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Information Technology in U.S. Education: Our Mistakes and How to Avoid Them

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In the U.S., efforts to bring information technology into schools have been going on for more than 25 years. In that time, there have been many problems, and we have made many mistakes. Those professionals in other countries who are interested in information technology in education should pay heed to George Santayana's frequently quoted and almost universally disregarded warning that *those who ignore history are doomed to repeat it*. The article discusses some of the errors made in the U.S., and whenever possible, presents some possible strategies to avoid these problems and errors.

Keywords: Information Technology, Mistakes, Research

It was an honor to be invited to write an article about research in information technology in education for this, the inaugural issue of *The International Journal of Technology in Teaching and Learning* (IJTTL). I was flattered to be asked, but I was also a bit intimidated by the writing task before me. After all, my experience with computers and in education (except for one summer stint as an educational technology consultant in the Kingdom of Kuwait) has been wholly in the United States. Therefore, I was not then (nor am I now) convinced that I have anything of great interest to offer education professionals in other countries who are interested in information technology.

As I tried to decide on a direction for the article, I asked myself if there was anything in the history of my country's involvement with information technology in education that might be important for those in other countries to know about and to understand. As I thought over my own 25-year involvement with information technology in education (and on my life in general), it occurred to me, as it often does, that I have learned much more from my many mistakes and failures than from any of my far less numerous and admittedly modest successes. That realization brought to mind George Santayana's frequently quoted and almost universally disregarded warning that *those who ignore history are doomed to repeat it*.

With these thoughts in mind, I eventually decided that it might be of some value to present (a) my view of some errors we have made in the U.S. in our efforts to bring

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computers into schools, and (b) some ways that attention to carrying out, and then making use of the right kinds of research evidence might have helped us avoid making these mistakes in the first place. Perhaps such information will be of use to those in other countries, especially those in which it is not too late to avoid some of the common pitfalls those of us in the United States have encountered in our efforts to implement information technology in education.

Before beginning to discuss some specific problems, I feel I should mention a more general problem in the U.S. That problem is a widespread lack of belief in the importance of educational research. It seems to me that many of our problems and mistakes in education in general and in information technology in education in particular can be traced back to this very basic and pernicious omission. The simple fact is that educational research is not highly valued by U.S. teachers, administrators, education professors, boards of education, legislators, or the public at large.

Unfortunately, identifying this as a problem is far easier than figuring out what to do about it. As I have suggested elsewhere, one thing that might help would be a requirement that research methods and statistics courses be successfully completed by undergraduates in teacher education programs and by all those pursuing graduate degrees, especially those working on degrees in educational leadership. Then too, practicing teachers and administrators should be given access to and time to read and discuss reports in educational research journals. A third step might be to improve the overall quality of educational research, and to encourage researchers who write research reports to always address the practical implications of their work. I have written extensively elsewhere about possible reasons for lack of respect for educational research and what might be done to rectify this problem (see Maddux and Cummings, 2004). As previously mentioned, this general problem has contributed too many, if not most of the following specific problems in information technology in education.

THE EVEREST SYNDROME

The Everest Syndrome is the belief that computers should be brought into schools simply *because they are there* (Abney & Maddux, 2004; Maddux, 1984; Maddux & Johnson, in press; Maddux, Johnson, & Harlow, 1994). This has led to many ill-advised educational practices and has contributed to the backlash in the U.S. against the use of computers in schools. The Everest Syndrome is the consequence of thinking myopically only about how computers *can* be used, and failing to think critically about how they *should* be used in schools.

To facilitate more thoughtful uses, we have suggested that educational applications of information technology can be conceived as *Type I* or *Type II* applications (Maddux & Cummings, 1986; Maddux & Johnson, in press; Maddux, Johnson & Willis, 2001). *Type I* applications are those educational applications that simply make it easier, quicker, or more convenient to continue teaching or learning in traditional ways. *Type II* applications are those educational applications that make available new and better ways of teaching or learning.

We have suggested that while *Type I* applications are helpful and should be encouraged, the success of information technology in education depends on the wide availability and use of *Type II* applications. This is true because bringing information technology into schools requires such large investments of time, effort, and money that policy makers, teachers, parents, and the public at large will be willing to continue providing the necessary resources, and students will be willing to make honest efforts to learn to use technology to facilitate learning, only if the technology employed in schools can be used to help solve the most important educational problems. Solutions to these

critical problems will require *Type II* applications and the new and better ways of teaching and learning that they make available.

Professionals in those countries desiring to avoid the Everest Syndrome should strive to encourage educators and policy makers to engage in debate about how computers *should* be used in education, rather than focusing merely on what they *can* be used for. Questions about what *ought* to be done are relevant only in the context of educational philosophy, theory, and research, three additional topics that have received far too little attention in the U.S.

Additional steps that might help avoid the Everest Syndrome include (a) creating incentives at all levels of schooling for the development and widespread implementation of *Type II* applications of information technology in education, (b) ensuring that teacher training and teacher inservice programs emphasize the importance of *Type II* applications, and (c) establishment of competitive research and training grants that target *Type II* applications. This last strategy brings to mind another, related problem.

TRAINING GRANTS THAT PRECEDE AND GREATLY OUTNUMBER RESEARCH GRANTS

I believe that a major mistake in the U.S. has been made with regard to the federal government's approach to grants related to information technology in education. In the first place, training grants have far outnumbered research grants. This, it seems to me, makes little sense in a fledgling discipline in which basic knowledge and principles are just now being developed. After all, without such knowledge and principles, how can grant recipients make intelligent choices about what and how to teach in their training activities? Then too, I see little, if any governmental efforts to ensure that training grants are given only to those who are making conscious efforts to make use of what research evidence exists concerning best practices in information technology in education.

The recent PT3 grants (Preparing Tomorrow's Teachers to Use Technology) are a case in point. Since 1999, this program has awarded 441 grants to institutions that train teachers at a total cost of 275 million dollars (U.S. Department of Education, 2005). Although these grants are not without merit, and have certainly done much to raise awareness among teachers in training as well as higher education faculty about the potential of technology in education, it seems to me that the entire program is somewhat premature. A more reasonable time for such a grant program would be after research has identified a much larger block of knowledge than currently exists.

In the absence of research findings, training grants too often resort to teaching trendy and faddish but largely untested ideas and methodologies. Thus, it seems to me that research grants should come first and should be used to establish best practices that will then be communicated to teachers in training and to inservice teachers in later training grants.

PREMATURE ABANDONMENT OF PROMISING PRACTICES

In the U.S., we have often abandoned promising practices in information technology in education before they have been subjected to sufficient competent research to determine their efficacy in teaching or learning. One of the best cases in point is the *Logo* programming language. *Logo* burst upon the scene in the 1980s with publication of Papert's first book (1980), a volume I still consider one of the ten best education books I have read. Papert spent five years in Geneva studying with Jean Piaget, and when he returned to his position at the Massachusetts Institute of Technology, he put together the *Logo Group*, which eventually developed the programming language. Papert based the

language on a modification of Piagetian psychology, in which he hypothesized that learning to program in *Logo* might act as a cognitive amplifier and enable children to engage in formal operational thinking (abstract thinking) earlier than Piaget thought possible.

The language was implemented for use on several popular computing platforms and was widely taught in U.S. public schools in the 1980s and early 1990s. Unfortunately, two developments virtually eliminated use of *Logo* in the U.S. (although there are still isolated areas where it is still taught, and it remains popular in some countries.) These developments included (a) a series of methodologically deficient research studies falsely purporting to prove that *Logo* was ineffective, and (b) the wide availability and popularity of the Internet and the World Wide Web.

Among many other problems, the research failed to eliminate subjects who had not adequately mastered *Logo*. Nevertheless, it was widely believed that these studies showed that *Logo* was not worth teaching. The Internet and the Web also contributed to the near demise of *Logo* in the U.S. by virtue of the ease with which it could be used. *Logo*, on the other hand, while making it very easy to manipulate the turtle in interesting ways, required some study and some time to master the list processing and other, more advanced features of the language—features that Papert clearly believed were necessary for students to master if the language was to act as a successful cognitive amplifier.

Ironically, a still-growing body of research has provided some strong preliminary evidence that *Logo* can, under certain circumstances, act successfully as a cognitive amplifier. Thus, *Logo* has joined the list of promising educational developments that have been abandoned before being fairly tested. Why this happens so often in education in general brings me to yet another problem.

INFORMATION TECHNOLOGY IN EDUCATION AND THE UNDUE INFLUENCE OF FADS

Education in the U.S. is nothing if not excessively fad-driven, and information technology in education is no exception to this phenomenon. A *fad*, as I define it, is an unvalidated idea or method that is widely adopted, used for a short period of time, and then abandoned before research can provide evidence of its efficacy or lack thereof.

The problem with fads is that many promising ideas and practices are abandoned before they have been given a fair trial. This was, for example, the fate of the *Logo* computing language, as explained in the previous section of this article.

Some of the current unproven trends that seem on the way to achieving fad status include the use of *electronic portfolios* and *Webquests*. Use of the term *constructivism* seems also destined for fad status, since the term is so ill-defined, and is used to mean so many different things by so many different people that abandonment seems inevitable.

The only solution to the problem of fads is to increase the influence of research. Practitioners need to decline to widely adopt new ideas or methods until there is at least some preliminary research evidence in favor of the innovation. Once an innovation is accepted, teachers need to insist on using it for a reasonable period of time before abandoning it in favor of some other innovation. We have addressed this problem elsewhere in detail and have discussed some specific ideas for reducing the influence of fads (Maddux & Cummings, 2004).

IMPROPER AND EXCESSIVE USE OF QUALITATIVE RESEARCH METHODS

One unfortunate current development in higher education is the excessive and improper use of qualitative research methods. While there are many excellent examples of qualitative research in education, it should go without saying that the proper choice of research methods depends on the question to be investigated. In my opinion, qualitative designs are currently being applied to many research problems that clearly call for quantitative methods.

There are many reasons why this is occurring. One reason is that some education professionals suffer from mathematics anxiety and believe that qualitative designs will relieve them of the necessity to use mathematics, or to make use of disciplined thinking or rigorous methods. Others gravitate toward qualitative designs and away from traditional quantitative methods because of their devotion to so-called *postmodern* thinking. Extreme postmodernists are actively anti-scientific in their thinking and contend that objective reality does not exist and cannot therefore be discovered through quantitative inquiry in particular or the scientific method in particular. I believe that the improper application of qualitative research has contributed to a recent overall reduction in the quality of general educational research and research in information technology in education, where radical postmodernism seems to have established an especially strong foothold.

It seems obvious to me that undergraduate and graduate education programs need to require courses in both quantitative and qualitative research methods. Then too, such programs need to emphasize the legitimacy of both methods and demonstrate to students that the research problem under consideration should dictate the choice of methods to be used.

LACK OF ATTENTION TO QUALITY CONTROL IN ONLINE EDUCATION

Online education is one of the current "hot topics" in the U.S., even though there are other countries that have been widely engaged in online education for a much longer period of time. The problem in the U.S. is that a great deal of time and effort has been devoted to placing individual courses and even entire undergraduate and graduate degree programs online, with insufficient research attention to questions of quality control. Researchers need to be encouraged to focus on quality control issues in order to help legitimate institutions avoid establishing online programs that are no better than those questionable and rapidly growing programs offered by the so-called *diploma mills* that have historically been interested only in the profit potential of their abbreviated programs.

SOME ADDITIONAL QUESTIONS FOR RESEARCHERS

Researchers should address many other problems if they hope to avoid the mistakes we have made in the U.S. Space does not permit a full discussion of these, but a partial list of additional important research questions follows:

1. What computer literacy skills are necessary for students at every level to profit from the information technology applications we want them to master, and how can these best be taught?
2. What personality types and/or learning styles characterize the students who do best or worst in online courses or programs?

3. What are the advantages and disadvantages of placing computers in labs versus individual classrooms in light of our information technology goals and objectives at every level?
4. How can the Internet and the Web be used to most efficiently contribute to curriculum goals and objectives at each level of schooling?
5. What technology applications are most consistent with the various developmental levels of students?
6. What technology concepts and skills should be taught to all teachers in their undergraduate preparation programs?
7. What kinds of building-level technical support staff should be provided in schools and what should their job descriptions and educational backgrounds look like?

There are many other problems that should be subjected to research. It is hoped that this brief article will serve to stimulate the thinking of education professionals in countries where professionals hope to effectively integrate information technology into education while avoiding some of the problems that those of us in the U.S. have created or failed to avoid.

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