Chapter 12
‘Intelligent Context’ for Personalized Mobile Learning

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ABSTRACT
There have been significant developments in higher education resulting in interest in personalised educational provision. Concomitant with these changes is the evolving capability and ubiquity of mobile technologies. To facilitate personalisation and leverage the power of mobile technologies in mobile pedagogic systems identification of individuals is a prerequisite; this can be achieved using an individual’s profile (termed context). This chapter considers the background to context with related research. Context modelling, the processing of contextual information, context matching and the context matching algorithm, ontology, and the Semantic Web technologies are introduced. Context reasoning and inference in rule-based systems is considered and the context reasoning ontology is presented with scenario-based evaluation. The chapter concludes with a discussion, consideration of future research, and open research questions.

INTRODUCTION
There have been significant developments in higher education (HE) reflecting the evolving socio-economic and demographic make-up of the student population (Cullen et al., 2002); this has resulted in interest in personalised educational provision – albeit currently at an embryonic stage (generally) in virtual learning environments (VLE) such as ‘Moodle’ (Moodle, 2009). A trial of Moodle was successfully completed at Birmingham City University¹ in 2004 in a third year undergraduate degree module within

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the Department of Computing; subsequently it has been rolled out University wide over a distributed system in a wide area network (WAN) linking multiple campuses delivering a broad range of courses including computing, law, music, and the built environment. For a consideration of VLE see Britain & Liber (1999) and Cullen et al. (2002).

Birmingham City University is characterised by a very diverse student base in terms of attainment, demographics, cultural background, and needs from the HE experience, to reflect this a broad range of courses are offered from Bachelor level degrees to Masters and Ph.D. The online presence has demonstrated positive benefits for students by providing learning ‘on demand…anytime and anywhere’ as discussed in Goh & Kinshuk (2004), Rushby (1998), and MacKnight (1998). There were, however, additional lessons related to staff involvement in a VLE, as discussed in Weller (2002) teaching staff need to feel comfortable with the increased demands of a VLE [which are manifested in the need to monitor modules delivered in the context of a VLE and provide increased levels if interaction and feedback] for its use to be successful; this is not always the case which can be detrimental to overall process.

Historically, computerised pedagogic systems designed to address the changing HE environment have used networked and Internet-based approaches (generally termed ‘e-learning’). Over time developments in mobile technologies have resulted in a blurring of the distinction between the ‘e-learning’ and mobile learning (‘m-learning’) concepts, the terms frequently being used interchangeably (Coppola & Della, 2004; Kossen, 2005). In this chapter the term ‘m-learning’ will be used to refer to both ‘e-learning’ and ‘m-learning’ systems.

Concomitant with the interest in personalisation is the evolving capabilities of mobile devices. Mobile devices fall into two broad classifications: (1) laptop and mobile computers (which whilst mobile are not generally useable ‘on-the-move’), and (2) wearable computing devices (which typically include mobile phones, smart phones, and Personal Digital Assistants (PDA) which can be used in a wider range of environments — albeit characterised by a diverse range of constraints — whilst ‘on-the-move’). Additionally, there has been significant convergence in mobile devices and their capabilities resulting in a blurring of the distinction between the two classifications introducing increased complexity in the demands of mobile systems and applications.

The developments in mobile computing will “free users from the desktop” (Abowd et al, 1997) however mobile devices have constrained capabilities when compared with desktop alternatives including restricted display, restricted bandwidth and fluctuating availability (Lonsdale et al, 2003). Effective ‘m-learning’ demands that these limitations are addressed, an individual’s profile (termed context) offers the potential to mitigate the identified constraints and enable service provision compliant with user need in a format to suit available devices (Moore et al, 2008).

There has been significant research targeting m-learning, for example, Goh & Kinshuk (2004) have considered issues in the implementation of learning modules in ‘m-learning’ using a simple case study and postulate that “from e-learning to m-learning, mobile learning is going to be the next wave in the evolution of learning environments”. Goh & Kinshuk (2004) in observing that a number of mobile learning and teaching applications have been deployed and evaluated (see for example Luchini et al, 2002; Mifsud, 2002) conclude that while ‘m-learning’ can compliment e-learning by creating an additional channel of access for mobile users to engage in learning “anytime and anywhere” many issues regarding mobile learning have not been exhaustively researched.

Hokyoung & Parsons (2008) discuss recent developments in ‘m-learning’ techniques and related technologies, emerging innovations are considered with identification of appropriate pedagogies and technology usage methodologies.
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