The advantages of distance learning

United Nation (2015): Sustainable Development Goals clearly determine on the 4th objective to promote equitable and inclusive education which may be only achieved by flexible and open education, http://www.un.org/sustainabledevelopment/ sustainable-development-goals/, accessed by 2015.

Universitas Tebuka (2012): UT Decree on Open License.

Universitas Terbuka (2014): UT Annual Report, Jakarta: Universitas Terbuka.

Wicaksono, T.Y. and Friawan, D. (2011): Recent development in Higher Education in Indonesia: Issues and Challenges *in Financing Higher Education & Economic Development in East Asia*, Armstrong S. and Chapman B. (Eds.), Australian National University E Press. Canberra, Australia.

19

THE ADVANTAGES OF DISTANCE LEARNING

Brad Huddleston

The concept of distance learning is not as new as one might think. Its roots go all the way back to 1892 when the first university-level distance learning program was developed by the University of Chicago. The United States Postal Service was used for course correspondence. Distance education then took advantage of radio in 1923 and television by 1963.[1]

Just to be clear on our definitions, distance learning "is a way of learning remotely without being in regular face-to-face contact with a teacher in the classroom".[2] Distance learning is synonymous with *distance education*. "Hybrid" or "blended" education seeks "to take advantage of the best features of both face-to-face and online learning."[3]

By the 1980's, classrooms around the world were beginning to be introduced to personal computers. The first personal computer appeared

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[1] Distance Learning Has Been Around Since 1892, You Big MOOC. James Marshall Crotty, 14 Nov 2012 http://www.forbes.com/sites/jamesmarshallcrotty/2012/11/14/distance-learning-has-been-around-since-1892-you-big-mooc/#4e65861c5bf7

[2] What is Distance Learning? Simon Midgley. The Complete University Guide. http://www.thecompleteuniversityguide.co.uk/distance-learning/what-is-distance-learning/

[3] About Hybrid. University of Wisconsin. http://www4.uwm.edu/ltc/hybrid/about_hybrid/

in 1981 and weighed in at a whopping 10.8 kg (24 lb).[4] Sometimes excitement overrides practicality, but there was a sense that "the future is now" and down that path they went. Contrary to some modern notions, each student being required to have their own computing device is not all that new. The very first school one-to-one laptop program was introduced in 1990 to grade 5 girls at Methodist Ladies' College in Melbourne, Australia.[5] At this point you might be guessing that each 10-year-old girl received an Apple computer. Not so. It was a Toshiba T1000SE.[6]

These are very exciting times in the world of education. Ever since computer scientist Tim Berners-Lee invented the modern version of the World Wide Web back in 1990,[7] educators saw the incredible potential to enhance and accelerate distance learning in ways that could not have been previously imagined. Because of this new technology of interconnectedness, these computers could now be networked globally. Combine that with technology advancing at an exponential pace and prices decreasing in many cases, distance learning could now take advantage of information sharing far beyond the local classroom and be made available to everyone.

19.1 Creative Engineering to Expand the Internet

Although the internet is also referred to as the World Wide Web, there are still large swaths of the world without access. Some very

[4] The Evolution of Technology in the Classroom. Purdue University Online. http://online.purdue.edu/ldt/learning-design-technology/resources/evolution-technology-classroom

[5] (25 Years Ago) The First School One-to-One Laptop Program. Audrey Watters. 12 Feb 2015. http://hackeducation.com/2015/02/12/first-one-to-one-laptop-program

[6] Ibid.

[7] Who Invented the Internet? History. Ask History. Evan Andrews. 18 Dec 2013. www.history.com/news/ask-history/who-invented-the-internet

creative engineering attempts are being made to make the internet available in the most remote regions on earth. For example, in the summer of 2016, Google's *Project Loon* experimented with launching internet-beaming balloons into the stratosphere over areas such as Sri Lanka[8] and Peru. Google managed to keep a balloon over Peru for 98 days.[9] Facebook co-founder Mark Zuckerberg has announced that his company will be making web access available from space. A satellite named *Amos-6* will take aim at large parts of sub-Saharan Africa.[10] Facebook is also experimenting with a high-altitude solar-powered drone named *Aquila* to bring the internet to faraway parts of the world.[11]

The motives for bringing the internet to isolated regions of the planet are, no doubt, many. Distance education stands to be one of the beneficiaries of such mind-boggling engineering.

19.2 Unintended Consequences

Almost no one disputes the potential efficacy of computer-aided, distance and blended learning. However, there have been a number of unintended consequences due to the overuse and misuse of ever-invasive technology. When the modern technology revolution hit in the 1990's, we did not have terms such as:

- Sexting
- Video game addiction

[8] Google's Project Loon: Now its internet-beaming balloon tests take off in Sri Lanka. Liam Tung. 16 Feb 2016. http://www.zdnet.com/article/googles-project-loon-now-its-internet-beaming-balloon-tests-take-off-in-sri-lanka/

[9] Google's Inernet-Beaming Ballon Gets a New Pilot: AI. Cade Metz. 23 Sept 2016. https://www.wired.com/2016/09/project-loon-google-brings-ai-skies/

[10] Facebook satellite to beam internet to remote regions of Africa. Sam Thielman. 6 Oct 2015. https://www.theguardian.com/technology/2015/oct/05/facebook-mark-zuckerberg-internet-access-africa

[11] Facebook's solar-powered internet plane takes flight. Sean Farrell. 21 July 2016. https://www.theguardian.com/business/2016/jul/21/facebook-solar-powered-internet-plane-test-flight-aquila

- Cyber-bullying
- Digital Addiction
- Internet Addiction Disorder
- Facebook Depression
- Nomophobia (fear of going without your phone)
- FOMO (Fear Of Missing Out)
- Text Neck[12]
- Revenge Porn
- Phantom Ringing Syndrome[13]
- Cybersickness[14]
- Cyberchondria[15]
- The Google Effect[16]
- Digital Detox

Not only is this list far from complete, it is ever-growing. What has become apparent to those of us who study these issues is that the scales of technology have been tipping in favor of the negative side for a very long time, and if we were to be honest, since the beginning. If we are going to be able to use technology to its maximum positive benefit, much self-discipline will be required to steer clear of what we now know, thanks to neuroscience, is clearly negatively affecting our brains.

[12] A Modern Spine Ailment: Text Neck. Stephen Shoshany, DC, CCEP. Spine-health , 6 Nov 2015. http://www.spine-health.com/blog/modern-spine-ailment-text-neck

[13] Eight new mental illnesses brought to you by the Internet. Evan Dashevsky. PCWorld. 16 Oct 2013. http://www.pcworld.com/article/2054386/eight-new-mental-illnesses-brought-to-you-by-wait-for-it-the-internet.html

[14] Ibid.

[15] Ibid.

[16] Ibid.

19.3 Neuroscience and Ethics

As the negative psychological and emotional side effects of an over-saturated technology culture continued to raise alarm bells, neuroscience took note and has stepped in to attempt to help us better understand what is going on in the brain. A 2012 article in *The Atlantic* titled "Exploiting the Neuroscience of Internet Addiction" described the ethical dilemma this way:

> "The leaders of internet companies face an interesting, if also morally questionable, imperative: either they hijack neuroscience to gain market share and make large profits, or they let competitors do that and run away with the market."[17]

The article goes on to give an example from the video game industry:

> "Gaming companies talk openly about creating a "compulsion loop", which works roughly as follows: the player plays the game; the player achieves the goal; the player is awarded new content; which causes the player to want to continue playing with the new content and re-enters the loop."[18]

You can also think of the compulsion loop as a dopamine loop. Although dopamine has many functions in the brain, it is most commonly associated with the pleasure system and produces feelings of enjoyment.[19] Dopamine causes us to seek out pleasurable activities such

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[17] Exploiting the Neuroscience of Internet Addiction. The Atlantic. Bill Davidow. 18 July 2012.
[18] Ibid.
[19] Dopamine Neurotransmitter: The role of neurotransmitter dopamine in movement and cognition, Psychologist World. https://www.psychologistworld.com/biological/neurotransmitters/dopamine.php

as sex, food, drugs,[20] video games,[21] social media,[22] and pornography.[23] Dopamine is not necessarily our enemy. In fact, dopamine is necessary for learning.[24] The issue is when we get *too much* dopamine. In an article titled *Why Limit Screen Time? Reasons You Should Limit Screen Time*, Sherrelle Walker writes:

> "Screen time causes the release of dopamine, a chemical that contributes to learning and concentration. As a result, our brains may become desensitized to the effects of normal levels of dopamine, making it hard to concentrate and focus on non-screen-based stimuli."[25]

19.4 I No Longer Feel Anything - Anhedonia

Clinical psychologist Dr. Archibald Hart describes a condition known as *Anhedonia* in his excellent book titled *Thrilled to Death: How the Endless Pursuit of Pleasure is Leaving Us Numb*. Anhedonia refers to the reduced ability to experience pleasure. And it is a phenomenon

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[20] Why We're All Addicted to Texts, Twitter and Google. Susan Weinschenk, Ph.D. Psychology Today. 12 Sep 2012. https://www.psychologytoday.com/blog/brain-wise/201209/why-were-all-addicted-texts-twitter-and-google

[21] Brains of Excessive Gamers Similar to Addicts. Jennifer Walsh. LIVESCIENCE. 15 Nov 2011. http://www.livescience.com/17033-gamer-brain-reward-system.html

[22] Social Media Triggers a Dopamine High. Molly Soat. American Marketing Association. https://www.ama.org/publications/MarketingNews/Pages/feeding-the-addiction.aspx

[23] Brain scans of porn addicts: what's wrong with this picture? Norman Doidge. The Guardian. 26 Sep 2013. https://www.theguardian.com/commentisfree/2013/sep/26/brain-scans-porn-addicts-sexual-tastes

[24] Dopamine and Learning: What the Brain's Reward Center Can Teach Educators. Martha Burns, Ph.D. The Science of Learning Blog. 18 Sep 2012. http://www.scilearn.com/blog/dopamine-learning-brains-reward-center-teach-educators

[25] Why Limit Screen Time? Reasons You Should Limit Screen Time. Sherrelle Walker, M.A. The Science of Learning Blog. 18 Nov 2010. http://www.scilearn.com/blog/5-reasons-you-should-limit-screen-time

that is growing by leaps and bounds. Scientists are adamant that as we push our stress level and exciting stimulation higher and higher, we are literally overloading the pathways to the pleasure centre of the brain. This overload causes our brain's pleasure centre to demand a further increase in the level of stimulation before delivering more feelings of pleasure. This results in a decline in our pleasure system's ability to deliver enjoyment out of ordinary, simple things.[26]

More and more I hear young people say, "I'm bored." With such a fast paced culture, I often think "*how can anyone be bored in this day and age?"* But it's true. Young people, despite all of the digital stimulation they experience, still manage to get bored very easily. Once the brain enters into an anhedonic state, the numbing effect causes us to be bored until we can get our next "digital fix" and the problem only grows worse the more we stimulate ourselves with our devices. What ends up happening is that children find slower-paced activities, including education activities, boring and if they have a smart phone nearby, they will opt for that.

On a regular basis, grandparents tell me that their grandchildren come to visit with digital devices in tow, and that they quickly disappear somewhere in the house opting for screen time. How sad that an entire generation of children are more stimulated by devices than they are by grandma and granddad. What have we done to these children? Fortunately, neuroscience is offering scientific insight into this dilemma. Hopefully, we will do something about it.

19.5 The Addictive Process

Digital addiction is just as real as any other drug addiction. Dr. Sylvia Frejd and Dr. Archibald Hart provide an example of the

[26] Dr. Hart, Archibald D. Thrilled to Death: How the Endless Pursuit of Pleasure is Leaving Us Numb. Tennessee. Thomas Nelson, Inc. 2007. Page 3

addictive process in their book *The Digital Invasion: How Technology is Shaping You and Your Relationships*.

> "As an example, let us imagine you are playing a video game. You initially spend half an hour playing the game, and it gives you a lot of pleasure. If you keep playing the game, however, the pleasure system becomes overloaded and starts to diminish the pleasure you experience. Now it demands even more game playing just to give a little pleasure. Therefore, you have to give increasing amounts of time to game playing just to keep the pleasure flowing. To put it simply, overloading the pleasure system gradually raises the bar so that you have to increase the level of stimulation to maintain the pleasure. This phenomenon is called the *addictive process*. It is the basic cause of all addictions.
>
> Dopamine is the basic neurotransmitter (chemical messenger) that carries the signal to your pleasure center from different parts of the brain. As you go for more and more pleasure, you push the dopamine level higher and higher. This is called *dopamine flooding*, and it creates a spiraling effect that results in compulsive drug or behavior abuse"[27].

19.6 Multitasking Is a Myth

When speaking to audiences around the world, I will often ask, "Who in this audience has the ability to multitask very well?" Of course many hands instantly go up. The truth is, no one on earth can multitask. As it turns out, the brain is a sequential processor. In an article titled *Students can't resist distraction for two minutes … and neither can you*, columnist Bob Sullivan writes:

[27] Excerpt From: Dr. Archibald D. Hart & Sylvia Hart Frejd. "Digital Invasion." iBooks. https://itunes.apple.com/us/book/the-digital-invasion/id598305287?mt=11. Pages 126 and 127.

> "Multitasking has been the subject of popular debate, but among neuroscientists, there is very little of that. Brain researchers say that what many people call multitasking should really be called "rapid toggling" between tasks, as the brain focuses quickly on one topic, then switches to another, and another."[28]

All of this switching between tasks, as it turns out, is bad for grades. Nicholas Carr, in his book, *The Shallows: What the Internet is Doing to Our Brains*, writes, "Many studies have shown that switching between just two tasks can add substantially to our cognitive load, impeding our thinking and increasing the likelihood that we'll overlook or misinterpret important information."[29]

Dr. John Medina, a developmental molecular biologist who focuses on brain development, explains:

The brain is a sequential processor, unable to pay attention to two things at the same time. Businesses and schools praise multitasking, but research clearly shows that it reduces productivity and increases mistakes.[30]

19.7 Multitasking, Depression and Anger

In the past quarter century, the mental health of teenagers has been declining at an alarming rate. Problems such as depression and anxiety

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[28] Students can't resist distraction for two minutes … and neither can you. Bob Sullivan. 18 May 2013 http://www.nbcnews.com/technology/students-cant-resist-distraction-two-minutes-neither-can-you-1C9984270

[29] Excerpt From: Nicholas Carr. The Shallows: What the Internet is Doing to Our Brains. https://itunes.apple.com/us/book/shallows-what-internet-is/id380556044?mt=11

[30] Medina, John J. Brain Rules: 12 Principles for Surviving and Thriving at Work, Home and School. Pear Press. Copyright © 2008 by John J. Medina. iBooks Page 133.

have increased by 70% among adolescents.[31] I find it interesting that this 25-year time frame corresponds with the popularization of the internet. My experience tells me there is a link.

According to a study from Michigan State University in an article titled: *Multimedia Use Tied to Depression, Anxiety*: "Using multiple forms of media at the same time – such as playing a computer game while watching TV – is linked to symptoms of anxiety and depression, scientists have found for the first time."[32]

Even though we can get an emotional high from task switching, there is a price to pay. The brain undergoes chemical changes that include the release of stress hormones and adrenaline. The release of the stress hormone cortisol has the potential of making us more aggressive and impulsive, not to mention raising our risk for cardiovascular disease[33] and weight gain.[34]

Dr. Alan Keen, a behavioural scientist at Australia's Central Queensland University, says that multitasking is a significant reason "we are witnessing epidemics of rage." He adds, "If I'm living in a big city with a busy job and I'm multitasking and I'm a busy parent, all that translates into chemical changes in the brain."[35]

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[31] Today's youth: anxious, depressed, antisocial. Madeleine Buntin. The Guardian. 13 Sep 2004. http://www.theguardian.com/society/2004/sep/13/childrensservices.mentalhealth

[32] Multiple Media Use Tied to Depression, Anxiety. Michigan State University. MSUTODAY. 4 Dec 2012. http://msutoday.msu.edu/news/2012/multiple-media-use-tied-to-depression-anxiety/

[33] Is multi-tasking bad for your brain? Experts reveal the hidden perils of juggling too many jobs. John Naish. Daily Mail. 11 Aug 2009. http://www.dailymail.co.uk/health/article-1205669/Is-multitasking-bad-brain-Experts-reveal-hidden-perils juggling-jobs.html

[34] Stress, Hormones, and Weight Gain. Medical Author: Melissa Conrad Stöppler, MD. Medical Editor: William C. Shiel Jr., MD, FACP, FACR. MedicineNet.com. http://www.medicinenet.com/script/main/art.asp?articlekey=53304

[35] Is multi-tasking bad for your brain? Experts reveal the hidden perils of juggling too many jobs. John Naish. Daily Mail. 11 Aug 2009.

19.8 Digital Education Content Causes the Same Reaction in the Brain

When many parents first observe the mesmerisation that occurs when their children stare intently and quietly at a television, tablet, phone, or computer screen, they feel a miracle is occurring right before their eyes. They sense relief that there is finally an activity that will hold their child's attention for long periods of time so they can do other things. These digital devices understandably become a very reliable and consistent babysitter. For many parents, digital devices such as tablets and video games end up becoming the bane of their existence when it comes time to take the device away. The tantrums often grow in intensity, and parents often relent and give the device back just to calm the child and restore peace. A short-term solution to peace often grows into an out-of-control monster.

During and after my seminars, it is not uncommon for well-meaning parents to say something to me like, "I agree with you. Regular video games are bad, so I only allow my child to play with education apps and games." With as much grace as I can muster, I explain to them that the brain does not distinguish content. In other words, when we are interacting with digital content, the brain is not working in the background on our behalf assessing educational versus non-educational content and then deciding what it will get addicted to and what it will not. It is simply responding to the stimulation that is generated by interacting with the digital device. Full stop.

In an article titled "This is Your Child's Brain on Video Games" that appeared in *Psychology Today*, Dr. Victoria Dunckley described the chronic brain stress that video games can cause:

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http://www.dailymail.co.uk/health/article-1205669/Is-multitasking-bad-brain-Experts-reveal-hidden-perils juggling-jobs.html

> "It's easy to imagine how an exciting video game can cause hyperarousal. But in fact, numerous mechanisms act synergistically to raise arousal levels with all types of interactive screen-time. And contrary to popular belief, many of them occur *irrespective of content.*"[36]

19.9 The Ramifications for Distance Learning

Distance learning curricula designers, educators, facilitators and students would benefit by understanding that brain health is affected by interacting with digital devices, regardless of content, and the clock starts ticking the moment our eyes lock on a screen. As good as distance learning can be, we must recognize that it has the potential to contribute to brain stress. If we place too much repetitive stress on our median nerve, carpal tunnel syndrome is likely to result with all of the associated painful symptoms in our hands and wrists.[37] Similarly, if we place too much repetitive stress on our brains by excessive interactivity and multitasking with digital devices, we will suffer the associated mental, emotional, psychological and cognitive consequences.

This calls for a conscientious strategy to assist our students in managing the manner and length of time in which they interact with digital media. A course on brain health management would be a recommended prerequisite to any course of study that utilizes digital media, and that of course includes distance learning.

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[36] This is Your Child's Brain on Video Games. Victoria L. Dunckley M.D. Psychology Today. 25 Sep 2016. https://www.psychologytoday.com/blog/mental-wealth/201609/is-your-childs-brain-video-games

[37] Carpal Tunnel Syndrome Face Sheet. National Institute of Neurologival Disorders and Stroke. http://www.ninds.nih.gov/disorders/carpal_tunnel/detail_carpal_tunnel.htm

The remainder of this chapter will contain solutions and recommendations that I hope will get a larger conversation started and also inspire additional research in this area.

19.10 Solutions

Although more research is needed, we know enough from neuroscience and psychology to certainly get started with a workable strategy and tip the scales of brain health, and all that is associated with it, in our favour.

If digital addiction has already set in, implementing these strategies will prove to be difficult until digital detox is achieved. If the addiction is particularly severe, professional assistance might be required for a season, but change *is* possible. When parents discover these principles on their own or implement the applicable solutions that I propose, it is very gratifying to hear some of them say something like, “It’s so good to have my child back.”

19.11 It All Begins at Home

In general, I sometimes notice a trend among parents when a school first introduces technology, such as computer-aided learning or a one-to-one laptop or tablet program. Well-meaning parents assume this is a good thing, believing that in order for their children to be successful later in life, they must learn computer skills at the earliest age possible. After a year or two of technology implementation, things don’t always go so well and parents start to become weary of their children not wanting anything but screen time. After hearing me speak about the preceding issues, it is common for parents and students to raise concerns that the school is requiring too much homework on a tablet or laptop. While that might be true in a handful of cases, I find that the real culprit

is the large amount of screen time spent on activities that have nothing to do with the academic work the school is requiring on a tablet.

It appears to me that some parents and students assume that the *pleasurable* digital activities such as social media and YouTube are not harming their brains but instead, the problems are stemming from the intensive concentration on school work on a tablet. The truth is, *all* screen time affects the brain. Common Sense Media has reported that on any given day, teenagers in the U.S. spend nearly nine hours using media for enjoyment.[38] My experience is that this is true anywhere in the world where there is a penetration of broadband internet and smart phones. Notice, the bulk of students' screen time is spent on *enjoyable* activities such as watching television, playing video games, watching videos and movies and listening to music,[39] and not on academic pursuits. Any educators worth their salt always hope their students find learning as enjoyable as any other activity, but this is generally not the case once digital addiction has set in. Once this occurs, enjoyment can only be found in activities that produce very large quantities of dopamine.

Knowing this, I always challenge young parents to first be honest about their own digital addiction before criticizing their children and their children's school. Nearly four in ten (39%) of them admit they interact more with their smart phones than they do with their children, friends, or co-workers.[40] Now that we have two simultaneous generations struggling with digital addition, it makes it particularly difficult to deal with. Anyone who has worked in the mental health field

[38] Teens spend a 'mind-boggling' 9 hours a day using media, report says. Kelly Wallace, CNN. 3 Nov 2015. http://www.cnn.com/2015/11/03/health/teens-tweens-media-screen-use-report/

[39] Ibid.

[40] Millennials engage with their smartphones more than they do actual humans. Catey Hill, Editor. MarketWatch. 21 June 2016. http://www.marketwatch.com/story/millennials-engage-with-their-smartphones-more-than-they-do-actual-humans-2016-06-21

will tell you that *denial* is the first and most difficult hurdle that an addict has to get over. Another layer of complexity is added with so many young teachers addicted to digital activities as well.

What I recommend to parents is that they severely limit all activities that involve technology and save their child's brain reserves for digital activities that are truly important, such as school work. Even then, a strategy for brain health management needs to be put firmly and consistently in place.

19.12 Remove All Technology from Bedrooms and Sleep

The average person now spends more time on their phone than they do sleeping.[41] The lack of sleep around world where technology has deep penetration is shocking and its devastating psychological, emotional, cognitive, and academic effects are well documented. Every parent should remove all technology, including televisions, from every bedroom in the house. The bedroom should be a dark, quiet place to sleep (without music).

The average amount of sleep that teenagers get is between seven and 7 1/4 hours. Studies show that they require 9 1/4 hours of sleep.[42] It is not uncommon for me to encounter teenagers who sleep far less than seven hours per night, especially those who are addicted to video games, social media and pornography.

In addition, all technology should be turned off at least an hour before bedtime as the blue light exposure from the devices sends a signal to our brains that it is still daylight and inhibits of release of the

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[41] Average person now spends more time on their phone and laptop than sleeping, study claims. Madlen Davies. Daily Mail. 11 Mar 2015. http://www.dailymail.co.uk/health/article-2989952/How-technology-taking-lives-spend-time-phones-laptops-SLEEPING.html

[42] Sleep in Adolescents (13 - 18 Years). Nationwide Children's. http://www.nationwidechildrens.org/sleep-in-adolescents

sleepy hormone melatonin.[43] One study found that "two hours of exposure to a bright tablet screen reduced melatonin about 22 percent."[44]

19.13 Work Sequentially

Understanding that multitasking is harmful to the brain, we must learn to work the way the brain functions, and that is in a sequential manner. This is also called unitasking and monotasking. Our grandparents worked more this way because they were not distracted by technology.

Curricula designers should consider structuring courses in such a way that students work on one learning task at a time as much as possible. Following is a partial list of recommendations for unitasking successfully.

- Parents and teachers must first model and then instruct young people to monotask.
- Parents and teachers must gently *force* students to work sequentially. Simply explaining these principles is important, but not enough. An underdeveloped prefrontal cortex will prohibit young people from being able to fully understand the ramifications of their actions.[45] This also means that children are

[43] Sleepless in America: How Digital Devices Keep Us Up All Night. NBC News. Hallie Jackson. 24 Jun 2015. http://www.nbcnews.com/nightly-news/sleepless-america-how-digital-devices-keep-us-all-night-n381251

[44] Really? Using a Computer Before Bed Can Disrupt Sleep. Anahad O'Connor. The New York Times: Well. 10 Sept 2012. http://well.blogs.nytimes.com/2012/09/10/really-using-a-computer-before-bed-can-disrupt-sleep/?smid=tw-nytimes&_r=0

[45] Barry Corbin, "Unleashing the Potential of the Teenage Brain: Ten Powerful Ideas." Victoria, Australia. Hawker Bownlow, 2008, 20.

not able to self-regulate[46] very well and are in need of constant policing.

- Do not allow students to listen to music while reading, studying and doing homework. This is a form of multitasking[47] and cognition will be hampered (among other things).
- When doing homework, physically remove all technology that is not germane to the work at hand.
- Do one subject at a time. When "brain breaks" are needed, do not do digital activities such as check email or social media. Instead, do analog activities such as taking a brief walk, power nap, etc.

19.14 Combine Analog When Possible

Remember the word analog? In this context, it simply means activities that do not involve digital technology. It is clear that if we are going to protect our brain health, mental and emotional well-being, and cognitive abilities, we are going to have to tip the scales in favor of analog activities in a day's time. Following are some suggestions to get the creative juices flowing as we seek ways to integrate more analog back into our lives:

- Offer printed textbooks and supplemental materials when possible.
- Offer audio versions of lectures and teachings when possible as audio does not require the learner to look at a screen.
- Encourage students to take notes on paper instead of typing.

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[46] What is Self Regulation and How To Help a Child to Learn Self Regulation. Day 2 Day Parenting. 7 Nov 2013. http://day2dayparenting.com/help-child-learn-self-regulation/

[47] Neuroscientist Daniel Levitin Explains Why Multitasking Is a Harmful Addiction. David Hershkovits.

- When doing research, encourage students to print their research and work off of paper as much as possible.
- Instead of education video games, encourage education board games.
- Use traditional flash cards.

At this point, some might be thinking, "What?!?! It sounds like we're going to have to go back to the Stone Age." Not so. I'm simply being honest regarding the limitations the brain has with digital technology and work within those limits.

19.15 Dramatically Reduce Screen Time

One of the most frequent questions I am asked is, "How much screen time per day do you recommend for children?" While there is a fairly large and growing pool of research related to media's negative effect on the brain, very little exists on appropriate time limits for each age group. There are plenty of answers floating around, but they are all over the map and are rarely based in science.

Much research still needs to be done to more accurately answer this most crucial and valid question. Nevertheless, I will do my best with the little information we have.

The brain is resilient but it is also fragile. That's why honest scientific scales must be developed to determine what balance looks like for each age group.

According to Dr. Archibald Hart, any digital activity that goes beyond one hour is going to push the adrenal system beyond its normal limits.[48] How much beyond that before the brain begins to suffer damage is not fully known, although we know it does eventually occur.

[48] Focus on the Family Weekend Magazine radio program. February 21, 2009

For an adult, working within an hour time limit, say 50 minutes, and then giving the brain an analog rest seems logical and wise.

As for children, many have understandably looked to the American Academy of Pediatrics for guidance. However, the AAP has recently relaxed their screen time rules for some kids.[49] This is very disturbing to me. With Virtual Reality and Augmented Reality now here, the brain stimulation will no doubt sky rocket.

Until more scientific study can be done, I think it would be good to get some parenting guidance from the tech industry itself. The New York Times ran a story titled *A Silicon Valley School That Doesn't Compute* that reported:

> "The chief technology officer of eBay sends his children to a nine classroom school here. So do employees of Silicon Valley giants like Google, Apple, Yahoo and Hewlett-Packard.
>
> But the school's chief teaching tools are anything but high tech: pens and paper, knitting needles and, occasionally, mud. Not a computer to be found. No screens at all. They are not allowed in the classroom, and the school even frowns on their use at home."[50]

The school that is being referred to is a Waldorf School, which has a teaching philosophy of using physical activity and learning through creative, hands-on tasks. There are 160 Waldorf schools in the United States, 40 of which are in California. Those who believe in this non-

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[49] A major update relaxes screen time rules for some kids. Ariana Eunjung Cha. The Washington Post. 21 Oct 2016. https://www.washingtonpost.com/news/to-your-health/wp/2016/10/21/big-updates-new-screen-time-rules-by-age-from-the-american-academy-for-pediatrics/?utm_term=.77755dbfc7fe

[50] A Silicon Valley School That Doesn't Compute. Matt Richter. The New York Times. 22 Oct 2011. http://www.nytimes.com/2011/10/23/technology/at-waldorf-school-in-silicon-valley-technology-can-wait.html

digital, analog form of learning say that computers interfere with attention spans, creative thinking, movement and human interaction.[51]

Why would a chief technology officer and Silicon Valley tech employees send their children to a non-tech school and even agree to limit it at home? What do they know that we don't? As one with a computer science degree, I think they are just being honest, from experience, about just how much brain stress technology causes, and they want to protect their children.

To further bolster the case, Technology Columnist Nick Bolton, writing for the *New York Times*, must have been shocked by Steve Job's answer to his question, "So, your kids must love the iPad?"

Job's reply was, "They haven't used it… We limit how much technology our kids use at home."[52]

After all of my research and experience, I recommend an 80/20 rule for adults: 80% analog in a day's time, and 20% digital. For children under the age of 12, I would conduct a simple test. I would give them some form of digital technology for 30 minutes and then ask for it back. If you get any response other than peaceful compliance, I would begin backing the time up until you do.

19.16 What We Would NOT Say to a Cocaine Addict

Time and again, scientists compare digital addiction to cocaine addiction. For example, consider this article titled *Internet addiction changes brain similar to cocaine*:

> "The researchers found more patterns of "abnormal white matter" on brain scans of internet addicts, compared with scans of non-

[51] Ibid.

[52] Steve Jobs Was a Low-Tech Parent. Nick Bolton. The New York Times. 10 Sep 2014. http://www.nytimes.com/2014/09/11/fashion/steve-jobs-apple-was-a-low-tech-parent.html

> addicts. White matter areas in the brain contain nerve fibres that transmit signals to other parts of the brain.
>
> These changes showed evidence of disrupting pathways related to emotions, decision-making, and self-control.
>
> The researchers said earlier studies have found similar white matter changes in the brain scans of people addicted to alcohol, cocaine, heroin, marijuana, meth, and ketamine (also known as "Special K")."[53]

In order to prevent digital addiction and to facilitate properly designed digital curricula, we have to first think about the issue correctly.

Here is what you would *not* say to someone seeking help for cocaine addiction: "You know, you just need *balance*. You know what they say, '*moderation* in all things'".

And yet, that is how we tend to treat addiction to technology. We tell ourselves and others that we just need to keep our technology use in balance. There is truth to that statement but please understand that a cocaine addict will not be free of the addiction by simply backing off some. Neither will a digital addict. South Korea is the most wired nation on this planet. As a result of their supersaturation if interconnected technology, they have set up approximately 200 counseling centers and hospitals with more than 1,000 trained internet-addiction counselors. South Korea is not the only country struggling. China has more than 300 of these digital detox rehabilitation centers.[54] When digital addicts check in for detox, no "drugs" in the form of technology are allowed.

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[53] Internet changes brain similar to cocaine: Study. Ryan Jaslow. CBS News. 12 Jan 2012. http://www.cbsnews.com/news/internet-addiction-changes-brain-similar-to-cocaine-study/

[54] Internet Rescue Camp. Frontline, digital_nation, PBS. 21 Mar 2009. http://www.pbs.org/wgbh/pages/frontline/digitalnation/virtual-worlds/internet-addiction/internet-rescue-camp.html

There is a difference, however, between technology and cocaine. There is no redeeming value in illicit drug use. Technology on the other hand, has the potential to be used for very productive purposes. Understanding technology's efficacy and addictive nature will help designers of digital curricula and students stand a much better chance of attaining true iBalance.