Chapter 72

Facilitating Learning Resource Retrieval for Students with Disabilities through an Ontology-Driven and Disability-Aware Virtual Learning Environment

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ABSTRACT

Existing virtual learning environments (VLEs) in educational institutions are not designed with the expectation that students with disabilities will use them. Consequently, retrieving relevant information by some students with disabilities is a challenging task. The focus of this study was to propose the design of VLEs to incorporate ontologies that facilitate information retrieval by students with disabilities in their learning, thus serving as a semantic web-based assistive technology in education. An Ontology-Driven Disability-Aware Personalised E-Learning System (ONTODAPS) was designed and then used to recommend specific learning materials to learners based on their learning goal and disability type. Preliminary results of the evaluation of ONTODAPS, by 30 students with disabilities, indicate that 70% of the participants found ONTODAPS to offer a better personalisation, better access to learning materials (68%) and is easier to use (63%) in retrieving learning materials than Sakai. Thus ONTODAPS serves as an assistive tool in their education through retrieval of relevant learning materials in a suitable format which is compatible with their disability.

INTRODUCTION

The advent of modern information and communication technologies (ICTs) and the Internet have brought numerous opportunities in education, especially the way learning is delivered. Educational institutions are now able to deliver courses online, which can be accessed from anywhere, provided the learner has the requirements to access these courses. What makes it even better is that the learner can access learning materials at any time. The learner now has control over his learning schedule and pace (Lau et al., 2014). Thus, e-learning, which involves using information and communication technologies in learning is not bound by a physical environment nor is it by time.

The Semantic Web (e.g. Berners-Lee et al., 2001) provides an exciting context to look at what can now be achieved using knowledge aware software. It allows a new use of Artificial Intelligence and its ability to produce smart solutions. Thus here we wish to look at e-learning in the context of how semantic based technologies can be used to significantly realise information handling and retrieval as well as communication and presentation.

Educational institutions are increasingly offering courses online, even lecturers who teach in a physical classroom upload lectures and other course materials to a virtual learning environment (VLE) for students to access in their own time. Some of the classroom activities and assessment, as well as interactions are also being translated into the VLE. In fact, in the United Kingdom, educational institutions are being encouraged to adopt educational technology in teaching, learning and assessing learning (Gordon, 2014). This mix of traditional learning with technology-enhanced learning is known as blended learning. Blended learning is not only satisfactory to students in how it enhances learning, but also improves teaching (Back et al., 2014). Interactivity is increasingly an important factor in VLEs. This interactivity in VLEs helps compensate for the absence of face-to-face communication (Sun & Hsu, 2013). Students can carry out group discussions online through forums and chats while lecturers can assess students through online quizzes and also give feedback online. Innovatively, students can also be engaged in peer assessments (Gordon, 2014). Today, the online learning environment is getting more and more interactive and popular. In interactive VLEs, students can communicate with lecturers via email or through forums.

E-learning has numerous advantages not only for students without any known disability or special needs, but has great advantages for students with disabilities. Some of the barriers that some students with disabilities could encounter in a physical classroom could be non-existent in the virtual learning environment. It is known that the use of video in classrooms may not be very beneficial for students with visual impairments who cannot see the video and rely only on audio which may not fully explain what is going on. On the other hand, a student with hearing impairment may not understand a video when there are no captions. In the virtual environment however, a full transcript of the video could be accessed by a student with visual impairment while captioning could be very beneficial to a student with hearing impairment. An important consideration for online videos for students with hearing difficulties could be the use of streaming videos with subtitles (Debevc et al., 2014).

Although e-learning has numerous advantages for students with disabilities, it poses significant difficulties when those who design such environments and those who use it to deliver courses do not take into consideration, the needs of students with disabilities. An example is when designers of VLEs fail to provide a good description of images or do not provide any description, making it difficult for visually impaired users to understand information presented in the form of an image (Nganji et al., 2013). When

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