EdTech by Design:

A Concise Practical Handbook for School Decision Makers

by

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Chapter I

Introduction – Asking the Right Questions

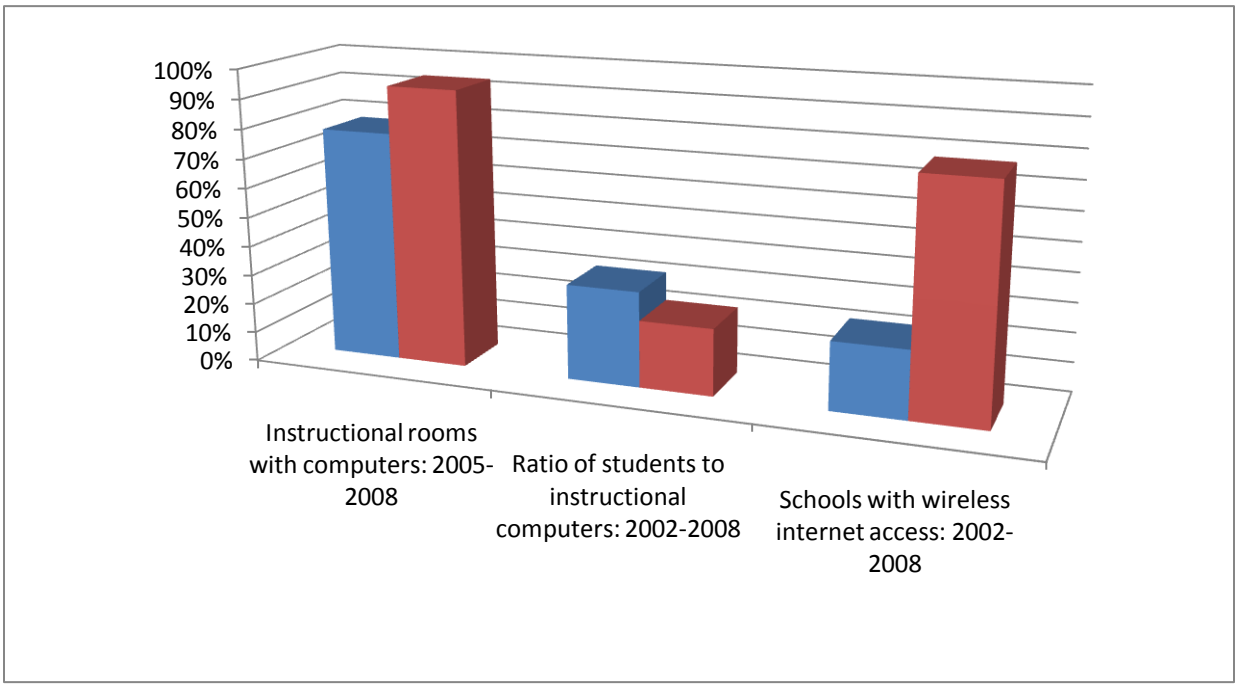
"The More Things Change, the More They Stay the Same."

In surveying current educational literature to prepare this handbook, I was struck by the sense that the well known French expression "le plus ça change, plus c'est la même chose" ("the more things change, the more they stay the same") applies very much to the field of educational technology. I had conducted a similar survey in 2003 to prepare an article entitled "Digest of Literature on the Impact of the Computer in Instruction".[i] While much has changed in the world of educational technology in the last 13 years, many of the same fundamental issues and discussions still resonate.

What has Changed?

Statistics from the U. S. Department of Education show that access to computers and the internet in schools[ii] in the first decade of the millennium increased impressively:

- By the fall of 2008, an estimated 100% of public schools in the United States had one or more instructional computers with internet access. Ninety-seven percent of schools had one or more instructional computers located permanently in classrooms, and 58 percent of schools had laptops on carts.
- The percentage of instructional rooms with computers rose from 77% in 2000 to 94% in 2005.
- The ratio of students to instructional computers with internet access was 3.1 to 1 in 2008, as compared with 4.8 to 1 in 2002.
- The percentage of schools with wireless internet access reached 78% by 2008, as compared with 23% in 2002.
- By 2005, approximately 85% of public schools with internet access indicated that their school or school district had offered professional development to teachers in their school on how to integrate the use of the internet into the curriculum. Of those, 49% reported that over 50% of their teachers had participated in such training, compared to 41% in 2002.



These figures suggest a trend toward increased use of technology in classroom instruction, probably reflecting a move from teaching computer literacy in dedicated computer labs to the use of educational technology to support learning of the school curriculum in the regular classroom.

The most significant change in the above data is the increase in internet access in schools. We can assume that wireless internet access in schools has reached an even higher level of saturation today than in 2008. While the full impact of the internet on education is not yet fully known, it is certain is that it is a potential game changer. By providing easy and immediate access to a vast amount of information, the internet has served as a catalyst for teachers to move from a "transmission of knowledge" mode to a "processing of information" approach, which might explain the increase in computer use in regular classrooms.

What has Stayed the Same?

In spite of what seem to be clearly positive trends in the integration of technology in instruction, the same debate that raged in 2003 over the impact of technology on student achievement persists today with very little change. Opinions on the subject in academic, professional, and quasi-professional literature range from those who claim that computer

based learning will soon replace teachers,[iii] to those who simply contend that the use of technology raises student achievement,[iv] to those who believe that the massive investment in computers in education has failed to significantly improve student achievement,[v] to those who claim that computers actually decrease student achievement.[vi]

How is it that after 13 years, we still seem to be in a state of confusion regarding the efficacy of computers and technology in education? Why do some studies demonstrate that computers increase student achievement while others demonstrate that they decrease achievement? The fact is that correlational research studies are often misguided because they assume that they can isolate one contributing cause and measure its impact, without taking into account that many other variables affect the outcomes. In our case, the studies assume that the use of technology is the determining factor, and fail to take into account other important variables such as the role of the teacher, socio-economic factors, and the like. Another factor that brings into question the validity of these particular studies on the impact of technology on student outcomes is the lack of clarity on what outcomes are being measured and should be measured.[vii]

A "technocentric focus" views employing technology in schools as an end in itself, rather than as a means toward an educational outcome.

The latter point is exacerbated by the fact that, in many instances, technology has been employed in schools without clear educational goals. This problem is the result of what Gavriel Saloman refers to as a "technocentric focus",[viii] that views employing technology in schools as an end in itself, rather than as a means toward an educational outcome. The technocentric focus has been fostered from the very beginning of the use of computers in schools. With the advent of the personal computer in the 1980's, schools were immediately under pressure to introduce computers into the educational process. The conventional wisdom was that this was the wave of the future, and that any school that did not employ computers would be left in the dust. In addition, computers in schools were easy to fund, as individual contributors and the government were eager to foster the use of this "sexy" new technology. And so we purchased computers based on an intuitive push from the society-at-large, without any clear educational agenda, and then tried to decide what to do with them. At first, the computers, which had memory capacities as low as 32k, were utilized as electronic worksheets. They might have been a bit more engaging for the students, but they worked slowly, and of course did not change pedagogies at all. In the next phase, we taught computer science, based on the rationale that students would have to master computer programming skills in order to succeed in the quickly changing society. When we realized a few years later that only a small percentage of people

needed programming skills in this new age, we turned to computer literacy, with a focus on software applications and subsequently internet applications, only to realize in a relatively short time that the students were well ahead of the teachers in these areas. Schools did not have to teach computer literacy because students were learning it already in much the same way that a child learns a first language.[ix] As a result, the computers moved from the computer labs into the classrooms to be used in instruction, as seen in the above cited statistics. Interestingly, some educators today advocate returning to the teaching of computer science, not to teach programming as an end in itself, but because it represents a strong problem solving discipline.[x]

Nevertheless, now that computers and the internet are employed more prominently as aids for classroom instruction, the question remains whether they have realized their potential to enhance student learning. As we have seen, many would claim that they have, while others still contend that they have had a relatively small impact that is not commensurate with the many billions of dollars that have been invested in employing them in schools. For example, Benjamin Herold, a staff writer for *Education Week* who specializes in educational technology, wrote the following in 2015:

> Technology is everywhere in education. […] But a significant body of research has also made clear that most teachers have been slow to transform the ways they teach, despite the influx of new technology into their classrooms. There remains limited evidence to show that technology and online learning are improving learning outcomes for most students.[xi]

So too, Stanford University professor Larry Cuban, whose book entitled *Oversold and Underused*: *Computers in the Classroom* (2003) was one of the more prominent critiques of the integration of educational technology in U. S. schools, still maintains his critical stance in spite of improvements in accessibility, claiming that usage tends to be largely limited to familiar methodologies rather than innovative pedagogy::

> With new machines appearing on the market and in schools annually, particularly hand-held devices, I have seen in my research in schools a clear trend line of increasing teacher and student use of new technologies in classrooms. The growth of online schooling and rise of blended learning options have contributed greatly to that trend as well. While the trend is toward

greater integration of technology into lessons, the overall portion of daily use falls well below half of teach time spent in instruction, even in those schools with 1:1 computing. I also note that the uses of the new technologies tend to be familiar (i.e. internet searches, direct instruction via interactive whiteboards, PowerPoint presentations, word processing, etc) and fall within the usual sequence of lessons (e.g. going over homework, use of textbook, teacher questioning, worksheets – often on screens now, etc.) rather than the imaginative uses that champions of the new hardware/software envisioned.[xii]

"The Technological Paradox" - A most powerful and innovative technology is often taken and domesticated such that it does more or less what its predecessors have done, only it does it a bit faster and a bit nicer. Consequently, nothing significant really happens.

The latter point was dubbed by Gavriel Saloman as the common 'technological paradox" – that a most powerful and innovative technology is often taken and domesticated such that it does more or less what its predecessors have done, only it does it a bit faster and a bit nicer. Consequently, nothing significant really happens.[xiii]

Making Sense of the Noise

It is not my intention to weigh in on the controversy over the impact of computers on student achievement. I am certain that just as this controversy has maintained itself over the past 13 years, it will probably be raging 13 years from now as well.

The most relevant question for school decision makers is what conclusions can we draw from the controversy itself? What are the implications of the skewed data and the conflicting perspectives?

If we disregard the most radical opinions on both sides, we will find a useful common denominator between the various positions. Even one who ascribes to the data that the use of technology increases student achievement cannot disregard the fact that in many schools and classrooms, educational technology is underused or not used effectively. And on the other side of the spectrum, few of the critics of technology in the educational system contend that computers are inherently harmful to education. On the contrary, most, including Cuban and Saloman, acknowledge that technology has potentially positive learning applications, but that it has been ineffectively integrated into the educational system.

As such, the most relevant question for school decision makers is not whether technology impacts positively or negatively on student outcomes, or whether the outcomes justify the

investment, but rather what are the obstacles that prevent teachers from implementing technology in a manner that creates more meaningful learning activities – or in other words, what are the requisite factors for ensuring successful use of educational technology? The most valuable current literature for school decision makers is that which attempts to answer that question by identifying the factors that have impeded technology from reaching its full potential in the educational system, and suggesting ways to overcome those obstacles. A good example is the following excerpt from a piece written by the National Conference of State Legislators (NCSL) specifically for government policymakers:[xiv]

What are the requisite factors for ensuring successful use of educational technology?

> Legislators considering investing in education technology must understand that an investment in hardware and software alone is not enough to lead to improved student achievement. Effective implementation is as important as the technology itself, and there are certain conditions that support effective implementation. The purpose of using technology should **be to meet already established educational goals**, and **must be accompanied by a teacher who is properly trained to integrate it into teaching and instruction,** as well as **strong school leadership that ensures effective deployment and implementation. Adequate technical support** and the appropriate school **infrastructure**, including adequate access to **computers and bandwidth**, are also important conditions that will help ensure technology has a positive effect on student learning and achievement.

The report goes on to identify "Essential Elements to Ensure that Technologies Are Used to Support Real Gains in Educational Outcomes":[xv]

1. Leadership around technology use that is anchored in solid educational objectives. Simply placing technologies in schools does little good. Effective technology use is always targeted at specific educational objectives.

2. Sustained and intensive professional development that takes place in the service of the core vision, not simply around technology for its own sake.

3. Adequate technology resources in the school, including hardware and technical support to ensure smooth operation.

4. Recognition that real change and lasting results take time.

5. Evaluations that enable school leaders and teachers to determine whether they are realizing their goals, and how to adjust if necessary.

Planning an EdTech Program

The above report of the National Conference of State Legislators provides a road map for planning a school EdTEch program. As we continue, we will suggest a four step process for devising and implementing a cogent educational technology program in your school based on the "essential elements" listed above.

- **Step 1** - The first element listed is the articulation of educational goals. This is clearly the first step of the process, reminiscent of the "backward design" model suggested in the Understanding by Design curriculum development model.[xvi] Thus, our next chapter, Chapter 2, will deal with setting goals for your EdTech program. Toward that end, we will examine the various functions of educational technology, with a focus on the use of technology in instruction – i.e. pedagogies that can be fostered using online tools and technologies. You will even be able to view some of these technologies in practice through still and video visuals.

- **Step 2** – In chapter 3, we will look at the technology resources needed to support your educational goals, including: the space needed for the educational activities you wish to promote, the hardware that is best suited to provide student access and to host requisite platforms, and the internet support needed to sustain the program.

- **Step 3** - In discussing personnel, the NCSL report alludes to two essential professionals needed to sustain a successful EdTech program – the teacher and the technical support person. In chapter 4, we will discuss the nature of the roles of these two professionals, and the professional development efforts required to ensure that they optimize the school's EdTech program.

- **Step 4** - In chapter 5, we will bring it all together to work on developing a sequential implementation plan. In the context of this discussion, we will deal with the quagmire of what we refer to as "skewed budgeting" – a budget that that overinvests in hardware at the expense of critical infrastructure, staffing, and staff development, often rendering the investment in hardware ineffective. We will also discuss some aspects of the dynamics of school change and dealing with resistance to change.

Continue reading to sharpen your vision by finding out from the technology what <u>can</u> be done, and allowing educational considerations to determine what <u>will</u> be done in your school.

Endnotes – Chapter 1

[i] Peerless, S., Feldman, E. and German, C., "Digest of Literature on the Impact of Computers in Instruction," *Jewish Educational Leadership*, 1:1 (2003), pp. 4-11.

[ii] These statistics are taken from the following sources: *Internet Access in U.S. Public Schools and Classrooms: 1994–2002*, National Center for Education Statistics (NCES), U.S. Department of Education, October 2003; *Internet Access in U.S. Public Schools and Classrooms: 1994–2003*, National Center for Education Statistics (NCES), U.S. Department of Education, February 2005; *Educational Technology in U.S. Public Schools: Fall 2008*, National Center for Education Statistics (NCES), U.S. Department of Education, April 2010. The figures are for public schools. We can assume that similar trends occurred in private schools as well.

[iii] For example, as English teacher Michael Godsey writes in *The Atlantic* ("The Deconstruction of the K-12 Teacher," *The Atlantic*, March 25, 1025): "We're at the point where the Internet pretty much supplies everything we need. We don't really need teachers in the same way anymore." A major proponent of this concept is Sugata Mitra who has demonstrated that students in remote Indian villages with no computer background can teach themselves computer skills, language, and sophisticated concepts using the computer. Read about his work at http://www.hole-in-the-wall.com/Beginnings.html . Watch him speak at https://www.ted.com/talks/sugata_mitra_build_a_school_in_the_cloud?language=en .

[iv] Research by the U.S. Department of Education in 2009 discovered 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."

[v] One of the biggest critics of school technology programs in 2003, Larry Cuban, claimed in his well known book *Oversold and Underused*: *Computers in the Classroom* (Harvard University Press, 2003) that the tremendous investment in computers in the educational system had not significantly affected pedagogies or student outcomes. In a 2011 interview, while acknowledging a greater integration of technology in instruction, Cuban continued to maintain that technology is still underused, and ineffectively used, in education today. See: http://www.agent4change.net/people/1351-larry-cuban-scourge-of-memory-loss-policymakers.html .

[vi] In a study, published on Sept. 15, 2015, the Organization for Economic Cooperation and Development looked at computer use among 15-year-olds across 31 nations and regions, and found that students who used computers more at school had both lower reading and lower math scores, as measured by PISA or Program for International Student Assessment. See: http://www.oecd.org/education/new-approach-needed-to-deliver-on-technologys-potential-in-schools.htm and http://www.usnews.com/news/articles/2015/09/22/study-students-who-use-computers-often-in-school-have-lower-test-scores .

[vii] These points were already raised by Gavriel Saloman in his keynote address at the 2000 Ed-Media Meeting in Montreal. See: http://www.aace.org/conf/edmedia/00/salomonkeynote.htm .

[viii] *Ibid*.

[ix] This was also demonstrated by Sugata Mitra. See: https://www.ted.com/talks/sugata_mitra_build_a_school_in_the_cloud?language=en .

[x] See a debate on this subject at: www.iste.org/explore/articledetail?articleid=216 .

[xi] Herold, Benjamin, "Technology in Education: An Overview", Education Week, Feb. 5, 2016. (http://www.edweek.org/ew/issues/technology-in-education/).

[xii] See: http://www.agent4change.net/people/1351-larry-cuban-scourge-of-memory-loss-policymakers.html .

[xiii] Saloman, *supra* note 7.

[xiv] Grinager, Heather, "How Education Technology Leads to Improved Student Achievement," *Education Issues: A Primer for Policymakers*, National Conference of State Legislators, November 2006.

[xv] Source: Testimony and Statement of Margaret Honey, vice president and director, Center for Children and Technology, before the Labor, Health and Human Services, and Education Appropriations Subcommittee, U.S. Senate, July 25, 2001.

[xvi] The method of beginning curricular planning with goal setting was proposed by Wiggins and McTighe, *Understanding by Design,* ASCD, 2005. We are not suggesting that the process of EdTech design mirrors the Understanding by Design model, but utilizing their terminology of "backward design" to describe the beginning of the process as articulated in the NCSL report.