



# The effect of users' tagging motivation on the enlargement of digital educational resources metadata



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## ABSTRACT

The emerging Web 2.0 applications have allowed new ways of characterizing digital educational resources, which moves from the expert-based descriptions relying on formal classification systems such as the IEEE Learning Object Metadata (LOM) to a less formal user-based tagging. This alternative way of characterizing digital educational resources is commonly referred to as social tagging, whereas the collection of tags created by the different users individually is referred to as folksonomy. As a result, a number of studies have been reported in the field of Technology-enhanced Learning (Tel) which provide evidence that social tagging has the potential to enlarge metadata descriptions, as well as the formal structured vocabularies with additional terms derived by the resulted folksonomy but more in depth studies are needed regarding this enlargement process. Thus, one issue to investigate further is the possible influence of users' tagging motivation to the resulted enlarged metadata descriptions. In this paper we aim to investigate this issue by first proposing a methodology that aims to evaluate whether users' tagging motivation can influence (a) the enlargement of educational resources possible descriptions compared to the anticipated creators' descriptions and (b) the resulted folksonomy compared with formal structured vocabularies used by the creators of the educational resources and then, apply it to an existing LOR with more than 3,000 science education resources, 434 taggers and 14,707 social tags. Our experiments provided evidence that taggers with a specific type of tagging motivation can produce tags that are significantly different from formal metadata generated by the creators of the educational resources.

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## 1. Introduction

Over the past years, several Open Educational Resources (OERs) initiatives have been emerged worldwide towards the provision of open access to digital educational resources, in the form of Learning Objects (LOs) such as: video and audio lectures (podcasts), references and readings, workbooks and textbooks, multimedia animations, simulations, experiments and demonstrations, as well as teachers' guides and lesson plans (McGreal, 2008). UNESCO (2002) has defined Open Educational Resources (OERs) as the "technology-enabled, open provision of educational resources for consultation, use and adaptation by a community of users for non-commercial purposes". A key objective of OERs initiatives is to support the process of organizing, classifying and storing digital educational resources and their educational metadata in web-based repositories which are referred to as Learning Object Repositories (LORs) (Lane & McAndrew, 2010; McGreal, 2004). LORs are mainly developed to facilitate search, retrieval and access to LOs through

their metadata descriptions. Within this context, a popular way for describing digital educational resources is by using a formal and centrally agreed classification system, such as the IEEE Learning Object Metadata (LOM) (IEEE LTSC, 2002). This implies that either the authors of the educational resources or metadata experts will describe the resources with the use of appropriate metadata authoring tools or that automatic mechanisms will be used to generate the educational metadata values.

On the other hand, the emerging Web 2.0 applications have allowed for alternative ways of characterizing digital educational resources, which moves from the expert-based descriptions following formal classification systems to a less formal user-based tagging (Anderson, 2007; Bi, Shang, & Kao, 2009; Derntl, Hampel, Motschnig-Pitrik, & Pitner, 2011). This way of characterizing digital educational resources is referred to as *Social Tagging* and is defined as the process of adding keywords, also known as tags, to any type of digital resource by the users rather than the creators of the resources (Heymann, Koutrika, & Molina, 2008; Marlow, Naaman, Boyd, & Davis, 2006). Moreover, the collection of tags created by the different users independently is referred to as *Folksonomy* (Golder & Huberman, 2006) and it can constitute an alternative (superset or subset) of the corresponding taxonomy used from

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the metadata experts. Social tagging of educational resources is an important issue to study since educational resources are not meant to be used only by their creators, but ideally to be re-used in different context and different purposes. Thus, mechanisms to capture the re-contextualisation process are important so that eventually educational resources will not only carry their creators' anticipated contextual value but other users' re-contextualisation too. This can enhance both educational resources' searchability (for various context of use) and their metadata descriptions.

In the field of Technology Enhanced Learning (TeL), a number of studies have been reported aiming to investigate this issue, that is: (a) the anticipated added value of social tagging when searching digital educational resources stored in LORs and compare it with the traditional approach of searching based on expert-based formal descriptions following centrally agreed classification systems, such as IEEE LOM and (b) the enlargement of educational resources possible description compared to the anticipated creators' descriptions following centrally agreed classification systems, such as IEEE LOM (Trant, 2009b; Vuorikari & Ayre, 2009). Additionally, recent studies in the field of social tagging systems suggests that users' tagging motivation has a direct influence on the properties of resulting tags and folksonomies (Gupta, Zhijun Yin, & Han, 2010; Korner, 2009; Korner, Benz, Strohmaier, Hotho, & Stumme, 2010) but there are not existing studies for investigating this issue in the field of TeL.

To this end, in this paper we aim to investigate this issue and we propose a methodology that aims to investigate whether users' tagging motivation can influence (a) the enlargement of educational resources possible descriptions compared to the anticipated creators' descriptions and (b) the resulted folksonomy compared with formal structured vocabularies used by the creators of the educational resources. The application of the proposed methodology in an existing LOR, namely the OpenScienceResources Repository (<http://www.osrportal.eu/>) provided us evidence that taggers with a specific type of tagging motivation can produce tags that are significantly different from formal metadata generated by the creators' of the educational resources.

The paper is structured as follows. Following this introduction, Section 2 discusses the concept of social tagging of educational resources, its expected benefits and provides an overview of related studies that investigate the enlargement of educational resources possible description compared to the anticipated creators' descriptions. In Section 3, we present our proposed methodology for identifying different types of users' tagging motivation and investigating their possible influence to the enlargement of metadata descriptions of digital educational resources, as well as to the resulted folksonomy compared to formal structured vocabularies used by the creators of the educational resources. Section 4 provides an overview of the OpenScienceResources (OSR) Repository, which was used for applying our proposed methodology, as well as the social tagging tool used for tagging the educational resources stored in OSR Repository and the dataset that was available at the time of our study. In Section 5, we present the results from the application of our methodology and we discuss our findings. Finally, we present our conclusions and ideas for future work.

## 2. Background

### 2.1. Social Tagging of Digital Educational Resources

In the field of TeL, Learning Objects (LOs) are a common format for developing and sharing digital educational resources and they have been defined by Wiley (2002) as: "any type of digital resource that can be reused to support learning". LOs and their associated metadata are typically organized, classified and stored in web-based

repositories which are referred to as Learning Object Repositories (LORs). McGreal (2004) has defined LORs as systems that "enable users to locate, evaluate and manage learning objects through the use of "metadata," namely, descriptors or tags that systematically describe many aspects of a given learning object, from its technical to its pedagogical characteristics". Most of the LORs that have been developed worldwide adopt the IEEE LOM standard (IEEE LTSC, 2002) or an application profile of IEEE LOM (Smith, Van Coillie, & Duval, 2006) for describing their LOs aiming to facilitate search and retrieval of them among different LORs (McGreal, 2008).

Despite the use of well defined formal metadata for digital educational resources, the users of the educational resources (that is, teachers and students) have difficulties to discover and find suitable educational resources from LORs (Al-Khalifa & Davis, 2007; Dahl & Vossen, 2008; Hyon, 2011). With the emergence of Web 2.0 applications, other means for describing digital educational resources have been investigated and proposed such as social tagging (Bateman, Brooks, McCalla, & Brusilovsky, 2007). This means that the creators of metadata need no longer be metadata experts or authors of the educational resources. Instead, the generation of metadata is done by the users of the educational resources, who can describe educational resources with tags that are meaningful to them and that can facilitate users' searching and retrieval of previously used and already known educational resources (Doush, 2011; Huang, Huang, Liu, & Tsai, 2011). The expected benefits of socially tagging educational resources can be summarized as follows:

- Educational resources metadata can be enlarged with users' personal tags, which reflect their personal way of describing, classifying and locating educational resources. This could offer (a) a personalized way of searching which is delivered by users' tags and not by an externally defined classification system (Cho, Yeh, Cheng, & Chang, 2011; Vuorikari, Poldoja, & Koper, 2010) and (b) a mechanism to capture users' contextual value of educational resources, which could be different from creators' anticipated contextual value (Dahl & Vossen, 2008).
- Formal structured vocabularies used by the creators of the educational resources can be enlarged with new terms that reflect the educational wisdom of the users' communities. This could offer alternative ways of classifying and retrieving educational resources based on folksonomies (Trant, 2009a).

Within the TeL literature there are existing works that have investigated the expected benefits of social tagging when applied for characterizing educational resources. More specifically, the following issues have been investigated:

- The added value of social tagging for improving the searchability of digital educational resources stored in LORs when compared with the traditional approach of searching based on expert-based formal descriptions. This can be assessed with appropriately designed questionnaires for asking LORs' users whether their searches based on social tags were more useful for them compared to their searches with formal metadata (Vuorikari & Ochoa, 2009).
- The enlargement of educational resources metadata (added by the creators of the educational resources) with additional information from the social tags (added by the users of the educational resources). This can be assessed by calculating the similarity between social tags and educational metadata, so as to identify whether social tags contain additional to creators' information (Trant, 2009b; Vuorikari & Ayre, 2009).
- The enlargement of the formal vocabulary terms (used by the creators of the educational resources) with additional terms derived by the resulted folksonomy. This can be assessed by

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