# Modern Misconceptions in Instructional Technology

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Abstract: *This position paper on educational computing policy and perspective details 15 misconceptions that are all a significant part of today's modern world of computing. As all claims of misconception are open to debate, convincing arguments explain an alternative perspective in each case. How individuals learn technology, the role of computing in education and implications for training and professional development are all examined.*

Computers were well established in American schools as early as the middle 1970's – more than a generation ago. Often given first to the math departments or volunteer "techies" early dialogue had already focused on how to empower teachers across the curriculum to learn and use the new technology.

The earliest debates of the 1980's addressed what teachers needed to know in order to make effective uses of computers in instruction and throughout their profession. There were concerns about policies and perspectives affecting the successful adoption and integration of technology in education. Educators were in search of the protocols, policies, methods and parameters that would yield appropriate, effective and successful utilization of computer technology.

This sounds much like today's educational initiatives with technology as we strive to achieve integration of computer technology in the classroom. New language and new terminology is in vogue often used to refer to the same issues, the same problems, indeed, the same goals. We have, for more than a generation, been in pursuit of essentially the same thing. Our attempt 20 years ago to change educators into computer-using, computer literate professionals essentially failed. Many will argue the point as clearly there are countless success stories. But, with the exception of the techies and innovative pioneers, educators across the

profession a generation ago did not, have not changed their basic approach to integrate technology. Certainly more educators now use technology but were these instructors on the job in 1980 or 1985?

As an analogy, when this author was young, rock-n-roll music was still the choice of the young and my father and grandfather did not relate and found it quite distasteful. In elevators, in 1968, one would hear music perhaps from Lawrence Welk and such. I believed that if my elders could simply understand and learn about rock-n-roll and what the artists were attempting to express that things could change and the music would be accepted. Today, in waiting rooms and elevators, we are likely to hear McCartney, Dillon, The Beatles, Buddy Holly or many of the other artists that were so objectionable to so many in those earlier years. However, the point is that this change did not occur because the elders were influenced or convinced. We, the younger, rock-n-roll generation did not change anyone. The elders were not convinced. No metamorphosis occurred. Society just moved along as the young grew older and the young simply brought their music with them. The young simply replaced the old.

The same seems true for the computer-using generation. Our efforts a generation ago were ineffective. We have simply waited around while a new generation, the youth of yesterday and today, has grown older bringing their technology-based lifestyle with them.

For real change to occur, for educators to be leaders rather than followers, it is necessary to have an understanding and a perspective of how technology is used and learned. The microcosm of an individual's development and progress is similar to the macrocosm of the profession in that proper and accurate perspectives are essential to achieving goals. Misconceptions, while a normal part of learning and developing, interfere with that development and inhibit progress. Misunderstandings waste energies and resources directed toward the wrong goals. We build defenses for bogus threats and plan agendas for ideas that will not and cannot succeed. Misconceptions are like viruses for the mind. They contaminate by masquerading as truth. They are the charade of legitimacy and impersonate valid choices and logical decisions. Problems are considered; priorities are made; actions are taken; consequences are considered; and the cycle begins again. This all seems legitimate except that a lack of understanding or misguided perceptions can inhibit the legitimacy of the process and ultimately result in an entire generation passing without truly adopting technology.

There has always been a wide range of technology and computing misconceptions (Galloway, 1990). For example, the notion that one can execute a data file as compared to a computer program is a common misunderstanding furthered by today's user-friendly icon based environments. The fact that a computer will find and execute the appropriate program to support a clicked data file icon is often overlooked by users. Understanding such technical details is typically useful for more advanced work with technology. Getting to know the wizard behind the curtain can help facilitate a fundamental understanding. To offer a different metaphor, seeing the strings and the puppeteer rather than just watching the show can improve one's problem solving and critical thinking skills in achieving technology mastery.

Misconceptions from almost 20 years ago are often still present among today's computer users. Many concepts from 20 years ago are still fundamental in computing today (e.g., file, program, data, command, etc.). However, this paper focuses less on the hands-on technical specifics of computing and more on misconceptions based in policy and perspective. While the broader term of instructional technology certainly includes everything from graphing calculators to video recorders and laser discs, this paper tends to limit the focus primarily to computers and computer-related tasks and concepts.

Here are 15 notions that are flawed, ill-conceived or merely incorrect:

**1. Online documents lack privacy** due to openness in a public electronic domain. Not understanding the remoteness and general anonymity of materials on the web often inhibits one from placing photos and other personal information online. From a practical point of view, knowledge of a specific URL address is typically necessary and, while locations are technically available to anyone, the odds of anyone finding your file through a random guess are considerable. The web can serve us well as a personal note file, storage bin or other utility if we were only comfortable enough to use it freely. To make this point more poignant, this author keeps a file on the internet of web personal "link" favorites. This is not a file for various educational topics or other interest groups. It is my personal "favorites" listing. It's on-line. Find it. For those who really need protected file access, there are web-based password services available for free on the internet.

**2. Students expect to accomplish work at home** rather than accepting the need to attend a computer lab. Students are resentful of assignments and expectations that are outside of the realm of the technology they possess at home. Students have not accepted the notion that visits to a campus computer lab is necessary where home technology is insufficient or incompatible. If one is in a computer class to learn new things, the odds are that one has not already mastered the material or the technology and may not have already acquired the technology for the home. In any event, the necessary experiences may indeed require travel to campus for work in a lab, perhaps for a great deal of time. A fair comparison might be made with traditional or non-technical education. Access to traditional paper materials in libraries was always an accepted part of study and getting an education. In the world before computers (remember?), students assumed that library time or other time spent at school was necessary and accepted. Often this amounted to a great deal of time. The presence of technology has not necessarily changed this fact, at least not yet.

**3. Computing (like word processing) is inevitably harder and more time consuming than paper.** This notion seems based on a desire to maintain old-world habits and a general resistance to change to a more technical lifestyle. For a non-technology person, gaining access to and using a computer for writing a simple note to someone (for example) is obviously too involved compared with paper and pen. Indeed, it is nearly impossible to prove to such nay-sayers the value of technological methods since their objections are quite real for them. The problem is simply that it is very short term thinking and such limitations are not true for an experienced user of technology. It may be thought that "techies" use computers because they enjoy that method or that they may have some hidden talent or ability. It is simply a matter of committing to the technical lifestyle and learning enough to get over the "hump," a threshold of efficiency where the hassle or trouble becomes well worthwhile. It is just like walking up to the corner store is much easier than driving all the way to the mall, especially if you have to first buy a car and learn how to drive.

**4. Becoming computer literate doesn't require a personal and fundamental change.** This will be called the recipe mentality. Students believe that a computing course should consist of the imparting of procedural methodologies for the various tasks of the day. There is an

unfortunate notion that teaching involves "showing" students things "to do" with technology with little or no attention to the development of a fundamental understanding, critical thinking skills and even a technology-based intuition to facilitate problem solving and adaptability. The language of computer education too often speaks of learning to do things with technology. Mathematics education of course involves procedures and tasks just as science education. Yet, in those disciplines becoming educated requires more than being shown what to do. While this issue alone rightly involves a more involved essay, computer education, just as in science and mathematics education, inevitably requires that a person change.

**5. Using technology in teaching can be accomplished by non-computer-using teachers.** Workshops to teach non-computer-using teachers to use technology in the classroom are often commissioned in an attempt to get teachers to learn to use computers with their students. Administrators often misallocate funds for these endeavors and justify it on the basis that the technology is "for the children," that schools and equipment don't exist for the teachers. Without naming anyone specifically, this justification was specifically offered in response to this issue by the superintendent of a local urban school district. While it is true, in a sense, that the end goal is clearly about the students, this issue addresses methodology. How are we to make a difference for the students? Research shows that non-computer-using teachers will not integrate technology into their classroom teaching. While there seems to be no real or substantive preclusion, no technical or necessary it's simply that the non-technical lifestyle inevitably and completely inhibits the successful application of technology. It is inevitably necessary to educate or empower teachers directly, to first educate the teacher. Then, they as competent computer-literate educators will bring those skills and that knowledge to bear on their instructional activities just as any other knowledge and skills applicable to teaching.

**6. Teachers do not need to use technology in their personal lives.** This is related to the idea that using technology in teaching will involve a special list of things to do. And, that anyone in possession of such a list can implement the list and thus integrate technology and teaching. A more involved use of technology is necessary, like a critical mass required for nuclear fission, in order to facilitate technology integration into teaching. As a computer educator, I tell my beginning students, that the assignments in the course, the experiences planned for them are

ultimately insufficient. They will need to seek technological solutions for problems throughout their everyday lives in order to progress. If they have a letter to write, word process it. If they're keeping track of their GPA, start a spreadsheet of all their grades. If they have a little black book, start a database. It is necessary to encounter difficulties and to seek solutions. It is important to fail to save as they should, to damage a disk, to accidentally delete something. Such encounters are all an important, necessary and recurring thing in technological progress and cannot all be provided through a series of course assignments. Research shows that computer-using teachers have integrated technology into both their personal and professional lives.

**7. Teachers of technology know how to use technology across the curriculum.** That is, teachers of biology (for example) would expect a technology instructor to show them how to use technology in the discipline of biology. To this author, this makes little sense, since technology is the domain of the technology teacher and biology is the domain of the biology teacher. Everyday teachers of literature, science, mathematics and more are taking computing courses to learn how to use computers in their domain. This sounds fine except that they take it literally seeking direct pedagogical methodologies unique to their content area. It doesn't really matter what the device is, whether a chalkboard or a magic toothbrush. Once the device is mastered, an educator, knowing their art of teaching, will ideally employ whatever is appropriate and applicable for their students' needs. If the biology teacher had mastered how to use a computer (for example) then it should be up to them as professional educators of that particular discipline to develop the pedagogy.

**8. Teachers of technology have or know how to use software for disciplines across the curriculum.** Not the same idea as number 7 above, it is often a mistaken notion that instructors of computing are connoisseurs of computer applications, software titles in every discipline area. And, that they have mastered, at least procedurally, all of the keystrokes, commands and rituals necessary to use that software. Too, related to number 4 above, that computing instruction then involves little more than acquainting the student with those commands and rituals. Teachers often confuse educational computing courses with software training classes and are disappointed when they aren't shown easy tricks with any number of software titles of personal interest to them. Software products in a given discipline area are ultimately the responsibility of educators

of that subject, not the computer educator. Software-specific workshops might be a useful resource, and, related to number 13 below, educators will, on their own, inevitably need to engage in personal study of a given product in order to sufficiently master its use. Aside from the questionable notion of designing instructional technology courses around the mere coverage of software titles, instructors are not likely to have reached that level familiarity and expertise with the many dozens of software products.

**9. A technical task can and should be something done quickly and easily.** Also, that such advantages of speed and convenience are the real basis for the value of technology. As a professor of technology I am able to accomplish many tasks quickly and more efficiently than my student counterparts. This is an inappropriate comparison and such assessments are all relative. I may be faster and more creative than a beginner but I too have computing difficulties, challenges and mistakes. A more important point is that I am willing to spend 5 hours to draw a simple graphic for some application where as students often object to 30 minutes and give up after one hour. Far too often colleagues are simply not willing to put in the time and effort necessary to accomplish a task. More importantly,

**10. Technical tasks should be free of mistakes, error, conflict and frustration.** There is a notion and much literature devoted to learning computing without frustration. Computing involves a great deal of problem solving. Problem solving, by definition, involves moving from the unknown to the known. That is naturally an experience involving some degree of frustration. Such concerns are highly relative where doing the easy stuff might more likely be error free and quickly done whereas the harder stuff takes more time and is more challenging. Many aspects of computing and technology products are frustrating and difficult and absolutely require a great deal of time. If you don't experience any frustration, make any errors or have any problems, then you aren't doing anything – especially in the world of computers.

**11. Computing no longer requires programming.** This has always been a highly desirable notion among educators as they have always been highly resistant to any sort of programming. However, not only has programming always been a fundamental part of computing, to be effective one still needs programming concepts and skills today. In the so-called old days of

computing, elaborate languages (Pascal, Logo, BASIC and others) seemed to distinguish the masters of computers from the mere users. Much software since that time (HyperCard, ToolBook, HyperStudio and of course HTML for Web Page development), very applicable to the activities and interests of educators, have all been forms of programming. Regretfully, educators typically believe that an easier way, an "automatic" and user-friendly alternative, is or should be available to produce the same things quickly and without any difficulties. In spite of the allure of authoring tools and point-and-click operating systems, programming is still very much a part of computing and continues to distinguish the journeyman from the apprentice. The conceptual development, improvement of problem-solving and higher-order thinking skills in computing have been directly linked to the inclusion of Logo programming (Allen, 1993; Battista, 1994; Borer, 1993; Dalton & Goodrum, 1991) and BASIC programming (Overbaugh, 1993). Even standard productivity tools like database, spreadsheet and word processing involve programming concepts.

**12. Being a casual or part time computer user is sufficient to meet professional needs.**
Many teachers at all levels of education are attempting to use technology – but only a little bit. Often, they hope to get by with as little involvement with computing as possible as if a computer is a tool to be avoided unless and until absolutely necessary. However, a considerable infrastructure in computing is necessary to have the tools available, to make access possible and worthwhile, and to work through an integrated network of choices and solutions. A complete commitment is actually necessary both to learn to solve problems that will inevitably arise and to become efficient enough with software to be productive. An integration of computing into the profession and into pedagogy requires more than mere casual or part time use. Research shows that a regular and complete involvement is necessary to support learning, progress and integration.

**13. To learn computing, one needs to take a computer class** or enroll in a computing workshop. The perception is that one needs to be given assignments and shown keystroke procedures in order to become a computer user. Research overwhelmingly shows that (a) competent computer users have taught themselves; and (b) those who have taken courses without an independent personal commitment still fail to integrate technology into their lives. This is not

to advocate that courses be avoided. To the contrary, courses can motivate and guide the study of technology. The misconception is that merely enrolling and performing the assignments is sufficient for progress. It is not. Assignments may be necessarily contrived and are inevitably limited. Enrollment in a course or participation in a workshop should include an increased personal commitment to and involvement in computing beyond the limited scope of the assigned activities.

**14. The computer is a tool.** More than an analogy describing what a computer can be (Beaty & Tucker, 1987; Galloway, 1992), computers are perceived as specialized devices dedicated to a limited set of purposes. The concept of a mere tool, like a toaster for toast, a wrench for a bolt, or a hammer for a nail implies that the tool is unnecessary if you don't want toast, don't have a bolt or the need to hammer a nail. Actually, the computer has become more than a tool. It is a complete environment where we live and work. Technology is a much more fundamental part of our lives. This is not only true in the future world for which our students prepare, but even for today's teachers. One finds tools within the computer environment to solve problems and complete tasks. But, computing technology itself is much more and we all, especially educators, need to advance this perspective. In the immediate future, if not already, we will get all information, produce and purchase all products, plan and execute all activities, communicate with family, friends and the world all through direct involvement with technology and computing electronics. It is our world – not a mere tool.

**15. Teachers need to be trained to use technology.** In fact, it has been claimed in many venues that the primary reason for the lack of technology integration into teaching is that teachers are not being shown how to use the technology. The problem with this notion is imbedded in the statement itself. One doesn't "show" someone how to use technology. There is a distinction between the terms "trained" versus "educated." The distinction is more than one of breadth and specificity. That is, while the notion of education may imply a more general and broader coverage of a topic, it is meant to indicate a deeper learning than what might be found in mere training. Learning involves the development of a conceptual understanding and critical thinking skills compared to the procedural rituals of training. Computing involves experimenting, adapting and sometimes convoluted problem solving beyond the realm of even extensive

training. Computing requires the development of an intelligent intuition that promotes insight and "educated" guessing. Curiously, in science and math we speak of education rather than training. Certainly, there are skills and competencies in both disciplines. For example, if a microscope slide is ill-prepared then microscope image quality will be impaired and an investigation could fail. Training could be the answer. But, such training is a means to a larger goal: learning science – an education. This distinction is more than just semantics. Consider hypothetically: Should a teacher in beginning computing learn programming? A "training" perspective would answer "no" (as most educators claim) based on the simple claim that teachers will not be doing programming so they have no need for it. Clearly, things not on the "action" list won't make it to the training agenda. On the other hand, an educational perspective might answer "yes" based on a consideration of what lessons and experiences would be useful in building a fuller, more complete education without regard to whether they constitute specific future actions. It is truly the most ironic fact in modern education that educators fail to realize that skills and competencies are made up of and empowered by the holistic set of our past experiences most of which are not performed in the rituals of task execution. Just as one doesn't "show" someone how to do science or math, using technology requires an education.

Whether these arguments are or are not ill-conceived is certainly debatable. Whether these so-called misconceptions are truly or directly related to limited progress in educational computing is also debatable. Where is the research that shows complete and continued integration of technology into the classroom by non-computer-using teachers? Where is the research that shows how being trained on yesterday's text editor enables and empowers teachers to adapt to tomorrow's highly complex and multifaceted word processor software? Individuals' misunderstandings of what's required to learn and use technology have always inhibited their progress. Misunderstanding how teachers learn and the epistemological issues of skills and competencies in being computer literate contribute to the impotency of misguided professional development programs.

Far too often, educational computing is thought to be little more than procedural rituals written into a simple lists of do's and don'ts. Many seem to behave as if learning computing is a matter of acquiring such lists. Critical thinking skills and a kind of discipline-specific intuition would serve teachers better than mere list acquisition. Perhaps further comparisons with what it

means to be educated in science or math would better illustrate learning in instructional technology.

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