Using Eco-Sensors to Support Children’s Participation in Environmental Health

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ABSTRACT

School has a major role in preparing young people to participate meaningfully in a context where digital technologies are increasingly mediating the way people interact with the surrounding environment. The goal of the research reported in this paper is to study how children can participate in school environmental health, using eco-sensors and digital technologies in scientific inquiries. Eco-sensors are used by children to acquire, analyze, interpret, and communicate data, as a support to the identification of problems and to their own environmental health decisions. This paper presents two case studies, one centered on noise and one on indoor air quality, in Portuguese elementary schools. It is a qualitative research that highlights that children can participate in authentic and meaningful environmental health problem solving in schools. Problem solving is developed through scientific inquiries that include children epistemic practices, scaffolded by teacher mediation and epistemic mediators, such as eco-sensors and other digital technologies.

KEYWORDS
Air Quality, Children, Electronic Sensors, Environmental Health, Epistemic Practices, Participation, Sound, Teacher Mediation

INTRODUCTION

The Portuguese National Plan for School Health acknowledges schools’ environmental risks, namely air (indoor and outdoor) and water quality, climatic (dis)comfort, solid wastes, and transportations (von Amann, 2015). This Plan for School Health recommends the participation of teachers and students, namely in environmental health projects, to improve the school environmental health. Accordingly, the research project “Eco-sensors for health: Supporting children to create eco-healthy schools (Eco-Sensors4Health)” aims at supporting elementary schoolchildren, in communities of practice (Lave & Wenger, 1998) to participate in the enhancement of Portuguese schools’ environmental health. In the context of the Eco-Sensors4Health project, the goal of this research is to develop and analyze two case studies, centered on noise and indoor air quality, in which eco-sensors are used to support children in identifying and suggesting solutions to such school environmental health problems, developing in this way digital and environmental health competences.

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The concept of environmental health is centered on creating health-supportive environments and encompasses the assessment and control of the environmental factors that can potentially affect health (World Health Organization (WHO), 2018). The Eco-Sensors4Health project, and this research, aim at improving environmental health in schools, through the assessment of environmental health problems by children and through children’s intervention on related environmental factors that may affect health. In this project, daily ICT, such as digital sensors support children participation and eco-innovation, towards the creation of healthy and sustainable schools.

In the last decade, the use of sensors, namely sensors embedded in mobile devices, such as tablets and smartphones, has become ubiquitous, at all times and in all places (Sagl, & Resch, 2015). Citizens acquire information about their environment and publish it in diverse settings, such as social networks, platforms of voluntary geographic information projects, citizen science projects, thus creating knowledge that influences decisions in social life, but also in political life and in science (Boulos et al., 2011; Elwood, 2008; Laituri & Kodrich, 2008; Zook, Graham, Shelton, & Gorman, 2010).

However, citizen science, or citizen sensing, can overcome the goal of having citizens equipped with low-cost sensors to acquire environmental and health data (Lupton, 2015). A critical approach to the use of sensors in health and environmental health promotion can empower citizens in controlling and using sensed data for change (Boulos et al., 2011; Castell et al., 2015; Lupton, 2015). The Senses@watch project (Gouveia, Fonseca, Câmara, & Ferreira, 2004) was a pioneer project in using citizen sensory data together with environmental sensors for environmental monitoring and change.

Since the beginning of the 21st century, and especially after the release of affordable and easy to use sensors, didactic sensors have been integrated in diverse children centered teaching activities (Druin, 2009). It is important to distinguish two main uses of didactic sensors: i) in platforms for physical computing and programmable tangibles (Blikstein, 2013); ii) in plug and play didactic kits of sensors for sensing the environment.

The use of didactic sensors in platforms for physical computing have been developed in the last thirty years, being twofold (Blikstein, 2013): from theory-driven development (e.g. Lego/Logo, Crickets, Topobo and Cubelets) to technology-driven (e.g. Phidget, Arduino). The plug and play didactic kits of sensors for sensing the environment are not centered on programming and robotics, they are centered on the acquisition of data in the context of mobile participatory environmental sense making activities (Rogers, Connelly, Hazlewood, & Tedesco, 2010; Silva et al., 2010).

Since the beginning of the century, tools such as mobile phones, as well as other environmental sensors were used in a participatory way to monitor environmental and health parameters in diverse projects (Silva et al., 2009; Rogers et al., 2005; Kanjo et al., 2008; Chamberlain et al., 2014). Our Eco-Sensors4Health Project research aims at promoting the use of electronic sensors by schoolchildren to acquire and read environmental data. This research also aims to find if children can analyze and interpret such data, and subsequently communicate the new knowledge, to support their own environmental health decisions (Boulos et al., 2011; Sheth, 2009). This way, this research intends to develop a scientific inquiry strategy to identify and solve environmental health problems, eliciting schoolchildren epistemic practices (Silva et al., 2013; Lopes, Branco, & Jimenez-Aleixandre, 2011; Kelly & Takao, 2002).

Teachers have a key role helping young people develop the critical thinking skills required to use technologies to support the processes of making sense of the context they live in and to actively participate in problem solving (Hague & Payton, 2010). This research illustrates how technologies can be used to foster young children’s capacities to interact with their surrounding environment taking action to solve everyday problems of their schools.

**METHODOLOGY**

This research used a qualitative approach centered on two case studies (Creswell, 2008; Yin, 2003), developed with primary school classes in Ciência Viva School (CVS), integrated in a science museum,
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