Wireless Systems and Health Risks – Implications for Educational and Pedagogical Practices

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Wireless devices enable place independent communication and thus provide usability and learning advantages. However, wireless information systems and networks are often installed without proper discussion about health implications. Similarly, there is seldom discussion where it is allowed to use wireless devices and how the radiation exposure can be kept minimal. The electro-magnetic fields (including microwaves) related possible health risks will be illustrated in the actual presentation through research findings, demonstrations and radiation measurements. The question here is how wireless information systems can be implemented risk-free in public organisations like schools and libraries. Therefore, this presentation contains pedagogical design discussion and recommendations from our earlier work at the mobile learning research area. The 'Health risks and wireless technologies?' session in the Online Educa Berlin starts with this short overview and continues with a general discussion session.

Introduction

Mobile devices and wireless networks are part of our everyday life. Often these network infrastructures consist of many overlapping technologies like Bluetooth, Wi-Fi, GSM and 3G. From usability and accessibility perspective, Luff and Heath (1998) separate these layers to micro-, local- and distant mobility. Quite often citizens are connected or exposed to many wireless networks simultaneously.

In Europe, the European Union has actively provided spectrum for ever increasing demand for new wireless network:

> Wireless communications is one of Europe's most dynamic technology sectors and underpins European society in areas as diverse as transport, security and environmental protection. The entire industry relies on radio spectrum – a 'raw material' in short supply. (EU, 2006)

This statement of EU officials emphasises environmental protection, but what about humans? How should these technologies be applied and used in a healthier way? Should all areas be covered with these networks or should there be zones without network coverage? This discussion has emerged especially since the European Environment Agency (EEA, 2007) recommended precautionary principle and indicated health risks in wireless technologies.

When thinking about public services, many wireless initiatives propagate the virtues of mobility and creativity by installing hot spot to schools, libraries and parks in a cloud like manner. The users of these public services are often children; therefore we will next take a closer look at health risks.

Health risks and recommendations

Children may be more vulnerable [to microwave radiation] because of their thinner skulls, their still developing nervous systems, their increased levels of cell division, and their less robust immune systems. (Hyland 2000, BioInitiative 2007, Wiart *et al*. 2008). However, children's long-term microwave exposure has not been adequately researched. Most of the research has focused on adults. Currently (in October, 2008) a large research project called INTERPHONE by WHO has not yet provided the final report and the research community has many conflicting views on risks.

The current guidelines for the pulsed microwave radiation are defined by The International Commission on Non-Ionizing Radiation Protection (ICNIRP, 1998). However, these guidelines are rather old, which leaves some open questions:

> Although safety guidelines—to which mobile telephones and their base-stations conform—do protect against excessive microwave heating, there is evidence that the low intensity, pulsed radiation currently used can exert subtle non-thermal influences. If these influences entail adverse health consequences, current guidelines would be inadequate. (Hyland, 2000, 1833)

In other words, the current ICNIRP guidelines only restrict the intensity of the radiation to prevent tissue heating in excess of what the body's thermoregulatory mechanism can cope with. This may be problematic, since 70 % of independently funded research is finding biological, non-thermal effects (Huss, 2007). The European Parliament (1998) recently described these guidelines 'obsolete'.

In adults the radiation induced by mobile phones has been reported by ECOLOG (2000) and the BioInitiative (2007) to affect negatively for example cognitive functions, cell communication and fertility. Of course, there are opposite results that indicate no such risks (e.g. MTHR 2007, Valberg *et al*. 2007). Currently the non-industry funded research differs in the amount of positive results from industry funded research (Huss *et al*., 2007). Based on current research findings, France has recommended as a precautionary approach that parents should not purchase a mobile phone to their children and adults should use a hands-free equipment (Reuters, 2008). In Germany several states recommend not to install Wi-Fi (aka WLAN) to schools and universities (Bundesregierung, 2007). Just recently the University of Pittsburgh Cancer Institute recommended caution with wireless technologies (2008). This discussion about tumours and mobile phones continued in September 2008 in the US Congress (US Congress, 2008).

In conclusion, there is no conclusive evidence of adverse health effects. But, the research has not shown wireless devices and networks to be safe, either.

Pedagogics and educational design issues

We have earlier worked with adaptive portfolios (Ahonen and Syvänen, 2005) and mobile architecture development (Syvänen *et al*., 2005) in the EU IST MOBIlearn project.

Based on our experiences, we would provide following recommendations:

If wireless connections pose even a minimal risk, their usage hours should be kept as minimal as possible. This is possible by using applications which do not constantly need wireless connection to the network. The wireless devices can be used in the off-line mode to make notes, take photos and record sound to support problem-based and collaborative learning. If the wireless data connection

(GPRS, 3G Data, Wi-Fi) is used, it should be short and well-planned. The Wi-Fi routers can be installed with directional antennas that do not cover the whole building. Similarly, the distance of user to access points and devices should be maintained long enough, and the wireless device should definitely not be pressed against body or head when the wireless connection is on. In schools and libraries a more sustainable alternative might be to provide enough Ethernet-cable slots instead of Wi-Fi (Le Figaro, 2007). Similarly, there may be a need for docking stations for PDAs and mobile phones (Soloway, 1999). Unnecessary exposure should be avoided, so we would even recommend that children would have their mobile phones shut down during school days.

> "Experience of mobility is embedded in an experience of temporality which includes mutually negotiated rhythms of contact, availability and accessibility" (Churchill & Wakeford, 2002, 173).

These practices may need some extra planning, but the end result may even provide time management advantages for teachers and students. Our presentation in the conference will provides more concrete examples of these practices.

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