

# On the Health Risks to Children from WiFi and iPads<sup>1</sup>

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Children's health is at risk from everyday wireless digital technologies. WiFi technology in iPads, wireless routers, and access points emit non-ionizing microwave radiofrequency radiation (RFR). The safety standards for such devices are based on the proven thermal or heating effects of microwave radiation exposure in adults, but not children. However, there are also significant and much more worrisome non-thermal effects. Between 1969 and 1976 the U.S. Naval Medical Research Institute identified over 3,700 research studies that found both types of effects. Thus, scientists have long been aware of equally harmful non-thermal effects from RFR exposure. Nevertheless, industry-funded scientists continue to hold that non-thermal effects do not exist based on obsolete theories. UK policy makers and Public Health England (PHE) follow the industry line and ignore the vast body of peer-reviewed scientific research that gives lie to its claims of safety.

## What are the health risks of WiFi?

A significant body of independent research studies since 1976 have demonstrated that low-intensity RFR, such as WiFi, elicits a range of risks to health in experimental animals and humans. The three main categories of serious health effects are:

1. **General Health Impacts:** Oxidative stress, apoptosis, low sperm count and sperm quality, immune dysfunction, cardiovascular effects, miscarriage, asthma, blood-brain barrier breaches, and Electromagnetic hypersensitivity (EHS).
2. **Neuropsychiatric effects:** Cognitive processing effects (affecting learning), altered brain development, sleep disturbance, insomnia, headache, depression, depressive symptoms, fatigue/tiredness, obesity, ADHD, Alzheimer's Disease.
3. **Cancer:** Ipsilateral gliomas, meningiomas, acoustic neuromas, salivary gland tumors, and a range of others, as RFR is also a co-carcinogen.

Recently two published reviews have analysed and presented the findings of over 100 peer-reviewed studies that confirmed the health effects of low-intensity exposure to WiFi RFR.<sup>1</sup> This is why parents, educators, and governments should be alarmed over the unquestioning acceptance of wireless digital technologies in the classroom and the home.

## Why doesn't the UK Government act to protect children?

UK policy makers must bear direct responsibility for putting children at risk, as they ignore the findings significant body of independent research. Instead they continue to offer 'boilerplate' responses to parents and concerned researchers that reference safety guidelines from the International Commission on Non-ionizing Radiation Protection (ICNIRP) and other related sources. The ICNIRP's guidelines focus on technical issues and present safety recommendations for the thermal effects of non-ionizing radiofrequency radiation on adults. They effectively ignore or deny the existence of non-thermal effects on adults and children.<sup>2</sup> Both the ICNIRP and the related EU Scientific Committee on Emerging and Newly Identified Health

Risks (SCENIHR) are 'captured' organisations—that is they are heavily influenced by industry-funded researchers and industry itself. Take, for example, that scientists from the ICNIRP, who are also members of SCENIHR, have well-acknowledged conflicts of interest due to their close ties with industry. An Italian court judgement recently underlined this and dismissed research reviews by both committee.<sup>3</sup> Furthermore, independent peer-reviewed research continues to identify the research deficiencies in both ICNIRP and SCENIHR reports. PHE and UK policy makers possess a fundamental ignorance of large body of extant research on the significant non-thermal health effects. As in other areas of UK life, the State end up either ignoring, or is deficient in protecting, the rights and well-being of children.

## What are the deep flaws in the UK EdTech strategy?

It is remarkable, but not surprising, that the government's EdTech strategy for Schools, whose objective is to integrate ICT into teaching, learning and assessment practices, is not based on scientific research. The UK is building its digital education strategy on belief and hype, mainly from big technology vendors, rather than scientific findings.

In 2015, I wrote a research review paper for the Teaching Council of Ireland and presented its findings at their annual conference. I updated the paper in December 2019, and titled it *A Critical Review of Digital Technology in Education that should give Policy Makers and Educators Pause for Thought*, its central findings are based on up-to-date peer-reviewed scientific research. It concludes that:

1. The LED screens in iPads lead to sleep disruption and deprivation (through melatonin reduction), which impacts on learning, and is associated with obesity.
2. The use of LED screens also lead to computer vision syndrome and myopia: Take, for example, that China has seen a large increase in myopia and is curtailing the use of tablets in education;
3. Computer use in class disrupts the learning process and impairs learning outcomes for users and non-users alike;
4. Learning with books and paper is superior in comparison to learning with e-books or iPads;
5. Taking notes with pen and paper, as opposed to touch typing lecture notes in class, leads to better learning outcomes and exam performance;
6. Smartphone, iPad and laptop use in class result in student distraction and multitasking, which impair learning and may lead to Internet addiction disorder and other psychological maladies.

So are there any benefits from using digital technology, such as iPads, in the classroom? The simple answer is that there is very little upside and a very big down-side to technology use in the classroom. First, it is significant that there is no current scientific evidence that attests to an overall benefit to learning outcomes from iPads, for example. It would appear that, in a general context, the benefits of digital learning only emerge when teachers employ digital technology.

Nevertheless, there may be benefits from digital technology in limited learning scenarios, particularly where blended learning is employed. Take, for example, that university students learning programming receive formal instruction in the laboratory and access tutorials on YouTube to deepen their understanding. There also appears to be significant benefits from digital technology to children with learning disabilities. Further benefits are identified in studies which "suggest that interactive apps may be useful and accessible tools for supporting early academic development in certain areas."<sup>4</sup> However vague this conclusion, it makes sense. Children can learn from a variety of

media. The problem is, however, one of transferring digital skills to the analogue world in which children live. Thus, when it comes to iPads: "The majority of the apps [reviewed] aimed to teach children the basics about numbers and letters. Overall, they were drill-and-practice-style, based on a low level of thinking skills, thereby promoting rote learning, and were unable to contribute to a deeper conceptual understanding of certain concepts."<sup>5</sup>

Minor benefits aside, school principals, teachers and parents should take note of the following conclusion from Andreas Schleicher, OECD Education Director who reports that "The results [of the OECD PISA study] show no appreciable improvements in student achievement in reading, mathematics or science in the countries that had invested heavily in information and communication technology (ICT) for education."

### **Why does WiFi have no place in the classroom?**

The roll-out of WiFi in primary and post-primary schools is in support of the Holy Grail of digitizing education. However, as with the research referenced earlier, the vast majority of peer-reviewed scientific studies conclude that WiFi puts those exposed to its RFR signals at significant health risks, even at low exposure levels. This is beyond question in 2020—except by those in the industry who are benefiting economically. Thus, policymakers in government, school boards, and health agencies have a moral responsibility to objectively and independently assess all research studies and not simply take the word of industry, conflicted scientists, or lobbyists. If they had taken a considered approach, we would not be seeing WiFi installed in schools.

Few policymakers understand why in 2011 the WHO's International Agency for Research on Cancer (IARC) classified RFR, such as WiFi, as a Class 2B carcinogen. RFR's status as a major environmental toxin and carcinogen has been confirmed in numerous studies since. A recent scientific review of RFR studies and the link with cancer is unequivocal and states that "[m]obile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A)". However, new experimental and epidemiological research has scientists conceding that it should be reclassified as a Class 1 human carcinogen.

A large number of related studies also recognize RFR as a potent environmental toxin, due to its ability to cause oxidative stress in animal and human cells. The relationship between non-ionizing RFR and oxidative stress in human cells of all types is significant. The vast majority of studies identify oxidative stress as the mechanism through which cancer and a range of other health ill-effects occur through RFR exposure. Of particular concern here are the effects on children's neurological and psychological development caused by RFR exposure—paradoxically, these impact learning.

The majority of animal studies have demonstrated that RFR's effects begin in the womb, when embryos' brains and bodies are developing. Pre-natal and post-natal exposures to RFR put the fetus and infant at high risk, due to their sensitivity to oxidative stress and its ill-effects. Indeed, one epidemiological study on 913 pregnant women in the US demonstrated that relatively high, but normal, exposures resulted in three times the normal incidence of miscarriage in those women with the highest

exposures. More significantly, children born to women with high RFR exposures were 5 times more likely to be obese, and under 3 times more likely to be asthmatic or suffer from ADHD. These findings have been replicated in the majority of related animal studies, with the added findings that cognitive processes and memory, which impact the ability to learn, and general neurological functioning were abnormal in animals exposed to RFR, when compared to the control groups, in experiments. The implications for children are grave.

As with any environmental toxin, the risks related to WiFi RFR exposures increase with the frequency and duration of such exposures over time. Unlike other carcinogens, WiFi RFR is truly ubiquitous: it radiates from multiple personal and other WiFi devices, routers and access points, in the home, public spaces, hospitals, cars, and now in the school. Thus, exposure to this carcinogen and general toxin is of high frequency and long, if not continuous, duration. This maximizes the risk of persistent and continuous oxidative stress and, hence, exposure to ALL the health risks listed earlier. Children are particularly vulnerable to such threats, which have a high impact, and therefore significant risk. Hence, scientists and medical practitioners globally are of the opinion that WiFi devices, such as iPads should not be used by children in the home or school, due to the high level of risk they pose to health and well-being, either through the blue light from Led screens, which decreases melatonin, a potent anti-oxidant in combating oxidative stress as well as a sleep regulator, or the RFR from its WiFi radios, which exposes them to the significant risk of non-thermal health effects. However, the exposures from WiFi routers and other devices, even toys, are also significant and to be avoided, minimized, or eliminated altogether.

### **Is Riskless Digital Learning Possible?**

The UK Government has a moral imperative and a legal obligation to apply the precautionary principle where the health risks of WiFi in the classroom is concerned. It fails to understand that the benefits associated with digital learning can be delivered without WiFi. Computers and iPads can be easily wired, using standard Ethernet or fibre optic technologies. Devices could also be used in airplane mode. Benign wireless alternatives to WiFi also exist: visible light communication or VLC technologies, also called Li-Fi, now offer viable wireless solutions at far less risk to children. This is common sense.

True change requires a transformation in government thinking, however. This is not impossible. In 2019, based on scientific evidence, the US State of Oregon declared a WiFi "emergency" and introduced new legislation which, *inter alia*, states: "The Department of Education shall develop recommendations to schools in this state for practices and alternative technologies that would reduce students' exposure to microwave radiation that the review...identifies as harmful." The UK needs to follow Oregon's lead, and make its classrooms safe digital havens for its children. To achieve this will require policymakers to be open to independent, rigorous scientific findings and have the courage to reject industry claims of safety that are legitimized by captured agencies. In the meantime, parents, teachers and school principals need to arm themselves with knowledge and have the courage to say no to misinformed and misguided government policymakers in order to protect the health, well-being and educational future of their children.

<sup>1</sup> See Pall M. Wi-Fi is an important threat to human health. *Environ Res.* 2018;164:405-416. <https://doi.org/10.1016/j.envres.2018.01.035>. Wilke I. Biological and pathological effects of 2.45 GHz on cells, fertility, brain and behavior. *Umwelt Medizin Gessellschaft.* 2018;31: 1-32.

<sup>2</sup> Starkey, S. J. (2016). Inaccurate official assessment of radiofrequency safety by the Advisory Group on Non-ionising Radiation. *Reviews on environmental health*, 31(4), 493-503.

<sup>3</sup> [https://www.diritto24.ilsole24ore.com/\\_Allegati/Free/Ca\\_torino\\_vers\\_1.pdf](https://www.diritto24.ilsole24ore.com/_Allegati/Free/Ca_torino_vers_1.pdf)

<sup>4</sup> Griffith SF, Hagan MB, Heymann P, Heflin BH, Bagner DM. Apps as learning tools: a systematic review. *Pediatrics.* 2020 Jan 1;145(1).

<sup>5</sup> Papadakis S, Kalogiannakis M, Zaranis N. Educational apps from the Android Google Play for Greek preschoolers: A systematic review. *Computers & Education.* 2018 Jan 1;116:139-60.

