

Computers, regardless of size, are really general purpose machines. The fact that they were first called upon to do extensive "computations" is largely responsible for the name by which we refer to them. True, they can do mathematical calculations quickly and accurately. But computers can do more. They can draw pictures and make music. They can drill us in rote memorization, tutor us in all subject areas, or simulate situations that might be too costly or dangerous to experience in real life. And they can store, sort, and retrieve large amounts of data with speed and ease.

Computers can be used in a variety of ways in a classroom, depending upon the grade level, the content of the course, and the intent of the teacher. The many ways in which computers can be used within a given discipline are only limited by the desires of the teacher. It is beyond the scope of this paper to try and cover all the possibilities. The focus here will be on "computer awareness" and "computer literacy" units and/or courses from grade school through college.

For the purpose of this discussion, "computer awareness" means becoming aware of the extent to which computers influence our lives. Such an awareness is also part of "computer literacy", which then goes further to give the student the ability to control the computer instead of only being able to respond to the computer. This implies some level of programming ability on his or her part. These terms are by no means universally agreed upon, and are defined here in the hope of obtaining greater clarity.

There are several subject areas which could be covered as a part of a "computer awareness" unit at almost all grade levels to one extent or another. These areas include:

- The history of computers
- The parts of a computer
- How a computer works
- How to control a computer (programming)
- What computers can do and where they are found
- The impact of computers in our lives
- Moral and ethical issues raised by computers

At lower grade levels many of these concepts can be introduced by various games and role playing activities, as well as by making some of the early computing devices such as an abacus or Napier's Bones. Older students will find a wealth of information in some of the books listed here, as well as in films and other media sources.

Computer literacy however, implies more than just knowing the terms and some of the history. It means being able to take an idea and express it in such a way that the computer can carry out the intent of the programmer. Computer literacy can only be achieved by hands-on experience and practice. The following suggestions are designed to help students at various ages gain this kind of experience.

GRADES K-3

TEXT: Spencer, Donald D., Computer Awareness Coloring Book, Camelot Publishing Company, Ormond Beach, FL. 1978.

COMMENTS: Students in kindergarten through third grade are usually too young to learn programming, but are among the most enthusiastic users of computers. They especially enjoy games, many of which have educational value.

Graphics-oriented games are excellent for introducing computers to these children. . .

- Color Sketch allows children to "paint" on the screen, using Apple II's hand control analog input devices.
- Harpsichord adds the dimension of music.
- Follow-Me is a concentration game.
- Sink-the-Ship involves eye-hand coordination.
- Shootout adds competition to the skill task.
- Hustle is a fast-paced game that accelerates as your skill increases.

Word-oriented games help build verbal skills. . .

- Letter Recognition lets students become familiar with the keyboard.
- Don't Fall! is a variation on the Hangman spelling game, only the computer also gets a turn to try and guess your word!

And, of course, Supermath is a favorite drill and practice program in arithmetic.

The children love the color and sound effects that are used. They can also learn at this time the parts of the computer and where they can find computers in their lives (the stop light, the grocery store, the bills that come in the mail, etc.). They especially love to role-play a computer, sending messages through various parts of the computer (their classmates!).

GRADES 4-6

LITERACY

- TEXTS: Ball, Marion J., What is a Computer?, Houghton Mifflin, Boston, 1972.
- Rice, Jean, My Friend the Computer, T.S. Denison & Co., Minneapolis, 1976. Outstanding Teacher's Resource book.
- Spencer, Donald D., The Story of Computers, Camelot Publishing Company, Ormond Beach, FL. 1977.

PROGRAMMING

Raskin, Jef, Apple II BASIC Programming Manual, Apple Computer Inc., Cupertino, CA. 1978.

COMMENTS: Children in the fourth through sixth grades are ready to begin learning the fundamentals of computer programming, but educational games are still the best way to engage their interest initially.

- Mission U-Boat
- Brickout
- Chaser . . . are graphics-oriented games and use the hand-held analog input devices. These are motor skill games that develop eye-hand coordination.
- Add-Libs builds on knowledge of parts of speech.
- Darts is a nifty game for learning fractions and number lines.
- Hammurabi
- Lemonade Stand . . . are simulations that require decision-making.

In beginning to program in BASIC, students can use their own names in learning PRINT and GOTO statements, filling the screen with their name and stimulating their interest. The Apple II BASIC Programming Manual is an excellent book to use for this purpose. It is at this age that students can begin to recognize the limitations as well as the capabilities of computers. They learn, for example, that computers don't decide anything (in spite of what some people have tried to make us believe). Programmers make decisions, which computers only carry out.

GRADES 7-8

TEXTS:

LITERACY

Ball, Marion J. and Sylvia Chase, Be a Computer Literate, Creative Computing Press, Morristown, N.J., 1977.

Rice, Jean, My Friend the Computer, T.S. Denison & Co., Minneapolis, 1976. Has outstanding Teacher Resource manual.

Spencer, Donald D., What Computers Can Do, Camelot Publishing Company, Ormond Beach, FL. 1977.

PROGRAMMING

McQuigg, James D. and Alta M. Harness, Flowcharting, Houghton Mifflin, Boston, 1977.

Raskin, Jef, Apple II BASIC Programming Manual, Apple Computer Inc., Cupertino, CA. 1978.

Spencer, Donald D., Fun with Computers and BASIC, Camelot Publishing Company, Ormond Beach, FL. 1977.

COMMENTS: Seventh and eighth grades are excellent times to establish computer literacy courses in schools. Often starting with single units in math or science classes, many schools have expanded these into courses of their own, either on a half-semester or semester basis. Even when offered as electives or after school not-for-credit, these courses have proven overwhelmingly popular.

Students at this level will also enjoy many of the programs listed previously. They will find additional challenge in a game like Deflection, or watching the operation of an internal combustion Engine displayed in high-resolution graphics. A program like Rod's Color Pattern provides a good example for students to analyze.

GRADES 9-12

TEXTS:

LITERACY

Billings, Karen and David Moursund, Are You Computer Literate?, The Math Learning Center, 325 - 13th Street N.E., Room 302, Salem, OR. 97301, 1978.

Rothman, Stanley and Charles Mosmann, Computers and Society, Science Research Associates, Chicago, 1972.

Spencer, Donald D., Understanding Computers, Camelot Publishing Company, Ormond Beach, FL. 1979.

PROGRAMMING

Albrecht, Bob, Leroy Finkel and Jerald R. Brown, BASIC for Home Computers, John Wiley & Sons, New York, 1978.

Raskin, Jef, Apple II BASIC Programming Manual, Apple Computer Inc., Cupertino, CA. 1978.

Sage, Edwin R., Fun and Games with the Computer, Entelek, 42 Pleasant St., Newburyport, MA. 1975.

Spencer, Donald D., BASIC, A Unit for Secondary Schools, Camelot Publishing Company, Ormond Beach, FL. 1977. To be used in teaching programming as a unit within another course, such as Algebra, Chemistry, etc.

_____, Accent on BASIC, Camelot Publishing Company, Ormond Beach, FL. 1977. A text and workbook.

COMMENTS: It is in high school that computer literacy courses are presently finding their greatest popularity, and the students are taking to programming like fish to water. A game like Turn Off the Lights is likely to interest most students in working further with a computer. One technique that has proven successful is to have students learn about programming by studying the programs of others. Two programs for the Apple II, Hustle and The Infinite Number of Monkeys, are structured in their format and come with an analysis built in!

Computers are often used at this level as problem-solving devices in science or math classes. They excell at running simulations, adding to their utility as media throughout the school.

- RPN is a simulation of a Reverse Polish Notation calculator, and graphically demonstrates the internal action of the registers.
- Spanish Vocabulary is an example of drill and practice in languages.
- Scrolling Window Tutorial is an example of a CAI program used in teaching programming.
- Computer Simulator is useful in learning machine language programming.

COLLEGE AND UNIVERSITY

TEXTS:

Dorf, Richard C., Computers and Man, Second Edition, Boyd & Fraser Publishing Company, San Francisco, 1977.

Martin, James and Adrian R. D. Norman, The Computerized Society, Prentice-Hall, Englewood Cliffs, N.J., 1970.

Spencer, Donald D., Computers in Society, Hayden Book Company, Rochelle Park, N.J., 1974.

_____, Data Processing, An Introduction, Charles Merrill Publishing Co., Columbus, OH. 1978.

PROGRAMMING

Coan, James S., Basic BASIC, Hayden Book Company, Rochelle Park, N.J., 1978.

_____, Advanced BASIC, Hayden Book Company, Rochelle Park, N.J., 1977.

Kemeny, John G. and Thomas E. Kurtz, BASIC Programming, John Wiley & Sons, New York, 1971. Written by the men who developed the programming language BASIC.

Raskin, Jef, Apple II BASIC Programming Manual, Apple Computer Inc., Cupertino, CA. 1978.

COMMENTS: Microcomputers are being purchased in large numbers by colleges and universities. Their computational capabilities provide a tool for the engineer or physical scientist to gather and understand data about the world. Their ability to run simulations assists the liberal arts student in experimenting with ideas in the social and behavioral sciences which would normally be impractical or impossible to test.

But most important, computers provide students with an invaluable tool for problem solving in any field throughout their lives, once they learn the art of programming. Many institutions have set up computer laboratories in their Learning Resource Centers, providing access for all students to use computers in their courses or to learn programming. Community service courses on programming in BASIC have proven very popular for institutions to offer.

RESOURCES FOR TEACHERS

SOFTWARE

- File Cabinet -- allows you to keep records on the computer.
- Professor True (True/False Quiz)
- Match Machine (Matching Quiz) -- make up your own quiz.
- Study Aide -- enter the material you want learned and the computer will drill your students.
- Save-A-Story -- a text storing program that allows you to control the rate at which material is displayed.
- Giant Typewriter -- print big colorful letters on the screen for classroom display.

BOOKS

Ahl, David H., BASIC Computer Games, Microcomputer Edition, Creative Computing Press, Morristown, N.J., 1978. An excellent source for programs.

_____, The Best of Creative Computing, Vols. I & II, Creative Computing Press, Morristown, N.J., 1978. A good source for articles and other background material.

Dwyer, Thomas A. and Margot Critchfield, Computer Resource Book, Houghton Mifflin, Boston, 1977.

Nelson, Theodor, The Home Computer Revolution, The Distributors, 702 S. Michigan, South Bend, IN 46618, 1977. A lively overview of microcomputers in general.

Ryan, Thomas J., The Adolescence of P-1, MacMillan, New York, 1977. A well written novel about a computer program that gets away! Good for stimulating discussion in class.

Spencer, Donald D., Computers in Action, Hayden Book Company, Rochelle Park, N.J. 1978.

_____, Fundamentals of Digital Computers, Howard W. Sams & Co., Indianapolis, 1978.

_____, Game Playing with BASIC, Hayden Book Company, Rochelle Park, N.J.

_____, Microcomputers at a Glance, Camelot Publishing Company, Ormond Beach, FL. 1977. A dictionary of computer terms.

_____, Problems for Computer Solution, Camelot Publishing Company, Ormond Beach, FL.

_____, Sixty Challenging Problems with BASIC Solutions, Hayden Book Company, Rochelle Park, N.J.

_____, The Computer Quiz Book, Camelot Publishing Company, Ormond Beach, FL. 1978.

_____, Using BASIC in the Classroom, Camelot Publishing Company, Ormond Beach, FL. 1978. An introduction to computers for teachers.

Squire, Enid, The Computer, An Everyday Machine, Addison-Wesley, Menlo Park, CA. 1977.

MEDIA

A list of films appears in Billings, Karen and David Moursund, Are You Computer Literate? The Math Learning Center, 325 - 13th St. N.E., Room 302, Salem, OR. 97301, 1978.

Spencer, Donald D., Computers for Kids, Camelot Publishing Company, Ormond Beach, FL., 1979. An AV kit with 60 slides, a cassette, and teachers manual.

_____, Visual Masters for Teaching About Computers, Camelot Publishing Company, Ormond Beach, FL., 1978.

_____, Visual Masters for Teaching BASIC Programming, Camelot Publishing Company, Ormond Beach, FL. 1978.

MAGAZINES

Calculators and Computers, P.O. Box 310, Menlo Park, CA. 94025

Creative Computing, P.O. Box 789-M, Morristown, N.J. 07960

People's Computers, 1263 El Camino Real, Box E, Menlo Park, CA. 94025

DIRECTORY

Many institutions around the country have been doing significant projects with computers in education for some time now. A directory of these projects is available from:

HumRRO
300 N. Washington St.
Alexandria, VA. 22314