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Information Technology in Education: The Need for Skepticism

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The field of information technology in education has experienced many successes over the years. Most schools have computers and Internet access for both students and faculty. However, the faltering economy and a series of "no significant difference" research studies have caused the public and educational policy makers to question the advisability of continued investment in educational technology. The article suggests that one reason for less-than-encouraging research findings is that too many unproven ideas, theories, and techniques are accepted as valid or beneficial in the absence of evidence. Some of these ideas are discussed and the author calls for a return to an attitude of skepticism.

Keywords: skepticism, assumptions, scientific method

INTRODUCTION

The modern revolution in information technology began approximately thirty years ago with the widespread availability of small computers. During this time, proponents of information technology have experienced many successes. Across the globe, computers are ubiquitous in nearly ever walk of life. The Internet and the World Wide Web have revolutionized communication and made simple and complex information almost instantly available to millions of people.

Efforts to make use of the new technology in education began at almost the same time that small computers began to appear. Thus, advocates of information technology in education have worked for almost thirty years to identify and implement ways to use technology to improve teaching and learning. At first glance, it would appear that they have been quite successful. Most classrooms have one or more computers and virtually every school in the country has at least limited Internet access for students and faculty. Most universities have undergraduate and graduate courses and degree programs in information technology in education, and there are dozens of both print and online academic journals dedicated to the topic.

Nevertheless, all is not well in the field of information technology in education. Policy-makers and administrators remain unconvinced that the new technologies are

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worth the time and effort required to bring them into schools, and a series of research studies have failed to find improved student outcomes when methods employing information technology are compared to those not making use of it. (A notable recent exception is the meta-analysis released by the U.S. Office of Education [2009], which looked at studies comparing student outcomes of online and face-to-face courses and concluded that "Students who took all or part of their class online performed better, on average, than those taking the same course through traditional face-to-face instruction" [p. xiv].)

The "no significant differences" research is a topic of it own, too complex to be dealt with in a comprehensive fashion in this article. Suffice it to say that there are doubtless many reasons why research has failed to find an advantage for the use of information technology in teaching and learning. These reasons are both theoretical and methodological. Also, much of past research that compared student outcomes when technology is and is not employed was simplistic and amounts to asking whether mere exposure to technology is beneficial to students. We do not ask whether simply exposing children to books, teachers, or much of anything else in the educational environment will improve teaching and learning. Why then do we design studies in which the implicit assumption is that merely exposing children to technology, regardless of what that exposure entails, will facilitate learning? It seems clear that mere exposure to technology carries no particular benefit, and that it is *how*, not *whether* technology is used that is critical to student outcomes.

Hawkins and Oblinger (2006) make a similar point:

> For example, asking whether technology makes a difference in student learning implies that learning is a high-tech or no-tech phenomenon. The issue is not that simple. Learning occurs as a result of motivation, opportunities, an active process, interaction with others, and the ability to transfer learning to a real-world situation. (p. 14)

The "no significant differences" phenomenon has contributed to a backlash against the use of information technology in education, particularly among administrators and educational policy-makers. There are many other influences that contribute to this backlash. The high monetary cost of bringing technology into schools is a factor, coupled with the fact that these costs are not one-time investments and frequent upgrades are required in order to stay up-to-date. The present poor state of the global economy makes the high cost of technology especially troubling to lawmakers, administrators, teachers and the general public.

Then too, policy makers at all levels are becoming aware that making use of information technology in schools also requires a high cost that must be paid in terms of the time, effort and enthusiasm required of teachers who must learn to use the new technology. These resources are not directly measureable, but they are surely not unlimited. There is a limit to the number of inservice workshops that can be effective in a single year, and to the number of new initiatives that teachers will be willing and able to support, actually implement and maintain over the long haul.

In the U.S., the high stakes testing movement has also caused some policy makers to regard information technology in education as a distraction from the more important goals of improving test scores in reading and mathematics. As they pressure administrators and teachers to concentrate on standardized test scores and "basic skills," the integration of information technology into the curriculum is sometimes seen as a frill that is not worth the considerable monetary and other costs involved, since they take student and teacher time and effort away from the teaching of reading and mathematics.

The pressure to emphasize reading and mathematics was the topic of an article by Dillon (2006), who suggests the following:

> Thousands of schools across the nation are responding to the reading and math testing requirements laid out in No Child Left Behind, President Bush's signature education law, by reducing class time spent on other subjects and, for some low-proficiency students, eliminating it.

The Washington D.C.-based Center on Education Policy (2007) reported that:

> A majority of the nation's school districts report that they have increased time for reading and math in elementary schools since the No Child Left Behind Act became law in 2002, while time spent on other subjects has fallen by nearly one-third during the same time.

Moore (2005), the Early Childhood Director of the Alabama Science Teachers Association suggests the following:

> There is a growing concern among Early Childhood educators that the teaching of science in the lower grades is becoming a thing of the past. . . . Some teachers are being told by administrators to forget science and teach reading and math as their core curriculum (p. 2).

It seems clear that the current disillusionment with information technology in education is caused by a host of factors, some of which come from within the educational establishment itself, and some from society outside that establishment

EDUCATION AND THE LACK OF SKEPTICISM

The focus of the present article is a problem that lies within education in general and within the field of information technology in education in particular. That problem is the current widespread lack of skepticism about popular educational movements and techniques. The lack of skepticism leads professionals to blindly accept the status quo and decline to question widely-held assumptions. Without a widespread attitude of skepticism, popular philosophies, theories, programs and techniques are self-perpetuating and are not subject to validation of any kind. This leads to the popularization of pseudo-scientific ideas, attitudes and practices and the establishment of a body of untested beliefs and techniques that are considered to be exempt from criticism. When the lack of skepticism becomes widespread, progress in any discipline is likely to come to a halt.

Skepticism has long been recognized as occupying a central role in science. Wivagg (1988) calls skepticism "the essence of science." Winstanley (2000) argued that skepticism is essential in both science and in intelligent policy-making in the public interest. Carl Sagan, in a 1995 article in the *Skeptical Inquirer* also made the case for the need for skepticism in both science and policy-making. He called for ". . . the most uncompromising skepticism, because the vast majority of ideas are simply wrong, and the only way you can distinguish the right from the wrong, the wheat from the chaff, is by critical experiment and analysis" (p. 30).

There are currently many examples in education in general and in information technology in education in particular of largely untested ideas that are taken for granted and that are seldom, if ever questioned. Here, by way of examples, are two of these:

CHILDREN'S USE OF TECHNOLOGY HAS CHANGED THE WAY THEY THINK AND LEARN

This idea and variants of it were popularized by Marc Prensky (2001) in a widely-quoted article entitled "Digital Natives, Digital Immigrants." In that article, he suggested that K-12 students are the first generation of students ". . . to have spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age" (p. 1). While this is most certainly true of some but not *all* K-12 students at that time (or even at the present time), the idea and the analogy to immigration caught the imagination of the popular press, teachers, and academics, and it wasn't long before the terms "digital natives" and "digital immigrants" began showing up regularly in all kinds of venues, including articles in scholarly journals and presentations at conferences in the field of information technology in education.

The analogy itself was certainly a clever one, and it was useful in illustrating how profoundly the lives of many of today's students (the more affluent ones, at least) have changed due to the ubiquity of information technology. However, many professionals became instant true believers and their articles and conference presentations seemed to take it for granted that the way today's students think and learn have been qualitatively changed by their use of information technology.

That Prensky himself believed this is true seems not to be in doubt. Indeed, his article stated "Today's students think and process information fundamentally differently from their predecessors" (p. 1). Many proponents of this idea seem to have no problem with such a sweeping generalization about all of today's students, or that the idea might seem far-fetched to experts in human growth and development. After all, human beings have evolved their thinking and learning abilities over hundreds of thousands, perhaps millions of years. Furthermore, the information technology revolution is not the first monumental change in technology that has taken place, and many other such changes were arguably similar in magnitude to the ones to which Prensky alludes. After all, some of them took place extremely rapidly and transformed life in a single generation. The Industrial Revolution is a case in point. More recently, many of our grandparents were born in rural, agrarian circumstances and were dependent on horse-drawn transportation and primitive living arrangements. Within a single generation, however, many (if not most) found themselves in urban environments characterized by factories, freeways, indoor plumbing, telephones, television, automobiles, and many other of the technological trappings of modern life. Yet no one has yet suggested that these changes, which again are arguably at least as profound as the changes occasioned by information technology in the last few decades, fundamentally changed the way our grandparents think and learn.

Prensky, however, suggests that the ways people think and learn have been fundamentally altered by the recent changes in information technology use. In fact, he goes further, and suggests that the physiology of the brain itself has been altered by that use: "As we shall see in the next installment, it is very likely that our students' brains have physically changed – and are different from ours – as a result of how they grew up (Prensky, 2001, p. 1).

Such suggestions seem to beg for a skeptical response and some basic questions:

- "*Can an entire generation of people have their human cognitive and physical growth and development, which are the products of centuries of evolution and experience, completely and fundamentally changed by a couple of decades in which some children spend a lot of time playing computer games and using cell phones and the like*?"

- "*Where is the body of evidence to substantiate this contention?*"
- "*Isn't it true that at some level, every experience we have changes the physiology of the brain as new synapses are created or existing ones modified*?"

Yet, instead of asking these and other such questions, many in education in general and in information technology in education proceeded to make uncritical use of the terms "digital natives" and "digital immigrants." Further, many proceeded to write articles and make conference presentations in which there was the clear implication (or the flat pronouncement) that Prensky's ideas were absolutely correct and that we should proceed to change educational practices because our students' brain physiology as well as their thought processes and ability to learn have been forever altered by the way some of them have used information technology.

Are Prensky's ideas correct or incorrect? The answer is that we do not know. We will not know until they are subjected to the systematic scrutiny of skeptical professionals. It is unlikely that these skeptics will come from the ranks of educators, many of whom seem to regard Prensky's hypotheses as established facts not open to question or criticism.

VYGOTSKY "DISPROVED" PIAGET'S IDEA

This idea has emerged in the wake of a wave of popularity of the ideas of Lev Vygotsky, the Russian psychologist and contemporary of Jean Piaget. Although Vygotsky died in 1934, his work was banned in his native country and only became available much later in the West. Both Vygotsky and Piaget were brilliant scholars who contributed substantially to our understanding of cognitive development. Although born in the same year, Vygotsky's career was cut short by his death from tuberculosis at the age of 37, while Piaget continued his work well into his eighties. (Thus, it would have been historically impossible for Vygotsky to have disproved anything but Piaget's earliest work, which Piaget continued to extend and modify until his own death in 1980 at the age of 84, nearly 50 years after Vygostky's passing.)

It is difficult to know where the idea came from that Vygotsky disproved Piaget's ideas. Most experts today seem to agree that while the two theorists disagreed on several points, their work shows far more agreement than disagreement on important issues. Kohlberg and Wertsch (1987) for example, stated that "Overall, we see Piaget and Vygotsky as presenting approaches that complement one another" (p. 219). Maddux and Cummings (1999) addressed this point in depth, and suggested that the theorists agreed far more than they disagreed and that they disagreed primarily on the role of self-directed speech and on socialization in young children. They summed up their differences as follows:

> Piaget thought it critical to explain how children arrived at a sense of "self" as individual and separate from other things and other people, while Vygotsky focussed on explaining how children came to find a place as productive members of various societal groups. (Maddux & Cummings, 1999, p. 7)

Another statement that is seldom questioned is that "Vygotsky was not a developmental theorist." Such a position is difficult to defend in light of the following quote from Vygotsky's *Thought and Language* (1986):

> The development of the processes that eventually result in concept formation begins in earliest childhood, but the intellectual functions that in a specific combination form the psychological basis of the process of concept formation ripen, take shape, and develop only at puberty. . . . It would not be an exaggeration to say that to equate the intellectual operations with three-year-olds with those of adolescents - as some psychologists do - means to use a sort of logic that would deny the existence of sexual maturation in puberty only because certain elements of sexuality are already present in infants. (p. 106)

And elsewhere in the same volume: "The ascent to concept formation is made in three basic phases, each divided in turn into several stages" (p. 110).

Such quotations lead one to question whether those making statements such as "Vygotsky disproved Piaget," or "Vygotsky was not a developmental theorist" ever consulted the original writings of Piaget and Vygotsky, or whether they relied only on short summaries by other writers. One would hope that a proper degree of skepticism would lead one to a study of the actual writings of these influential psychologists, and a survey of available relevant research studies.

OTHER UNTESTED AND UNCONTESTED IDEAS IN EDUCATION AND IN INFORMATION TECHNOLOGY IN EDUCATION

There are many other examples of largely untested ideas that are regarded as if they are exempt from questions or criticisms. Some of these ideas are found in general education circles and some in information technology in education. Maddux and Johnson (2009) identified several as follows:

> Some of these are represented by single words, and are so widely used that it is difficult to find an article in a current journal in which they do not occur over and over again. Two such examples are "constructivism," and "scaffolding." Others are ideas or concepts that are simply implied, such as the notion that "all learning is social," or that "all qualitative inquiry produces data that is necessarily richer than that produced by quantitative research."

Maddux and Cummings (2007) identified and discussed another such idea - the notion that any Webquest is appropriate for use with children of any age and ability level. Two other examples from information technology in education include the following: (a) Web 2.0 applications are uniformly beneficial to students, and (b) jobs of the future will demand much more collaborative ability on the part of employees than do today's jobs.

Two examples from outside the field of information technology in education began in special education: (a) the idea that RTI (Response to Intervention) can be successfully implemented in any school if we simply do it correctly, and (b) inclusion is superior to special classes for all students with any disability and across the gamut of severity.

There are many other such examples in education. The above examples have been selected only because they are widespread and are familiar to this author.

HOW IDEAS ACHIEVE AN UNTOUCHABLE STATUS

There are probably many reasons why so many ideas or techniques in education come to be taken for granted in the absence of real evidence to establish their validity or their effectiveness. Michael Shermer, in an article in *Scientific American*, suggests that one cause for the general public's belief in unproven ideas is "The postmodernist belief in the relativism of truth" together with the mass media's short attention span (2009, p. 33). This may be a contributing cause in education, where postmodern thinking has recently become popular.

Another reason may be that in the absence of persuasive evidence, we tend to select ideas and techniques that are most compatible with our own political, social, and philosophical beliefs and preferences. This idea was proposed by Nicholas Pastore, a little-known writer who, in 1949, published a volume entitled *The Nature-Nurture Controversy*. Pastore (1949) became interested in the debate that was then raging over the nature-nurture controversy: that is, whether intelligence is largely determined by heredity or by environment. He was surprised at the certainty with which various experts advocated for one position or the other, and decided to study the literature that was available and decide for himself which was the more reasonable position.

Somewhat to his surprise, he found that the evidence that was available was equivocal, and did not actually favor either the nature or the nurture hypothesis. Since the evidence was not strongly supportive of either position, Pastore became even more interested in the fact that experts were passionate in their advocacy. He began to wonder if their positions with regard to this controversy were based on political, rather than scientific beliefs, and he decided to do a study to see if his hypothesis was correct.

First, he identified 24 well-known experts who had written extensively between 1900 and 1949, and who had taken strong positions on two controversial topics of the day: (a) the nature-nurture controversy, and (b) political beliefs. He studied their writing carefully, and classified their position on both controversies. For the nature-nurture controversy, he categorized each expert as either an environmentalist or a hereditarian. For political orientation, he classified each as either conservative or liberal. For the purpose of his study, conservatives were defined as those who opposed social change and any increase in the involvement of the common man in government. Liberals were those whose writing advocated social change and further democratization of government.

Pastore's findings were dramatic. With only two exceptions, he found that the conservatives were hereditarians, while the liberals were environmentalists! He concluded that experts may base their stand on the nature-nurture controversy on their own personal political beliefs, rather than on scientific evidence.

Does this phenomenon still occur today? It would be interesting to conduct further research using Pastore's hypothesis about political beliefs and their influence on opinions about scientific and professional issues. Issues such as those discussed previously in this article and a host of other questions might be tested with Pastore's method. Shermer (2009) reminds us that "What I want to believe based on emotions and what I should believe based on evidence does not always coincide" (p. 33). Perhaps Pastore's phenomenon accounts for at least part of the reason why certain ideas, concepts and techniques attract believers in the absence of evidence.

A FINAL WORD

The purpose of this article was not to refute or affirm any of the ideas identified as closed to criticism, but merely to draw attention to the fact that many such ideas exist in information technology in education, and to suggest that this may not be a healthy development. Perhaps a return to skepticism wouldn't be a bad idea at this time. This article has addressed a few of the popular ideas in information technology in education that we might be wise to subject to closer scrutiny. A few of the others that come to mind include the definition and methodological efficacy of the concept of Technological

Pedagogical Content Knowledge (TPCK), the most important skills for students to learn in order to profit from the use of e-portfolios to document acquisition of subject matter concepts and skills, and whether it is possible to arrive at some degree of consensus about the operational definition of terms such as "constructivism."

Perhaps the "no significant differences" research came about partly because we started to take too much for granted, and we stopped asking important questions and subjecting popular ideas to careful and critical scrutiny. Regardless of one's philosophical or political beliefs, can we not agree that if we stop asking to be convinced, we may stop producing convincing results?

It's possible to go too far in the direction of skepticism, of course. The trick is to find the right balance of skepticism and openness to new ideas. Sagan (1995) put it well:

> Too much openness and you accept every notion, idea, and hypothesis -- which is tantamount to knowing nothing. Too much skepticism -- especially rejection of new ideas before they are adequately tested -- and you're not only unpleasantly grumpy, but also closed to the advance of science. A judicious mix is what we need. (p. 30)

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