Beyond Learning Objects - Dynamic adaptation in learning scenarios for lifelong learners

Systems that support lifelong learning help work-based learners to accomplish their goals and tasks while keeping abreast of ongoing changes in their fields. They can also guide the learner in improving their skills and competency levels for a particular work-based environment (Sharples, 2000: Jarvis, 2008). The notion that "what I learn in school will get me through my entire working life" no longer exists. As a consequence, work-based learners need continuous learning support to update their occupational skills and knowledge or to learn new occupational competences. For technology enhanced learning, it is a major challenge to develop learning environments that effectively enable each learner to get individualised support in filling ever-changing skills and competence gaps; i.e. to create environments for personalised adaptive learning (Aroyo et al., 2006).

Current learning management systems (LMS) are used to deliver learning content; however, they usually have limited adaptive functionality and hence do not fully consider the diversity of learners. A recent study was conducted in six European countries to gather personalization and adaption needs among corporate learners and training providers. According to that study, an adaptive learning system has an added advantage over a non-adaptive system due to its personalized nature in supporting work-based learners (Hover & Steiner, 2009). An important component of an LMS is the learning objects (LO) that encapsulate various goals. However, in order to construct an intelligent and adaptive LMS according to the needs of lifelong learners, we must go beyond the concept of the LO and consider learning scenarios in a broader vision of learning activities (Ruis et al., 2008).

The idea behind LO-based systems is to enhance the efficiency of learning processes and human performance in work-based learning. Current learning standards and specifications include IEEE LOM (Learning object metadata), which gives information about the contents or the format of the learning object, and IMS-LD (Instructional Management Systems Learning Design), which focuses on the activities. Neither approach captures sufficient information for personalization of the learning process, which requires an awareness of context. When learning content is presented to lifelong learners, many assumptions are made about the learners and the conditions of their learning, which include the experiences, skills, and competencies of the learners, their personal preferences, learning styles, goals, motivations, time availability and so on. These factors all contribute to context (Jovanovic et al., 2006), which may also include special needs, so that lifelong learners "can make the most of their talents, irrespective of their physical and mental disabilities" (Kay, 2008). Specific issues in explicitly representing context in design include the limited size and complexity of metadata: (the amount of metadata is usually small and either too open, with non-specific words such as 'Learning', or too closed, with excessively specific descriptions), prediction of information at design time and reusability of the content at different levels of granularity (Jovanovic et al., 2006). However, the concept of a learning scenario provides a model of an expected sequence of events to achieve a learning goal within the LMS (Ruis et al., 2008).

In order to achieve dynamic adaptation, we might adopt an ontology based approach for defining the behaviour of all the elements involved in every scenario (Ruis et al., 2008). One definition of ontology in the field of computer science is given by Gruber (1993), who defines ontology as "an explicit specification of a conceptualisation". An ontology provides the vocabulary for referring to the terms in a particular domain. It also defines some logical

statements that describe what the terms are, how they are classified as well as some rules for combining terms and relations to define extensions to the vocabulary (Hendler, 2001). In personalised LMS, reasoning rules are used for some specific adaption purposes. These rules query learning resources and metadata, and reason over distributed data and metadata descriptions. A major step for reasoning is to get information about the learning process while applying any adaptation rule (Henze et al., 2004). Thus different types of ontologies may be used together to model a learning process across a LMS. Current literature on how ontology-based systems can possess the necessary flexibility to respond to dynamic learner activities is limited. Therefore, further study of the application of ontology to LMS is needed.

This article has presented a need to explore ontology-based systems with the aim of supporting dynamic adaptation in learning scenarios of LMS. Work is needed to identify the main concepts used in adaptive learning processes within the domain of lifelong work-based environments, which might be represented as ontologies. We may then leverage these ontologies to develop personalized and adaptive LMS environments for work-based lifelong learners.

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