Chapter 5
Designing Personalised Learning Resources for Disabled Students Using an Ontology-Driven Community of Agents

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ABSTRACT

The exploration of social artifacts for the disabled is an important and timely issue. The affordances of new technologies like the Semantic Web allow more intelligent handling of educational learning resources that open up the potential of personalisation of services to individuals. Contemporary legislation calls for "reasonable adjustments" and "reasonable accommodation" to be made to services in order to accommodate the needs of disabled people. Here, the authors examine, from a design perspective, how this might be done in the context of higher education. Specifically, they advocate a design based upon an ontology-based personalisation of learning resources to deliver to students' real needs. To this end, so far little effort has been directed towards disabled students in higher education. The authors note some of the problems and issues with online assistive/adaptive technologies and propose a methodological fix. Here, they propose an ontology-based methodology for a Semantic Web community of agents that personalises learning resources to disabled students in higher education, specifically highlighting a disability-aware Semantic Web agency development methodology. The authors also present the results of usability evaluation of the implemented visual interface with some disabled and non-disabled students.

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INTRODUCTION

An increasing number of disabled students worldwide enter into higher education institutions every year. In the UK for instance, the Higher Education Statistics Agency (HESA) estimated the number of such students in the 2007-2008 academic year to be about 62,510 (HESA, 2009). This increasing number makes delivering education online more challenging as disabled students may have varying requirements based on their specific needs. To solve this problem, educational institutions utilise assistive technologies to assist disabled students in their learning. The problem however is that some of these technologies are not compatible with some digital learning systems, resulting in an exclusion of some disabled students if the institutions cannot handle the disability (Steyaert, 2005). The Disability Discrimination Act (DDA) was enacted in 1995 and extended in 2005 to prohibit discrimination against disabled people. Service providers are thus required to make "reasonable adjustments" to their services to meet the needs of disabled people. The Special Educational Needs and Disability Act 2001 (SENDA) introduces the right for disabled students to have equal opportunities to contribute and benefit from education and not to be discriminated against. The Americans with Disabilities (ADA) Act 1990 also prohibits discrimination against disabled people. Higher education institutions amongst other solutions have resorted to personalisation of e-learning and other services.

The problem of searching and retrieving online information continues because the current Web is not meaningful and hence using search engines to retrieve information is in some cases a difficult task as the results are often numerous and sometimes irrelevant. To solve this problem, there is need to provide students with personalised resources that meet their needs. To accomplish this, intelligent and semantically rich agents forming a community or society of agents (Minsky, 1986) which could empower the students based on their needs and requirements analyses are therefore needed. The semantic Web offers a solution as it is by its nature more meaningful. Hence, researchers are currently using semantic Web technologies to personalise learning and services (e.g. Brut & Braga, 2008; Henze, et al., 2004; Nganji, et al., 2011; Razmerita & Lytras, 2008) and to facilitate search and retrieval of information. However, as semantic Web technologies are used for personalisation, little seems to be done to consider the needs of disabled people and to personalise services for them thus inaccessibility problems continue, requiring more robust agents that understand their needs. The difficulties encountered in presenting learning resources using the current non-semantic Web which is based on HTML can now be resolved using the more meaningful semantic Web particularly with technologies such as Web ontologies. In order to successfully integrate assistive technologies with online learning environments in a way that will be suitable for disabled students, the integration must be based on an architecture that is disability-aware, using an approach that includes the needs of disabled students. In this light, this study proposes a personalisation approach based on a disability ontology containing information on various disabilities, which can be used to present disabled students with learning resources that are suitable for their specific needs, following a disability-aware Semantic Web agency development methodology. This chapter will therefore focus on presenting a disability-aware and agent-based methodology for designing personalised learning resources for disabled students. The fact that disabled students are emphasised does not mean that this methodology cannot be employed to personalise learning for non-disabled students. It will be shown in the results section that this methodology can be effectively employed to meet the needs of all students regardless of their disability status (disabled or non-disabled), thus being inclusive of all learners.