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Reflections on The Computer in the School

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Twenty-three years ago, when I put together the 1980 book, *The Computer in the School*, personal computers were just making their debut. Figure 1 shows a photo from the the book of a kindergartner in a vendor booth at the 1979 National Computer Conference in New York. He was using a just-debating digital stylus and tablet to draw directly into an attached Apple II and view the drawing on the screen as he made it. It was exciting—for him and for the many people watching.



Figure 1. Kindergartner drawing into an Apple II, 1979 National Computer Conference.

For the most part at that time, though such PCs were beginning to appear, the computers found in schools (and most other places for that matter) were primarily larger, multi-user computers, and educational software was not yet very widely available. The arguments and theses advanced in the book depended on the insights of the five relatively visionary authors it featured, extrapolating from the limited capabilities of hardware and software then available. Each had done his foundational work on learning and computers largely in specially constructed digital environments, different from those ordinary teachers might have had at their disposal (an inevitable difference, given the size, and nature of the computers and attachments then available). However, each had, nevertheless, logged considerable experience with young people actually using computers as a support in learning and from that, despite the unique environment, had drawn perceptive conclusions about what it meant.

The world, in general, and the world of computers and digital technology in particular, have changed considerably since that day, as Figure 2 shows.



Figure 2. Digitally waiting in Amsterdam airport, 1997.

Drawn at Amsterdam's international airport as I waited there one day in August 1977 for my flight back to New York, both this absorbed laptop user, and the KLM jumbo jets outside—technology-dependent descendents of the once mighty global Dutch fleet of sailing ships—suggested just how radically the world is changing.

This article is a reflection on some of those changes and their implications and incorporates an earlier set of reflections that I delivered as a keynote presentation in Vina del Mar, Chile, in December 2000, exactly 20 years after the original book was published. The occasion for delivering that 20-year reflection was the biannual RIBIE meeting of experts in digital technology and education from all the world's Spanish and Portuguese speaking countries. (*Editor's note:* See the [Resources](#) section at the end of this article for Websites.)

Reflecting on the past can be helpful in noting what we should be pleased about and perhaps in suggesting how we might improve further upon something that has been successful, making it somehow still more effective or beneficial. Reflecting on the past can also help us to identify mistakes and failures, and, if we are honest and fortunate, suggest how we can overcome or avoid at least some of them in the future.

That 2000 reflection was constructed by considering digital developments since 1980, formulating various alternatives to the original title that these developments might suggest, merging and synthesizing those into a single new title and subtitle, and then filling in the details. Retitling as Reflection ([Appendix A](#)) presents several of these alternative titles and briefly discusses their implications. They reflect such realities as the radical increases in power and numbers of computers in the school that had occurred in the two decades between 1980 and 2000; the unprecedented increasing in staff retraining that utilizing them demanded; and the breadth and depth of previously inaccessible information outside the classroom that effective use of this digital technology could make instantly available. The title so derived is still suitable today, provided the word *global* is appropriately incorporated in it. As Retitling as Reflection suggests, the word *global* underscores the need for more emphasis on a dimension of human orientation and thinking that technology and events since 2000 have demonstrated is sorely needed but sadly underrepresented in education around the world. As a fitting transition to the reflections on an analogous 2003 book which follow, here is today's proposed title.

A DIGITAL WORLD IN THE GLOBAL SCHOOL: ACCESS, COLLABORATE, COMMUNICATE, EXPERIENCE

Unlike the three-noun subtitle of the 1980 book, this subtitle uses four verbs to categorize the uses of digital technology in today's schools. This new categorization of how digital technology is used reflects four types of activities in which students and teachers can engage to enhance their educational experiences together. Though not overtly conceived to do so, the use of verbs appropriately suggests a very active use of digital technology.

Access

Access suggests that, over networks—wired or wireless—students and teachers can access directly a broad and extensive body of information around the world, far beyond the limits of their own books and libraries, and far beyond anything possible in 1980 when the original categories were framed. Moreover, as Figure 3's illustration from a current, much visited website on music suggests, the diversity of forms of the information they can access is astounding, far beyond anything previously so easily available, from high-fidelity audio to high-resolution still images and video in brilliant color.

For example, so long as they have wired or wireless access to the web, students, without ever leaving the school, can not only access and hear high fidelity music like trumpeter Alex Holton's performance of a Telemann Air in sites like Figure 3's WebConcertHall (see [Resources](#)), they can also access digitized textual material in some library of renown thousands of miles away or browse digital images of art in a museum halfway around the world (as an example, see metmuseum.org).

Collaborate

Collaborate suggests that students and teachers can use digital technology to work together, not only with each other, but also, as appropriate, with those outside their school, even across the world, to develop and refine their



Figure 3. Accessing the multimedia riches of WebConcertHall.com

ideas, as they construct and refine projects realizable only through collaboration. For example, the seismology departments of several universities are connected digitally to a number of secondary schools distributed over a wide geographical area so students in each school can collect data from their school's own seismometer and then digitally transmit the data from all the schools into a pool accessible by the university scientists. They, in turn, analyze the pool of data and transmit their analysis back to the individual schools. Students, by actually participating in scientific work, can understand a concept (like the activity in the earth's crust) in ways and to a degree that would never have been possible before such digital collection and transmission became available.

Communicate

Communicate suggests that students and teachers can communicate with peers and with experts of all sorts, again, anywhere in the world where such peers are connected by wired or wireless networks, using a global language, English, or one of a number of other broadly used, regional languages like Spanish or Arabic. They, thus, potentially broaden their own understanding of life through reference to those with different relevant experiences. Examples include all sorts of email and Internet interchanges, some elaborately structured by the participating institutions at each end, others left loose and informal. And special networks of school collaborators have now been established, like the worldwide Kidsnet or the Chilean *Enlaces*, each focussed on a particular population of students or a particular theme of collaboration.

Experience

Experience suggests that through radically improved, network- or CD-resident simulations of all kinds, students can experience things about their world, not just through the possibilities the three other verbs imply, but also through simulations of events, or chains of events, that, for any of a variety of reasons, either *cannot* or *should not* be actually experienced.

An example of this is Brownfield Action, an undergraduate earth science course developed at Columbia University (see [Resources](#)). Brownfield Action presents students with a simulation of a geographic locale in which prior pollution of the earth is suspected but not proven. Working in teams, the students must use the simulation to discover if such pollution did occur, and if it did, exactly where and in what quantity, using what they find to present an argument for buying or abandoning the land.

To get such an experience into a science class by any other means would be impossible. Yet without actually polluting any environmental area for their students to explore, or having to spend time locating one that is already appropriately damaged in an understandable way (and struggling to gain permission for the students to explore it), through simulations like Brownfield Action, professors are able to give students relevant experience with a serious environmental problem that their society will increasingly confront.

In addition, the Brownfield experience enables students to understand better how scientists actually think and proceed. And though these Brownfield students read traditional books and articles and conduct traditional lab experiments, their involvement in the simulation gives both reading and lab relevance seldom, if ever, communicated in the analogous earlier traditional course.

EFFECTS OF DIGITAL TECHNOLOGY IN SCHOOLS

Incorporating significant digital technology into learning in schools is likely to have many effects, some with positive and other with negative implications.

Three Effects With Positive Implications

The following are three likely effects with positive implications:

A transformation of the teacher's role will occur, from the impossible traditional role as Wizard of Oz to the more manageable, useful role of coach. The teacher's role as font of information will be reduced, because digital technology offers the student so many viable and rich alternative information sources pursuable through websites, CD's, and other digital means. At the same time, freed from the responsibility of providing and dispensing knowledge, the teacher, in becoming more of a coach or coordinator, will routinely advance student efforts to master use of such digital sources for themselves.

A very helpful increase, so far as many topics and certain students are concerned, will occur in the role of audio, images, and other alternatives to textual representation of information, both as information repository and communication vehicle. The presentation of information in nontextual modes, either in place of textual or in addition to it, can only grow. Ideas, records, and procedures that are better understood when presented in part or completely through sound or images (still or moving), can, and increasingly will, be presented in those alternative representations to the benefit of many students.

A significant rise, with time and laborsaving consequences, will occur in the use of alternatives to sequential order, both for accessing and presenting information. The rise in the use of alternatives to sequential order will occur because of a basic property of digital information storage and processing known as *direct access*. This basic property of digital computers has already reduced the relative role of sequence in every context in which computers are used to handle information and will do the same in schools, too.

Direct accessing is an integral property of a computer that functions like a very effective index, allowing it to access any piece of information once digitized and stored by its exact digital address within that computer's vast domain of storage, thus relieving the computer of the need to search that memory, location by location, from beginning to end, looking for the desired piece. A fairly new, but by now very familiar incarnation of this property and its use can be seen in the hyperlinks in websites, where clicking on a given hyperlink causes the computer to "take" the user directly to some portion or feature of the website reflected in the link. For example, in a well-designed website index like that reflected in Figure 4 from Musicians, a site exhibiting over 300 drawings of musicians, each hyperlink in the index provides direct access to a different one of that site's major exhibitions, the subdivisions in that site.

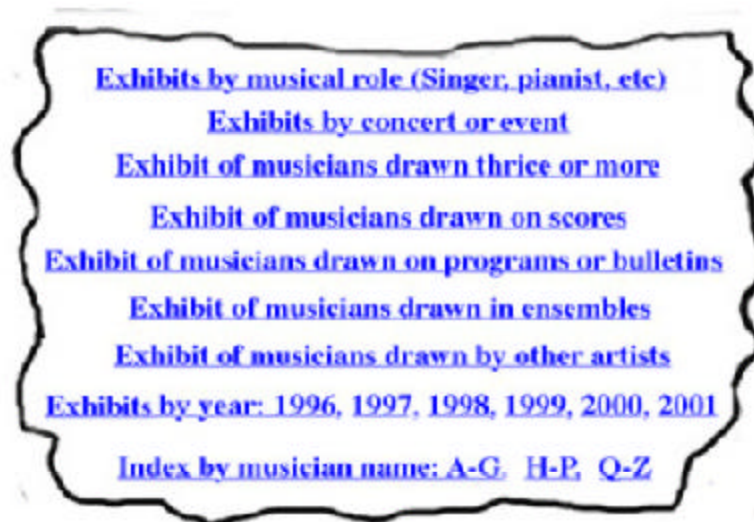


Figure 4. The index of the Musicians website, direct access via hyperlinks (see [Resources](#)).

Three Effects With Negative Implications

Three likely effects with negative implications from incorporating significant digital technology into learning in schools are the following:

1. The exhaustion of the user of technology by the effort to keep abreast of the exponentially increasing rate with which digital technology is changing. This increasing rate of change is fed as much by the greed of the manufacturers and marketers of the technology as it is by necessity, and one must learn to adapt to it in that context. Nevertheless, a whole new way of living must be developed, accepting that one cannot afford to take in and begin using something just because it is the latest, and that one must sometimes, rather than physically solving each puzzle raised by something gone wrong, avoid a technical problem by finding an alternative way to accomplish the same thing.
2. The feeling of drowning in the expanding ocean of knowledge it makes available. This feeling can be addressed by accepting that any individual's knowledge of both facts and procedures can only be exemplary and never comprehensive. There is just too much to know on any given topic to ever learn it all. One can only take in and understand examples or slices of a field, not everything, and then collaborate with and rely upon others to help keep the full picture involved as one personally deals with some part of it.
3. The ensuing uncertainty of identity associated with the world's movement toward a technologically supported, increasingly global homogeneity. Drawn only 3 days apart, the two men reflected in Figure 5 at least suggest the problem. Making yet another routine multi-thousand mile flights to the Persian Gulf to arrange the chartering of giant tankers to transport oil from there to destinations all over the world, the English shipbroker (left) is a man whose work depends on an increasingly global community of users and businesses. By contrast, the old drummer (right), playing cross-legged on the floor, was one of a group of musicians ringing a small room in Bahrain's old city re-enforcing through performing traditional music, the centuries-old, local cultures of the island. The divergence between such global and local orientations is one the digital world in the classroom will increasingly have to confront and deal with.



Figure 5. Global travel, traditional culture, and globalization—1999 (See [Appendix B](#) for additional context for these drawings.)

Because of increasing travel, instantaneous worldwide communication, and the increasing use of regional and global languages, the differences between local cultures must decline. This can create serious problems, as September 11, 2001, (the date of the terrorist attack on the World Trade Center) so clearly demonstrated. As a way of nurturing identity, humans have always cultivated subcultural differences, even to the extent of enslaving or killing those of another subculture.

Now, as digital technology and other factors make extensive globalization an inevitable reality, we must find some other approach to reality, some other way to understand and teach the equivalent of cultural identity. We must through better education present the young men with alternatives to the violent approach, whether that approach is in the form endorsed by the 9/11 hijackers, or in the form periodically proposed by national leaders who, to consolidate power or to make their respective points, coerce and mislead their own people into inappropriate violence in the form of war. Now we must use education to help people establish social realities that meet the

human need for identity, but do so without the damaging and destructive aspects too often part of the identities we have developed in the past. Perhaps global communication in schools through websites and otherwise will provide part of the answer.

An Effect With Enormous Mixed Implications

One effect associated with incorporating significant digital technology into learning in schools, has positive and negative implications, inseparably linked. It is the effect on the teachers. Considering the many points already made about incorporating appropriate new digital technology applications into education, many teachers will be positively improved by developing new insights and approaches to teaching and to learning.

On the other hand, the increasing inclusion of digital technology into the schools worldwide will require expensive and time-consuming training, both initially and thereafter periodically, so long as technology is used. Teachers can only become and remain coaches able to guide students through the morass of complex digitally shaped activity that will continue to develop as we move ahead.

While such training and retraining can give teachers refreshing new insights, it costs a lot of money, both in terms of teacher time and trainer salaries. Unfortunately, one thing we have learned since 1980 is that schools and educational institutions are generally reluctant to underwrite such costs, particularly for any sort of periodic retraining, which has no permanent end. In return for their money, investors seem to prefer it be spent on physical objects they can easily see rather than on training whose results may be very difficult to assess.

Nevertheless, if we would improve education through increasing the use of appropriate digital technology, we must somehow include the training of those who will implement the education.

HOPES AND CAUTIONS FOR THE FUTURE

It is probably wisest to end this article with a mixture of hope and caution. Many unbelievable things underwritten by technology now happen so frequently and with such apparent ease that we no longer even notice them, despite their immense implications for education. The two examples with which this last section begins are personal because they are ready at hand, but both have analogous counterparts in the experience of hundreds of thousands of those using digital technology today.

The first illustrates the extreme casualness with which people undertake long distance travel today, travel heavily dependent upon digital technology, and suggests just how integrated that technology is on the one hand, and how reliable it is on the other. The portrait (left) and self-portrait (right) in Figure 6 were drawn in a taxi. The casualness with which they were drawn may seem understandable if they are viewed as done by someone who draws a lot and did it just to fill the time in another taxi ride. The casualness is astounding though when one considers carefully that the taxi-riding artist was bound for the airport in Prague, where he would catch a flight to New York that would cover more of the earth's surface in *7 hours* than Columbus did in *5 weeks* on his perilous first voyage from the Canary Islands to the Bahamas 500 years earlier.



Figure 6. Self-portrait before a 4,000-mile flight.

While many things make such a flight possible today and render taking it so matter-of-fact an event given the subject of this article, it is important to remember that behind every such flight, digital technologies of many kinds play a crucial role _ in the design and manufacture of the aircraft involved, in flight scheduling, in the jet's operation by the airline, in its guidance by international air traffic controllers, and so on.

The second example illustrates the extreme casualness with which millions of us now use Internet communication, something that did not even exist in 1980 when *The Computer in the School* was published. Since it became global in the last decade especially, such communication has become so routine that the indispensable enabling role of digital technology in such communication is forgotten as easily as is its role in long-distance, high-speed air travel.

The communication example is this. One day while preparing this article, I received email at my office in New York from a pianist in Seoul, Korea, with whom I have performed in the past in New York, and in it she asked for a drawing I did of her violinist husband, playing at a concert a couple years ago. From my hard drive, I immediately retrieved a digital version (Figure 7) of the drawing and promptly emailed my response to her, inserting the digital version of that drawing as a file attached to the email, indicating the file's type. Then, confident she would receive it shortly and have no trouble opening and using it, I exited the email system and returned to some other work.



Figure 7. Drawing attached as jpg file to e-mail sent to Seoul

Such examples suggest just how digital technology invisibly facilitates travel and communication on a global level to a degree never before imaginable. And such technology has also played (sometimes invisibly, sometimes noticeably) an important role in offering or contributing strongly to the development of many other valuable things, things like new insights about human development and health, practical ways to extend the productivity of the environment without degrading it,

solutions of all sorts of engineering and scientific problems, and so on. A catalogue of digital technology's supporting contributions could go on and on and certainly suggests there will be more in the future. It is easy to see why, and at least partially to see how, we must do everything necessary to guarantee the incorporation of adequate understanding of, and facility with, digital technology and its application in general education in the years ahead.

At the same time, if nearly a half-century of widening experience with digital technology has proven anything, it is that in addition to the positive contributions many applications have made to human life, inadequately, erroneously, or evilly planned applications have produced some disastrous results. Concurrent with the positive implications suggested in this reflection, careless or inadequately planned applications of digital technologies have contributed to disasters like the Chernobyl meltdown and the TWA Flight 800 explosion. And deliberately evil applications have also contributed strongly to the development of new ways to advantage some at the expense of others, by deceiving and misleading, by destroying the environment for immense personal gain, or by destroying others either directly by violence as terrorists have, or indirectly by theft of assets as corporate executives have.

This means that whatever we do as we alter our educational systems to make them more digital and more global, we must work to ensure that ongoing education, besides including training in digital technology use, continually emphasizes our mutual dependence on each other and the danger implicit in our innate tendency to advance ourselves without adequate regard for, or even in disregard of, others. At the same time that education should help us to remember constantly the limits that inhabiting a finite world imposes on human activity, whether we like those limits or not.

Our educational system education must also make us all ever conscious that using technology to exceed the bounds of nature may be beneficial to someone, to some subgroup, or even to many, for a while, but it will have a cost eventually, a cost substantial enough that the education we construct must make everyone appreciate this cost and learn to reasonably estimate how much it will be and whether what is gained will be worth that cost.

Moreover, education must continually make clear that if digital technology is involved in a process, the more remarkable or powerful that technology is,

the more rapid and extensive the damage caused may be if the process is flawed in any way. The education we implement with digital technology support must train everyone to continually consider both these dimensions, and do so on both a local and a global scale. Even as we must dream of new ways to capitalize upon digital technology so that it helps us all, we must simultaneously constantly consider the cost of each use in terms of destructive possibilities should anything go wrong. We must, therefore, accompany any new use with careful built-in monitoring for defects, failures, and vulnerabilities.

Only such an education can hope to be adequate for what lies ahead.

Resources

www.ccnmtl.columbia.edu/projects/brownfield

This website represents the group at Columbia University that has, working with faculty responsible for the courses, digitized significant portions of a number of the university's regular courses over the last several years. One of the first was the environmental science course, and for that course the Brownfield Action simulation and related materials were developed.

WebConcertHall.com

This website presents a rich fabric of music and related materials, including an archive of digitally recorded works by professional and prize-winning musicians, background educational material, including historical summaries and art (or links to it) produced in the eras of various composers whose music is accessible in digital recording in WebConcertHall, and other things of interest to musicians and music students. It also annually holds an international music competition, entered by submission of digital recording, which has attracted a number of top-flight musicians from around the world. The recordings of the winners and a number of the entrants may appear in the archives later. Since thousands of visitors from all over the world access it each month and a number of them are from various educational institutions, this is a quintessential example of how the digital world can now enter the school.

www.tc.columbia.edu/taylor/bahrain

Reflecting a conference on Globalization and Arab Higher Education held in the island nation of Bahrain in the spring of 1999, this drawing-based site also concisely reflects the issues of globalization in the world as the 20th century ended, including the triviality of long-distance travel, the struggles between local cultures, and the increasing incorporation of digital technology in education and life in general. Since this site is publicly available, it can be entered from a school by anyone with Internet access, making it a good example of the digital world that can enter the school.

www.tc.columbia.edu/taylor/SeeRIBIE

This drawing-based site reflects a trip to Argentina and Chile in December of 2000, with the greater portion of it reflecting the RIBIE2000 meeting at which the presentation summarized in part of this article was made as a closing keynote. Like the website Bahrain referenced above, this site also strongly reflects a number of issues of globalization at this time and is a good example of a piece of the digital world that can enter the school.

MetMuseum.org

There probably is no “typical” museum site, since each strives to be unique. However, this is the site of one of the world’s largest and best known museums, New York’s Metropolitan Museum of Art. It is included here as a reflection of the sort of intellectual resource any student in the world with Internet access can now browse, from her or his classroom, providing another good example of how the digital world is now “in” the classroom.

www.tc.columbia.edu/taylor/zmusician

This site presents over 300 drawings of musicians _ some in rehearsal, some performing, some at rest _ drawn over several years, primarily in New York, but a few in other locales like Prague or Bahrain. It explores many of the properties of exhibiting drawings once digitized and also suggests something about the globalization of music. It has a very different purpose and effect than WebConcertHall.

APPENDIX A

2003 REFLECTIONS ON TITLES FOR TODAY'S ANALOGUE TO *THE COMPUTER IN THE SCHOOL*

To prepare the RIBIE presentation, a rough list was made of the digital technology being used in schools in the year 2000, and then its elements compared with their 1980 analogues to suggest what and how much had happened in the intervening 20 years. Preparing that list and making the comparisons revealed all sorts of changes had taken place, both in the technology itself and in the breadth of its application. For each such change that seemed major, a new title, subtitle, or combination reflecting that direction was drafted and briefly expanded upon to better see where it led. Although these alternative titles and the comparisons that led to them were not included in the RIBIE keynote, a subset of five of them are included below, because of the additional insight they provide into the overall reflections. The five are preceded by a review of the original title and followed by slight modification of the last to better reflect 2003.

THE ORIGINAL TITLE

According to the many reviews published and comments offered following the 1980 publication of *The Computer in the School*, using the subtitle to propose three principal roles played by the computer in education was quite helpful in bringing order to the understanding of a first generation of work in computers and education—work which, given its early stage, appeared rather fragmented. The first role reflected a significant subset of that work, one in which the computer was seen as an ideal tutor. The second reflected a whole broad set of applications that saw the computer primarily as a tool in learning, as it was in other environments. And the third described another role in which others saw the computer functioning in education, that of a virtual person being taught, reflecting the simple idea that one learns best what one must teach.

Since to construct software that would enable the computer to function as a tutor on some topic, one must first thoroughly learn that topic oneself, an excellent way to learn is to construct tutorial software. In doing that, one must in effect “teach” the topic of the tutorial to the computer, thus making it the “tutee.”

Though for a number of years following its publication, the original title and subtitle proved very helpful to people trying to grasp what might be going on in this new world of computers in education, now, 20 or more years later, the title proper appears too narrow and the use of roles for subtitling, both narrow and inactive. The first four alternatives to the original title that follow suggest things omitted or underrepresented in the original, while the fifth presents the title that was given the 2000 RIBIE keynote reflection presentation, delivered 20 years after the book's publication. That fifth is followed by a brief discussion of how and why that one was modified for this 2003 reflection.

Title Reflection 1

For the original title the two primary words were *computer* and *school*, because linking them thus suggested the main idea of the book. Keeping *computer* singular was appropriate, because in the 1970s only a minority of schools possessed computers, and of those that did, few possessed more than one. Although through terminals wired to the school's computer that computer might have been accessible from more than one location in the school, it was still typically the *only* computer in that school. By the next decade, this was no longer true, and by 2000, a single large city alone, like New York, owned and used more computers just in its schools, than the whole world had in the mid-1970s. Today that title would certainly require an "s" on the word computer. But even that could not adequately reflect the astounding increase in power, speed, and versatility incorporated in computers since 1980. Considering both the increase in numbers and in capabilities, a better title for an analogous book today would probably be

The Super-Computers in the School and Their High Speed, Multimedia Access to the World Beyond the Classroom.

Title Reflection 2

But with the flood of super-computers came a tidal wave of related problems that continue today. In the 1970s, when all but three articles in the original book were written, a computer could be expected to remain usable for a

period of from 4 to 6 years, its software kept up to date by a series of new releases during its lifetime, each reasonably compatible with the software and hardware base of the original computer. In the decades since, at least partly because so many hardware and software makers are so eager to upstage rivals by marketing new and sometimes deliberately incompatible features on their particular version of an analogous product, by the time a digital product even hits the market, it is almost certainly conceptually, and soon may be actually, out of date. Though fixes to this problem continue to be proclaimed, none has proven lasting or satisfactory.

If it were to reflect this serious problem and the continuing need within education itself to do something about it, a title for the analogous book today might more appropriately be

Outmoded Digital Technology in the Schools and Dealing With the Relentless Acceleration of Change Underlying It.

Title Reflection 3

Neither original title nor subtitle mentioned teacher training, though those experienced with computers and teaching urged schools to undertake it, certain that considerable ongoing training of teachers would be an essential component of any long-term, fruitful use of digital technology in schools. Despite the astounding growth in numbers and capabilities of computers and in the analogous changes in related digital technology available, widespread failure to consistently provide such teacher training has seriously constrained the benefits of such technology for education. Though there is some truth in the argument that once everyone becomes “computer literate” the need for some training will be significantly less, that lessening will apply only to certain kinds of training, not all. Factors like the relentless acceleration of change mentioned in Title Reflection 2 will continue to make significant periodic retraining absolutely essential. In light of these facts, a more appropriate title of the analogous book today might be

Digital Technology in the School and the Career-Long Periodic Retraining of Teachers Essential to Capitalizing on It

Title Reflection 4

Another shortcoming of the original title today lies in the importance it gives to the word computer. In 1980, using that word, in that position in the title, had startling implications—computers were just entering the public consciousness and what they might have to do with schools and education was of great interest in many circles. Today, accurately or inaccurately, the term computer implies far less than the broader “digital technology.” This term is used to imply support for a broad range of things that a 1980 computer in the classroom could neither do nor provide access to—things the term “computer” in 1980 did not even suggest to most members of the education establishment or the general public. Today’s broad use might, therefore, better be reflected by a title and subtitle like

Digital Technology in the School, and Digital Reflections of the World Accessible Through It

Although this version’s subtitle fittingly suggests the *content* such digital technology will bring to education, it does not suggest the very active ways this technology increasingly will be used by students and teachers to explore such content. The next and final title does.

Title Reflection 5

Finally, when the original book appeared, it certainly reflected that those urging introduction of computers into education anticipated many changes this would bring to education. Even so, few people—even experts—anticipated just how many and how extensive these changes might be. For example, few then could imagine the methodological changes that would follow: the ease with which information could be represented in alternative forms like audio and video, the ease with which it could be accessed in arrangements other than sequential, and so on. Few realized how much collaboration would be spurred by digital technology or how broadly the collaboration might be. Few realized how soon and widely digital technology would be linked smoothly into local and global communication. And while simulations were an early part of computing activity, few probably realized in 1980 how easily simulation could be broadly linked into education through digital technology. When these changes were considered in preparing the

RIBIE reflection, the following title emerged.

A Digital World in the School: Access, Collaborate, Communicate, Experience

While this 2000 version reflected the methodological changes that using digital technology can bring to education, one crucial element was still missing. That element is a suitably global perspective in education. This is a startling change, because education is an enterprise, which around the world, has traditionally been designed primarily to reinforce a local or regional view of the world, one reflecting primarily the part of the world where the education was taking place.

The globalization of human activity has been taking place in the world for several millennia at least, but it has now accelerated beyond denial. That globalization now demands a share in education's focus. It requires a tempering of traditional local or regional orientation with a global outlook. If humans are to survive, education must develop a global perspective that maintains diversity among peoples, but in that diversity encourages humans to recognize their common roots and interdependence. Assuming such a perspective is incorporated and that learning will methodologically and increasingly utilize digital technology everywhere, 2003's analogue to the original book might more appropriately be titled

The Digital World in the Global School: Access, Collaborate, Communicate, Experience

APPENDIX B

SUBSTITUTE SUMMARY TEXTUAL CONTEXT FOR FIGURE 5

Drawn on a February 28, 1999, flight from London to Bahrain, the chap reading was a shipbroker, returning to Ryad, Saudi Arabia, where he arranged ships for oil transport and other purposes. When generalized to cover all those engaged in analogous work in today's world, the curricular implications of his flying back and forth to London from Ryad and arranging ocean shipping that might go anywhere in the world is far-reaching, the digital technology supporting what is involved, extensive. By contrast, the other fellow drawn was one of a band of traditional musicians lining the small room in which they played, each seated cross-legged on the floor as they performed for themselves and a few visitors on March 3, in Bahrain's old city. Playing the ancient music with intense absorption, this man may well never have left the Persian Gulf or even Bahrain and may not know that long before Saddam Hussein, Alexander the Great and other powerful figures each had their turn in trying to control his island's fate.

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