Expert centred vs learner centred approach for evaluating quality and reusability of learning objects

Eugenijus Kurilovas [a,b,*], Silvija Serikoviene [a,c], Riina Vuorikari [d]

[a] Vilnius University Institute of Mathematics and Informatics, Akademijos Str. 4, 08663 Vilnius, Lithuania
[b] Vilnius Gediminas Technical University, Sauletekio Ave. 11, 10223 Vilnius, Lithuania
[c] Kaunas University of Technology Panevezys Institute, Daukanto Str. 12, 35212 Panevezys, Lithuania
[d] European Schoolnet, Rue de Treves 61, B-1040 Brussels, Belgium

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ABSTRACT

The aim of the paper is to present and compare so-called bottom-up and top-down approaches for evaluating quality and reusability of learning objects (LOs). The paper proposes bottom-up methodology that outlines the central role of learners' individual and social behaviour while working with LOs. This includes social tagging and some parameters of interaction for measuring context to describe LOs usage, attention, and other aspects of the context as well as helps to exploit context data towards making LOs repositories more useful, and thus enhance the reuse. The paper also presents top-down methodology for the expert evaluation of LOs quality and reusability. This methodology consists of consecutive application of several scientific approaches, methods, and principles. The authors investigate how these two different, however complimentary approaches for evaluating LOs quality and reusability can be better applied for the aims of eQNet project in order to select reusable ("travel well") LOs for implementing in different educational contexts and countries. These approaches could be considered as suitable applications of information and communication technologies (ICT's) for development of human capital. The examples of practical application of these approaches for evaluating LOs quality and reusability in eQNet project are also presented in the paper.

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1. Introduction

LO is referred here as "any digital resource that can be reused to support learning" (Wiley. D. A., 2000). A number of learning objects (LOs) available through search engines and LO repositories (LOR) is rapidly increasing. The provision of LOs provides better access to quality LOs and supports technology enhanced learning outcomes. According to Haughey and Muirhead (2005), the purpose of LOs is to increase the effectiveness of learning by making content more readily available, by reducing the cost and effort to produce quality content, and by allowing content to be more easily shared. These two purposes, effectiveness and efficiency, receive differing emphases from different sectors.

One of the main criteria for achieving the high LOs effectiveness and efficiency level is LOs reusability. According to (McCormick, Scrimshaw, Li, & Clifford, 2004), the need for reusability of LOs has at least three components:

(1) *Interoperability* – LO is interoperable and can be used in different platforms.
(2) *Flexibility* in terms of pedagogic situations – LO can fit into a variety of pedagogic situations; and
(3) *Modifiability* to suit a particular teacher's or student's needs. LO can be made more appropriate to a pedagogic situation by modifying it to suit a particular teacher's or student's needs.

Since the last decade, the evaluation of LOs has been a concern. The growth in the number of LOs, the multiplicity of authors, their increasing diversity of design and their availability to trained and untrained educators has generated interest in how to evaluate them and which criteria to use to make judgments about their quality and usefulness. Usefulness of LOs is often considered as their personalisation level, i.e. their compliance with the learners' personal preferences such as learning styles (Beres, Maguar, and Turcsanyj-Szabo (2012), Lubchak, Kupenko, and Kuzikov (2012)). As the quantity of LOs has grown, the development of LORs has come about to allow for greater ease in finding and using LOs (Kurilovas, 2009).

There are also a number of topic related papers published in scientific journals during last years, e.g. Lavrov, Kupenko, Lavryk,

* Corresponding author at: Vilnius University Institute of Mathematics and Informatics, Akademijos Str. 4, 08663 Vilnius, Lithuania.
E-mail addresses: eugenijus.kurilovas@itc.smm.lt (E. Kurilovas), silvija.serikoviene@gmail.com (S. Serikoviene), riina.vuorikari@eun.org (R. Vuorikari).

and Barchenko (2013), De Bettio, Pereira, Martins, and Heimfarth (2013), Bodea, Dascalu, and Lytras (2012), Labra Gayo, Ordóñez de Pablos, and Cueva Lovelle (2010), Lytras and Garcia (2008).

Teachers, students, and instructional designers can access large repositories and a number of even larger meta-collections such as European Schoolnet's Learning Resource Exchange (LRE., 2012) which contains more than 220,000 LOs and assets from over 30 providers. As a pan-European service, the LRE particularly seeks to identify LOs that "travel well" (i.e., reusable) across national borders and can be used in a cultural and linguistic context different from the one in which they were created.

Research on "travel well" LOs was performed in eQNet project. eQNet is a three-year Comenius Multilateral Network funded under the European Commission (eQNet, 2012). The project was coordinated by European Schoolnet and involved 9 Ministries of Education or agencies nominated to act of their behalf (countries involved: Austria, Belgium Flemish community, Czech Republic, Italy, Lithuania, Norway, Portugal, Slovakia and Sweden). The aim was to improve the quality of LOs in LRE by establishing a network consisting of policy makers, researchers, and practitioners (teachers) that developed and applied "travel well" quality criteria to both existing LRE content as well as that to be selected in future from national repositories.

Reusability of LOs (or their ability to "travel well" between different contexts and education systems) is considered in the paper as a part of the overall quality of LOs. This means that any high quality LO has some reusability level (or the potential to "travel well"), but this does not mean that any reusable LO is qualitative one.

The rest of the paper is organised as follows: bottom-up (learner centred) methodology for evaluating "travel well" quality of LOs is presented in Section 2, LOs top-down (expert centred) evaluation methodology is presented in Section 3, and experimental LOs evaluation results are presented in Section 4. Discussion and Conclusion are presented in Section 5.

2. Bottom-up methodology: using context to acquire metadata to enhance "travel well"

The term micro-context is used to denote the context that is relevant for interpreting a specific user input (e.g., a search term) and for designing adequate system responses and other system output. Micro-context may be provided by the activities themselves, the user (model), or further background knowledge, often referring to the LO. In each case, the question arises how to measure these variables. For many types of (meta)data available in electronic environments, it is rather straightforward to determine whether they relate to activity, user, or material. Tags are an interesting exception: At first sight, a tag may be thought of as just another feature of the object (e.g., LO). However, this view ignores the essential role that the user takes when tagging. Tags and the resulting networks (folksonomies) are commonly modelled as tri-partite hypergraphs, e.g. Cattuto et al. (2007). This means that they are formed by triples of (user, item, tag). For analyses, this ternary relational structure is often projected to a lower-dimensional space. This gives rise to (item, tag) relations that that – for our purposes – allow tags to be part of the LO as context. By looking at the (user, tag) relation, one obtains tags as part of user models – which may for example be leveraged to infer preferred language(s) of the user. Additionally, an investigation of the (user, item) relation can give important clues to the user's LO preferences. The full relational structure emphasises that tags may also be regarded as a parameter of the interaction between a user and the LO.

2.1. Interaction as context – parameters of interaction for measuring context

This view of context regards a user action that is an interaction with a material as an atomic unit of analysis (such as clicking a hyperlink, giving an answer in a multiple-choice question, or downloading a document). This action is associated with certain parameters/metadata: date and time including access time and dwell time; action type such as download, insertion, viewing; query terms; IP address; operating system, browser and further technical characteristics of hardware and software; the application or tool used including its name, URI, type such as LOR or Learning Management System (LMS) (e.g., Najjar, Wolpers, and Duval (2006); Bateman, Brooks, and McCalla (2006)). We call such information "implicit interest indicators" because it is collected non-reactively (Claypool, Le, Wased, & Brown, 2001) without intruding the user. In contrast, "explicit interest indicators" are derived from users (more) consciously expressing their interest in LOs. Explicit interest indicators include tags, ratings, and bookmarks. They can give rise to metadata describing the user's/learner's perspective on the LO including feedback on it or knowledge of the content. Both implicit and explicit interest indicators can be regarded as atomic, or in the context of a complex activity such as a session or search episode (which may be a sequence of atomic interest indicators with different values). We first describe the atomic versions and subsequently their use in activity structures.

2.1.1. Atomic implicit interest indicators
Attention metadata in the technology enhanced learning (TEL) context for enriching the metadata regarding LOs in LOR and LMS are studied in Najjar et al. (2006). The idea is to capture the attention metadata about the user's actions across system boundaries to enable better targeted personalisation of learning services (e.g. Recommender systems). The authors propose a Contextual Attention Metadata framework that is based on the exchange of information using an extended version of AttentionXML. Wolpers, Najjar, Verbert, and Duval (2007) complement the concept of tracking user's attention (e.g. when, how long, in what sequence have this taken place) across applications that are used regularly in TEL (e.g., Office Suite, Web Browsers, Mail Clients). The authors suggest that contextualised attention metadata schema enables the correlation of the observations, thus reflecting the relationships that exist between the user, his/her context and the content he/she works with better. This type of concept seems important especially for informal learning, where learning rarely takes place using institutionalised learning platforms or learning management systems. Khoo et al. (2008) investigated the use of session length (derived from the times of the session's clicks) as a metric for digital-library site performance. They report that this metric can be very misleading in the context of digital libraries (as opposed to e-commerce), as the relationship between session length and web site quality is a contextual relationship; for some sites, short sessions might be indicators of quality; while for other sites long sessions might be indicators of quality.

2.1.2. Atomic explicit interest indicators, in particular tags
Cattuto et al. (2007) found that folksonomies are highly connected and that the relative path lengths are small, which facilitates the "serendipitous discovery" of new content and other users. Tags have therefore become popular as clear-cut indicators of interest and a basis for recommendation. For example, Santos-Neto, Ripeanu, and Iamnitchi (2007) track user attention in collaborative tagging communities for academic papers in order to harness usage patterns to improve navigability in a growing knowledge space. They find a clear segmentation of interests into a significant number of small sub-communities of interests that