80
Subtotal Minimal System	<u>\$ 698</u>	<u>\$1,319</u>
Dual Floppy Disk	499 499 +16K RAM 290 +Interface 299	1,000 +8K RAM 250
Printer	599 <sup>2</sup>	250 <sup>3</sup>
Total Maximum System	<u>\$2,884</u>	<u>\$2,819</u>

<sup>1</sup>With Level II BASIC

<sup>2</sup>This is a "screen printer", 64 characters wide on 4-inch paper. A Centronix printer is available for \$1,299.

<sup>3</sup>This is a 40-column printer.