When introducing the metadata standard learning object metadata (LOM), objectives such as the ability to find or reuse learning objects were followed. These objectives are actually achieved in LOM only to a limited degree, despite the designation as de-facto standard for description of electronic learning content: Based on the complexity of the standard, a high theoretical potential faces rejection in practice. One reason for this is that the process of metadata generation (e.g., who creates which metadata attributes) is not defined in detail yet. This article illustrates an approach that guarantees a high quantity as well as a high quality of learning object metadata records, bringing together known ways of metadata creation and the new paradigm of users describing content as implemented in recent Web 2.0 applications. In the context of a concrete e-learning platform, we exemplarily define who creates which metadata records of LOM in which way at what time.

Keywords: learning objects, metadata generation, LOM, repositories, Web 2.0
respectively in a single system, a reduction of the attribute amount might even be reasonable, as the focus can be set regarding the specific end user (Dahl, Vossen, & Westerkamp, 2006); by doing so, complexity is decreased and usability increased. Problems arise if repositories communicate and interact with each other; for example, when querying distributed e-learning catalogues. While on the one side, metadata records might be considered crucial and obligatory, the same attributes might never be used on the other side, as they are only optional. With a small intersection of filled metadata records, the primary objectives like finding and reusing learning objects become achievable. Furthermore, if metadata are created the way they mostly are today, a high risk for superficial records arises when a single person tries to fill as many metadata fields as possible. As a result, a high quantity might face a low quality. In order to enable cross-system finding and cross-system reusability of learning objects, a high quantity along with a high quality of metadata must be guaranteed, which actually is seldom the case.

Thus, the core dilemma of learning object metadata creation is derived from the discrepancy between the high potential of LOM in theory and the rare implementation and usage of the complexity in practice. We put this down to the aspect that a crucial question is not answered yet:

**Who Creates When Which Metadata Records in Which Way?**

Although it is obvious that a single person is not predestined to fill all metadata records (e.g., presented in some kind of list with empty text fields), this approach often can be found in practice. We rather see different sources interacting within the process of metadata generation. In order to be able to find and reuse, it has to be defined in detail which records are generated by whom at which time and in which way. Only in this way can a high quantity along with a high quality of metadata be achieved.

With the objective to define the process of learning object metadata generation for a concrete learning context at a university, the remainder of this article is structured as follows: In Section 2, we examine in which way metadata for learning objects actually can be created. Furthermore, the Web 2.0 tagging approach introducing the user of a system as metadata creator within a community is analyzed. Section 3 brings together the various ways of metadata creation in a single model and draws first conclusions regarding actors within the process of learning object metadata creation (answering *who?*). Section 4 disengages the well-known structure of LOM consisting of nine main categories and shows a view founded on a more classical metadata perspective. This view, breaking up the original LOM hierarchy, reveals groups of metadata records that might be generated together in the same way (answering *which metadata records?*). Section 5 describes in a real world scenario the use of a learner-centered e-learning platform; it is shown where metadata is created before and during the usage of learning objects (answering *when? in which way?*). Section 6 summarizes the article and outlines future work and research.

**RELATED WORK**

Learning object metadata can be created in many ways, each of which has its individual advantages and disadvantages. Two approaches can primarily be identified: Following a top-down approach, metadata records are filled purposefully and explicitly; while following a bottom-up approach, information that was collected over time is analyzed and processed in order to gain relevant metadata. In the following, some top-down approaches as well as one bottom-up approach will be discussed.

It is obvious to delegate the task of metadata creation to an expert of the respective learning context; for example, the author of a learning object or another explicitly selected person. In order to simplify the process of metadata creation, so-called LOM editors who represent the standard's hierarchical model (e.g., in a tree view) (Cebeci & Erdogan, 2006) can be used. Filling text fields and selecting drop-down lists step by step, the full complexity of LOM
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