

A research review regarding the impact of technology on child development, behavior, and academic performance.

By Cris Rowan, Pediatric Occupational Therapist
<http://www.zonein.ca/>

Zone'in Fact Sheet

- **Infants watch 2.5 hours per day of TV and 25% have TV's in their bedrooms**
- **Children use 7.5 hours per day of entertainment technology, and 75% have a device in their bedroom**
- **30% of children will enter kindergarten developmentally vulnerable**
- **25% of children are obese in Canada, 30% in the U.S.**
- **14.3% of children, have been diagnosed with a mental illness**
- **Half of grade eight students do not have job entry literacy**

The ways in which we are educating and raising our children with technology are no longer sustainable.

Impact Statement

The past decade has seen a profound increase in use of entertainment technology by children, some as young as one year of age. Critical milestones for child sensory, motor and attachment development are not being met. Developmental delay, obesity, mental illness, attention deficit, and illiteracy are now becoming the norm. Attachment to technology is "detaching" children from humanity, with consequent increased incidence of childhood psychological and behavior disorders, often accompanied by prescription of psychotropic medication.

Media violence has now been categorized as a Public Health Risk due to causal links to child aggression. Brain development research shows technology overuse by children results in "pruning" of tracks to the frontal cortex, adversely affecting executive functioning and impulse control. Early studies now indicate that electromagnetic radiation emitted from some forms of technology is harmful to adult physical and mental health, with no studies to date on the effects of EMF radiation on children. Schools continue to escalate use of "educational" technologies without any research evidence to show efficacy or safety.

It is now time for parents, teachers, health professionals, government, researchers and technology production corporations to join together to manage balance between healthy activity and technology use, a concept termed *Balanced Technology Management*.

The *Zone'in Fact Sheet* information is formatted by impact topic, with referenced research alphabetized at the end of document.

1. **Technology Use**: usage statistics; technology addiction prevalence
2. **Physical Impairments**: developmental delay; obesity, cardiovascular disorders and diabetes; movement deprivation, sensory overstimulation, electromagnetic radiation, sleep disruption
3. **Mental Disorders**: human detachment and mental illness; psychotropic medication, restraints, and seclusion rooms, touch deprivation, pornography and risky behavior
4. **Social Disorders**: communication, aggression and declining empathy,
5. **Academic Performance**: attention deficit; failure to print and illiteracy, "education" technology;
6. **Implications and Solutions**: costs, technology screening and management, playgrounds as epicenter for child development and learning

Technology Use Overview

- **Elementary aged children now use an average 7.5 hours per day entertainment technology**, (TV, video games, internet, movies, and cell phones), with total amount of exposure time averaging 11 hours per day. Two thirds of children report their parents do not restrict their access to technology, and 75% of these children have devices in their bedrooms (Kaiser Foundation Report 2010).
- **"Baby TV" now occupies 2.5 hours per day for the 0-2 year old population**, and television occupies 4.5 hours per day for 3-5 year olds, and 6.5 hours per day for elementary aged children and is causally linked to developmental delays (Christakis D 2007). This situation has prompted France to ban its broadcasters from airing TV shows aimed at children under three years of age (CBC News, 2008), and Disney to offer refunds for their "Baby Einstein" DVD's (NY Times, 2009).
- 173 research efforts going back to 1980 were analyzed and rated, showing 80% of the studies showed a **link between the following negative health outcomes and media hours or content: obesity, smoking, sexual behavior, drug use, alcohol use, low academic achievement and ADHD** (Nunez-Smith M 2004, Zimmerman F 2007, Hancox R 2005, Murray J 2006).
- **By preschool age, 80% of children are in some form of** child care. Average screen time was 4.1 hours daily, including 3.6 hours at home and 0.4 hours in child care. **Children in centers had the lowest screen time (3.2 hours)** compared with children in parental care only (4.4 hours) (Tandon et. al, 2011).

Technology Addiction

- **12% of boys and 8% of girl video game players exhibit pathological patterns of play, and fit the DSM IV category of addiction.** Study also showed that pathological gamers are twice as likely to have ADD or ADHD (Gentile D 2009).
- **ADHD was the most associated symptom of Internet Addiction, followed by impulsivity** (Yen J 2008).
- **Young adults experience distress when they try to unplug from technology for even one day**, a research project has found. Many students also reported mental and physical symptoms of distress and "employed the rhetoric of addiction, dependency and depression," when reporting their experiences of trying to go unplugged for a full day (CBC News 2011).
- The stronger blood volume pulse and respiratory responses, and the weaker **peripheral temperature reactions of the high-risk Internet Addiction abusers** indicate the **sympathetic nervous system was heavily activated in these individuals** (Lu D 2010).
- A Harris Interactive Poll in the US release in April 2007 found that **8.5% of youth gamers could be classified as "pathological" or "clinically addicted" to playing video games.** A British survey of gamers indicated 12% reported being "addicted". 2.4 % of South Korea from ages 9 – 39 have video game addiction according to a government funded survey. Another 10.2% were found to be borderline cases at risk of addiction. Addiction was defined as an obsession with playing electronic games to the point of sleep deprivation, disruption of daily life and a loosening grip on reality, depression and with drawl when not playing. 10 South Koreans died in 2005 from disruption in blood circulation caused by prolonged use. S. Korea has government funded counseling and clinics for gamers. Most addictive video games are the MMORPG's massively multiplayer online role playing games (Washington Post 2006).
- A German nationwide survey in 2007 and 2008 of 44,610 ninth graders indicates that **3% of male and 0.3% of female students were diagnosed as Video Game Dependent** accompanied by increased levels of psychological and social stress in the form of lower school achievement, increased truancy, reduced sleep time, limited leisure activities, and increased thoughts of committing suicide (Rehbein, Kleimann & Mobie, 2010).
- **Difficulty identifying feelings, higher dissociative experiences, lower self esteem, and higher impulse dysregulation** were associated with higher incidence of internet addiction (DeBerardis D 2008).
- Internet addicts are **lonelier and have lower self-esteem and poorer social skills** than moderate users (Ghassemzadeh L 2008).
- Video game addiction can be statistically predicted on measures of **hostility and poor academic achievement** (Shao-I C 2004).

- An internet-obsessed Korean couple allegedly allowed their infant daughter to starve to death while they cared for their virtual child (Telegraph, UK, 2010).
- In an effort to **solve the problem of escalating child internet addictions**, the South Korean government has created the **Jump Up Internet Rescue School**, a camp designed to cure Internet-addicted or online game-addicted children (Koo C 2010).
- A German population survey indicated that if the internet is used excessively to cope with **negative affect states** and alternative means of coping are diminished, a vicious cycle may ensue with **increasing stress and reliance** on the reinforcing properties of certain online activities that may finally lead to addictive behaviour (*Rehbein et al.*, 2010)
- In a German population based survey regarding internet use, **9.3% overall reported at least one negative consequence of Internet use**, especially neglect of recreational activities and problems with family/partner, work or education, and health. Problematic use was associated with longer average daily online times, avoidance of negative emotions, preference for certain applications (gaming, gambling, online sex) and an increased rate of depersonalization (Beutel et al., 2011).
- In a study covering evolution of internet addiction in Greek adolescent students, results indicate that **Internet addiction is increased in this population parallel to an increase in Internet availability**. The best predictor variables for Internet and computer addiction were parental bonding variables and not parental security practices. The three online activities most associated with Internet addiction were watching online pornography, online gambling and online gaming (Siomos et al., 2012).
- Results show that those suffering from Internet addiction showed **increased levels of trait impulsivity which were comparable to those of patients diagnosed with pathological gambling**. Additionally, the severity of Internet addiction was positively correlated with the level of trait impulsivity in patients with Internet addiction. These results state that Internet addiction can be conceptualized as an impulse control disorder and that trait impulsivity is a marker for vulnerability to Internet addiction (Hae Woo Lee, 2012).
- A **sizable minority of students experience problems related to Internet use** and that the **use of Facebook may contribute to the severity of symptoms** associated with Internet addiction (Kittinger et al., 2012).
- A cross-sectional study conducted with 257 adolescents found **evidence among females for the mediating role of a preference for online social interaction, and a relationship between self esteem and internet addiction**. No significant effects were found for males (Fioravanti et al., 2012).

PHYSICAL IMPAIRMENTS

Developmental Delay

- A joint study by the BC Business Council, and University of BC researchers with Human Early Learning Partnership showing that just under **30% of BC children entering kindergarten are "developmentally vulnerable"** - lacking in those basic skills they need to thrive in school and in the future. These children will go onto fail their grade 4 and 7 exams, and drop out of high school prior to completion. This study, entitled *A Comprehensive Policy Framework for Early Human Capital Investment in BC* states "Economic analyses reveal this depletion (in human capital) will cause BC to forgo 20% GDP growth over the next 60 years, costing the provincial economy a sum of money that is 10 times the total provincial debt load." (Kershaw P 2009)
- **Canadian children were granted a "F" grade for inactivity** in 2009 by Active Healthy Kids Canada, citing TV, internet, and video games as the primary cause (Active Healthy Kids Canada 2009 Reports).
- American Physiotherapy Association reports **two-thirds of over 400 members surveyed report they've seen an increase in early motor delays in infants** over the past six years (Jennings J 2005).
- A 2006 Canadian study reported **one in six children have a developmental disability** with only 55-65% of developmental disabilities are detected prior to school age entry (Hamilton S 2006).
- Data from the **1988 National Health Interview Survey** reported **17% of U.S. children had a developmental disability** with 6% of child population having language impairment, 8% a

learning disability, 7% ADHD and 0.5% Autism with 13.2% accessing special education assistance, resulting in 1.5 times more physician visits, 3.5 times more hospital days, twice the number of lost school days and a 2.5 fold increase in the likelihood of repeating a school grade compared to a non-developmentally disabled child (Boyle C 1994).

- A **2006 US study** reported **32% of children admitted to inpatient pediatric ward demonstrated a developmental disability** (Petersen M 2006).
- The **past decade** has seen an **unprecedented rise in numbers of referrals to occupational therapists for children with disorders** such as printing and reading delays, attention and learning difficulties, and significant behavior problems, which has placed the occupational therapist under considerable workload management stress (Davidson & Bressler, 2010).

Obesity, Cardiovascular Disorders & Diabetes

- Professor Andrew Prentice told the British Association's science festival in Leicester that due to the secondary effects of obesity on child cardiovascular systems and potential for diabetes, the **21st century generation may be the first generation to not outlive their parents** (BBC News, 2002).
- **There is a large body of evidence** from all study designs which suggests that decreasing any type of sedentary time is associated with lower health risk in youth aged 5-17 years. In particular, the evidence suggests that **daily TV viewing in excess of 2 hours is associated with reduced physical and psychosocial health, and that lowering sedentary time leads to reductions in BMI** (Tremblay et al., 2011).
- **TV and video game use accounts for 60% of childhood obesity, and is now considered a North American 'epidemic'** (Tremblay M 2005, Strauss R 2001).
- **Research indicates 70% of hispanic children have a TV in their bedroom, raising their risk of obesity by 30%**, increasing TV usage by one hour per day, and increasing their consumption of fast food (Feng et. al, 2011).
- In **1996, 10% of Canadian children ages 7-13 years were obese**, with estimated economic costs of 1.8 billion (Tremblay M 2002). In **2004**, just eight years later, this number is **50% higher** with a prevalence of obesity at fully **30% of Canadian children** (Statistics Canada, 2010).
- **US study reports obesity incidence doubled** in 2 to 5 year old toddler population, increasing from 2.1% to 5.0% in boys and 4.8% to 10.8% in girls over a 6 year period (Harvey-Berino J 2001).
- Health care providers are finding more and more **children with type 2 diabetes**, a disease usually diagnosed in adults aged 40 years or older (Center for Disease Control and Prevention, 2010).
- Health study **intervention lowered obesity rate in youth at high diabetes risk**. Interventions included healthier food choices, longer, more intense periods of physical activity, and participation in activities that promoted long-term healthy behaviors (National Institute of Health, 2010).
- Climbing obesity rates in European countries have lead a team of **child health experts to recommend placing obese children in foster care**, citing that parents of obese children are negligent in some way as to have indicated that the parents have caused their child's obesity. By neglecting to identify child technology overuse as a causal link to obesity, these experts are subjecting whole families to what might be an unnecessary and uncalled for traumatic and catastrophic event (Vilner R, 2010).
- A boy who spent an entire day kneeling down playing computer games needed hospital treatment for a **blood clot in his leg** (BBC News, 2004).

Movement Deprivation

- **Rapid advances in technology and transportation have resulted in a physically sedentary society** with high frequency, duration and intensity of sensory stimuli (Nelson M 2006).
- These **environmental changes are faster than human being's ability to adapt and evolve**. Children who immerse themselves in virtual reality may exhibit signs of sensory

deprivation, as they become disconnected from the world of physical play and meaningful interactions (Tannock M 2008).

- Overuse of TV and video games may result in children lacking essential connection with themselves, others and nature. **Child now fear nature**, limiting outdoor play which is essential for achieving sensory and motor development (Louv R 2005).
- **Four critical factors** for healthy development and learning are **movement, touch, human connection, and nature** (Rowan C 2010, Insel R 2001, Korkman M 2001).
- **Developing children require 2-3 hours per day of active rough and tumble play** to achieve adequate stimulation to the vestibular, proprioceptive, tactile and attachment systems (National Association for Sport and Physical Education 2002). This type of sensory input ensures normal development of posture, bilateral coordination and optimal arousal states necessary for attainment of printing and reading literacy (Schaff R 2007, Braswell J 2006, Rine R, 2004).
- Scottish study reports **toddlers aged 3 years engaged in only 20 minutes per day of moderate to vigorous physical activity**, which correlated with a decline in total energy expenditure and sedentary behavior. Study identifies TV, video games, strollers as “culprits” (Reilly J 2004).
- Infants with **low tone**, toddlers **failing to reach motor milestones**, and children who are **unable to pay attention** or **achieve basic foundation skills for literacy**, are frequent visitors to pediatric physiotherapy and occupational therapy clinics. **Infant flat head has increased 600% in the past 5 years** (Jennings J 2005).
- **Delayed vestibular maturation** correlates significantly with **sensory integrative dysfunctions, slow vision processing, impaired hearing, and reading disability** (Solan H 2007)..
- **Researchers found no increase in physical activity with active video games**, possibly due to games were played with minimal effort and/or children exercised less during the rest of the day as a result (Baraknowski et. al, 2012).
- **A systematic review of children with autism and physical exercise showed decreases in stereotypy, aggression, off-task behavior, and elopement** (Lang, 2010).

Sensory Overstimulation

- **Sensory Processing Disorder affects 1 in 20 children** www.SPDFoundation.net, 2009.
- The ability of a child to adapt to sensory responses in their environments emerges early in life as a protective and discriminative mechanism, and as children grow they typically become better at tolerating uncomfortable sensory stimuli by applying strategies to self regulate. Sensory over-responsivity reflects a failure to achieve a balance between sensitization and habituation, and can affect many aspects of a child’s life in both home and school settings. A study long term study looked at infants with sensory over-responsivity when they entered the school system and found that **early sensory sensitivities were associated with sensory over-reactivity status at school-age** (Ben-Sasson, 2010). Technology overuse may result in sensory over-reactivity (Rowan, 2010).
- Study investigating sensory over-responsivity in children with ADHD shows **substantiated links between sensory over-responsivity and anxiety**, in both typical and ADHD children. Results suggest that ADHD should be considered in conjunction with anxiety and sensory responsivity; both may be related to bottom-up processing differences, and deficits in prefrontal cortex/hippocampal synaptic gating (Lane, S 2010).
- **Inattention was greater in ADHD than SMD, while SMD** had more sensory issues, somatic complaints, anxiety/depression, and difficulty adapting than ADHD, as well as greater physiological/electrodermal reactivity to sensory stimuli than ADHD. **Evidence suggests ADHD and SMD are distinct diagnoses** (Miller LJ 2012).
- **94.4% of adults with ASD reported extreme levels of sensory processing** on at least one sensory quadrant of the Adult/Adolescent Sensory Profile (Crane, 2009).
- **69% of children with Autism demonstrated sensory symptoms** on the Sensory Experiences Questionnaire (Baranek, 2006).
- **95% of children with Autism demonstrated some degree of sensory processing dysfunction** on the Short Sensory Profile Total Score, with the greatest differences reported on

the underresponsive/seeking sensation, auditory filtering and tactile sensitivity sections (Tomchek, 2007).

- **Children with photosensitivity have increased risk of epilepsy when using video games** or other high speed visual technologies (Singh R 2004 and Kasteleijn-Nolst Trenite DG 2002).
- **Children with Autism frequently exhibit photosensitivity** (Baron-Cohen S 2010).
- A study on phenotypes within **sensory modulation dysfunction**, describes the **first subtype as characterized by sensory seeking/craving, hyperactive, impulsive, externalizing** (eg, delinquent, aggressive), unsocial, inadaptive, and impaired cognitive/social behavior. The **second subtype is characterized by movement sensitivity, emotionally withdrawal, and low energy/weak behaviour** (James et.al, 2011).
- **The findings in a brief report on sensory abnormalities in Autism provide support for the notion** that **sensory abnormality is very common in young children with autism**. This symptom has been proposed for inclusion among the diagnostic criteria for ASD in the upcoming DSM-V (Klintwall, 2011).

Electromagnetic Radiation

- Recently released research from the Department of Biophysics, Faculty of Medicine in Cukurova University, Turkey indicates **exposure to extremely low-frequency electromagnetic fields (ELF-EMF), known to be emitted from technology including computers, wireless internet, cell phones, and televisions, causes oxidative cell damage and cell death in rats** (Emre M 2011).
- Using a **cell phone for > or = 10 years approximately doubles the risk of being diagnosed with a brain tumor on the same ("ipsilateral") side of the head** as that preferred for cell phone use. The data achieve statistical significance for glioma and acoustic neuroma but not for meningioma (Khurana V 2009).
- **Electromagnetic radiation can cause difficulty sleeping, dizziness, headaches, tingling in the hands, ringing in the ears, pain in the eyes, "unexplained" cardiac conditions, electro-sensitivity, low immunity, ADHD and Autism** (Crofton K, 2011).
- **Findings provide new epidemiological evidence** that **high maternal magnetic field levels in pregnancy may increase the risk of asthma in offspring** (Li et al., 2011).
- **Whole body exposure to pulse modulated RF radiation** that is similar to that emitted by global systems for mobile communication (GSM) mobile phones, can cause **pathological changes in the thyroid gland** (Esmekaya et al., 2010).
- **When electrical properties are considered, a child's head** absorption for electromagnetic radiation can be over two times greater, and absorption of the skull's bone marrow can be ten times greater than adults (Gandhi et al., 2011).
- **Time-varying electromagnetic waves have the potential** to temporally modulate the **nervous system**, particularly when populations of neurons are required to act together. The most likely source of temporal noise in the environment is artificially generated electromagnetic radiation (University of Wales Swansea, 2006).
- **Research suggests a precautionary approach to the use of technologies**. Dr. Frangopoulou researched the cognitive effects of the exposure to radiofrequencies in mice, and found **reduced memory after only 2 hours per day for 4 days exposure to a cell phone** (Frangopoulou, 2011).

Sleep Disruption

- **Passive and active TV watching results in irregular sleep patterns and sleep/wake transition disorders**. Attention and learning are negatively impacted by sleep deprivation (Paavonen E 2006).
- **30% of children consumed a daily caffeinated beverage**, reducing total sleep by 15 minutes per night. **42% had a television in the bedroom reducing total sleep by 45 minutes per night** (Calamaro et. al, 2011).

MENTAL DISORDERS

Human Detachment and Mental "Illness"

- **Children who watch more than the expert recommended 1-2 hours per day of technology, have a 60% increase in psychological disorders** (Bristol University, 2010).
- **Nationwide survey reports problematic use of video games was associated with lower scores on life satisfaction and with elevated levels of anxiety and depression** (Mentzoni R 2011).
- **Anxious attachment, depression, and anxiety** could explain problematic alcohol use. In contrast, both **anxious and avoidant attachment** as well as depression and phobia **explained problematic Internet use**. Additionally, depression moderated the effects of avoidant attachment on problematic Internet use. We demonstrated that the interaction of attachment and psychopathology predicts problematic Internet use originating from an earlier stage of life than that associated with problematic alcohol use (Shin S 2011).
- **Mood disorders showed a statistically significant ($p = 0.044$) correlation with a higher score on the IAT** (Internet Addiction Test). Mental health care practitioners must consider questions on Internet use as an essential part of the patients' evaluation given its significant correlation with diagnosis of a mood disorder (Liberatore K 2011).
- **People who report they are not happy watch over 30% more TV hours per day than people who report they are happy** (Robinson J 2008).
- **Television exposure and total media exposure in adolescence are associated with increased odds of depressive symptoms** in young adulthood, especially in young men (Primack B 2009).
- A recent study revealed that **20% of parents did not know how to "play" with their children, and one third of parents found play "boring"** (Guardian News, 2010).
- **Parent time spent connected to various forms of technologies is disconnecting them from forming healthy, primary attachments with their children**. This parent-child "disconnection" is a major contributing factor to the reported increased incidence of mental diagnoses (Flores P 2004).
- **In Canada 1 in 165 children have been diagnosed with Autism** (Autism Society of Canada, 2010), and in the **US 1 in 110 children have Autism** (Autism Society, 2010).
- **Children born after shorter intervals between pregnancies are at increased risk of developing autism**; the highest risk was associated with pregnancies spaced <1 year apart with a more than three times elevated odds of Autism (Cheslack-Postava K 2011).
- **9% of US children age 8-15 years meet criteria for ADHD** (Rapport M 2008).
- Recent studies document a **rise in psychological disorders in children reporting increasing incidence of ADHD, autism, bipolar disorder, depression and anxiety** (Zito J 2001, The Well-being of Canada's Young Children Report 2003, Mental Health: A Report of the Surgeon General, Overview of Mental Disorders in Children, Mental Health in the United States: Prevalence of Diagnosis and Medication Treatment for ADHD, Center for Disease Control and Prevention 2003).
- 2007 mental illness statistics for children in **Canada show that 14.3% of children have a diagnosed mental health disorder** with anxiety disorders 6.4%, ADD or ADHD 4.8%, conduct disorders 4.2%, depressive disorders 3.5%, substance abuse 0.8%, autism spectrum disorders 0.3%, obsessive compulsive disorders 0.2%, eating disorders 0.1%, schizophrenia 0.1%, bipolar disorder <0.1% (Waddell C 2007).
- Based on the ways in which the parent copes with the stresses of their own technology overuse, the parent consequently might raise their children in such a way as to result in either an avoidant, ambivalent, or disorganized attachment disorder. A study conducted in Beijing, China reports that **adolescents with Internet Addiction Disorder consistently rated parental rearing behaviors as being over-intrusive, punitive, and lacking in responsiveness**, indicating that the influences of parenting style and family function are important factors in the development of internet dependency (Xiuquin, 2010).
- **Parents who stay in touch with their university aged children using social networking** (texts, email, Facebook), have children who are **more anxious, lonely and who indicate loneliness, anxious attachment, as well as conflict within the parental relationship**, than children who's parents stay in touch by phone (Gentzler, 2010).

- **Recent changes from a 'categorical' to a 'dimensional' model** in the upcoming Diagnostic and Statistical Manual, Fifth Edition to be released in May of 2013, has **opened the flood gates for increasing diagnosis of children with mental disorders**, reports Dr. Allen Frances, who was chair of the DSM-IV Task Force and of the department of psychiatry at Duke University School of Medicine in North Carolina (Psychiatric Times, 2009). Dr. Francis states that this paradigm shift is premature, as there is not even one biological test ready for inclusion in the criteria sets for DSM-V.
- With **increasing numbers of experts in the field of child psychiatry now questioning whether there even is a biological component in child mental illness** (Breggin P, 2008), it seems pertinent to investigate environmental causes for the incremental rise in child mental and behavioral diagnoses.
- **13% of respondents ages 8 to 15 years of age who participated in the National Health and Nutrition Examination Survey reportedly met criteria for at least one of the following mental health disorders** in the past year: generalized anxiety disorder, panic disorder, eating disorders, depression, ADHD, and conduct disorder (National Institute of Mental Health, 2009).
- **There are no reliable, valid, or replicable studies showing genetic evidence for any psychiatric disorders**, including ADHD, Autism, bipolar disorder, schizophrenia, depression or anxiety (Joseph J 2003, Baughman F 2009).
- Yet – in a study of 491 physicians in Washington D.C., almost **half of the diagnoses of ADHD in their patients had been suggested first by teachers** (Sax L 2003).
- **Teachers have taken on the role of "disease spotters" and "sickness brokers" for ADHD**, as pharmaceutical companies escalate their infiltration of the school system (Phillips C 2006).

Psychotropic Medication, Restraints, Seclusion Rooms

- **Child behavior diagnoses and subsequent use of psychotropic medication may be a result of technology overuse**, resulting in the development of a novel "Unplug – Don't Drug" policy initiative and routine technology screening (Rowan C 2010). **Every behavior is an unsolved problem, unmet need or lagging skill.**
- **Behaviors associated to technology overuse** may be confusing for parents, teachers and physicians, and could be easily misunderstood, possibly **resulting in psychiatric diagnosis and prescription of psychotropic medication** (Ruff M 2005, Diller L 1999, Welch M 2006, Mukaddes N 2000).
- Dr. David Stein reported at the International Center for the Study of Psychiatry and Psychology conference in October 2009 that **32% of children ages 0-18 years covered by Blue Cross insurance are currently on psychotropic medication** (Stein D 2009).
- Between 1991 and 1995, **prescriptions for psychotropic medications in the 2 – 4 year old toddler population, as well as in children and youth tripled** (Zito J 2000, 2003, Mandell D 2008). 80% of this medication was prescribed by family physicians and pediatricians (Goodwin R 2001).
- **28-30% of children receiving psychotropic medication are on multiple medications**, with minimal knowledge regarding drug interactions or long term toxicity (47).
- Study performed by researchers from the Government of Western Australia, Department of Health, report **reduced academic performance and increased risk of heart malfunction in children who receive ADHD medication**. "We found that stimulant medication did not significantly improve a child's level of depression, self perception or social functioning and they were **more likely to be performing below their age level at school by a factor of 10.5 times.**" Prof Landau said the study also suggested that a child's heart function may be affected by long-term stimulant use and may remain affected even after stopping medication (Raine ADHD Study).
- A comparative study of children diagnosed with ADHD who were **on stimulant medication showed a 10% decrease in growth rate** when contrasted with children diagnosed with ADHD who were not receiving stimulant medication (Swanson, Elliot, Greenhill, Wigal Arnold & Vitiello, 2007).

- **Antipsychotics have a subtle but measurable influence on brain tissue loss over time**, suggesting the importance of careful risk-benefit review of dosage and duration of treatment as well as their off-label use in children (Ho B 2011).
- **Limited high quality evidence guiding appropriate dosing and inexperience in documentation of long term effects of these prescriptions in children** may mean that these children undergo unquantified risks (dosReis S 2005, Rosack J 2003, Kirsch I 2004, Thomas C 2006).
- Dr. Peter Breggin reported at the International Center for the Study of Psychiatry and Psychology conference in October 2009 that **ADHD medication causes permanent neurotransmitter changes due to receptor down regulation, resulting in depletion of the transmitter the drug was originally designed to increase**. New psychotropic medication molecular structure has added fluoride and chloride ions to improve long acting ability, which are proven to be toxic with long term (> 4 months) administration to cell mitochondria causing eventual cell death. **ADHD medication results in growth retardation and 20% brain shrinkage, appetite loss, 50% depression, 50% Obsessive Compulsive Disorder, Tardive Dyskinesia, and alcohol and cocaine abuse**. Psychotropic medication decreases spontaneity and increases obsessive compulsive disorder, two traits which are ALWAYS interpreted as "improvement" by the educational system (Breggin P 2008).
- Research regarding stimulant medication with children is rife with conflict. Studies have **low validity and reliability ratings, and findings can rarely be replicated**. Clinical trials are generally small in sample size (30-40 children), and on children older than FDA approved regulations, resulting in prevalent "off label" prescribing. **Clinical trials are rarely conducted for longer than 4-8 week periods**, which is insufficient to document any toxicological side effects, and authors state **"Neither the long-term effectiveness nor the long-term safety of stimulant medications has ever been demonstrated"**. (Jensen P 2002)
- Three year follow-up of treated **ADHD subjects showed increases in heart rate, and/or systolic and diastolic blood pressure in 20% of children taking stimulants for ADHD** (Winterstein A 2009).
- Health Canada warns that **Atomoxetine (Strattera), a drug commonly used to treat ADHD disorder in children, has been linked to 189 reported adverse reactions as of December 31, 2007, including 55 suicide attempts** of which 43 were among children between the ages of 6 and 17 (CBC News 2008).
- Two world-renowned **Harvard** child psychiatrists Dr. Joseph Biederman and Dr. Thomas Spencer, whose work has helped fuel an explosion in the use of powerful antipsychotic medicines in children, found in a 2006 study increased prevalence of adult ADHD and call for increased detection and treatment (Kessler R 2006). Senator Charles E. Grassley **implicated these same researchers in payments of \$1.6 million of unreported income from pharmaceutical corporations** over a 6 year period (New York Times 2008).
- Although "off label" marketing of psychotropic medication and suppression of negative results of drug trials are illegal, they are widely accepted practices by pharmaceutical companies (Bass A 2008). Researcher concerns regarding the correlation between stimulant use and cardiovascular risk in children, (Vitiello, B. & Towbin, K. 2009), **indicates immediate attention be directed to nonpharmacological behavior interventions for the treatment of child behavior and learning disorders**.
- **School management difficulties with increasing numbers of aggressive children, is resulting in the rising use of physical and chemical restraints** (Irwin M 2009), as well as the rising use of seclusion rooms (Vancouver Sun 2010).
- When there **is no evidence that locking children in "safe rooms" improves behavior in the long term, and may actually be harmful to children** (PENT Forum 2008), *why are schools increasing their use?*
- **Two children (out of sample of 43) on fluvoxamine, a serotonin reuptake inhibitor**, showed **drug-induced apathy**; neither had depressive illness (Reinblatt et al., 2006).
- **A preliminary but provocative new study finds women who take antidepressants during pregnancy have a moderately higher risk of having a child with autism**, according to a paper published in the Archives of General Psychiatry (Wane, 2011).
- **Antipsychotics are now the top-selling class of medications in the United States**, with prescription sales of \$14.6 billion in 2009. Many clinicians worry these agents are being overprescribed and used inappropriately (Culpepper, 2011).

- **500 pediatric occupational therapists, physical therapists and** speech-language pathologists reports that more than **two-thirds had seen children with deficits processing and integrating sensory information who had been misidentified as having Attention Deficit Disorder or Attention-Deficit Hyperactivity Disorder**. This finding is significant as the treatment for ADD or ADHD is medication while the treatment for sensory processing deficits is therapy (Pathways awareness, 2011).
- It was established years ago that **Paxil carries a risk of suicide in children**, but GlaxoSmithKline has been conducting a study of the antidepressant in children as young as seven – in Japan (Edwards, CBS News 2010).
- Study shows **stimulant-related decreases in growth rates** after initiation of stimulant medication (Swanson et al., 2007).

Touch Deprivation

- **Adequate tactile stimulation is integral to optimizing infant and child development, and tactile deprivation can cause abnormal development of the tactile system.** Dr. Ann Bigelow, pediatric researcher at St. Francis Xavier University, Nova Scotia found that skin-to-skin tactile stimulation between mother and infant was shown to reduce gurgitation, improve sleep, and improve overall growth, as well as enhance infants' sensitivity to their mother which accelerates knowledge about, and expectations for, her behavior (Bigelow, 2006).
- The use of **safety restraint devices such as infant bucket seats and toddler carrying packs and strollers**, have further limited movement, **touch** and human connection, as have TV, internet, and video games (Rowan C 2010).
- A comparative study of two different types of neonatal infant care: the use of a 'kangaroo care' where the infant was carried in a pouch-type device at all times by the caregiver optimizing skin-to-skin contact, and the use of traditional incubators concluded that **kangaroo care had a significant positive impact on the infant's perceptual-cognitive and motor development and on the parenting process**, and speculated that kangaroo care has both a direct impact on infant development by contributing to neurophysiological organization and an indirect effect by improving parental mood, perceptions, and interactive behavior (Feldman, R 2002).
- **Sixty nine percent of the boys with ADHD were categorized as tactile defensive** (Parush 2007).
- **Following touch therapy, children with Autism showed decreased touch aversion, off task behavior, orientation to irrelevant sounds, and stereotypic behaviors** compared to a control group of children with Autism who sat on researcher's lap and were read a book. The touch therapy group also improved more than the control group in stereotypic behaviors and orientation to irrelevant sounds. The authors suggest the effectiveness of touch therapy might be related to changes in vagal tone and/or EEG patterns (Field T 1997).
- **Dr. Montagu reports that when children lack touch and human connection, they may respond by 'turning in' (anxiety, depression) or 'turning out' (aggression)** (Montagu A 1972).
- **Differences in response to tactile stimuli are prevalent in ASD, and tactile contact early in infancy is a foundation for the development of social and communication skills affected by ASD.** While tactile hypo-responsiveness correlates strongly with increased social and communication impairments, and to a lesser degree, repetitive behaviors, researchers found that tactile hyper-responsiveness did not significantly correlate with any core features of ASD. (Foss-Feig et. al, 2012).

Pornography and Risky Behaviour

- **Researchers report 42% of children ages 10-17 actively use pornography, with average age of first exposure 6 years** (Wolack et al., 2007).
- Children's **online participation was associated with increased exposure to online risks**. The association was moderated by Internet skills and parental restrictive mediation (Sook and Chae, 2012).
- **Teens viewing pictures on social networking sites of teens getting drunk, passing out, or using drugs are twice as likely to say they are very or somewhat likely in the future**

to use drugs, compared to teens who had not viewed such pictures (National Center on Addiction and Substance Abuse at Columbia University, 2011).

- **Children who use pornography are significantly more likely to report delinquent behaviour and substance use in the previous year**, as well as depression and lower levels of emotional bonding with their caregiver (Ybarra et al., 2005).
- **Approximately 10,000 Canadian youth reported their screen time**, or time spent with a television, computer, or video game, as well as their participation in risky behaviors such as smoking, drug use, and non-use of condoms. **Youth who reported the highest amount of screen time, especially computer time, were significantly more likely to engage in risky behaviors.** These results suggest that that media use may contribute to youths' decisions to engage in risky behaviours (Carson et. al, 2011).
- **Video game playing during adolescence succeeded in predicting later risky driving behaviour** through adolescents' attitudes and intentions to exhibit this behaviour in the future (Buellens et al., 2010).

SOCIAL DISORDERS

Communication

- **One in five toddlers have speech and language delays associated with overexposure to television**, and Dr. Sally Ward recommends improving quality and quantity of communication with parents to optimize speech and language acquisition (Ward S 2004).
- The ability of the 21st century child to socialize with both adults and peers is deteriorating at a rapid pace. Sally Ward, a professor of speech and language pathology reported in her book "Baby Talk", that one in five toddlers demonstrate speech and language delays (Ward S 2004).
- Canadian parents spend an average 3.5 minutes per week participating in meaningful conversation with their children (Turcotte M 2006).
- Dimitri Christakis, pediatric researcher at Children's Hospital and Regional Medical Center in Seattle, reports that children learn language skills largely from verbal interactions with their parents. In his recent 2009 study where he used digital recorders on both parents and children in their homes, Dr. Christakis found **that adults typically utter approximately 941 words per hour, yet these adult words are almost completely eliminated when television is audible to the child.** Dr. Christakis found that each hour of audible television was associated with significant reductions in child vocalizations, vocalization duration, and conversational turns. On average, each additional hour of television exposure was also associated with a decrease of 770 words the child heard from an adult during the recording session. **Since 30 percent of American households now report having the television always on, even when no one is watching, researchers report these findings have grave implications for language acquisition and therefore perhaps even early brain development (Christakis, 2009).**
- **Time spent using social media was associated with a larger number** of online social network "friends." However, time spent using social media was not associated with larger offline networks, **or feeling emotionally closer to offline network members** (Pollet T 2011).
- **Social self-efficacy in the real world** (offline) is negatively related with the degree of game addiction, whereas social self-efficacy in the virtual world (online) indicated a positive association. **Social activities with parents are negatively associated with game addiction**, although no relationship is found between gaming activities with parents and game addiction (Jeong E 2011).
- Parents reported greater communication and closeness when adolescents initiated calls seeking social support. **Adolescents reported greater conflict when parents called for monitoring activity, for tracking schoolwork, and when upset.** Calls to ask and confer by adolescents and to track school work positively related, but parental calls when upset negatively related to parental self-esteem. **Adolescent self-esteem is predicted by calls seeking support and negatively associated with parents calling when upset** (Weisskirch R 2011).
- **Participants of a study comparing communication patterns and satisfaction levels in three dimensional versus real life intimate relationships, indicated that the quality of their communication** was significantly better in their Second-Life relationships and **that they experienced higher levels of satisfaction with their virtual partners** (Gilbert et al., 2011).

- **Data indicates that excessive internet users have deficits in the early stage of face-perception processing** but may have intact holistic/configural processing of faces. Whether some deeper processes of face perception, such as face memory and face identification, are affected in EIUs needs to be investigated further with more specific procedures (He et al., 2011).
- **17% of Dutch adolescents surveyed reported real-life encounters with online contacts;** one third of these adolescents did not tell their parents about the encounters. Low self-esteem and certain Internet-related parenting techniques were related to the prevalence of such encounters (Van Den Eijnden et al., 2011).

Aggression and Declining Empathy

- **American Physician, Pediatrician, Psychiatrist and Psychologist Associations in 2001 declared media violence a Public Health Risk, stating violence is the leading cause of death in children** (Committee on Public Education – Media Violence 2001).
- Review of 50 years of research on the impact of violence in TV, movies, video games and internet concludes that **watching media violence significantly increases the risk that a viewer or videogame player will behave aggressively in both the short and the long term.** 60% of TV programs contain violence and 40% contain heavy violence. **Most videogames contain violence.** Video game ratings are a poor indicator of content and constitute conflict of interest, as the rating process is performed by the video game industry. Authors state the impact of violent electronic media on public health is second only to the impact of cigarette smoking on lung cancer (Huesmann L 2007).
- **Results of a study examining social outcomes associated with media viewing habits of low income preschool children, suggest that viewing of inappropriate content was associated with higher hyperactivity and aggression scores and a lower social skills rating,** whereas the amount of viewing was not related to these classroom outcomes (Conners-Burrow et. al, 2011).
- In the short term, **media violence can increase aggression by priming aggressive thoughts and decision processes** increasing physiological arousal, and triggering a tendency to imitate observed behaviors. In the long-term, **repeated exposure can produce lasting increases in aggressive thought patterns and aggression-supporting beliefs about social behaviors,** and can reduce individuals normal negative emotional responses to violence (Anderson C 2003).
- Studies regarding the effects of violent video games on children found **even violent cartoons increased aggression in 9-12 year old children.** Violence is defined as doing intentional harm to another, not how graphic or gory the game is. Increased exposure to violent videogames results in more pro-violent attitudes, hostile personalities, less forgiveness, belief that violence is typical, and causes children to behave more aggressively in their everyday life (Anderson C 2007).
- **Young children are most vulnerable to media violence as they are more impressionable, can't distinguish between fantasy and reality,** cannot discern motives for violence, and learn by observing and imitating (Buchanan A 2002).
- Recent incidents of **growing child aggression against other children and school staff** members have been reported in the press to have **doubled** in the Vancouver School District in the past three years (Vancouver Sun, 2010).
- Results by gender showed **boys played more often and longer than did girls** and type of game: **boys mostly played sports and racing games, and preferred shooter games and games with graphic violence,** whereas girls tended to play games that are characteristically socio-affective and educational (Choliz & Marco, 2011)..
- **School management difficulties with increasing numbers of aggressive children, is resulting in the rising use of physical and chemical restraints** (Gaskin, 2007; Muralidharan & Fenton, 2009), as well as a rising use of **seclusion rooms** (Vancouver Sun 2010; Muralidharan & Fenton, 2009).
- A 2010 University of Michigan study shows **today's college students are 40-per-cent less empathetic than those of the 1980s and 1990s** determined by an analysis of the past 30 years of students who participated in the Davis Interpersonal Reactivity Index which looked at empathic concern, emotional response to the distress of others, and "perspective-taking" or the ability to imagine another person's perspective. This study cites the influx of callous reality

television shows and the growth of social networking and texting as causal factors for the decline in empathy in today's young people (Globe and Mail, 2010).

- Tyrone Spellman, 27, played long hours on his Xbox, so when his 17-month-old daughter pulled on some cords and tipped the Xbox to the ground, breaking it, he became completely enraged. He struck her with such force that it "cracked her skull several times." The autopsy too, revealed a broken arm that was at least two weeks old which social workers had failed to identify previously (CBS News, 2008).
- Survey of 3,767 grade 6, 7, 8 students who attended six schools in the US found **11% had been electronically bullied and 4% indicated they had bullied a victim in the past month.** Half of the electronic bully victims reported not knowing the perpetrator's identity (Kowalski R 2007).
- **Youth who reported being harassed online were 8 times more likely to carry a weapon to school in the past 30 days** (Ybarra M 2007).
- While online cyberbullying occurs off campus, **resulting altercations happen on site** (Willard N 2007).
- **Internet bullying is correlated with school behavior problems**, and media literacy programs may mitigate the negative effects of electronic media on youth (Worthen M 2007).
- **Cyberbullies demonstrated less empathic responsiveness than non-cyberbullies**, and were also more afraid of becoming victims of cyberbullying. The findings confirm and substantially extend the research on the relationship between empathy and aggressive behavior. From an educational point of view, the present findings suggest that training of empathy skills might be an important tool to decrease cyber bullying (Steffgen G 2011).
- Research **results revealed a positive association between exposure to profanity in multiple forms of media and beliefs about profanity, profanity use, and engagement in physical and relational aggression** (Coyne et al., 2011).
- **Research shows that violent video games increase aggressive behaviour and decrease prosocial behaviour**, but could relaxing video games have the opposite effects? Compared to those who played violent or neutral video games, **those who played relaxing video games were less aggressive and more helpful** (Whitaker and Bushman, 2011).

ACADEMIC PERFORMANCE

Attention Deficit

- Study indicates that the **more time students spend on consuming media and the more violent its contents are**, the worse are their marks at school, even when controlling for vital factors such as family, educational, or immigrant background (Mossle et al., 2010)
- People who spend more time playing **video games** have **more attention problems**, and individuals who are more impulsive or have more attention problems subsequently spend more time playing video games (*Swing et al, 2010*).
- **Research on four year old children showed significant reduction in executive function after 9 minutes of Spongebob cartoon.** Long term implications for attention and learning ability are discussed (Christakis, 2011).
- **Each hour of TV watched daily between the ages of 0 and 7 years equated to a 10% chance of attention problems** by age seven years (Christakis D 2004).
- **Viewing TV and playing video games each are associated with increased subsequent attention problems** in childhood (Swing, 2010).
- **Every additional hour of TV exposure at 29 mo. Corresponded to 6% unit decrease in classroom engagement, 7% unit decrease in math achievement, 10% unit increase in victimization by classmates, 13% decrease in time spent doing physical activity, and 10% higher consumption of soft drinks and snacks** (Pagani L 2010).
- **The more time students spend on consuming media and the more violent its contents are**, the worse are their marks at school, even when controlling for vital factors such as family, educational, or immigrant background (Mossle T 2010).
- **ADHD should be re-termed "attention inconsistency"**, as these children have episodic attention ability. Attention Restorative Theory has three tenants: 1) attention ability is subject to fatigue and restoration 2) voluntary and interesting tasks are less fatiguing than involuntary and uninteresting tasks 3) attention ability is subject to environment modifications (Kaplan S 1995).

- **People switched between media at an extreme rate**, averaging more than 4 switches per min and 120 switches over the 27.5-minute study exposure. Participants had little insight into their switching activity **and recalled their switching behavior at an average of only 12 percent** of their actual switching rate revealed in the objective data. Younger individuals switched more often than older individuals (Brasel and Gips, 2011).

Failure to Print – The Foundation for Illiteracy

- In 1994 and 2003, comparative literacy studies of Canada, Germany, the Netherlands, Poland, Sweden, Switzerland and the United States were completed covering four literacy domains – prose (reading and understanding text information e.g. stories, editorials), document (locating text information e.g. maps, schedules), and numeracy (understanding math embedded in text e.g. weather and loan interest charts) and problem solving. Participants were ranked on five levels, with level one being the lowest. **15% of Canadians scored in level one, and only 50% reached level three.** Canadians scored in the middle of the pack, and results were the same for 1994 and 2003 (Sloat E 2000).
- In the U.S., more than **eight million students in grades 4-12 read below grade level**, and while they can decode, they cannot comprehend what they read. Between 1971 and 2004, the reading level of America's 17 year olds showed no improvement at all. **40% of high school graduates lack the literacy skills employers seek.** Early exposure to print is largest predictor of reading ability (National Center for Education Statistics 2005).
- **Literacy is defined as competency in handwriting, reading, math and communication skill.** A foundation in spoken language competence in the early years, is important for the successful achievement of literacy, academic and social competence. Printing is a precursor to reading and speech fluency, and **poor handwriting skill is related to language disorders.** Motor planning required for automatic letter production when printing "maps" the sensorimotor cortex for eventual visual letter recognition for reading, and word finding for oral sentence production (Shanahan T 2007, Goldberg E 1999, Tomblin B 2006).
- **Teachers spend an average 14 minutes per day teaching handwriting**, far less than the 45 minutes per day spent in the 60's and 70's, and slightly less than the 15 minutes per day mandated in the 80's. A US study by Steven Graham reports that 90% of US primary school teachers college education did not adequately prepare them to provide lessons in penmanship, and therefore do not devote much time to teaching printing. Textbooks offer less information on teaching printing, and universities have less instruction. Handwriting teaching methods and methods for student evaluation are inconsistent and non-standardized. 100% of the 169 primary teachers who participated in this study reported they thought printing should be taught as a separate subject (Graham S 2008).
- **Children who cannot print are illiterate.** Teacher misperception that the computer will replace the need to print, is unfounded and shortsighted. Slow printing speed resulting from inadequate teaching of letter and number formation, impacts on every subject and is the leading cause of illiteracy (Rowan C 2010).
- Another study by Graham documents that in **1996 70% of teachers indicated that handwriting was "not as good as it should be", and expressed concern regarding the "downward plunge in the standards of handwriting legibility required of elementary school children"**. Authors also state that students who have difficulty with automaticity of writing, thus achieving poor quality and quantity of written output, results in avoidance and minimization of the writing process. Authors state that for beginning writers, both visual and verbal modeling appears to be the most effective means of introducing a letter prior to practice i.e. the teacher demonstrates how a letter is made while describing how it is formed (Graham S et al 1993). Graham goes on to report in 2000 study how **poor ability to produce quality and quantity of written output can result in a long term disability in written expression** (Graham S et al 2000).
- In Steven Graham's 2006 book *Handbook of Handwriting Research*, this meta-analysis concludes that **printing strategy instruction is effective in improving student's writing performance in the areas of quality, elements, length, and revisions**, with results maintained over time and generalized to new tasks and situations.
- Steven Graham's 2007 book *Best Practices in Handwriting Instruction* draws the **correlation between poor printing and subsequent difficulty with spelling, sentence composition,**

math, science and any subject requiring printing skill. Graham states "Failure to develop legible and automatic letter and word formation interferes with content in writing." and "Because of the excessive labor and unattractive results involved in such writing, students are more likely to avoid or minimize the process when possible". Graham instructs that for beginners, both visual and verbal modeling is the most effective means of introducing a letter prior to practice.

"Education" Technology – The Learning Paradox

- **The more schools invest in technology, the less likely children are to pay attention and learn constituting what is termed "The Learning Paradox" (Rowan C, 2010).**
- PET scan studies showed that **technology use of greater than 5 hours per day was consistent with neurological "pruning" of tracks to the frontal cortex**, known for executive functioning and impulse control (Small G 2008).
- Internet Addiction Disorder demonstrated widespread **reductions** of fractional anisotropy in **major white matter pathways** and such abnormal white matter structure may be linked to some **behavioral impairments** (Lin et al, 2012).
- **Education technology is not evidenced based**, yet – **whole school districts are moving rapidly toward both virtual teaching**. Referred to as the "**\$100 curriculum in a box**", TeacherMates, XO's and iPad are replacing teaching, referencing the teacher as a "moderator" (Fast Company, April 2010).
- Comparative study of digital (screen) reading vs. print reading reports the following **problems with screen reading**:
 - **Attention**: clicking and scrolling disrupt attention and disturb mental appreciation
 - **Comprehension**: reader lacks both completeness and constituent parts
 - **Memory**: change in physical surroundings has a negative effect on memory
 - **Learning**: doesn't allow required time and mental exertion
 - **Meaning**: isn't a physical dimension, loss of totality

Mangen Quote: "*The digital hypertext technology and its use of multimedia are not open to the experience of a fictional universe where the experience consists of creating your own mental images. The reader gets distracted by the opportunities for doing something else*" (Mangen A 2008).

IMPLICATIONS AND SOLUTIONS

Costs of Child Technology Overuse to the Canadian Health and Education Sectors

- **Total annual costs to the Canadian health and education sectors to address problems that strongly correlate with child technology addictions are \$35.5 billion.**
- Extrapolation from previously cited research indicates estimated annual costs to the Canadian health care system to support children with developmental disabilities, psychiatric and behavioral disorders are \$9.3 billion, obesity are \$3 billion and medication costs are \$0.3 billion, totaling \$12.5 billion.
- Estimated annual costs to the Canadian education system for failing literacy are \$10 billion, and educational support of children with developmental disabilities are \$13 billion, totaling \$23 billion.
- Treating child technology addictions will collapse both education and health budgets.

Technology Screening and Management

- In 2001 the American Academy of Pediatrics issued a policy statement recommending that **children less than two years of age should not watch or be exposed to any TV or video games** (Children, adolescents and television. Committee on Public Education, AAP 2001), and further recommended that **children older than two should restrict usage to one hour per day if they have any physical, mental, social, or academic problems, and two hours per day maximum if they don't** (Children, adolescents and advertising. Committee on Communications, AAP 2006).
- Further evidence suggests **some parents may have technology addictions** (Horvath C 2004), and Adult Internet Addiction has been proposed for inclusion in the Diagnostic and Statistical Manual 5th Edition (Block J 2008).

- Mounting research evidence suggests that **childhood is the optimal time to influence determinants of social and emotional wellbeing** (Willms J 2002), with recent research demonstrating that prevention programs in childhood can reduce the prevalence of mental disorders, while also addressing causal factors. For example targeted parent training within disadvantaged families can significantly reduce subsequent prevalence of behavior disorders in children, while also improving educational and social outcomes (Waddell C 2007).
- These facts **support implementation of school based technology management programs, teaching children how to balance activities they need to grow and succeed, with technology use.** A randomized controlled trial of a 6-month classroom curriculum to reduce TV and video game use resulted in not only statistically significant reduction in technology use, but also showed relative decreases in obesity (Robinson R 1999).
- With researchers advocating for increased services for children to address increasing prevalence of child mental health disorders (McEwan K 2007), and solid evidence that many of these disorders may be related to technology overuse, it seems warranted that the health and education sectors participate in **routine technology screening and management programs** (Rowan C 2010).
- **Balanced Technology Management is a concept where adults manage balance between activities children need to optimize growth and success, with technology use** (Rowan C 2010 and www.zonein.ca).
- Health and education professionals may want to consider an **Unplug – Don't Drug policy** where prior to costly diagnosis and medication of child behavior, the child and family undergo a three month supported technology unplug trial. Alternatively, the medical profession may consider routine technology usage histories for all their clients (Rowan C 2010).

Playgrounds and Nature – Epicenters for Development, Learning and Behavior

- **Many of today's parents perceive outdoor play is 'unsafe'**, even though most crimes against children are instigated by family members (Burdette H 2005), limiting essential developmental components usually attained in outdoor rough and tumble play.
- **Exposure to "green space" results in a significant reduction in ADHD**, in both areas of impulse control and attention ability. Nature not only has attention restorative benefits, but also activates all the senses to enhance multi-sensory learning ability (Faber-Taylor A 2001, Kuo F 2004).
- Studies have shown that **access to "green space" for 20 minutes per day significantly reduced ADHD symptoms**, yet drug use continues to climb. Inner city children suffer from ADHD at three times the rate of children in rural areas (Kuo F 2004).
- **Participation in physical activity is positively related to academic performance in children** (Singh et al., 2012).
- **The health effects of "forest bathing"**, or taking walks in the woods, are measured in several recent studies. Subjects in a study by Qing Li and his colleagues take a walk in a forest park in Saitama prefecture, north of Tokyo, Japan, in September 2010. The sample size is small, but the results indicate that **time spent in forests may have such salutary effects as lowered blood pressure and noradrenaline levels** (Philips, 2001).
- There is a **positive correlation between physical activity and seven categories of cognitive performance:** perceptual skills, intelligence quotient, achievement, verbal tests, math tests, developmental level, and academic readiness. Studies show that a reduction of 240 minutes per week of academic class time, replaced with increased time for PE, led to higher math scores. Adding PE time alone does not improve grades, it's vigorous exercise that improves cognition e.g. climbing walls, exercise bikes, tread mills, dancing (Ratey J 2008).
- **Students with greater than 15 minutes per day of recess had teacher reports of better classroom behavior.** 30% of 3rd graders had little or no recess (< 15 minutes per day) and 40% of schools surveyed had cut back at least one daily recess period. Since the 1970's, children have lost 12 hours per week in free time (Barros R 2009).
- **Licensing and fear of litigation has dramatically changed playgrounds to boring and developmentally unchallenging structures.** Merry-go-rounds, tall swings and slides are all a thing of the past. Many daycare and preschool environments have eliminated swings altogether (Rowan C 2010).

- Injury accounts for 40% of all childhood death, but – **environmental modifications reduce 50-75% of injuries and therefore playgrounds can be designed to be safe** (Howard A 2010).
- **Canadian Standards Association (www.csa.ca) sets rules for playgrounds and if followed, halves the injury rate.** Safe Kids Canada (www.safekidscanada.ca) has a number of resources and information (Howard A 2005).
- **U.S. Consumer Product Safety Commission has published detailed guidelines for playground safety**, which specifically address requirements for raised play platforms and protective playground surfaces. CPSC has produced a handbook for public playgrounds and a playground safety checklist (U.S. Consumer Product Safety Commission).
- **Risk factors for severe playground injuries are associated with falls from playground equipment.** Majority of playground injuries are sustained when falling from heights greater than 1.5 meters onto inadequate falling surface (MacArthur C 2000).

Biography

A frequent guest on both radio and television, Cris Rowan is a well known and impassioned speaker on the topic of the impact of technology on child development and learning. Cris has provided over 200 workshops to health and education professionals throughout North America, and authors the monthly Zone'in Child Development Series newsletter. Cris is CEO of Zone'in Programs Inc. offering products, workshops, training and consultation services to reverse the effects of technology on children. Cris is author of the following policy initiatives: Unplug – Don't Drug, Creating Sustainable Futures Program, and Linking Corporations to Communities. Cris recently completed her first book *Virtual Child – The terrifying truth about what technology is doing to children*. Cris promotes the concept "Balanced Technology Management" where adults manage balance between activities children need to grow and succeed with technology use.