

# INSTRUCTIONAL USES OF COMPUTERS: PAST, PRESENT AND FUTURE

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To speak of the past when referring to computers is to speak simultaneously of the present as the two are quite thoroughly merged. For that matter, the future is now for many schools as well. There is a wide discrepancy between the types and quantity of uses of computers in instruction around our country and, indeed, the world. What is a story of long ago—at least 15 years—in Minneapolis is not yet in effect in many other districts. The rate at which the industry changes is accelerating. This acceleration enhances the difference between past, present and future—which seems to be all happening at the same time—in schools today.

Many controversies appear when educators begin to ask:

- "Who" should use which sorts of programs,
- "When" (in the regular curriculum) should computer applications be introduced,
- "What" is the role of the computer in particular subjects, and
- "Where" in the school should computers (and/or terminals) be placed?

These are some of the questions which occur in the instructional environment: the classroom, media center, study hall, computer room. Other questions arise in the area commonly called "administrative uses," those areas related to but not directly involved with instruction such as classroom management, i.e., attendance, scheduling, office needs, district needs, etc. The controversies seem to grow as the number of computers in homes increases and the quantity of commercial software, both instructional and recreational, mushrooms.

It appears that the issues are the same whatever the environment in which computers might be used. Questions introduced 15 years ago are still valid.

1. What are appropriate uses?
2. What are ethical uses?
3. What are legal uses?
4. And what can we do about any of it?

There is, for the most part, a consensus of opinion about instructional uses of computers. Regardless whether the delivery system is a large, sophisticated timeshare computer, or inexpensive microcomputers, most educators involved in instructional uses agree that computers are excellent tools to: (1) introduce concepts, (2) reinforce concepts, (3) practice skills, and (4) create learning environments or settings.

To help accomplish these tasks a large body of packaged educational software now exists in formats generally referred to as: (1) demonstration programs, (2) simulations, (3) drill and practice, (4) learning games, and (5) tutorials. In addition, many educators subscribe to the notion that logical thinking and problemsolving skills are enhanced by learning to program the computer, then using the computer to explore and solve problems.

Let us look at the basic objectives of using computers in education more closely. The notion of "introducing concepts" via a computer is not new. In early developments such as the Huntington simulations, concepts in social science, physical science and economics were often introduced in the sense of allowing students to "discover" them while participating in the simulation. That notion of "discovery learning" has been accepted by educational philosophers for some time. The availability of computers has only recently made it practical. That students learn concepts they have "discovered" more thoroughly and retain the knowledge longer has been documented by educational research. More recently, computer programs which "demonstrate" certain concepts have begun to appear. The demand for this type of program, one by which a teacher with some ease could convey a complex concept, is strong. This leads us right back to the question of appropriateness. Not all concepts lend themselves to demonstration on a screen or paper. But, even for those that do, such as the slope of a line based on its equation, there still remain the questions "who," "when," etc. Taking just one concept, the slope of a line based on the equation for that line, some of the answers may seem obvious, yet are often contested. This concept is normally

taught in regular eighth-grade mathematics classes. As a demonstration format computer program, it works well handled by the teacher, using a single computer, in front of the whole class. Yet, it could also be used by one or more students to "explore" the notion and "discover" on their own. Since the program allows the user to input any number of equations and observe the line on a graph, it has been called (and used!) by some as a drill. Before the computer program, a common technique used in teaching this concept was to have the students draw a great many graphs of lines given their equations. Rather than change that style of teaching the concept, some teachers simply insert the computer where graph paper and pencil used to fit. Most of us would call that an inappropriate use of the computer. A demonstration program such as SLOPE, used to introduce a concept known to occur at a particular place in the curriculum may not generate controversy regarding "when" it should be used but is still open to other questions.

In other schools where the computers have been designated "for remediation," what will be the chances of an 8th-grade math teacher getting use of the machine to demonstrate a concept to a regular class? Likewise, in situations where the computers are believed to be "best" used in classes for the gifted? A recent research project by an eastern college referred to cities where decisions had been made at the top administrative level to limit use of computers to particular segments of the population. In one where they were used entirely for remediation, the regular and gifted students felt some stigma attached to computer uses, an attitude likely to close many doors to them in their future in our highly technological world. The other side of the coin, in the city where only the academically-able were allowed to use computers in the elementary school, underachievers—who might have benefited greatly by computer-assisted learning—felt that they could not possibly handle them and were reluctant to try. When we ask "what" the role of the computer might be in a particular subject, we are again asking "what is appropriate."

Perhaps at some point in the curriculum of every subject there is a place for the computer; where it will accomplish a teaching task better than any other means. This is not to say that at every point in every curriculum the computer is the answer to teaching the subject. There is a time to review the rules of a sport using a computer, perhaps even to simulate playing the sport, as a way to develop strategies for play, but there is also a time to put on your sneakers and get out on the field! It is the responsibility of educators to learn how to discriminate, how to recognize "appropriate" uses of computers. Even the "where" becomes a bone of contention in many schools.

Should the computer be in the media center with students sent out of class to use certain programs? Should it be in the classroom, like an overhead, for the use of the teacher and the class at the important teachable moment or should it reside in some special "computer room" staffed by parent volunteers or school aides and used freely by any student who so desires? What is "appropriate"? Perhaps the best answer to the above set of questions is YES! All of the above! When it is educationally appropriate! A small school district in Minnesota adopted a slogan for its computer project which is well worth repeating:

"When you are thinking about the role of computers in education you should not be thinking about computers, you should be thinking about education!"

There are rarely simple answers to complex questions. The case of appropriate uses of computers in instruction is a complex question. One solution is training. Training staff in computer literacy (what computers can and cannot do, their impact on society, hardware operation and sufficient programming to really believe that people control computers) is only the beginning. Staff must have training on teaching methodology and strategies using the computer as well as opportunities to review the available software. A trained staff can make better decisions about when, where, what and who should be using the computer. Best of all, a trained staff can incorporate the computer into the regular curriculum in a way which will make it a part of the students' school experience in a natural, yet thorough way. Our responsibility as educators to graduate computer-literate students is not in question. Yet, this apparently simple solution to the question of appropriateness of uses is indeed complex. How can a district accomplish that much training? How can a district acquire sufficient machines to complement the curriculum? For that matter, how many computers does it take to implement instructional uses? Should they be the same units used for administrative uses? No, there are no simple solutions to the problem. What we do have is a wealth of experience from all over the country, spanning more than a decade of successful uses of computers in education. Meetings of professional organizations such as NCTM, AEDS, NECC, are one method of disseminating the results of experience. That is where you can learn how one district "subverted" the schools into buying computers by loaning them one until they were deeply involved, then retracting the loan: Result—school buys computer. That is where you can learn how a district motivates teachers to demand training by supporting just one lively active teacher in a school. When the rest of the staff observes the joy and success connected to computer use in teaching, the demand reaches proportions well cal-



culated to respond to offers of inservice training during free hours. That is where you can learn the training techniques to use with administrators as opposed to groups of elementary teachers and the things to watch for when training secondary teachers and media specialists. We learn from each other. We also learn by sad trial-and-error.

Two of the issues raised at the beginning of this article, ethics and legality, are relatively new, or at least have just recently begun to be realized as serious issues. There is no large body of experienced school districts to approach seeking answers. We will have to discuss the problems, suggest solutions, share results, and wait. Hopefully, it will not be long before positive results begin to show.

No one ever denies that copyright laws exist. At most, someone may say that they are unclear or should be changed. Nevertheless, copyright laws exist and apply to computer programs. There is an old story among pilots of retractable-gear airplanes to the effect that it is not a question of whether or not you will one day make a gear-up landing, but a matter of "when" you make your gear-up landing. The same may be said, these days, of "when" you make your first illegal copy of copyrighted software.

People in positions like mine are often asked to serve on committees discussing the impact of technology on the curriculum, e.g., "What changes will be caused by the very presence of the technology?" We might also be asked: "What changes in values in our society are being caused by the presence and nature of computer technology?" The popular media, reporting economic research, tells us that information is becoming the major product of our country. We are besieged by organizations concerned with "privacy" as an issue in our government. States are passing "privacy acts." The general public is legitimately concerned with the uses to which the immense amount of easily accumulated data on each of us may be put. What "ethical" uses exist for the easily accumulated data on students being stored in computer memories all over the country? It is good teaching practice to group students by the learning objectives on which they need help in order to provide timely

intervention. Classroom management programs which analyze test results, report student achievement based on teacher—or school, or district—determined objectives and offer suggested prescriptions are an extremely popular type of computer program. The current technology allows classroom-level information to be transmitted to larger memory banks, wherein the entire student records are maintained including attendance, health, socio-economic information, etc. I have never heard of such records being used unethically, but the potential is certainly there. What a bonanza for commercial sales representatives for everything from "auxiliary schools" ("is your child having trouble in school? Send him to us. For only \$\$\$ we will guarantee . . .") to computer companies ("buy a Brand X computer and let your child learn at home"). For years, educational institutions have resisted pressure from the commercial domain for mailing lists and personal information. How do we insure, in a technological society, that personal information is not easily stolen? Perhaps more difficult to answer, but closer to home, is the question of how we insure that the great masses of information about students and staff is used ethically. Is it ethical to perform a computer survey of the achievement of each year's students, over several years, to determine the effectiveness and continued employment of a particular teacher? Is it ethical for a teacher to review a student's past history before beginning to teach that student? How much information needs to be kept on anyone? Who should have access to that information? With information so easy and inexpensive to store, must we really store everything?

In predicting a little "future," I would like to include the retention of mountains of useless data on students and staff for some period of time until educators pass through the phase of collecting data just because it is so simple to collect. That great bear of education, "the paperwork," can be so easily conquered now. It will take time for educators to start discriminating among the data to be kept and that which can safely be ignored. It is surely effective for a classroom teacher to have daily information about a student's progress, but that wealth of information would only burden the permanent files about the student. Is it not enough that a student has progressed from Objective A to Objective Z in a curriculum? Do we really need to review the steps along the way?

The question of ethical uses is not limited to the storage of information or privacy issues. There is no "law" covering one student (or teacher) erasing the computer programs stored by someone else on an instructional computer. It is not patently illegal. Whether or not it is unethical—whose responsibility it is to decide that question, and whose responsibility it is to "teach" the

decision—seems to depend on which end of the situation you reside. If you are in the middle of a long and complex program and run out of space you may decide that destroying someone else's program to get some space is justifiable. If you are the student whose program was destroyed, you may not agree with the decision which was made. If you are a teacher who has occasionally zapped someone else's program yourself, you may not be willing to take on the task of teaching others that it is wrong.

The student who, in a zealous pursuit of information about how computers function, crashes the instructional timeshare system probably does not feel the experience was either unethical or illegal. Was it either? That is not a trivial question these days. We find ourselves "tempering" judgement based on the circumstances. Should the student who inadvertently crashes a computer and immediately reports the fact and how it was done be treated exactly the same as the student who deliberately sets out to crash the system? Are we dealing with accidental homicide versus premeditated murder? Who decides? We are seeing many of society's deepest problems repeated in a different environment. Before laughing off the crash of a computer system as being far different from murder, consider that the students of today have access to terminals in homes, libraries, school, etc., and seem always to have "IDs" to numerous computers including several which have the potential for serious effect on the rest of the world. It is one thing to crash a system dedicated to K-12 instruction. It is another to crash the phone company, American Express, or the computers in the Department of Defense. Yet the process and many of the techniques are the same. Yes, theft may be involved. If a student "steals" the "ID" to a State Department computer or is given it by a member of the family who works there and thinks it is "OK" for junior to use the machine at night—the result is the same after the crash. Is anyone liable? Can we stop it? Students with whom I work have only one suggestion. They claim there is no way to stop them from getting access to various computers, that we can only teach them that it is wrong! But, can we do that? When a teacher is faced with a roomful of eager programmers and the instructional computer fails and one of the students says, "My Dad works for the phone company and I have an access code," what do you suppose that teacher is going to do? It is a very difficult decision. It sounds like the days of riots and reform to speak of providing sufficient computer power, supplies and software so that teachers and students are not motivated to break copyrights or steal codes or destroy each other's programs. Has our societal value system changed to the point where a personal, perceived

need has precedence over private property? Some companies prosecute copyright infringements of software. Are staff ever fired for copying a copyrighted book or diskette? Programmers are warned of the impossibility of protecting their products. Are we seeing tacit acceptance of lawbreaking depending on the circumstances? It has been said that when a law is known more for the breaking than the keeping (like Prohibition) it is a bad law and should be changed. Are we approaching a time when copyright laws are revoked because they cannot be enforced and because no one (but the author) wants them?

In summary, we live in an exciting time when technology has presented us with a tool that diminishes the drudgework associated with education, provides better management of learning, saves valuable instructional time, and offers a fantastic potential for improved learning. Yet we must deal with the "Good, the Bad and the Ugly" aspects of this new environment. With all those very "good" uses of computers in education comes the potential for "ugly" misuse of good instructional materials, addiction to arcade games, unethical behavior toward others' programs and blurring of values in our society. The "bad" uses of computers: computer crimes, control of society through the use of sensitive information, etc., have added a dimension of fear to a world already terrified. It is our responsibility as educators to show the world, especially the young, that the advantages and benefits of computer technology, used wisely and well, far outweigh the hazards. A more computer-literate society can guard itself from many bad and ugly uses, e.g., the loss of millions of dollars to crime and error in banking could have been avoided had bankers understood the round-off/truncation problems of computer designs. The students reassure us that they, at least, do not fear misuse of information they feel confident they could erase at will—an interesting twist to the question of ethics. That becoming technologically knowledgeable is difficult cannot be denied; that it is imperative in our society must be acknowledged. The past is just not that long ago, the present is noted by the increasing rate of change—and the future was yesterday. . . .

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