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The opaque 21st C reversed polarity default paradigm: ON

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ABSTRACT

Keeping pace with the ever-changing global landscape in terms of energy usage, carbon footprint and resource extraction is critical for environmental education (EE). For most of modern human history, the standard behavior for every day, household or institutional use of electricity in appliances, vehicles and lighting has been 'off until turned on'. 21st century use of electricity in information and communications technologies including AI, 'smart' appliances, computers or buildings has reversed this polarity. It is argued in this paper that the new polarity is "ON" and that this opaque phenomenon may be creating a mindset involving "inattentive blindness" and "culpable ignorance" in regard to digital pollution. Rather than promoting an ecologically conscious mindset that critically examines personal and community involvement, this new, anesthetized mindset is flowing in an uncritical direction. EE curriculum needs to provide a critical focus on digital pollution and digital sobriety.

Keywords: reversed mindset, digital pollution, ON, abstraction

INTRODUCTION

Over millions of years, the earth's magnetic polarity has reversed many times. Currently the magnetic lines run from south to north with compasses always being attracted towards the magnetic north pole. However, when this magnetic field has reversed naturally in the past, the magnetic lines flowed towards the magnetic south pole. They reversed their polarity.

A reversed polarity occurs when the opposite situation to the norm becomes the new normal, default situation. North becomes south. However, this natural reversed polarity phenomenon has now gravitated metaphorically into human behavior, particularly with the advent of automated, digitally controlled electricity usage. In this paper, a culture of ignorance (Proctor, 2008; Rose & Bartoli, 2020) as influenced by this **ON** position is characterized by disengagement from critical thought and active participation in ecological consciousness (Stibbards and Puk, 2011; Puk, 2012). This has a significant bearing on environmental education (EE) curriculum.

This article will examine

(a) the reversed default polarity mindset in the use of electricity,

(b) the effect this has on human thought, and

(c) how this default mindset might impact the development of EE curriculum.

THE REVERSED DEFAULT POLARITY MINDSET IN THE USE OF ELECTRICITY IN THE 21ST CENTURY: ON

Up until the 21st century, the default position in electronics and use of electricity has generally been "*off until turned on*". Lighting and most household appliances were always turned off until electricity was required, and they were subsequently turned on by the user only when required. In the early decades of the 21st century in many parts of the industrial world, **ON** has now become the default position in regard to the use of electricity in our daily lives. Now, electricity in electronic appliances, gadgets and the internet is either always on and/or comes on without human intervention or thought, rather than being in the off position prior to usage. Now you have to turn things off that automatically have come on, i.e., "**ON** until turned off". However, even the off position is automatically controlled. But even when electronic mechanisms are in the so-called "off" position, the word off has lost its intuitive meaning. Off has become a mirage. Prior to the advent of the **ON** mindset, there were signs on the walls near light switches reminding users to 'turn off lights when leaving the room'. Signs to 'turn off the lights…' have been removed in the 'modern' washroom or classroom. Leave it to the sensors and algorithms to do that for you- no thinking required.

There are many examples of this new **ON** phenomenon:

1. In the new LED technology in buildings, lights automatically turn on as soon as movement is detected in a room or hallway and stay on until there is no more movement in the room regardless of whether there is sufficient natural light coming in through windows or not. But because no one has to physically turn them on, often no one thinks to physically turn them off and the lights remain on automatically even when they aren't needed and/or when natural light would suffice. And they are never truly off (see vampire energy below).

2. New cars have been described as 'computers on wheels'. There are many computer sensors connected to a corresponding 'button' that control functions such as a/ automatically turning off the engine when stopped at an intersection or b/ taking control of the steering wheel when coming too close to moving into a different lane. These features can be turned off but **ON** is the default position. And in some of these features such as the engine automatically turning off, the button that turns this feature off has to be re-engaged every time the engine is turned off. Otherwise, this feature will automatically be **ON.**

3. In 21st C washrooms in public buildings such as universities, hospitals and schools in many parts of the world, almost everything (other than the bodily functions) involves the automatically-delivered use of electricity utilizing AI algorithms and IoT sensors (the Internet of things components) (Chide & Bobade, 2020): automatic door opening (rather than turning a doorknob), automatic lights turning on (rather than flicking a switch), automatic flush (rather than pushing a lever), automatic heating of toilet seats, automatic water from the faucet, automatic soap from a dispenser in order to wash hands (rather than turning a faucet lever or pushing a dispenser button) and automatic hot-air hand drying or automatic paper-towel dispensing (rather than picking up a paper towel). All this mindless need for increased electricity usage just to perform bodily functions. The modern washroom has become decontextualized in a non-transparent manner.

4. In households and businesses, idle load energy, otherwise known as 'vampire energy,' exists in most modern technologies from television to microwave to lighting. Sensors keep a portion of the electronics always **ON** so that they can deliver electricity without delay. The only way they can be truly turned off is to unplug them from the building's wall sockets (which seldom occurs). Otherwise, the default status is **ON**. It is estimated that in the USA, 100 billion kilowatt hours are used by vampire energy in just one year, contributing approximately 80 million tons of carbon dioxide or the equivalent of 15 million cars (Earthday.org, 2013). This idle load energy requires the equivalent of 50 large power plants just in the U.S.A. to produce the required electricity (Natural Resources Defense Council, 2015)!

All of these examples and many more of what are often referred to as 'smart appliances' and 'intelligent buildings' might be described as involving human *inattentional blindness* (Levitin, 2014). We don't notice these gradual yet all pervasive changes that are otherwise 'right in front of our noses'. We don't notice them because we have been acculturated to do so. And human desire for convenience is built into the **ON** position. It is a matter of convenience not to have to think about heavy issues such as energy usage, resource extraction, pollution and consumption- and most importantly, personal responsibility. Many people don't even notice when they aren't noticing! This inattentional blindness may have far-reaching effects on human behavior and ecological consciousness.

Dethinking and a Culture of Ignorance

It can be argued that this **ON** default mindset contributes to dethinking, i.e., not reflecting on and internalizing what is all around us, as well as a culture of ignorance, i.e., whereby ignorance is socially constructed through the constant circulation of misinformation and deliberate disinformation (Proctor, 1995, 2008; Rose & Bartoli, 2020). Much of this ignorance is delivered via technologies. However, unlike the effect of misinformation and disinformation in creating doubt through media, there is no direct human intervention in the delivery and use of the **ON** position in the modern institutional washroom, hallways and classrooms. With the pervasive **ON** influence, there is no need to manipulate information to create doubt, confusion and distrust. Rather ignorance is created by utilizing technologies that employ exogenous, A.I. algorithms and hidden electrical sensors to create a mindless, invisible, silent barrier to critical information. Ignorance is often "used wittingly or unwittingly to distort, suppress or withhold knowledge" (Bhatt & MacKenzie, 2019). Ignorance or more generally unthoughtfulness on the part of the user might be described as being either culpable or non-culpable depending upon one's ethical and moral viewpoint (Robichaud, 2017). However, who is more culpable, the general public user or the designer who creates the **ON** technologies and/or the institutions who purchase and install these **ON** technologies all the while espousing the rhetoric of environmentalism! Regardless of the answers to those questions, either way the **ON** mindset contributes to this vacuum.

Unlike propaganda, these covert influences are hidden out of sight in the sensors and algorithms. It may in fact be easier to ignore environmental information and be less likely to act in a pro-environmental manner when the information is more casually or subtly available rather than when environmental information is provided explicitly (Moyal & Schurr, 2022). Unlike propaganda, the fact that these sensors and algorithms are created by a small technological elite and yet utilized by everyone, often goes unnoticed. There is zero transparency as well as zero choice. In the automated washroom, there are often no alternatives, e.g., taps, levers and switches, when using these facilities. Because more and more technological systems in our daily lives are automated and hidden, the individual and society in general don't need to pay attention to their immediate surroundings and circumstances. As Moyal and Schurr (2022) contend, "choices and behaviors are affected not only by *if* ignorance is offered, but also by *how* it is offered" (p. 4). These daily experiences become ritualized into our psyche at the expense of critical awareness and at the expense of ecological degradation.

It must also be noted that a large number of people in the world don't have any kind of indoor electricity, indoor plumbing and indoor lighting, as does the modern industrial

lifestyle, this privilege often goes unnoticed and unappreciated. Thus, privilege may contribute to ignorance.

It might be argued that most people don't need to know how AI algorithms and sensors work. However, what is important is for the user to at least know these hidden technologies exist, are operating and that the internal parameters are constructed and controlled by a small elite! As Kahneman (2013) described, the default thinking mode is best described as level 1 thinking, i.e., WYSIATI: 'What you see is all there is'. In this surface level mode, we use the information we mindlessly consider in the moment as being sufficient for understanding. While using an automated washroom, lighting in a room or when you click on a YouTube video, what you see is what occurs in front of you, e.g., the faucet runs when you wash your hands, the lights come on when you enter a room, and the video runs in a matter of seconds. Most people don't perceive what they don't see and what they don't perceive, they often don't care about. "Ignorance may represent a culpable failure to put effort or skill into knowing something one ought to know" (Bhatt & Mackenzie, 2019, p. 306).

The **ON** electrical systems are purposely concealed behind convenience and a very stylish, brightly lit veneer that quietly hides information. The pleasure derived from this 'modern' ambiance may dull the inclination towards critical thought, curiosity and action. No overt propaganda is required to create this ignorance. The **ON** position does not need to be proactive. Most people may be content with level 1 thinking and don't move into what Kahneman also described as the level 2 mode of thinking, i.e., thinking about what is really going on out of sight through follow-up inquiry and problem-solving. Level 2 thinking is not as convenient as is level 1. This is where the role of education is vital in developing not only the skills involved in level 2 thinking in order to become aware of the power hidden within the 'meta-data' of culturally "produced, and re-produced and sponsored" ways of being (Bhatt & MacKenzie, p. 315); but more importantly the affective valuing of critical thinking. Creating a constant 'pilot light' that works unconsciously to turn on critical thinking especially in the daily experience of an opaque veneer is a challenge at all levels of education.

Exogenous electric sensors and algorithms are designed to direct you away from level 2 thinking. As McLuhan (1960) described in his aphorism 'medium is the message', "any new structure for codifying experience and moving information … has the power of imposing its structural character and assumptions upon all levels of our private and social lives,–even without conscious acceptance" (p. 79). We should also keep in mind that McLuhan created this aphorism long before the advent of A.I. and digital algorithms … and automated heated toilet seats! We might now go even further in suggesting that in the 21st century, the digitally-controlled machine is codifying experience, moving information and thus imposing a mindset. And that mindset is one in which blind dependence on hidden technological processing becomes the default position. By not engaging in the purposeful, physical act of turning lights on or off, turning water faucets on or off or flushing the toilet, the individual is no longer participating in or thinking about energy and resource usage. It is not any one of these processes that creates this default mindset, rather it is these individual processes collectively that may do so. The **ON** position is automatic and pervasive. It is like an addiction in which the digital user compulsively feeds the conditioned need to be connected (Brand et al., 2016). After a while, the individual no longer notices nor cares that they are contributing to the increased use of electrical energy and resource extraction and remains ignorant of the sources of energy that produce electricity. It is convenient to not have to think about and take personal responsibility for our actions. "Some people use ignorance as an excuse to reduce pro-environmental behavior" (Thunstrom et al., 2014, p. 1). The modern automatized **ON** position creates a haven for the growth of dethinking and ignorance.

Reversed Polarity Default Mindset in Human Thought

This always **ON** position of energy usage now influences thinking patterns as well. Due to the internet and digital means of communication, the human brain and central nervous system in most jurisdictions are always **ON**, tuned in to receiving exogenous digital information, mechanically, much of which is distorting. Receiving distorting information continuously is now the default position. Many concerns about the effects of chronic screen usage (Puk, 2021) have been identified such as increased anxiety, lack of empathy and narcissism (James et al., 2017). What is usually referred to as 'multitasking' might better be described as multi-switching, i.e., continuous switching from one focus to another and another. This constant habit makes it easier to be distracted when focused attention on a single task is required (Moisala et al., 2016; Ophir et al., 2009). The **ON** paradigm of continuous, excessive information may exceed the limit of neuronal processing capacity, compromising the storage of relevant facts (Sajikumar et al., 2014). Text analysis and comprehension may also be negatively weakened as the digital media user constantly glances at text as they switch superficially from item to item (Makin, 2018; York & McGee, 2015) rather than developing deep reading skills (Wolf et al., 2012).

Modern smartphones are set up to automatically feed algorithmically derived news stories to the user, 24/7, without ever having to be turned on and searched for by the user. Digital 24/7 news stories are like the air we breathe–we absorb them into our minds without thought. Whereas, active, deep, probing, critical thought is now often in the *off* position, turned on only occasionally and often randomly. Monitoring, reflecting and acting becomes the exception, not the rule.

All of the human behaviors as a consequence of the **ON** position become ritualized whereby the user is numbed into following the rules hidden behind the veneer.

Fusion of These Two Reversed Polarities: Ecological off Mindset

At some point, the reversed polarity default mindset in the usage of electricity and the reversed polarity default mindset in human thinking, merge, fuse into one all-consuming paradigm, a paradigm shift that may further erode personal participation in public affairs, particularly in developing ecological consciousness.

One of the main contributors to the ON mindset is the concept of efficiency. Energy efficiency is often described as being 'value-free and completely neutral'. The common rhetoric from business and industry is that as machines

become more efficient, there will be a corresponding decrease in energy usage, resource extraction and pollution. Therefore, we should embrace the evolution towards "technology paradise" (Goldsmith, 1993, p. 168). On the surface, this technological elitism propaganda seems intuitive. However, as the rebound effect (Sorrel, 2007) and Jevons paradox (Sorrel, 2009; York & McGee, 2015) have identified, the actual outcome is often counter-intuitive. In the rebound effect, consumption does not decline at the same rate as efficiency. In the Jevons paradox, efficiency is often associated with increased resource use. As York and McGee (2015) have demonstrated, "the higher the level of efficiency in a nation, the faster energy use, electricity consumption, and CO_2 emissions grow over time, suggesting that efficiency, ironically, may serve to entrench high energy lifestyles, processes, and technologies"(p. 8).

Concepts such as efficiency are used to give permission to mindlessly use energy, in particular electricity, in the often-exaggerated claims of using less energy. Corporate sponsors who provide these technologies may be willfully content in not providing any signs and symbols that might motivate ecological consciousness, through the mantra of 'efficiencies'.

Even if technologies may become more energy efficient, there are more and more electronic machines, an increased use of these machines and in many jurisdictions, an increased population using these machines. Because of the **ON** default mindset, many people may not observe the societal usage of machines, and their own usage of machines may be contributing to more consumption, energy usage, resource extraction and pollution. Other influences to the rebound effect include investment following efficiencies such that they both contribute to expanding production and consumption (York & McGee, 2015). This relationship between increased efficiency and increased energy use, production, consumption, and CO2 emissions occur at many unit scales such as "nations, power plants and households" (p. 9).

The very concept of efficiency is in itself most often quite narrowly directed towards quantifiable, measurable, economic outcomes rather than social, health and ecological outcomes. This means that efficiency at one end of the supply chain can also lead to reduced quality of life and ignore less measurable benefits in other areas. Improving efficiencies can help perpetuate resource-intensive practices which can impede less measurable, societal structural changes that would lead to reduced energy usage, production, consumption and CO_2 emissions (Zehner, 2012). Some benefits such as developing critical awareness can't be easily quantified. However, at this point, the reader should not lose sight of a critical observation: a debate about efficiency can't be enjoined if you are ignorant of the need to engage in such a discussion. If modern electricity usage was indeed more transparent, the user would have opportunity to join discussion about energy efficiency.

As a consequence of the **ON** default mindset, there is usually a corresponding perceived need by government to increase energy production in order to keep feeding the hungry, addicted consumer, a hunger and addiction managed and often encouraged by a coalition of government, business, industry, and education.

However, the questions that receive little attention amidst this chaotic reversed polarity phenomenon are, as follows:

1. Where does this increased electrical energy come from (i.e., sources) to support the always **ON** default dynamic?
2. What are the hidden ecological costs of the **ON** position?
3. What are the hidden influences eroding the human psyche and human behavior due to the **ON** position?

And here is what we need to know and is hidden away from the public eye. As of 2023, in Ontario, the forecast is for an increased need of 2% of electricity annually for the next 20 years, which is 40% over 20 years! Much of this increased electricity is planned to come from uranium (euphemism, nuclear) and methane (euphemism, natural gas) (Independent Electricity System Operator, 2022). Globally, the International Energy Agency (IEA) (Reuters, 2023) forecasts that world demand for oil will increase in 2024 from 2023 levels. This amounts to an increase of "1.1 million barrels per day" (p. 2)! And this follows the COP 28 rhetoric of transitioning away from fossil fuels. The IEA also has stated that "a single Google search takes 0.3 watt hours of electricity, while a ChatGPT request takes 2.9 watt hours" (2024, p. 34), mainly due to "managing enormous volumes of data, processing capacity, dealing with power consumption, resolving security threats, and encrypting / decrypting massive amounts of data" (Thabit et al., 2023, p. 3). Google's own report admits that their 2023 greenhouse gas emissions were 48% higher than in 2019! They attribute this to the increasing amounts of energy required by its data centers, particularly in supporting AI (Google, 2024). The IEA further conclude that when fully implemented on a global scale, AI usage could see a "tenfold increase in electricity demand" by 2026 (p. 34-35). The IoT network of "physical objects (things) equipped with sensors, intelligent networking, radio frequency identification and other technologies that communicate and exchange data with other systems and devices online" will grow exponentially (Thabit et al., 2023, p. 1). The **ON** position represents a predominantly opaque cycle of dethinking on the part of the general public.

Implications for Environmental Education Curriculum

The AI phenomenon and in particular generative AI such as ChatGPT has become a massive planetary use of natural resources in a very short period of time (Crawford, 2021; Pitron, 2023). The consequence of this is that EE curricula may not yet include an emphasis on this phenomenon. For example, in Ontario, provincial curriculum guidelines such as *Environmental Science* (2008) make no mention of digital pollution, the ecological degradation caused by digital computational systems nor the massive energy, water usage and resource extraction required to support Artificial Intelligence. Because of the hidden nature of AI digital programs and the new constant ON default paradigm use of electricity, little attention has been directed to modernizing EE in regard to digital pollution … even though as described in this article, digital pollution has become a pervasive planetary phenomenon.

Digital Pollution and Digital Sobriety as Two of the Proposed Core Concepts of Environmental Education Curriculum

"Bringing to the curriculum theories and policies about EE is a problem for teachers because it is not always clear how to move from ideas to practice" (Tovar-Galvez, 2021, p. 1). The author utilizes the following curriculum sequence that is based on four main inquiry studies as described by Puk (2024) and Robinson et al. (1985). In this topic development process, the topic of digital pollution is sequentially elaborated upon from one inquiry to the next resulting in a more in-depth understanding of the topic of digital pollution by the end of the sequenced curriculum unit. The overall goal of the unit is to assist the learner in becoming informed about digital pollution.

Unit Title: The ecological degradation of a simple 'click'

1. What is it? e.g., what is artificial intelligence? This might involve deconstructing the concepts of "artificial" and "intelligence" in order to challenge whether or not these accurately describe the true nature of AI. Similarly, words such as the cloud, dematerialization and datafication as they are used by A.I. companies to obfuscate the ecological degradation that digital systems cause, would be examined. The goal of this focus is to appreciate the misdirection in using these and similar concepts.

2. How does it work? i.e., how does digital pollution manifest itself in the AI process? This involves constructing a conceptual model that is utilized by students in an experiential manner.

In teacher education courses, the author has created an ecological macro-model called "revealing the Dark Cloud" (Puk, 2024). The purpose of these kinds of emergent learning activities is to place students as participants within an experientially conducted conceptual model so that they can begin to understand how the process works from the 'inside'.

This activity begins in the classroom with a query as to whether or not anyone has clicked the 'like' button in an internet program such as Meta. Students then proceed outside where they engage the conceptual model that is laid out over a large space to replicate a global geographic journey. Students are told they will be moving as infrared photons during this activity (infrared photons carry the 'like' message through fiber optic cable). They are also told that their journey began in the classroom, but they are not told that this activity involves one student clicking the 'like' button for a photo stored on Meta (Facebook) (see Pitron 2023, p. 28) of another student in the same class. The goal of the activity is for the students to figure out what it is these photons are doing but more importantly to realize the significant impact this seemingly innocuous event of clicking "like" has on global ecological degradation.

Signs are placed in a circuit around the activity area. Teams move from one station to another as they follow the global route the like signal follows (Pitron, 2023). There are four location stations on the outside of the circuit (Virginia Data Center, submarine cable station, Sweden Lulea Data Center [where the photo is stored] and submarine cable station). A station in the middle represents the materialization required to create and maintain the digital information and communications technologies (ICT) global systems. This includes large amounts of electricity, fossil fuels, water, rare earth metals, PVC, copper, graphite, fluorine gases and the large physical spaces required for the data center buildings (Crawford, 2021; Pitron, 2023; Oo et al., 2023). Each time they visit a location station, teams return to the materialization station, reinforcing the fact that ICT systems are heavily dependent on materialization.

Leaving the author's classroom (as an example of a starting point), teams begin the circuit by traveling to Virginia where Meta has one of its largest American data centers. They then proceed to the submarine station that represents the fiber optic cables traveling along the bottom of the Atlantic Ocean and then to Sweden where the first Meta data center built outside the USA operates. The students then travel back to the submarine cable station and then the Virginia Data Center before returning to the classroom.

Note: we can never know exactly what route infrared photons travel. The route in this activity is simply symbolic of the global, intercontinental scale that the world-wide digital effect entails involving data centers and the seven layers of the internet (Jasud, 2017). This global circuit of data centers and submarine cables is also not confined to just clicking like on Meta. It involves the daily usage by millions of people, processes such as email, text chat, social media, video streaming, etc. It is an axiom of ICT systems that **data created, has to travel and be stored somewhere.**

Back in the classroom students try to explain what it was they were trying to recreate and what they learned along the way.

The goal of this focus is to provide students with the opportunity to visualize the global scale that A.I. encompasses and the resulting ecological degradation.

3. How do the components of the conceptual model vary? This involves conducting a comparison inquiry.

This inquiry would follow what the students would learn from the Dark Cloud activity above and examine in greater depth the details of the ecological degradation that digital technology systems cause. This might involve comparing the amounts, sources and effects of using the natural resources that digital technologies rely on including electricity and sources of energy, carbon footprint, water usage for air conditioning the vast areas of global data centers, materials such as the seventeen rare earth metals, graphite, lithium, PVC, the land required to build these expansive data centers as well as the constant and ever-increasing production of global e-waste (Oo et al., 2023).

The goal of this focus is to become knowledgeable about the details of digital pollution.

4. How can we change this behavior? i.e., what can be done either personally or as a global community about digital pollution? This would involve conducting a decision-making inquiry.

The topic of digital pollution can be quite intense, potentially creating a sense of discouragement and angst. Even though large data centers cause significant ecological

degradation, they actually come in second to users' devices in contributing to the worldwide digital effect (Oo et al., 2023, p. 67). Therefore, it is important to complete the unit by creating a sense of agency. Ferreboeuf et al. (2019) use the term "digital sobriety" as the behaviors we might undertake in order to counter digital pollution. Students would examine and discuss three main meta-principles that we all might consider in order to lessen our ecological footprint in using AI systems:

(1) buying the least powerful digital equipment possible,

(2) changing these mechanisms the least often possible, and

(3) reducing unnecessary energy-intensive uses (Ferreboeuf, 2019, p. 2).

The goal of this focus is to empower the learner with options that they might choose in order to lessen their contribution to digital pollution.

CONCLUSION

Both natural gas and propane are odorless before chemical additives such as mercaptan are added. This chemical smell acts as a warning to the user that there may be a leak and therefore precautions should be taken. However, there is no "mercaptan" added to the **ON** position. It is "odorless". As Crawford (2021) points out, the planetary ICT system is based on "abstraction and extraction". There are no warnings that the abstract nature of the **ON** position may be altering and undermining our ability and desire to critically examine our surroundings, particularly as it relates to ecological consciousness. "The need to store information and knowledge within one's mind/brain is constructed in the postdigital age as unnecessary" (Rose & Bartoli, 2020, p. 196). The exogenous IoT sensors and AI algorithms hidden deep within the electrical infrastructure of the always **ON** mindset may anesthetize the historical human condition in the pursuit of knowledge. 100, 99, 98, …

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