On the necessity of time and resource issues to support collaboration in e-learning standards

Abstract. In this paper we motivate the necessity of time+resource metadata in current e-learning standards to support collaborative activities. Learning Objects (LOs) are currently defined in a very independent way from each other, which makes it difficult to use them in a real scenario where students interact and have their own constraints. We present some challenging features that, at least, should be discussed when elaborating new e-learning standards.

Motivation

In e-learning, metadata labelling offers an effective way to annotate LOs by means of title, description, keywords, relations and some technical data. Basically, e-learning standards focus on the educational perspective, dealing with LOs in an isolated way, which facilitates the dynamic sequencing of learning routes tailored to the students' profiles. However, a fully-tailored route should not only cover the individual user pedagogical aspects, but also the physical issues of the real setting in which the route will be used [1]:

1. LOs and their involved activities could require group interaction, collaboration and sharing of some particular resources which are not always available.
2. Students (and teachers) have their own temporal constraints (e.g. number of hours devoted to each course), which implies constraints on the learning route.
3. Not all the students have the same learning goals; some students are interested in being acquainted with some general contents, but others want proficiency in just a few topics. And students also have different preferences in terms of difficulty of the course, duration or even fees.

Therefore, it does not suffice to bring the right content to the right person, but also at the right time and with the right resources, which is usually missing in traditional e-learning standards. In addition to these static characteristics, students have to eventually execute the learning route, which means that some discrepancies (e.g. an activity takes more time than expected, a resource is no longer available, or one student cannot finish an activity on time) may appear and invalidate the original route. At this stage, students may opt for keeping as much of the original route as possible, or to find a similar cost/length new route. And again, nothing about these stability concerns is considered in current standards.

Most Learning Management Systems (LMSs) and tutoring tools now provide options to address collaboration, such as shared calendars, chat, forum tools and on-line surveys (i.e., evaluation checkpoints where teachers monitor the accomplishment of a learning activity). However, this information is poorly supported in current e-learning specifications. For instance, i) IMS-LD models collaborative activities but cannot represent temporal nor resource constraints; and ii)

goals are usually represented as nested activity structures, and checkpoints are modelled as properties that represent predefined conditional routes. This information is currently too static, and prevents us from using an automated mechanism that adapts the learning route to the students' profile in a dynamic way -mainly because there is not a clear standard specification from where to obtain this information. Perhaps, IMS-LIP could be used to define goals at different levels, or IMS-MD to define temporal margins for collaborative LOs; but again, there is no metadata to express this.

Use of modern techniques and applicability

AI planning techniques offer very appealing possibilities for the development of e-learning environments that effectively consider the previously described constraints and requirements. In fact, a lot of everyday activities imply some kind of intuitive planning to determine a series of tasks to reach some goals under definite constraints. The advantage of using intelligent planning (and scheduling) techniques is that they bridge the gap between the purely e-learning necessities and the accommodation of time+resource constraints of the real environment. Planning techniques go beyond the traditional e-learning insights and give support not only to adaptation and LO sequencing, but also to scheduling constraints and multi-criteria optimization metrics. This raises a challenge for a successful integration with LMSs that facilitate the dynamic navigation of contents/LOs, monitor the students' progress when following their proposed learning routes, check whether some discrepancies appear and react to them to adapt the routes to the new necessities.

The possibility of directly encoding in the e-learning standards all the information related to temporal and resources constraints, students' goals and preferences would highly increase the effective applicability of planning, independently from the LMS adopted. And not only for planning application, but also for other approaches that address these issues. In fact, many authors have tried in the last years to handle these constraints using different techniques, such as adjacency matrices, integer programming models, neural networks and graph-based sequencing procedures [1,2,3], but the main limitation is the lack of standard metadata on which to rely.

Conclusions

We propose the integration of time+resource metadata in current e-learning standards to promote a more effective learning process. This is fundamental to support collaborative activities, sharing of resources, handle users' constraints and goals independently from the LMS adopted. We have used AI planning techniques which have shown to be very adequate to generate fully tailored routes [1], although other approaches could benefit from these additional information. All in all, we think that the use of automated techniques that deal with temporal and resource constraints would be very important for the development of effective e-learning collaborative methods and their integration with current LMSs.

References

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