Article

e-learning and digital media

E-Learning and Digital Media
0(0) 1–24

DOI: 10.1177/2042753017752583
journals.sagepub.com/home/ldm

SAGE

A shifting paradigm: An evaluation of the pervasive effects of digital technologies on language expression, creativity, critical thinking, political discourse, and interactive processes of human communications

Andrea E Cladis
College of Arts and Sciences, Fairfield University Fairfield, CT, USA

Abstract

Technology is an all-encompassing aspect of life in the 21st century. Its existence has implications on how communication occurs, education is shaped, knowledge is spread, and ideas are formulated. There is a significant shift taking place in society as we become more accustomed to existing in a digital world. Digital natives, young people who have been born into a virtual reality, view the world differently, have a 'digital footprint,' process info-graphics speedily, but lack basic capacity for interpersonal interactions. They also present neurological differences from those who were exposed to digital technologies later in life. However, regardless of human capacity for technological understanding, digital technologies adversely impact our shared humanity and the ubiquitous nature of these technologies is quite frightening. As a high school English teacher, I experience the impact of digital technologies on learning and language expression first-hand through my work with digital natives. My concern is that because of student dependence on the rapid influx of digital technologies, they will not possess certain imperative faculties of the mind including the ability to embrace mystery, wonderment, and inquiry. There is also concern for the potential loss of creativity. The research that follows attempts to evaluate the impact – both positive and negative – on the domain of language expression including reading, writing, and faculties for imagination and critical thinking. Through thorough examination of neuroscience, trends in reading and writing, usage of electronic communications, social media and politics, levels of digital literacy, primary observations of high school students in a tech-dependent classroom,

Corresponding author:
Andrea E Cladis, College of Arts and Sciences, Fairfield University, 1073 N Benson Road, Fairfield, CT 06824, USA.
Email: andrea.cladis@gmail.com

the evaluations that follow form a basis for theoretical assumptions about technology's impact on language expression and education.

Keywords
Digital media, technology, writing, education, digital literacy, digital natives

Introduction

Ask Siri. Google it. Check your phone for updates. Use the new app. Download it. Follow me on Instagram, Snapchat, Twitter, Facebook, and Pinterest. Blog with me on Tumblr. Check out my website. Text me. Scroll your newsfeed. Skype call Mom later. Discover new emoticons. Spell check, instantly. Copy, paste, and plagiarize. The majority of our time in the in the 21st century, dubbed the "age of technology," is spent navigating a virtual world (Seife, 2014: 5). From social media networks to reality television and on-demand movies, to e-books, and students holding small computers in their hands in classrooms across the United States, we are rapidly outsourcing entertainment and educational experiences to technological devices and programs.

Our growing digital dependency has profoundly changed basic human interaction, and access to information at our fingertips has created a vast new landscape of digital learning and connectivity. The exponential growth of technology and its all-consuming nature has been fascinating to witness from the early development of the web to multi-faceted computerized devices that fit to the size of our hands. But what is the result of this instant access, virtual reality in which we live? How does our digital dependency affect our consumption, use, and understanding of language? Furthermore, what impact does our reliance on technology have on our ability to create and think critically?

At the time this research is being formulated in 2017, a movie about Emoji's has just been unveiled in theatres, the latest iPhone is available for purchase, hundreds of new apps are being developed every day, and a surge of digital natives are seamlessly navigating an increasingly interconnected, technology-reliant world. Children are more accustomed to screens than paper books, and adults are becoming innately tethered to their electronic devices. We are compelled to publicize our lives on social networks, and to let our pocket computers do all the thinking for us. From maps giving visual and auditory directions, word definitions being provided via multiple digital dictionaries, and how-to articles and videos in every possible category imaginable, we no longer have the need to actively participate in organic thinking processes (Birkerts, 2016). Organic thinking processes require self-generated thought. Rather than being informed of personal thinking from outside sources, an individual generates ideas and meaning on his own. Larissa Pahomov (2014), author of *Authentic Learning in the Digital Age,* states that a possible solution to the interference of the digital age in regard to authentic learning is to teach students organic thinking processes so that they can create new ideas and solutions to problems on their own.

Our dependence on digital technologies in the 21st century has transformed human interaction, improved the mode and speed by which we perform daily activities, and increased the efficiency of production. But in consequence, it has had detrimental effects on human capacity for creativity, critical thinking, and language expression. With change and

complacency a common result of our increased access to information and growing reliance on technology, do we still have what it takes to read, to write, to express, to understand literature, to analyze problems, or to imagine innovative solutions? What can we forecast as the cumulative results of our behaviors in the digital age? If we cannot debate or sustain meaningful discourse without the interruption of digital technologies, can we ever become rational, self-functioning, *thinking*, human beings again?

Overview: Digital dependence and its impact on language expression

The existence of technology has implications on how communication occurs, how education is shaped, how knowledge is spread, and how ideas are formulated. The genesis of technology was to create commerce and improve quality of life. Today, technology is used for everything from entertainment and communication to data mining and assisting in or preventing acts of war. Technological advancements have been isolating as well as liberating. Most notably recognized in the form of smart phones, digital technologies are no longer a part of our world we can avoid (Palfrey, 2009: 10).

Digital natives are young adults who have been born after the advent of the internet (Palfrey, 2009). They have been born into a virtual reality of life via screen and as such, view the world differently, process info-graphics speedily, lack basic capacity for interpersonal interactions, and present neurological differences from those who were exposed to digital technologies later in life (Ray, 2017). There is a significant shift taking place in society as we become more and more accustomed to existing in a digital world. However, regardless of human capacity for technological understanding and ease of its implementation, the ubiquitous nature of digital technologies have the potential to adversely impact our shared humanity (Palfrey, 2009).

As a high school English teacher I experience the impact of digital technologies on learning and language expression first-hand through my work with digital natives. My concern is that because of student dependence on the rapid influx of digital technologies, they will not possess certain imperative faculties of the mind including the ability to embrace mystery, curiosity, wonder, and inquiry. There is also concern for the potential loss of creativity. The research that follows attempts to evaluate the impact on the domain of language expression including reading, writing, and faculties for imagination and critical thinking. Through examination of neuroscience, trends in reading and writing, usage of electronic communications, levels of digital literacy, and first-hand observations of high school students in a tech-dependent classroom with a digital curriculum, the evaluations that follow form a basis for theoretical assumptions about technology's impact on language expression and education. The following research coalesces collaborative solutions for authentic, inquiry-based learning that cautions against the use of technology as the primary means for which students acquire information and instead promotes the implementation of hybridized learning that uses both technological and traditional learning practices.

Understanding the neuroscience of "wired" brains

In order to fully engage in digital research, it is imperative to understand the physical science behind the evolution of our brains in response to a digital world. As Cathy Davidson (2013), English professor and co-founder of HASTAC (Humanities, Arts, Science, and Technology Advanced Collaboratory) explains, "We are in the midst of a major information

revolution...there have only been three or four of this magnitude in history" (Ray et al., 2013). As an educator most concerned with how to prepare students for the digital age, she continues, "digital media and learning is not just about machines; it's about a new way of thinking and learning" (Davidson, 2013: 55). The magnitude of the digital world is beyond comprehension. Thus, it is necessary to understand how we have unwittingly adapted to it so instead of becoming numb to its presence, we can employ technology in new and innovative ways.

One of the primary neurological considerations for cognitive development is the acclimation to elusive or invisible technologies – ones that appear to operate even without our functional knowledge of what they are doing or how they are affecting us. "Signals, data, networks. New habits and reflexes. Watch older people as they try to retool; their aptitudes, their weaknesses. I wonder if any population in history has had a bigger gulf between its youngest and oldest members" (Birkerts, 2016: 1). Older adults, referred to as "digital settlers," who have gradually become acclimated to digital technologies and processing over time, still have slower synapses in their brains, longer connection times for memory and information-storing, and they are generally able to think independently of technological assistance (Palfrey, 2009: 1). Digital natives have never experienced a world apart from digital technologies and as such, brain science has revealed an actual neurological shift in their brain functioning and development (Palfrey, 2009: 1). Digital natives can process images faster and compartmentalize information more efficiently, yet they often lack long-term memory functionality and the cognitive functioning required for critical thinking and imagination. Thus, these digital natives are said to have "wired" brains that are conditioned to operational thinking in a digital-first language (Birkerts, 2016: 3).

The high school students I interact with are all digital natives. They grew up learning in an environment saturated with digital language and they navigate technology seamlessly. While technological skills are certainly necessary to have as a commodity in the digital age, they do not guarantee achievement or learning outcomes with more favorable objectives (Ray et al., 2013).

For example, during a unit I taught on transcendentalism, designed to have students move their focus away from our fast-paced world and back to nature as transcendentalists such as Henry David Thoreau advocated in his philosophical writings, students had no desire to become "one with nature" or practice transcendentalist philosophies. When students were asked to remove themselves from their phones and digital devices for one class period of 44 minutes, they were horrified. The goal of the lesson was to disconnect from technology, spend time outside, experience and reflect upon the natural world in the same way a transcendentalist would. I completed this activity with seven classes, approximately 220 students in total. They were only allowed to bring a pencil and piece of paper outside and they were instructed to record specific reflections and observations from their quiet "time in the woods."

Out of the seven classes, one class – an advanced English Honors class – embraced the activity, silenced their phones, left all devices inside, and enjoyed their peace and quiet outside. However, with the other six classes who unwillingly participated in the activity, I received countless complaints from students who believed the practice to be unfair. Many of these resistant students snuck their phones outside and became belligerent when I asked them to turn them off, and others elected to run back into the school building long before the activity was over because they just *had* to check their phones and social media accounts. They literally could not distance themselves enough to be comfortably away from their

devices for a time period of less than one hour. My students became anxious and aggravated when they could not access any form of digital communication. They did not want to experience nature, nor did they care to understand the "why" of what I was asking them to do.

My presumption was that a free class period spent outdoors to embody transcendentalism would be seen as a reward from usual classroom proceedings. However, it caused stress, anxiety, and fear in my students that I had not before witnessed. Their unbreakable attachment to the virtual world scared me, leading me to wonder how I could modify my teaching to accommodate the separation anxiety caused by their lack of connection to the outer world. Their behaviors were consistent with what psychologist Christine Hohlbaum (2013) defines as "digital addiction." She suggests that to effectively break patterns of digital addiction, one must modify behaviors and be introduced to stimuli outside of a digital-only environment.

So rather than place more emphasis on using more technology to appease my students, I chose to implement a mix of tech and tech-free learning activities into daily learning strategies. Most of the tech-free activities failed tremendously because my students were unable to fully participate in them on account of their refusal to remove their focus from their digital environment. As I continued to observe these behaviors, I developed new questions. What exactly does this mean for the basic inquiry of human existence, use of language, and connectivity to others? What are the repercussions of such a monumental neurological shift?

There is no confirmed consensus on the effects altered brain functioning in digital natives. The gravest concern now is that "in the culture at large...there may not be such a thing as mind apart from brain function" (Birkerts, 2016: 3). Birkerts defines our *mind* as what enables us to independently think, process, and create. He defines our *brain function* in relation to the means by which we carry out tasks or activities that require rote cognition. Our brain function is similar to muscle memory. For example, in the same way a gamer becomes more and more adept at playing a video game through strategic practice, he generally has to think less and less in order to win. His *mind* is activated at the beginning of the gaming procedure, but his *brain function* takes over to continue executing the strategic procedure of game play once it has been learned. This process could be occurring because the gamer is subconsciously conserving brain power for difficulties he may encounter at different levels of the game he will play. However, it is this cyclical pattern of repeated *brain functioning* behaviors that produces an erosion of brain intelligibility, which neuroscientists fear as human brains become increasingly "wired." Our brain can adapt and improve to fit its given environment, but the fear is that this will happen in tandem with the detrimental decay of our 'thinking' minds. Birkerts (2016) argues that the brain and the mind are two fundamentally different resources we have. The brain is what computes, the mind is what thinks.

Eventually, it is predicted that we "will be talking less and less about experiences, perceptions, thoughts, beliefs, purposes and aims; and more and more about brain processes..." (Birkerts, 2016: 3–4). Our brains will continue to adapt to the constant stimuli to which we are exposed resulting in new brain patterning that will serve to override the functionality of our "thinking" minds. In consequence, it is possible that our faculties for imagination will diminish, our ability to use language to capture meaning and express new feelings will atrophy, and the digitizing of nearly every sphere of human activity will erode our ability to experience life humanely.

Reading in the digital age

The assumption that more people are actively reading in the digital age simply because of increased access to reading material on screens is not verifiable. Our brain functionality has changed drastically so that we can ingest more information at faster speeds. However, what about the functionality of our minds? Perhaps we are actually "seeing" more words and images on screens than in past decades, but are we really engaged in authentic reading behaviors? Have we actually jeopardized the art of reading with the influx of digital technologies? These questions are at the forefront of research on language expression as the answers to these questions form the crux of concern for the wide-reaching impact of digital technologies on our ability to think, imagine, and be human.

With the majority of information consumption done on electronic reading devices, we are presented with a consistent stream of digital stimuli to occupy our minds. Studies show that as we gain new and more mobile ways of reading, such as eBooks, Kindle, and iBooks, we are not reading as "attentively and thoroughly" as we did in the past when reading primarily on paper. With digital technologies, we read with less accuracy and overall comprehension suffers (Jabr, 2013: 3). "There is physicality in reading. . .maybe even more than we want to think about as we lurch into digital reading," claims Maryanne Wolf (2003) of Tufts University (Ray et al., 2013). When reading paper books, there is a physical connection between brain, body, and text. E-readers, on the other hand, "fail to adequately recreate certain tactile experiences of reading on paper that many people miss and, more importantly, prevent people from navigating long texts in an intuitive and satisfying way (Jabr, 2013: 3)." As a result, important information within a digital text might be overlooked. This is problematic not only for recreational reading, but for informational and academic reading. While e-readers try to mimic paper books in form and function, they will never be able to replace the experience of reading on paper because the brain computes and interprets language on a screen differently.

The most significant challenges to digital reading include levels of attentiveness, long-term memory function, levels of engagement with story or text, depth of comprehension, active recall or reflection, and story mapping. First, it is essential to understand how our brains navigate different textual landscapes. To human brains, letters are merely designs on paper or screens that alone have no meaning at all. Yet, when grouped together to create text-sets, words appear and meaning evolves through the repeated constructs of letter groupings. "The brain literally goes through the motions of writing when reading, even if the hands are empty," demonstrating that our brains are constantly creating new circuits for reading by "weaving together various regions of neural tissue devoted to other abilities, such as spoken language, motor coordination, and vision" (Jabr, 2013: 4).

Language becomes a part of our human capacity over time through repeated exposure. Unfortunately, when we read on screens versus paper, we are not able to transfer skills of spoken language, motor coordination, and vision as well as we can when reading on paper. This is not necessarily a concerning point of data, but it is worth considering in the scope of literacy and communication as a whole (Jabr, 2013: 4–5). Going forward, how can we ensure the spectrum of expressive language skills aptly develop in a digital-first world?

Levels of attentiveness

Imagine holding a paper book, magazine, or pamphlet in your hands. Think about how you can touch and interact with it. Now, compare that to the feeling of holding an iPhone,

electronic reading device, or small computer in your hand. Chances are that while the physical book or magazine might be pleasurable to touch or browse, the small computer you hold has far more options for instantaneous interaction than a paper book does. Computers and electronic readers create easy access to a world of scrolling print, moving images, sound, virtual realities, data, and ready distractions including, but not limited to, games, pop-ups, calendars, messages, and music. This can make it difficult to read attentively on a multi-purpose device. Even with a dedicated Kindle or e-reader, there are still distractions of movement, noise, light, updates, eye-strain, and a digital library of books to choose from that can easily divert a person from engaging in focused reading. This is not to say that internal and external distractions to do not exist when reading on paper, but they are most certainly heightened when reading digitally (Jabr, 2013: 4–10).

Ferris Jabr (2013) of *Scientific American* notes, "An emerging collection of studies emphasizes that in addition to screens possibly taxing people's attention more than paper, people do not always bring as much effort to screens in the first place." So, not only is digital reading more distracting, we actually view it as less important or rewarding. We believe digital reading to be a far "less serious affair" than when reading on paper (Jabr, 2013: 4). When discussing reading on paper versus reading on screen, my students unanimously confirmed that they do not read with intent when reading on screen. They skim, scan, and move on. When they read on paper, they are more apt to slow down, ingest what is read, and are able to easily and intentionally navigate their progress through a text. When reading on screens, we also spend more time caught up in distractions, hunting for keywords, browsing the internet, scanning articles, and bouncing from source to source to validate information, as opposed to more focused reading on that often occurs when we read on paper because we are not confronted with so many distractions from digital stimuli. "People reading on paper. . .are more likely to read a document once and only once" (Jabr, 2013: 9). Jabr avows that digital-only reading could be responsible for dwindling levels of memory, engagement, comprehension, and recall in relation to consumption of text (Palfrey, 2009: 5–20).

Long-term memory function

Another fascinating aspect of paper-based reading versus digital reading is their differing effects on memory. Psychologists make the distinction between knowing something and remembering something pointing out that *remembering* implies a basic recall of events, while *knowing* something means it was fully learned and has found its way into long-term memory. Kate Garland (2013) of the University of Leicester and her colleagues studied a group of 50 college students in Britain to determine how they performed on assessments when completing them on different mediums – digital or paper. What they found was is fascinating to consider in the realm of education. They unveiled "that students who read on paper learned the study material more thoroughly more quickly; they did not have to spend a lot of time searching their minds for information from the text, trying to trigger the right memory – they often just knew the answers" (Jabr, 2013: 7–8).

I completed a similar study in an academic English classroom containing 35 high school juniors. The results were similar. When students read something on paper, their recall immediately afterwards was at a 95% rate of accuracy and when tested on that material two months later, recall remained at 90%. When the same group of students completed a reading assignment on their digital devices, their recall immediately afterwards was 65%.

Further, when tested two months later, only four of the 35 students even vaguely recollected the reading to which they had been exposed. This very small-scale study demonstrated that the concepts read on paper were not only being stored in the short-term memory, but rather being planted into long-term memory. As for the ingestion of material on screen, I speculate that memory deficits occur because it is difficult to distinguish one text, article, or book from another. For example, if a reader is studying a topic and reading several on-screen articles, after a while, they all begin to run together because they have a similar appearance. This can be a challenge with multiple texts on paper as well, but students are able to better map out placement of words, phrases, and information in text on paper than in text on screen (Jabr, 2013: 4–5). This makes recall with digital reading more confusing for readers than paper reading, and makes long-term memory even more challenging to achieve.

An additional factor that influences memory shortages when using digital devices is the fact that screen-based reading can be far more physically taxing than reading on paper. The primary cause generates from the compulsion to scroll through text, the bright light from screens, and the resulting eyestrain or blurred vision that can occur over long periods of use. To prove this theory of cognitive and physical fatigue from using digital reading devices, Erik Wastlund (2013) of Karlstad University in Sweden completed several studies observing student outcomes on paper tests versus tests taken on screen. He assessed levels of perceived student fatigue, levels of attentiveness, working memory, and potential for long-term memory recall. The results of his studies overwhelmingly proved that testing via digital screens and digital text yielded far worse results than testing via pencil and paper. When digital reading causes the mind to become fatigued more quickly, a person cannot physically interact with a text, and the actual text gets jumbled due to its changing location on a screen. Recall becomes difficult and it is much harder for people to commit learned information to long-term memory. "Wastlund thinks that scrolling – which requires readers to consciously focus on both the text and how they are moving it – drains more mental resources than turning or clicking a page, which are simpler, more authentic gestures" (Jabr, 2013: 9). Higher test scores were observed overall for students taking paper tests versus digital ones.

These studies all provide a glimpse into brain psychology at a deeper level. If we cannot recall information well enough to create new channels for the absorption of new information, the act of learning becomes a useless commodity. As Rushkoff and Leland (2011) argue in *Program or Be Programmed,* digital technologies have caused us to outsource our brains. We no longer need to read or analyze text at deep levels because we can access it with ease at another time. Neurologically, our capacity for memory has not changed, but because we are utilizing it less, those areas of our brains are experiencing recognizable decay (Holhbaum, 2013).

Levels of engagement

In addition to digital reading being littered with distractions and affecting long-term memory, digital reading has also decreased our levels of engagement in a text. Textual engagement, also referenced as deep reading, refers to a reader's full interaction with a text incorporating reading for content, understanding, and inquiry.

One probable reason for lack of engagement in reading is our cultural addiction to instant gratification. Chuck Klosterman (2016) addresses this subject in *But What If We're Wrong*. As he evaluates societal systems and structures throughout this text, he explains that in the 21st century, we have become conditioned to expect immediate results

from actions that we take. We do not want to wait for answers or results, we want to have them now (2016).

Novels, for example, do not necessarily allow for this in the same way that the instantaneous nature of digital communications do. Why read a book when a movie can be watched? Why engage in deep thinking when one can simply 'look up' a reasonably reliable answer? There seems nothing to gain from patiently reading a novel when the internet can source its plot, characters, and ending. Our lives, mediated by 24–7 access to digital networks, have been transformed. In consequence, being wholly engaged in a singular activity for long periods of time has become increasingly demanding (Palfrey, 2009: 4–5).

Engaged reading requires patience. A reader must live in the present moment of a story and create visuals as they progress. Because so many other forms of entertainment have occupied our minds, reading, according to many of my high school students, is cast aside as a "chore" or something not worth doing because it "takes too long" to complete. High school students admit that they are eager to use Google to quickly find brief answers to substitute information needed for longer reading assignments. In survey response, over 75% indicated that they rarely stay on one internet page for longer than a minute before clicking a link to the next (Appendix 1).

Students also stated that when looking for factual information, they will use word-for-word verbatim of the question they have in search engines to facilitate direct responses. When they are required to produce content that demonstrates analysis of a specific literary character, a personal reflection, or connection to the text, they will seek out online forums to find discussions relating to said topic. Students admitted that there is always an "easier" way to find information online and that it is rare that they encounter an assignment or question for which they cannot find some relevant resource for further research and learning (Appendix 1).

Perhaps then even more frightening than the fact that we are distracted by technology, is the fact that because of technology our minds are losing the capacity to functionally engage in what it means to think and be human in the world. This is not a problem new to humanity as a whole, but the pace at which it is occurring surpasses the pace of several other transformative technological events in history (Bruce, 2017). The changing aesthetics of our digital world have consequences, and it is our responsibility to mediate them. We are currently altering the way we read, think, write, and interact, and as Birkerts and Greenberg (2016) argue, we may also be destroying the most essential components of what makes us human. "The real key is being able to imagine a new world. . .I can be creative in solving today's problems, but if I can't imagine something new, then I am stuck in the current situation" (John Seely, 2013; Ray et al., 2013).

The necessity and relevance of mental story mapping

> When we read, we construct a mental representation of the text in which meaning is anchored to structure. . .likely similar to mental maps we create of terrain. . .(as such) people report that when trying to locate a particular piece of written information they often remember where in the text it appeared. (Jabr, 2013: 4)

This is of particular importance when understanding how reading differs in digital mediums. Not only do print books supply the aspect of physicality to reading, but "turning the pages

of a paper book is like leaving one footprint after another on the trail – there's a rhythm to it and a visible record of how far one has traveled" (Jabr, 2013: 5). These aspects make reading on paper easily navigable and allows readers to form mental maps of text.

Visualization is an important part of understanding what is read as it utilizes faculties of our imaginations. While digital texts do not intend to challenge important parts of the reading process, they inevitably do (Birkerts, 2016: 12). A conglomerate of studies about photography and memory point to similar conclusions. Research indicates that people who take digital photos of events have less memory or recall of those events further suggesting that digital text and images actually detract from rather than enhance life experiences. Linda Henkel, a psychologist at Fairfield University, conducted a study in, 2014 on human interaction with memory and photography and she discovered that participants who went to a museum and did not photograph the objects there were more likely to remember them as opposed to their counterparts who did. Henkel believes that when people photograph things, they do not have to rely on their brains for storing the image and thus, "no longer need to mentally save the image for later" (Chen, 2017).

Henkel's research supports what psychologists call "cognitive offloading," a phenomenon that could also be responsible for our lack of memory when reading. Cognitive offloading occurs when our brains use an outside aid to reduce the amount of cognitive work that has to be completed. Many researchers agree that digital devices are "encouraging us to offload many of our cognitive functions onto other things, reducing our need to think, process, and remember" (Chen, 2017). The more we "offload" information, the less we remember, and the less we remember, the more difficult it is to garner meaning from reading.

Daily observations of high school students and their interactions with digital devices have demonstrated that cognitive offloading is merely part of their habitual means of recall. In terms of behavioral observation, they are more likely to capture pictures of notes on the board instead of copying them down by hand. When I surveyed a junior level high school class of thirty students and asked them a host of questions relating to social networking, digital media, and memory recall, I was not surprised by their incomplete responses. These are a few samples of the questions I posed to them. For the full questionnaire, see Appendix 1.

1. Tell me the phone numbers of your mom, dad, and two closest friends. Whom do you call in an emergency?
2. What homework were you assigned in first period today?
3. What is the name of the final street you turn on to get to your favorite sports arena or concert venue?

In response to the first question, only 5 out of the 30 students were able to answer with accuracy. The rest of the students asked to take a quick peek at their phones. In regard to the question about whom they call in an emergency, 55% of students gave a direct answer with a phone number of a parent or guardian which they had committed to memory. The rest of the students stated that in an emergency they would contact Mom or Dad and they have them in listed in their "favorites" or easily accessible via a speed dial number in their phone contacts. This presents an interesting conundrum. In one sense, it proves the relative ease of cognitive offloading for the storage of information. On the other hand, it also gives credence to the fact that when confronted with the idea of emergency, our minds may more consciously create space for the preservation of necessary information.

In regard to the second question, 16 of the 30 students were able to answer with accuracy. Most of the students who were unable to answer, however, did say that they wrote down their first period homework assignment in the homework planning application they manage on their smartphone. This again demonstrates a sort of fusion between rote memory and the use digital applications. The scale of importance between a homework assignment and an emergency is rather drastic. In conversation post survey, students admitted that smartphones and computers assist their need to offload certain information that they do not perceive as being of vital importance for long-term memory (Appendix 1).

As for question number three, which relates to maps and directional understanding, I was attempting to discover how reliant students were on GPS or digital maps. Most of them admitted that when they travel somewhere by car or by foot, they do not bother to survey directions or street names. Rather, they plug in the address of their destination and trust the GPS devices on their phones to get them where they need to be. The variables in response to this question included their driving frequency, gender, and how many past visits had been made to the sports venue or concert arena chosen for reference. Nonetheless, only 10 students were able to produce at least one street name on the route to the location they selected. This demonstrates cognitive offloading practices and also illustrates our dependency on digital tools to outsource everything from how we read to how we travel. Cognitive offloading is convenient and readily available. Therefore, it is being enthusiastically employed by digital natives who have become accustomed to its accessibility.

Writing in the digital age

The loss of formal language structure evidenced by the use of text shortcuts, emoticons, the inability to clearly express feelings through words, indicates that the relationship between technology and writing skills has become a rather tenuous one. Computers are regularly used for transference of communication and to facilitate differing forms of human interaction. Computers are also increasingly being used as vital components of fundamental learning processes such as writing. "Writing," as Adnan Omar and Muhammed Miah (2013) of Southern University at New Orleans assess in their research, *Digital Evolution of the Written Language*, "is a complex process that involves many skills, processes, and strategies. . .Good writing is defined by clarity, accuracy and logical thinking, among other characteristics" (Omar, 2013: 1). Developing the necessary reasoning and processing skills to become a good writer is not easy, and technology has changed the process of composition and participation in writing activities. Because writing for work tasks and communication is such a necessary skill for people to master, it is yet to be determined just how broadly digital media has impacted language development, and the construction of words, phrases, and symbols in collaboration to produce meaningful, critical writing.

Writing by hand versus composing on screen

In correlation to ingesting words from the page of a paperback book versus a pocket-sized screen or digital reading device, the outcome of the experience greatly varies. This dichotomy is likewise notable when it comes to writing with pencil or pen and paper versus composition on screen. Multiple studies over the past 10 years have proven that composition by hand is a far more cognitively stimulating experience as it provides an experience that

promotes deeper learning, engages a writer directly with the production of text, and leads to stronger language usage and understanding of meaning (Ray et al., 2013). This is not to insinuate that one cannot write well via all digital platforms, but it does suggest that for purposes of usage and understanding of language, the actual task of physically writing letters to form words and sentences is a far better option.

Howard Rheingold (2013), an educator and author of *Virtual Reality & The Virtual Community,* has performed extensive studies on Digital Media Learning (DML), essentially referring to learning that is done with the aid of digital media. His perspective on writing and learning language is that technology can help, but it "needs to be an additional pathway for information, not a replacement or substitute for authentic learning" (Ray et al., 2013). He argues that if students learn to write only via digital means, they will not develop skills needed to become effective writers. They will miss out on directly learning the conventions of language and lack a complete understanding of letter function and structuring. Surprisingly, when I surveyed 50 high school students about whether they prefer writing by hand or writing by computer, 80% surveyed said they prefer to write by hand while only 20% said they prefer to write by computer. Those in favor of handwriting said they feel the experience is more "authentic" and they "learn better" (Appendix 1). However, they mentioned that their school experiences have forced them into almost solely composing via computer because digital learning is now not only an expectation, but a requirement.

Rheingold (2013) suggests that a hybrid approach to learning how to write using tech and analog practices promotes the best outcomes. Learning to write by hand creates the physicality of experience which shapes connective synapses between brain and language formation – somewhat similar to the physical experience of reading on paper. Learning to write digitally does little to promote language understanding, but remains a necessary skill in the digital age. Rheingold recommends, "Use tools together with critical thinking, as means of empowering students to take on their own learning" (Ray et al., 2013).

The lack of grammatical usage in composition

Another aspect of digital writing that causes concern is that it has fostered 'lazy' habits when it comes to language use. Because digital natives readily use digital communication via a plethora of social media platforms such as Instagram, Snapchat, Twitter, and Facebook, they are accustomed to using improper English, shorthand forms of language, as well as implementing new jargon that has been inserted into the English language as a result of digital technologies. The students I interact with would be the first to inform me that the language I teach in a high school English class is not the language they use when communicating through digital networks with their peers.

The problem is not only that digital technologies create a fast-paced, shorthand language which adolescents become accustomed to using and mimic across all mediums – formal and informal, rather, that "information technology may actually be making us stupid, because computers take away from student engagement in the learning process (of language)" (Omar, 2013: 2). Possible causes for this include the use of text jargon as well as the spell check tool on computers which can help writing activities, but can also "cause deterioration in spelling ability as students may no longer bother about their spelling since they can rely on the spell checker" (Omar, 2013: 2–3).

It is not uncommon to see sentences as follows in formal writing assignments submitted by high school juniors and seniors:

> *she LOLed with her friend sara for "FOMO" for the late basketball game.when rick woke up he found sara down in the kitch cookin up some pancakes.*

For all intents and purposes, this is not acceptable in a high school English class or any class or work environment. This sentence lacks in proper punctuation including usage of proper nouns, periods, and capitalization. It also uses shorthand such as "kitch" and "cookin'" as well as popular acronyms, "LOL" and "FOMO," which are a couple of common-place examples of text-speak shorthand used on digital media platforms. The other issue here is that the sentences students produce do not make sense in terms of presenting evidence of textual comprehension or student creation of new meaning. The remedy for these writing pitfalls is to break students of such habit formation and teach them the differences between the language subculture of social media and the formalities of academic language. Student writing improves when they read deeply and also when they are given multiple opportunities to practice formal writing skills on a daily basis. It should also be noted that structured "writing activities also increase students' critical-thinking skills, which can be applied to other tasks" (Omar, 2013: 2).

Deterioration of language standards, norms, and words

Digital media platforms consume the lives of young adults. My observational research at demonstrated that 75%–80% of high school students' day is consumed by the use of digital media platforms (Survey: "Perspectives on Digital Media and Communication," Cladis, 2017). "Those who were born digital don't remember a world in which letters were printed and sent, much less hand-written, or where people met up at formal dances rather than on Facebook" (Palfrey, 2009: 4). The concern for digital natives is not just in language processing and usage, but in how language will be shaped and changed by their tech-driven generation. The transformation in how they write and communicate has been profound. It has thus facilitated the question of whether or not they will master formalities that presently and have previously existed in the English language. When students are exposed to conventions of digital language in a fast-paced, media-saturated environment every single day, it is not easy to break these habits. Face-to-face interactions happen less and less frequently and many language researchers argue that "the deterioration of language is due to the increased use of electronic communications" (Omar, 2013: 3). On account of the inundation of digital media platforms, students no longer have much need for writing well, revising, or making meaning through the use of language. As a result, the overall structuring of the English language will most likely continue to see broad, evolutionary shifts in years to come.

Strong competency in writing across disciplines is gradually rising as one of the most marketable skills in the workplace because so few applicants possess the ability to write and communicate well in formal settings (Seife, 2014: 10). This emerging gap is going to continue to divide competency skills in the workplace. Other effects of digital technology on writing skills, include poor punctuation skills, syntactical confusion referring to how words are ordered in a sentence, loss of attentiveness when formulating sentences, loss of sequencing, and an absence of proof-reading skills.

Furthermore, students routinely plagiarize. And because the digital world is so fused with their own, plagiarism is not seen as inherently wrong as a mode of transferring data. Digital natives believe they are merely sharing or recycling interesting information or materials – a practice which social media has made them accustomed to doing without consequence (Appendix 1). Language is becoming looser and more informal across disciplines, work, and recreational settings. Digital technologies will continue to impact writing, and challenges will remain with balancing technological innovation with the preservation of language as a whole. If these trends continue, how will language evolve from here? Who will set the standard of usage for formality in the English language as the encroaching digital dominance of "lazy" or informal "net-speak" continues to overwhelm patterns of communication?

Trends and consequences of digital technology: The rapid dissolution of creativity and critical thinking:

> What's more, digital information is changing our perception of identity and reshaping our society. We're altering our behavior toward one another because of the influence of the online world – we humans are deeply social animals, and the online world is reshaping how we make and maintain social bonds. In so doing, it's altering the way we interact with one another, changing the nature of public discourse, and driving us to ever more extreme beliefs. (Seife, 2014: 5)

As digital communications continue to shape and change the basic dictates of human nature, we have to think beyond the mere consequences to reading and writing. Our instant-access, data-driven culture does not provide ample time to think, process, and practice ingenuity. What will happen when free imagination is lost, creativity dissipates, and there is no need for critical thinking?

As remarkably sedentary consumers of information, we are often content being told what to think, how to feel, and how to act upon the feelings projected upon us. Technology acts as an interrupting stimulus of chatter and information, but as consumers, our utilization and reliance upon it only shows that we want more of the same. At some level, we find comfort in being told what to do and what to think, as though it is one less chore of our lives (Ray et al., 2013). Media outlets diminish the intellectual capacity of free-thinking individuals. When another person or entity via digital platforms or technologies can easily propagate ideas that ultimately influence another person's beliefs or worldview without any foreseeable actuality of consequence, there is little motivation for the receiver of said ideas to think independently.

Digital addiction

To understand the extent to which our connection or obsession with digital is a problem, look no further than digital media as an addictive behavior. A growing number of psychological studies suggest that more and more people now suffer from what is being termed "digital addiction" or "internet addiction." People who suffer from IAD, or Internet Addiction Disorder, show patterns of abnormal white matter on their brain scans indicating that "internet addiction changes the brain similar to cocaine" (CBS News, 2012).

When I asked my high school students why they enjoy social media or digital communications, 95% responded stating that they fear not being engaged because they would miss

out. They also indicated that their interest in social media platforms stems from curiosity about what other people are doing with their lives. "We have to know. We want to know. We need to know," one student responded (2017). Perhaps this demonstrates that we still share a sense of common humanity in the digital world. Yet, on the other hand, is this really a form of shared virtual humanity, or is this desperation to connect rather a siren's call for the lack of tangible human experiences that we now share?

When probed further, 90% of students said they are constantly logged in to at least three or four different social media sites at a time including, but not limited to Twitter, Instagram, Facebook, Reddit, GroupMe, Tumblr, and Pinterest, with Snapchat and Instagram being the clear favorites in terms of popularity. While they did not describe their social media behaviors as addictive, 73% of students said they feel like they have to be "perpetually" connected to their peers and to the world around them. Nevertheless, they spoke passionately about wanting to disconnect. If the palpable anxiety experienced through disconnecting was not the result of logging out, all 73% of them would chose to do so – at least periodically. As one student survey response noted, "Keeping up in a digital world can be exhausting. It never sleeps, so neither do I" (Appendix 1).

Selective reading

In our desperate attempt to find information that validates our own opinions or fits narrative beliefs we hold, we eagerly sift through copious amounts of information to find that which we seek. The practice of doing this is a type of selective consumption of information or data. In so doing, we may actually *physically* read more, but we most likely *learn* less. This is because the excess amount of information to which we are readily exposed allows us to turn away from that which does not conform to our ideas or beliefs.

Mizuki Ito, a Cultural Anthropologist who studies tech and young people's changing relationship to media and communications, explains that, "What has made interest-driven learning much more important is the fact that digital networks are becoming ubiquitous and social connection much more abundant" (Ray et al., 2013). Interest-driven learning has its place, but because consumers of information are not forced to spend time with information outside of the realms of what they seek, they are not being challenged to think differently or to develop new ideas. This explains why the most difficult analytical assignments for students to complete are the ones which require them to support and defend an issue that does not align with their own pre-conceived beliefs. They have difficulty searching outside of their prescribed belief system and often admit that an upper-level high school English or History class represents the first time many of these digital natives have ever had to do this in their lives.

Consequently, the world of digital media perpetuates the prevalence of existing ideas and diminishes the need to generate new ones. "As we sink into the comfortable monotony of constant reinforcement, as we spend an increasing amount of time listening to sources of information that are tailored to strengthen our mental fictions rather than challenge them, we are slowly being turned into cranks ourselves. And those who don't succumb are often at the mercy of those who do" (Seife, 2014: 77). The challenge thus becomes not only to mitigate a vast amount of information, but rather, to actively seek out information that tests our thinking and enables us develop new ideas that may contradict or even invalidate our own.

Mediating the digital paradigm: Authentic learning and cognition in the digital age

Fostering intellectual engagement in the digital age

With the commonplace ease of access to a wealth of information as a result of the internet and the digital age, the speculative question remains: *How do we train our brains to think independently in an informative, idea-saturated world?* This question becomes especially prevalent when considering digital natives who have never experienced a world without the aid of the internet or computer-like devices that generate ideas, answers, and means for mediating problems. One of the best solutions for this challenge is not to shun or avoid technology altogether, but rather, to successfully maximize its positive attributes. For digital natives who are constantly involved in some sort of digital conversation, one way to moderate the gap is to welcome digital conversations in the classroom. Educators should allow for digital conversations to take place and enable students to interact on digital platforms. The key is doing it in a way that maximizes thinking and active learning rather than passive consumption of information. It is far easier to passively ingest information than to actively create it, analyze it, or generate intuition from it.

The creators of *StudySync*, an all-digital, computer based curriculum for English and History classes, have implemented creative programming that limits access to the "open internet" and forces students into using minimal information to produce their own answers and their own solutions to problems or inquiries. Such technologies utilize tools that champion collaboration in inventive ways, including the student creation of social media campaigns and written responses that must fit a 140 character limit to mimic twitter conversations, while also renewing the importance of independent thought and learning processes. Students using *StudySync* are often forced to generate their own questions and not merely find, but rather, create their own solutions. *StudySync* is one of many new digital learning platforms designed to limit the overwhelming nature of internet access and hone student focus on individual topics of study while presenting them with multiple ideas and input to assess and analyze.

Kate Hertz, an English Teacher and *StudySync* user at Geneva High School in Geneva, Illinois explains that

> *StudySync* leverages the power of giving students autonomy in their learning while also creating high levels of accountability. It is incredibly focused on skill-driven learning and the transparency between student acquisition of skills and teacher input makes for an incredibly dynamic and responsive learning experience. (2017, personal communication)

As an educator, my personal experience with *StudySync* has proven that digital learning works. Digital learning can effectively provide students with opportunities that they would not otherwise have through a verbal lecture or via notations within a textbook. There are numerous avenues within StudySync for students to interact with the information they are consuming, to collaborate with peers, to ask questions, and to personally cater instruction to their own needs and learning style. I believe that educational platforms such as this one engender challenging learning experiences that are critical to progressive student growth.

Study Sync is a learning tool that supports what Larissa Pahomov (2014), author of *Authentic Learning in the Digital Age: Engaging Students through Inquiry* advocates.

Classroom practices in the digital age should be geared not towards tech-avoidance, but rather towards creating an environment that supports digital learning experiences and presentations that are "flexible, shareable, and interactive" (Pahomov, 2014: 86).

Inquiry-based learning

Another solution to the digital dominance of learning environments is to teach inquiry-based learning. Inquiry-based learning empowers students to use metacognition to inform their own learning experience. While this can be daunting because it does not allow for complete teacher control of the direction of learning objectives, it more effectively engages students in their own thinking processes. As Kate Hertz observes of her students

> A developmental challenge that I have noticed more this year than any other year is that my students are very concrete thinkers. They take everything literally and abstract thinking is not readily available to them. They prefer things to be black and white and they are uncomfortable with any gray area in responding to questions or ideas. This is the first year that I have noticed such a distinction between concrete and abstract thinking in my students and perhaps it is because they have become accustomed to the immediate availability of perceivably reliable answers that they did not have to work very hard to find. (Kate Hertz, 2017, personal communication)

The difficulty with inquiry-based instruction lies in teaching students how to ask the "right" questions that move beyond 'who, what, when, where, why, and how' questions and lead to deeper, generative thinking. Having active, question-driven conversations in a classroom is one way to do this, as is asking students to create broad to narrow lists of questions about a topic, issue, or collective pieces of literature that build upon one another or share thematic connections. This sort of practice teaches students to move from surface-level thinking to critical analysis or synthesis-based questioning. Once students have successfully completed research paired with data synthesis and analytical writing, they will eventually show progression towards retrospective thinking and operative inquiry.

One of the many benefits of this type of inquiry-driven learning environment is that students become aware of all of the things that they do not know as they delve deeper into topics. And when performing learning activities or research based on questions they personally posed in the first place, they become empowered in their learning, are more engaged in the process, and will most likely retain knowledge for the long-term. "The key," Pahomov suggests, "is giving students the autonomy to gain access to these bodies of knowledge while they are pursing lines of inquiry that feel relevant to them personally" (2014: 23).

In defense of digital natives

Educators with whom I interact on a daily basis, including Kate Hertz (2017), whom I personally interviewed, expressed concern that learning outcomes for digital natives will not be favorable in relation to creativity or organic thinking. It is believed that with this newfound reliance on digital technologies, educators will not be able to remove the interference of technology produces from creative or organic thinking processes (Kate Hertz, 2017, personal communication). However, Palfrey (2009) argues that we might be surprised

by the ingenuity possessed by digital natives. "Digital Natives are tremendously creative. They express themselves creatively in ways that are very different from the ways their parents did at their age. Many digital natives perceive information to be malleable; it is something they can control and reshape in new and interesting ways" (Palfrey, 2009: 6). Regardless of Palfrey's speculation, the digital world scares consumers and psychologists alike because no one knows what is to come around the next corner and we cannot predict what information will flood our newsfeeds and possibly dictate our ideas or opinions. Propaganda certainly has a strong foothold and digital natives must learn how to become cognizant, critical consumers of information (Bellstrom, 2016). Understanding bias and differing perceptions is a large part of this, but so is being an active participant in the 'digital' conversation.

In *Authentic Learning in the Digital Age: Engaging Students through Inquiry*, Pahomov (2014) labels participation in the 'digital' conversation as having a "digital connection" to the world. She believes that if students develop fluency with digital tools that allows them to create websites, publish videos, or share ideas through social media, they can enter into the digital conversation with an "elevated" status in society because they are able to mimic adults performing similar work. This type of involvement leads to engagement, credibility, and the development of active learning attributes that promote critical thinking. "When students are supported in exploring problems and issues that matter to them, they will leverage these skills to educate and instigate positive change" (Pahomov, 2014: 24). Fluency with digital tools gives students a voice with which to share or promote ideas. This makes them feel empowered to become part of the conversation and to proactively explore current events, or important issues in depth.

Despite this relative ease of personal empowerment, we must keep in mind that, "The choices that we are making now will govern how our children and grandchildren live their lives in many important ways: how they shape their identities, protect their privacy, and keep themselves safe; how they create, understand, and shape the information that underlies the decision-making of their generation; and how they learn, innovate, and take responsibility as citizens" (Palfrey, 2009: 7). The collection of interviews from *Leading Thinkers Digital Media and Learning* conclude that digital natives have a pulse on the digital narrative that many non-digital natives do not (Ray et al., 2017). Therefore it is important to listen, to work together, and to create a conglomerate of ideas stemming from both the digital and the physical world. Of course, there is not a one-size-fits-all solution to the conundrum of a digitized world, but there are countless means by which we can work towards creating collaborative networks that better connect us to each other and enable us to learn well, to maintain curiosity, and to think deeply.

Irrespective of our fears and speculations about the effects of a digital world, the blatant reality is that it is not going away. As Palfrey (2009) writes, "No major aspect of modern life is untouched by the way many of us use information technologies (4)." Digital dependency will continue to grow and digital natives will eventually outnumber those who have experienced the wide-ranging impact of technology later in life. These people are said to be "digital immigrants" or "digital settlers" because their lives were shaped by the analog world. Palfrey explains that the most notable change of this shifting paradigm "is the way the digital era has transformed the way people live their lives and relate to one another in the world around them" (Palfrey, 2009: 4). There is no going back to a time before digital; there is only going forward to a world more and more attuned to technology. It is our duty

to ensure that we harness technological tools to enhance learning and communication outcomes rather than detract from them (Pahomov, 2014: 26).

Implications/discussion

Digital natives, those born only knowing a digital rather than analog world, are far more adept at functioning in a world dependent on digital technologies than those labeled digital settlers or people who were exposed to digital technologies later in life. While this may seem like progress, this shift in brain processing and communications has left concerning cognitive voids in its wake. For example, when we read on digital devices, we do not comprehend as much, recall as much, or care to savor that which we have read. When digital natives are writing or composing only through digital mediums, they lack the knowledge of basic language structures, and they fail to make much meaning from what they are writing (Omar, 2013).

In regard to basic forms of human expression, the digital world has been detrimental to our ability to directly interact with other human beings through touch, through verbal conversation, and through personal connections (Jabr 2013). Of course, the digital world also connects us in ways we have never been connected before, but are we really that much closer to the people that exist in the world around us? Or has the digital world merely given us a new sort of freedom to isolate ourselves from direct interaction with others and avoid self-sufficiency through lackadaisical patterns of learning behaviors?

Conclusions

As John Palfrey and Urs Gasser (2009) point out, "The invention and adoption of digital technologies by more than a billion people worldwide has occurred over the span of a few decades." So regardless of our acceptance or denial of digital media's impact on language expression and literature, the ever-burgeoning inquiry about whether the laws of human nature will outweigh the omnipresent rule of technology in our lives remains. The advent of technology has caused us to read differently, to write differently, and to process information through multiple digital channels. Neurological science has proven that our brains have adapted to the constancy of stimuli present in our digital world. We can ingest more information, but we store it less effectively than we once did when living in a mostly analog world. Our brains have adapted to technology in terms of computational tasks, but our brains have not progressed in the human sense of generative thought and the ability to embrace common humanity with others.

The most alarming corollary of digital dependence is the sense that we do not know what will ultimately result from this shifting paradigm. The digital age has paralyzed our need for independent thinking and problem solving. High school students passively accept opinions and ideas being fed to them with little care for questioning. Analytical skills are no longer being honed as they once were because easy answers are but one "google" click away. Both short- and long-term memory are failing because of the ease of access to practices such as cognitive-offloading.

On the other hand, the digital age has also brought about new opportunities, especially through social networking to engage with the world. The digital age allows for availability of information and communication, but also limits the authenticity of learning and engagement, which is at the core of what has caused such widespread apprehension from educators, psychologists, doctors, and authors.

Overall, the outcome of digital dependence will remain undefined. As an educator, I am hopeful that a progressive shift occurs wherein digital communication is effectively harnessed for the propagation of creative faculties of debate and *not* for the demise of original thought. For the necessity of technological innovation does not overshadow the severity of the most dehumanizing characteristic of our digital thought processing and communications which is our waning ability to inquire, to think, to wonder, and to freely generate new ideas of our own.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

Bellstrom K (2016) This is why social media will decide the 2016 election. *Fortune*, 30 November.

Birkerts S (2016) Critical reading and writing in the digital age. *The American Scholar*, doi:10.4324/9781315616728.

Bruce BC (2017) ERIC – literacy in the information age: Inquiries into meaning making with new technologies, 2003.

Chen J (2017) How taking photos affects your memory of the moment later on. *Science of Us*, *New York Magazine*, 7 August. Available at: nymag.com/scienceofus/2017/08/how-taking photos-affects-your-memory.html.

Cladis A (2017) Perspectives on digital media and communication. A survey administered on September 22.

Dill-Shackleford K (2009) *How fantasy becomes reality: Seeing through media influence*. Oxford: Oxford University Press.

Feldman D (2016) Election day played out on Facebook with over 716m election-related likes, posts, comments & shares. *Forbes Magazine*, 9 November.

Franklin B (2017) The autobiography of Ben Franklin. *Project Gutenberg*. Available at: www.gutenberg.org/files/20203/20203-h/20203-h.htm (accessed 27 December 2017).

Heitin L (2016) Common core gives nod to digital skills. *Education Week*. ASCD Smart Brief.

Hertz K (2017) *StudySync* and its impact on the high school classroom. Personal Interview.

Hohlbaum CL (2013) Understanding digital addiction. *Psychology Today*. Available at: www.psychologytoday.com/blog/the-power-slow/201302/understanding-digital-addiction (2013, accessed 27 December 2017).

Jabr F (2013) The reading brain in the digital age: The science of paper versus screens. *Scientific American*. Available at: www.scientificamerican.com/article/reading-paper-screens/ (2013, accessed 27 December 2017).

Klosterman C (2016) *But what if we're wrong*. New York: Blue Rider Press.

News CBS (2012) Digital addiction may damage your brain: Study. *CBS News*. Available at: www.cbsnews.com/news/digital-addiction-may-damage-your-brain-study/ (2012, accessed 27 December 2017).

Omar A (2013) Digital evolution of the written language. In: *Proceedings of the Information Systems Educators Conference*. New Orleans: Department of Management Information Systems Southern Illinois University at New Orleans.

Pahomov L (2014) *Authentic Learning in the Digital Age: Engaging Students Through Inquiry*. ASCD.
Palfrey J and Gasser U (2009) Born digital: Understanding the first generation of digital natives. *Choice Reviews Online* 46.12 (2009) n. page. Web. 05 Aug. 2017.
Ray B, Jackson S, Cupaiuolo C, et al. (2013) *Leading Thinkers: Digital Media and Learning*. Spotlight on digital media and learning.
Rushkoff D and Leland P (2011) *Program or Be Programmed: Ten Commands for a Digital Age*. Berkeley, CA: Counterpoint.
Seife C (2014) *Virtual Unreality: Just Because The Internet Told You, How Do You Know It's True?* New York: Viking.

Author Biography

Andrea E Cladis is a former journalist and high school English teacher currently working as a fitness professional and freelance writing consultant. She is a Summa Cum Laude graduate of Elmhurst College with degrees in English, Communications, and French. At present, Andrea is pursuing an MFA in Writing from Fairfield University. Andrea's poetry and prose have been published in *The Greek Star, Kane County Magazine* (Shaw Media), academic journals and online entertainment and news publications including *Thought Catalog* and *Patch Media*. Her first non-fiction book, *Finding the Finish Line: Navigating the Race of Life through Faith and Fitness*, was released in 2017 by Crosslink Publishing.

Appendix 1

Perspectives on digital media and communications

Directions: Briefly reflect upon your experience as a digital native and what that label means to you. After doing so, please answer the following questions with as much detail as possible. Give examples if possible to substantiate your opinions.

1. How often do you use social networking sites per day? Do you ever log out or are you always connected?
2. What are the top three social networking sites that you use? How long do you spend on these sites each day? What do you do on these sites? If you post, what do you normally post?
3. Describe what it is you most like to view on social media? Why?
4. When you have a question about something, what is the first thing you do when seeking an answer?
5. Define inquiry and give an example.
6. Describe the last creative activity you participated in. Do you normally seek out ways to creatively express yourself? If so, what do you like to do?
7. How do you perform research? If you want to learn more about something that is of interest to you, what do you do to learn more about it?
8. Describe your favorite color without telling me what it is. You must use at least twenty words to describe it.
9. Spontaneous Imagination: Pretend you are given two objects - a paperclip and a large jellybean. Explain three different ways you could use these objects together to accomplish a task or create something new.
10. Do you prefer to write by hand or on a computer?

11. Do you know how to write in cursive? If so, when did you learn?
12. Tell me the phone numbers of your mom, dad, and two closest friends without looking at your phone. If you do not know those numbers, please write that below. (I will not be sharing this information)
13. What homework were you assigned in first period today?
14. What is the title of the last article or story you read online? What is the title of the last book or story you read in print?
15. What is the name of the final street you turn on to get to your favorite sports arena or concert venue?
16. Discuss the impact of technology on your life. How has it affected your life? How do you normally use technology on a daily basis? What do you like about technology? What things does it allow you to do? If you could improve something about technology what would it be? If you had to spend a day without any access to technology or virtual communications, what would you do? What do you think that would be like?

Google form

Digital media: What's your perspective?

Briefly reflect upon your experience as a "digital native" and what that label means to you. After doing so, please answer the following questions with as much detail as possible. Give examples to substantiate your opinions.

* Required

1. How often do you use social networking sites per day? Do you ever log out or are you always connected? *

Your answer

2. What are the top three social networking sites that you use? How long do you spend on these sites per day? What do you normally do on these sites? If you post things, what do you usually post? (You may create a bullet point list for your response) *

Your answer

3. Describe what it is you most like to view on social media. Explain why you think you enjoy it so much? *

Your answer

4. When you have a question or are curious about something, what is the first thing you do when seeking an answer? *

Your answer

5. Define inquiry and give an example of an inquiry. *

Your answer

6. Describe the last creative activity you participated in. Do you normally seek out ways to creatively express yourself? If so, what do you like to do? *

Your answer

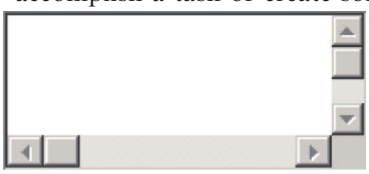
7. How do you perform research? If you want to learn more about something that is of interest to you, what do you do to learn more about it? *

Your answer

8. Describe your favorite color without directly telling me what it is. You must use at least twenty words to describe it. The words can stand alone or be part of descriptive phrases. *

Your answer

9. Spontaneous Imagination: Pretend that you are given two objects - a paperclip and a large jellybean. Explain three different ways you could use these objects together to accomplish a task or create something new. *



10. Do you prefer to write by hand or on a computer? *

Handwriting
Computer

11. Do you know how to write in cursive? If so, when did you learn? *

Yes (When did you learn?)_____
No

12. List the phone numbers of your mom, dad, and two closest friends without looking at your phone. If you do not know these numbers, please share that below. (Please note that I will not be sharing this information outside of this reflective survey) *

Your answer

13. What, if any, homework were you assigned in first period today? *

Your answer

14. What is the title of the last article or story you read online? What is the title of the last book or story you read in print? *

Your answer

15. What is the name of the final street you turn on to get to your favorite sports arena or concert venue? *

Your answer

16. Summary Response: Discuss the impact of technology on your life. How do you think it has affected your life? How do you normally use it on a daily basis? What do you like about technology? What does it allow you to do that you might not otherwise be able to do? If you could improve something about technology, what would it be? Finally, if you had to spend a day without any access to technology or virtual communications, what would you do? What do you think that experience would be like? *

Your answer