Integrated Paper–Based and Digital Learning Material for Smart Learners

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SMART LEARNING, SMART LEARNERS, AND INCLUSIVE LEARNING

Smart learners are lifelong learners (Leone, 2010) whose potential is unleashed by the seamless use of smart technologies (i.e., smartphones, tablets, tablet PCs, sensor network nodes, contact-less smart cards, RFID and QR codes) to access huge amounts of open resources and connections, anywhere anytime. Personal, and personalised, smart technologies increase a learner's independence in a novel way, and makes the context for engaging in study more tailored and potentially self-directed (Middleton, 2015).

Smart learning encompasses any teaching and learning approach that flawlessly accommodates technology and enhances practice through social uses of new inclusive spaces. Fruitful interactions are the core of a smart learning cycle and are supported by a smart learning environment (Liu, Huang & Chang, 2015). Indeed, the current digital learning environment is gradually evolving into the smart learning environment (Li, Chang, Kravcik, Popescu, Huang, Kinshuk & Chen, 2015), that is a user-friendly space that facilitates easily accessible, appealing and effective learning. A learning environment may be considered smart when it includes adaptive technologies or innovative features and capabilities that improve understanding and performance. Specifically, features of smartness are

1. Conversational support for learners, teachers and designers,
2. Dynamic updating of student profiles, resources and databases, and
3. Automatic [re-]configuration of interfaces to adjust to different learners and learning situations (Spector, 2014).

The concept of smart learning includes that of ubiquitous learning (uLearning). The only difference stands in the higher power of next generation (smart) technologies that are creating disruptive learning landscapes and learners' profiles.

Today's students expect always-on, available-anywhere information and personalised, multichannel learning. The term "classroom" is becoming more figurative than literal (IBM, 2015). In a smart learning environment the physical and virtual dimensions merge (Liu, Huang & Chang, 2015), and learning is inclusive.

Inclusive education is an essential component of lifelong learning; it is concerned with an individual's effective participation in society and with the achievement of his/her full potential. The affordances of new educational technologies can enable the development of uLearning environments and of multimodal learning contents that foster inclusion, personalisation and interaction, provided that a learner-centred and technology-enhanced approach is adopted.

Internationally, inclusive education is increasingly understood more broadly as a change, in a holistic approach, that supports and welcomes diversity (in race, economic status, social class, ethnicity, language, religion, gender, sexual orientation and ability) amongst all learners (UNESCO, 2009).

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Since learning takes place in many contexts, formal, non-formal and informal, inclusive and quality education become synonyms and are vital for the development of more inclusive societies.

Specifically, quality learning is characterised by two important components: the learner's cognitive development, and the promotion of values and attitudes of active citizenship and/or of creative and emotional development.

An inclusive curriculum is based on the four pillars of education for the 21st century – learning to know, to do, to be and to live together (Delors et al., 1996). Promoting inclusion means stimulating discussion, encouraging positive attitudes and improving educational and social frameworks. This involves changes in content, approaches, structures and strategies in order to provide all learners with flexible and personalised learning to meet individual needs, abilities and learning styles.

uLearning, supported by the growing diffusion of wireless smart technologies and institutional policies, is becoming more and more a modality of flexible and participatory learning to be adopted in and out of the classroom exploiting smartphones, tablets, tablet PCs, sensor network nodes, contactless smart cards, RFID (El-Bishouty, Ogata, & Yano, 2007) and QR codes.

Thanks to this technological growth, a personal learning environment could be embedded in everyday life (Ogata & Yano, 2004) and become a Computer Supported Ubiquitous Learning (CSUL) environment, characterised by permanency, accessibility, immediacy, interactivity, situatedness and adaptability (Curtis, Luchini, Bobrowsky, Quintana, & Soloway, 2002; Leone & Leo, 2011a). Learning theories for CSUL are authentic learning (Brown, Collins & Duguid, 1989), situated learning (Lave, & Wenger, 1991) and learning by doing (Schank, 1995).

It is widely acknowledged that information and communication technologies (ICT) enrich the learning experience (UNESCO, 2012). Anyhow, the focus has to be placed on learning, rather than on technology in itself. In a technology-enhanced learning approach, the advantages arising from the integration of ICT in the learning curriculum have to be assessed within the learning experience, the usefulness of learning and its enhancements (Leone, 2008; Leone & Leo, 2011a).

Pedagogical and psychological researchers have debated for decades on a common understanding of "effective learning". According to recent literature (Bulu & Yildirim, 2008; Calvani, 2006; Ellis, 1999; Liu, Huang & Chang, 2015; Wasson, 2007), social interaction among learners is a major element of the learning process, indeed, it can decisively impact on learning outcomes (Agostinho, Lefoe, & Hedberg, 1997).

Cooperation is an essential factor in the construction of an "effective learning" environment since it engages students in knowledge construction through interaction and negotiation with their peers. Cooperation enables learners to discuss, argue, agree and reflect on ideas, principles and knowledge. In the design of a suitable – situationed, real – learning environment prior attention has to be paid to knowledge construction and effective learning, that is to learning relevant for learners (Johnson & Johnson, 1994).

Smart learning emphasises technology-embedded learning to enhance cooperation and interaction between learners (Bae, Shin, Kim & Choi, 2015).

This work aims to illustrate the *QRcode* format, a framework that supports uLearning by the integration of paper-based and digital learning material through Quick Response (QR) code. The format was devised within the research project *Learning4All* (2009-2012) and was validated by several learning experiences of English as a foreign language (EFL) for different clusters (Leone, 2014). Subsequently, the format was selected as element of techno-pedagogical innovation in the *Eureka* project (2012-2014), a network of 11 schools in Apulia, Italy, for the enhancement of curriculum continuity from middle into high school.