Introduction

In the following pages, an effort is made to answer the four questions: What is education; What is technology; What is educational technology; What are some of the positive and negative criticisms regarding technology integration in schools? Using a mixture of early 20th and early 21st century peer reviewed, academic literature, definitions for the first three questions are explored and short but comprehensive explanations are attempted. For the fourth, areas of student engagement, addressing the needs of different learning styles, and collaboration are addressed as plaudits while integration difficulties / impediments, faculty training, and gender issues are examined as legitimate concerns.

Literature Review

What is Education?

“Education is what survives when what has been learnt has been forgotten” — B. F. Skinner.

“Education consists mainly in what we have unlearned.” — Mark Twain's Notebook, 1898.

“Something to keep the child busy while he is growing up” — O. A. Stevens, 1945.

While Skinner and Twain were of obviously similar mindsets, many see a grain of truth in the seemingly flippant Stevens' quotation above as well as in what he wrote for the journal *Science* in 1945. He stated his critics claimed his above quotation was incorrect, and he concedes that definition for education varies “greatly in individuals and in subjects.” After teaching for many years, he noted such disparity and wrote he favored the “old styles” of teaching while it readily admitted that others would find success in using new methods. In the end, he asserted the best education could be had by following what he suggested to students: “It doesn't matter what course you take. Pick out the best
teachers and take the hardest course they offer.”

In essence, all three suggested a pair of elements necessary in defining education. First, it has more to do with the process of learning via experience rather than the recollection of facts. Another piece concerns the acquisition of knowledge, skills, and broader views. Wallace Buttrick and Malcolm S. Knowles, both from the early part of two different decades, expound on that part of the definition.

Education is the determined and long-continued effort of a serious-minded person to train his powers of observation, thinking, and reflection through gain in knowledge (Buttrick, 1925, p. 126).

Education is an activity undertaken or initiated by one or more agents that is designed to effect changes in knowledge, skills, and attitudes of individuals, groups, or communities. The term emphasizes the educator, the agent of change who presents stimuli and reinforcement for learning and designs activities to induce change (Knowles, 2011, p. 10)

Buttrick and Knowles outlined both the participants and the transactional elements in their respective definitions. Those involved are the learner or learners in addition to (in the Knowles quotation) the educator. Together, they form an economy, a commercial relationship. “Effort” and “activity undertaken” are the recompense paid in exchange for the gains in “powers of observation, thinking, and reflection through gain in knowledge” to the “agent of change.”

Any discussion of the definition of education would be lacking without, at least, brief consideration of the purpose of education. Historically, the answer to that question varied widely. Some believed it was for educating students to become productive members of the workforce. Others asserted that it was about creating upstanding members of society and citizens. Many argued its purpose was to
cultivated students to become knowledgable, critical, independent thinkers who would become life-
long learners. A lofty stated purpose was often phrased as helping students to meet their potential. To this day, religious schools promote the idea that a more direct moral component (i.e., teaching students to know right from wrong) must be part of any such definition.

Today, most would probably opt for a more comprehensive purpose. Nigel Smith wrote the following:

“Education has innate benefits; it provides a person with the skills to think more effectively than those without it. It also confers advantages in terms of accreditation that are primarily valuemarkers [sic] for access to the job market.... What is the purpose of education? To foster the development of knowledgeable, skilful [sic] and ethical citizens in whom we can have confidence about the future of our society and our world” (2013, 35).

Most simply, education can be thought of as a primarily intellectual treatment or training aimed at making students more aware, skilled, critical, and knowledgable and with the intent of preparing them from their present and future roles beyond that training.

What is Technology?

The term technology comes from an early 17th century Greek work tekhnologia which can be defined as a ‘systematic treatment.’ It stems from two Greek roots, techne and logia. Techne is the root of Greek words like tekhnētos, which is defined as ‘artificial,’ and of tekhnasthai, which means ‘made by art.’ Roughly, the root translates as “art, skill, cunning of hand.” Logia is a form of the root logos, which means “words” (New Oxford American Dictionary 2012). Literally, the compound phrasing
might appear narrow, but figuratively it covers a great deal of ground. A word that references an artistic, clever, artificial but systematic use of tools is a comprehensive starting point.

At the start of his book, *The Nature Of Technology: What It Is And How It Evolves*, W. Brian Arthur offered a pithy definition that attacks the question from the direction of the user. He wrote that technology is “a means to fulfill a human purpose” (2009).

Alternatively, the National Institute of Health has an excellent lesson engaging students in the topic of that very question. It begins with asking students, “How do you define technology?” and recording but not clarifying their responses. The act engages students and activates prior knowledge, but is likely to result in answers relating to more high technology examples (e.g., computers, robots, etc). It continues by asking students to consider how humans from the stone age might deal with a torn garment. That question brings into focus the connection between technology and problems, in this case the ripped clothing (NIH, 2012). There is a direct relationship between the two concepts.

Additionally, the NIH lesson uncovers a bias that many have. Most people think of technology as computers, rocket ships, etc, as primarily complicated electronics. It is often difficult to remember that paper is a technology just as much as the above lesson's referenced sewing needles. There is a tendency to take for granted solutions that society have used for years and forget they were once grand solutions to vexing problems. A person from the stone age might well freeze to death without a way to stitch together furs, and paper allowed from a more permanent and transportable medium for thoughts. Language that allows for abstraction might qualify as one of humanity's greatest technological achievements, but few probably consider *words* technology any more. Like sewing needles and paper, it served an immediate purpose and solved a problem: direct, immediate communication addressed many pressing needs.

Returning to the notions of technology and problems being interrelated, the concept of the tool must be explored. For some, the word “tool” undoubtedly conjures images of picks and shovels, axes
and chainsaws, hammers and nails, computers and printers, etc. The central notion is that tools are device that extend the capacities of its user(s). A definition, though, must be larger and more comprehensive. Algebra is a tool in that it expands a person's mathematical ability. It allows them, for example, to predict expenses and future celestial events. Returning to Brain Arthur, he added the ideal that technology included the “components” and “collection of practices and devices available to a culture” (Arthur, 2009, 28).

In the modern day, we have tools inside of tools. Consider the search features built into most operating systems. They allow people to find the documents that other tools (e.g., word processors) made within a tool (e.g., computer operating systems) on a tool (e.g., a computer). More broadly, a tool could be any scheme, device, system, or concept that simplifies a task or increase the prowess(es) of its user(s). Like problems, the relationship between technology and tools is an intimate one.

While technology is often broken into six main modern, albeit it overlapping categories (i.e., transportation, energy, biologic, construction, manufacturing, and communication), most simply technology can be thought of as a tool created to solve one or more problems.

What is Educational Technology?

The obvious inclination would be to combine the definitions for education and technology and hope for coherence. For many compound terms, that affords a reader an excellent starting point, but, for others, it does not (e.g., the oxymoron of “jumbo shrimp”). For educational technology, it is not inclusive enough.

The Association for Educational Communications and Technology (AECT) web site offers their definition for educational technology. Interestingly enough, it borrows some of the moral aspects of the religious institutions discussed above. “Educational technology is the study and ethical practice of
facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (2008).

Dr. Denis Hlynka and Dr. Michele Jacobsen critiqued the above definition and were mostly positive in their assessment. They noted that the “tool” portion of the definition comes later and was therefore deemphasized in relation to the educational aspects (i.e., the study, practice, learning, and intended gains.), which they assert should take priority (2009). Accordingly, they argue the following:

In short, educational technologists are interested in creating and evaluating learning and performances that are more effective or efficient because of the technological processes and resources. Further, educators are interested in creating, adopting and managing new, novel and innovative learning experiences that only become possible because of technological processes and resources.

What is missing from both the AECT statement and the Hlynka and Jacobsen piece is threefold: missing is specific reference to engagement and assessment, also absent is the student's role in the definition, and there is a subtle basis toward new and larger scale technological solutions.

Punyal Mishra et al. wrote of that very bias in their 2009 historical perspective of educational technology titled *The Song Remains the Same: Looking Back to the Future of Educational Technology*. New technologies were and are often seen as the next, big thing, the paradigm shifting innovation. The aforementioned piece referenced an educator from the 1930s who wrote about the “talking picture” (i.e., movies) being that revolutionizing technology that would open proverbial doors and shrink the planet, affording students access to virtual experiences that were hitherto impossible. Afterward, they resort to a nearly verbatim AECT definition, minus the ethical section.

Most simply, educational technology can be thought of as the study and use of tools to aid
students' learning and achievement via using tools and resources to that end.

**Impact on...**

**What are some of the criticism regarding the integration of technology in schools?**

**Advantages:** There are a growing number of positives associated with integrating technology in schools. For the purpose of this paper, three areas will be discussed: student engagement, addressing the needs of different learning styles, and collaboration.

It is not an exaggeration to write that education technology that is well implemented and thoughtfully used offers students are wide variety of advantages over students without such access. The Gary B. Shelly textbook *Teachers Discovering Computers: Integrating Technology in a Connected World* highlighted many such positives, citing over two decades of research (Shelly, et al., 2012, p. 210).

One such area lies in the realm of student engagement. Technology not only captures the attention of students, but it “encourages them to take a more active role in the learning process” (Shelly, et al., 2012, p. 216). They are motivated by and enjoy the act of conducting their own research, authoring their writing, and presenting their work via a digital platform that can extend beyond their school building. Such engagement has quantifiable outcomes which include lower dropout rates, higher student achievement, improved retention, and greater self-esteem (Shelly, et al., 2012, p. 207-9).

Educational technology can also help better meet the needs of students with special needs and different learning styles. The Shelly textbook said it succinctly:

One of the main reasons for teachers to utilize digital media software in the classroom is that it appeals to a variety of learning styles. Helping every student learn in his or her unique way
ensures success for all students. Digital media software applications assist teachers in meeting diverse learning styles by combining interactive software integrated with teaching strategies to enhance the learning process (2012, p. 207).

For example, graphics are particularly useful for visual learners. Often, they are able to learn concepts faster and be capable of greater recall “if they see the information presented graphically” (Shelly, et al., 2012, p. 206).

Likewise, Alice Armstrong, in her piece, *Technology in the Classroom It's Not a Matter of If,' but 'When' and 'How',* made the strong argument that network classrooms “lend themselves naturally to peer collaboration” (Armstrong 2014, p 42). Not only can raw data and entire projects be created, critiqued, shared, and presented amongst multiple members of a class, but the more technically sophisticated have the opportunity to help the less so (Armstrong 2014, p 42).

**Disadvantages:** There are many negative criticisms or concerns regarding technology integration in schools. For the purpose of this paper, three areas will be discussed: integration difficulties / impediments, faculty training, and gender issues.

The Punyal Mishra et al. article outlined three main problems with implementing educational technology.

The first is that using the newest technologies ... in ways that are instructionally effective requires specific knowledge of how the technology can be used for pedagogical purposes.... Educators who are not skilled beyond basic usage will need to learn both the technology as well as how to use it instructionally—a completely different skill (Mishra et al, 2009, p. 49).
Above, they made two arguments. The first is that educators must be taught or otherwise learn how to make instructional use of technology. The second is that they need to be “skilled beyond basic usage,” which is not always true. For example, an ELA educator does not need more than a cursory understanding of a word processor to use them in their writing workshop. The same applies to a Social Studies teacher using Google Earth to illustrate the Appalachian Trail or a Math teacher using Excel to demonstrate the FOIL principle. Granted a fuller comprehension of such tools could well allow for better and more efficient use, but it is far from imperative.

Their article went on to describe two other roadblocks, including a pervasive (and historical) mistrust of new technology (e.g., Socrates believing that writing was harmful to education since it would preclude memorizing speeches) and a lack of focus on how to use technologies instructively. They assert that more emphasis is “inordinately on the technology rather than more fundamental issues of how to approach teaching subject matter with these technologies” (Mishra et al, 2009, p 49-50).

Borrowing from the above example, teaching a Social Studies teacher about Excel's worksheets or relational features does not mean they will have a sense of how to effectively and instructionally use spreadsheets in class. Some can make that leap, but many cannot as Mishra et al. are entirely correct about it being “a completely different skill.”

With that said, such training does not have to make an educator into an expert. The importance of educator training is not debated, but the lack of it is often cited as legitimate criticism of technology integration. Armstrong relayed complaints about SMART boards being littler more than fancy albeit expensive chalkboards, when teacher do not make adequate use of the products' interactive features (2014, p. 45). Without a doubt, few faculty without proper training educational technology would make use of all of a product's features. Even so, if a teacher does not know how to create the interactive elements of a lesson using a SMART Board, the digital components could still be a positive for students. For example, students could have access to electronic copies of their teacher's class notes or
assignments at the end of a period.

Changes in technology require changes in pedagogy. Armstrong referenced several studies by Pew Research where educators feared a student “overreliance” on search engines and that many believed students thought that such searches comprised the entire research process (2014, p. 40-1). She argued that students must learn that search engines are only part of the process. Clearly that is true, but it is incomplete as an education technology strategy. Most simply, raw web searches rarely produce the answers to more than basic, closed questions. For example, finding out when Nathaniel Hawthorne was born is easy, why he was famous is trickier, but how his transcendentalist views impacted his literature cannot be done exclusively by filling in the question field. Students and teachers must learn how to perform more efficient, strategic searches using boolean logic, structural modifiers, different kinds of search engines, and with an understanding of how they work.

In the *Women and Information Technology* article by Rachel Baruch, she wrote, “the Internet is currently considered to be the largest source of information. Its essence as a center of resources intricately connected without order or a master organization has implications on the processes of knowledge construction taking place within it” (2014, p. 192). It is necessary that professional development starts to provide a framework for understanding and using relevant parts for educators so that they can do the same for their students.

Another criticism in the integration of educational technology deals with notions of gender differences. The Baruch piece also cited numerous studies and research concerning the gender gap in interest in computer technology. They included educators subtly encouraging boys toward “computer games” while girls are pushed toward “social games,” that the disparity grows and reinforces the perception that computer aptitude as a “manly achievement” (2014, p. 194-5). Interestingly, as adults the two main genders view computer technology differently. Males tend to see it as a tool, where as women are more likely to see it as a means, over which they have little control (2014, p. 194-6).
In contrast, Baruch noted a growing body of research that lauds women's more recent success with online coursework. The documented levels of women's insecurity about using educational technology and the internet fade. E-learning is an environment where female students do not participate less. Instead, they achieve higher overall grades and are more successful requesting and getting support from their educators (2014, p. 196-7).

What the SMART Board, web searches, access to the unmoderated vastness of information on the internet, and gender differences all have in common is the notion of access. Additionally, they are all situations where criticism can be easily and cheaply overcome. Learning to use the SMART Board as a creator / replicator of digital content, how to do more efficient and effective web searches, how to better categorize data sources and structures, and to be aware of gender bias can be addressed in a single in-service presentation. Such a training does not eliminate such concerns or the issues themselves, but it can start the process.

The move is to consider education and technology and make it educational technology where students needs are better met.

**Summation**

For the purpose of this paper, the follow three definitions were assembled:

- *Education* is a treatment or training aimed at making students more aware, skilled, critical, and knowledgable and with the intent of preparing them from their present and future roles beyond that training.
- *Technology* is tool created to solve one or more problems.
- *Educational Technology* is the study and use of tools to aid students' learning and achievement via using tools and resources to that end.

School implementation of educational technology offers both faculty and students numerous benefits. Among them are increasing the level and quality of student engagement, better meeting the needs of those with various learning styles, and improving collaboration. On the other hand, there are many legitimate concerns about the way schools implement educational technologies. Three of them include
implementation roadblocks, a lack of faculty training, and understanding gender issues. While there are no simple solutions to such and other concerns, beginning the process of addressing them can sometimes be done with minimal outlay of resources.

In short, it is not a question of when education technology is integrated into schools, but, in deference to Alice Armstrong, a question of how well.
References


