# EFFECTIVE USE OF COMPUTERS IN THE SCIENCE CLASSROOM

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The rapid introduction of computers in schools has prompted many researchers and educators to criticize school districts for jumping on the "bandwagon" of the new technology without proper planning. Without adequate forethought and research, we as educators are in danger of failing to use microcomputers effectively. Student outcomes may not justify the continued expenditures on hardware and software. In effect, the fate of microcomputers could follow the fate of previous curricular movements, such as, the open classroom and Biological Science Curriculum Study (BSCS). Lack of research and effective planning and training can have disasterous effects on the future of technology in education.

Fortunately, the pace of research has been increasing. Early results are pointing the way to a successful future, but we as the implementers will carry the responsibility for the successful use of computers. In this regard, the primary rule of thumb should be one of maintaining a critical, yet inquisitive attitude toward their use. We should strive to keep up with the research literature, at least in the form of summaries of the research. In the classroom, student responses should be monitored and informal studies performed. In other words, certain key questions can be kept in mind as we continue and expand the use of computers in the classroom. Are students motivated by this package? Are students learning what they should be learning? Are students using their time more efficiently? These are just examples, however teachers should be generating questions that are relevant to their specific needs.

## Uses of microcomputers in the classroom and laboratory

There are two primary categories of computer use (1) computer managed instruction (CMI) and (2) computer based instruction (CBI). Computer managed instruction involves uses that make a teacher's job easier. The following list provides an easy reference to some of these possibilities.

Managing student records
- attendence
- grades
- addresses and phone numbers
- textbook records
- anecdotal records

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| Managing information | - resource list (people)<br>- resource list (suppliers)<br>- electronic bulletin boards<br>- mainframe databases |
| Managing instruction | - individualized instruction progress reports<br>- group investigation progress reports<br>- mastery learning management<br>- testing (formative and summative) |
| Accounting | - equipment inventories<br>- supply inventories<br>- departmental budget |
| Communications | - form letters and reports to parents<br>- forms and hand-outs<br>- lesson plans and notes<br>- memos<br>- general writing |
| Other | - graphing and graphics<br>- statistical analysis |

For the most part, existing software can handle most of these tasks. The initial time spent in setting up data bases to keep records, will save time later. Data bases, form letters, and other formats can be set up before school starts. Then, while in the midst of teaching, only a minimum amount of time is needed to keep records current, send reports to parents, run off assignments, add up and average grades, and so on. In addition, you might need information about some topic. By calling into a major data base (The SOURCE, Knowledge Index) or other source, the information needed can be received within minutes.

Computer based instruction, on the other hand, involves student use of the computer. The following list provides an overview of potential uses.

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| Remediation | - drill and practice<br>- tutorials<br>- learning games |
| Demonstration | - tutorials<br>- simulations (of events)<br>- simulations (of experiments) |

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| Problem Solving | - problem solving games<br>- simulations (interactive)<br>  - performing experiments<br>  - manipulating variables in systems<br>  - making decisions in simulated real life situations |
| Research | - data collection<br>- data analysis<br>- information gathering (from data bases)<br>- communicating with other classes doing similar research<br>- programmming to meet specific needs<br>- record keeping<br>- calculating |
| Production | - graphing results<br>- using a word processor to write the final report |

Although the list may seem a bit overwhelming, the idea is to start out slow and add activities. Software should be evaluated before it is used. Each package or other computer use should be analyzed in terms of its potential impact on learning effectiveness. A couple of guidelines to consider when looking at software are (1) that it should not replace laboratory experiments or good teaching and (2) that it should present a content area or process that is difficult to present by any other means. Software and other computer uses should facilitate learning.

A new product that is being marketed by HRM Software allows various measurement instruments (temperature, force, light intensity, and sound analysis) to be connected to a computer. In conjunction with their software, students can perform experiments while the data is being simultaneously displayed on the screen in graphic form. The instructional result is that students (1) are able to manipulate more variables in less time, (2) can become more actively involved in the scientific method (analyzing and questioning the results as they proceed through the experiment), (3) can maintain their level of interest (by eliminating lengthy calculations), and (4) can obtain much more accurate results than they would by using hand-held instruments.

Communication devices (modems) can allow students to communicate with other science classes around the country (or world). Potentially, students could arrange to do similar experiments where geographic location could be a critical independent variable. Both classes could perform the same experiment and then share their results.

Modems can, also, allow students who are working on research projects to tap powerful sources of information, such as, large data bases, bulletin boards, and other larger computers.

Data base and word processing programs provide students with the opportunity to keep organized records and to formulate high quality finished products. The drudgery and frustration of making changes and corrections in records and papers is considerably reduced. When the product is complete, a sense of pride can result.

The potential uses are extensive. The imagination and skillfulness of the instructor are the essential ingredients.

## Summary of the research

Briefly, the patterns emerging from the research literature indicate that certain types of software are effective. Tutorials and drill and practice are most effective in science and foreign languages and with low and high achievers. Students tend to learn more in less time, but retention is questionable. Affective outcomes, such as, attendance, motivation, attention span, and independence, are affected positively.

Unfortunately, research is lacking in the area of problem solving, simulations, and other uses of computers. However, teachers can pursue a more active role in research. Informal studies in each class help the individual teacher, but collaborative efforts with university researchers could benefit vast numbers of teachers and education as a whole.

## Concluding remarks

In order to successfully put computers to their best use in the science classroom and laboratory, careful planning and evaluating are of utmost importance. On the other hand, fear of trying something new will not yield new and exciting results. Computers are powerful tools, that if used properly, can transform a passive science curriculum into an active and exciting process of discovery. Even remediation can become more rewarding for both the teacher and the student.