Chapter 6
Do Current Standards Support Adaptive Sequencing Interoperability?

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ABSTRACT

In the complex world of e-learning, there are many aspects to consider: administrative issues (e.g. keeping track of the courses of a student), technical issues (e.g. packaging learning content in a platform-independent way), and academic issues. This chapter concentrates on one of the latter, namely the problem of adaptive sequencing. This problem can be stated like: given a student and a set of learning resources, find the optimum sequence for his or her special characteristics, goals, needs, and background. An appropriate sequencing, adapted to the student, has a positive impact on motivation and learning, hence its importance. However, this is a problem that has not been yet carefully considered in any standard or specification, hindering interoperability among platforms that adapt the sequencing of learning content to their users. This chapter reviews the two specifications most relevant for the standard expression of adapted sequencings: IMS Simple Sequencing and IMS Learning Design. The strong and weak points of each specification are highlighted, showing their implications on adaptive sequencing interoperability.

INTRODUCTION

The evolution and widespread presence of e-learning requires its material to be interoperable among different platforms. International specifications and standards define a common framework to make e-learning software adaptable, interoperable and reusable. E-learning is so wide and touches so many aspects that the task of defining such standards is being done gradually. This chapter concentrates on standards that are relevant for the sequencing of learning content.

One of the main advantages of Web Based Education is the large number of different resources that are provided to the user. There is the risk, however, of becoming lost in cyberspace (Edwards & Hardman, 1989). This problem becomes more important in those situations in which the amount
of resources that a student uses is large. One possible approach to solve this problem is by filtering. Another approach is to adapt the sequencing of learning resources to the learners. Instead of creating courses with the same resources for every user, the resources can be authored so that an adapted environment is created for each learner (Cristea, 2004), i.e. every learner has its own sequence of learning activities, having into account their different backgrounds and different needs.

Having the possibility of providing each student with an adapted sequence of activities has a positive effect on their learning. The important effect that personalisation has on learning was first quantified by Benjamin Bloom, who called this ‘the two-sigma problem’ (Bloom, 1984). Bloom detected that learners that undergo a personalised learning experience get results that are two standard deviations above those of learners that get a one-size-fits-all experience (e.g. in a classroom of 30 students). Although Bloom’s study was not framed in the context of technology-enhanced learning, its conclusions about the importance of adapting the material and improving the students’ learning process are not invalidated by the use of technology.

Adapting the sequencing in the learning process properly is a problem that has drawn considerable attention from different fields like artificial intelligence in education, intelligent tutoring systems, and adaptive hypermedia. The earliest attempts to adapt the order in which some questions were presented to students date from the 70s (Barr, 1973). More modern systems continued the trend in the 80s (e.g. McArthur, 1988) and 90s (e.g. Rios et al., 1993), when the literature used to refer to this processes as ‘task sequencing’. Based mostly on the grounds of instructional design, similar systems grew in complexity, being able to sequence sets of learning material (i.e. lessons), including questions and examples (Capell, 1993; Khuwaja, 1996). This process evolved naturally with the gradual expansion and mass-use of the WWW into the concept of course sequencing (Brusilovsky, 2000), where the goal is already to be able to generate an individualised course for each student. At this level, it is possible to sequence tasks, lessons, or even other teaching operations like examples and assessments (Brusilovsky and Vassileva, 2003). Different AI techniques can be used to generate an adapted course, including planning (Ulrich, 2005), ontology-based reasoning (Karampiperis & Sampson, 2004), and combination of semantic web techniques with SCORM (Baldoni et al., 2004).

In the days of the WWW, sequencing adaptation is more important than ever, especially in distance-learning scenarios. However, most modern Learning Content Management systems (LCMS) have little or no support at all for designing rich adaptive sequencings of learning material. The usual sequence is just a linear juxtaposition of elements, sometimes adding some hierarchy in the form of a tree. Part of the reason lies in the additional difficulty of creating an effectively adaptive sequencing strategy, compared to a typical linear sequence. Several authoring tools and frameworks have appeared to tackle this problem, but it is beyond the scope of this chapter to study them (interested readers can look at Hendrix et al., 2008; Cristea & Aroyo, 2002). Another important reason is the difficulty in reusing material from one LCMS into another: in other words, the additional constraints that sequencing adaptation puts on system interoperability.

This chapter focuses on the support of current standards to the reuse of adaptive sequencing strategies among e-learning platforms. Two are the main “standards” that relate to the problem of sequencing: IMS Simple Sequencing and IMS Learning Design. The first one is specifically designed for sequencing, but it is inherently limited. IMS Learning Design is more flexible than its counterpart, but it has not been specifically designed for sequencing, with several consequences. The chapter describes both specifications, analysing their strong points and their weaknesses, indicating possible solutions that have been proposed in the literature for some of them. But first, we
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